



QUESTIONS and ANSWERS (Q&As)

**A compilation of Q&As
regarding chemical
science activities
answered by Science
ASSIST for
Australian schools**

Introduction

This compilation of Questions and Answers (Q&As) has been created from the Q&As posted on the Science ASSIST website prior to its closure in December 2021. They are grouped by their science area focus and hyperlinked from the contents page to enable easy navigation.

They have been compiled so that they can continue to be available to support schools after the closure of the Science ASSIST website in December 2021. Note: The Q&As have not been revised since the date of publication in the answer, so many of the links to further information may no longer be current.

The questions were all asked by Australian schools and answered by the Science ASSIST Team (SAT) and supported by references to information from reputable sources.

These Questions and Answers (Q&As) were produced by the Science ASSIST project which was managed by the Australian Science Teachers Association (ASTA) in consultation with the Science Education Technicians Association (SETA).

They were developed by Science ASSIST prior to 1 July 2020 and can be used under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence <https://creativecommons.org/licenses/by/4.0/> except in relation to 'Excluded Materials'.

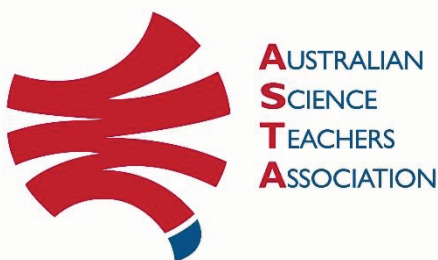
Except in relation to Excluded Materials this CC BY 4.0 licence allows you to:

- Share — copy and redistribute the material in any medium or format;
- Adapt — remix, transform, and build upon the material;
- Use — for any purpose, even commercially

provided you attribute ASTA as the source of the copyright material. ASTA requests attribution as: "From the Science ASSIST website: <http://assist.asta.edu.au>".

Excluded Materials

The Science ASSIST, ASTA and SETA logos, other logos and trademark protected material are not licensed under a CC BY licence and may not be used.



Disclaimer: Science ASSIST accepts no liability for any damages to individuals or property arising directly or indirectly from using these resources. All content is provided in good faith and on the basis that readers will be responsible for making their own assessment of the matters discussed herein, and that they should verify all relevant representations, statements and information. Risk assessments and appropriate safety precautions must always be undertaken and are the sole responsibility of the user.

Table of Contents

Chemical science

Chemical Activities

1. [Acetone and polystyrene foam](#)
2. [Alkane/Alkene/Bromine Water clean up](#)
3. [Bonding and conductivity](#)
4. [Burning Magnesium Ribbon](#)
5. [Chemical Cell](#)
6. [Chemicals \(cold pack practical\)](#)
7. [Chemistry](#)
8. [Chemistry Experiment](#)
9. [Combustion reaction](#)
10. [Determining empirical formula](#)
11. [Effect of catalyst and surface area on reaction rate](#)
12. [Flame testing](#)
13. [Formation of crystals](#)
14. [Fuels](#)
15. [HCl + NH₄OH Reaction](#)
16. [Lightning in a test tube](#)
17. [Making ionic compounds](#)
18. [Making Nylon](#)
19. [Making Polyurethane foam](#)
20. [Making Sherbet](#)
21. [Measuring Corrosion of Iron-Yr12 EEI](#)
22. [Microscale Chemistry](#)
23. [Mixing of alcohols](#)
24. [pH Probe](#)
25. [Potassium Dichromate in the determination of alcohol content in wine](#)
26. [Precipitation reaction \(sodium hydroxide and barium nitrate\)](#)
27. [Precipitation reactions](#)
28. [Reaction between iron and sulfur](#)
29. [Reflux and distillation](#)
30. [Rusting of steel wool using vinegar](#)
31. [Safe concentration of HCl for Year 8 students to use?](#)
32. [Tollens Test](#)
33. [Toxic Alcohols in Spirit Burners to test Fuel Efficiency](#)
34. [Use of Liquid Nitrogen](#)
35. [Use of Sodium in Schools](#)
36. [Whoosh bottle](#)

Chemical Disposal

1. [Biodiesel](#)
2. [Broken Max Min Thermometer](#)
3. [Calcium Metal](#)
4. [Calcium oxide disposal](#)
5. [Can Potassium Permanganate waste be neutralised?](#)
6. [Chemical clock practical - waste disposal](#)
7. [Chemical disposal](#)
8. [Chemical disposal \(chromium\)](#)
9. [Chemical disposal of Sudan 3](#)
10. [Chemical waste and septic systems](#)
11. [Chemical Waste from Ester Prac](#)
12. [Copper sulfate waste](#)
13. [Disposal of agar with silver nitrate](#)
14. [Disposal of Ammonium Thiocyanate](#)
15. [Disposal of potassium permanganate and glycerol reaction](#)
16. [Disposal of silver nitrate solid](#)
17. [Endothermic reaction disposal of products](#)
18. [Ethylene Glycol disposal](#)
19. [Laboratory Chemicals and Waste Management/Setup](#)
20. [Mercury Spills](#)
21. [Mercury Thermometer](#)
22. [Organic chemistry](#)
23. [Organic waste](#)
24. [Potassium permanganate](#)
25. [Risk assessment \(thiosulfate\)](#)
26. [Sulfur disposal](#)
27. [Waste chemical disposal](#)
28. [Zinc Nitrate](#)

Chemical laboratory preparations

1. [Bromine Water](#)
2. [Copper Sulfate Crystals](#)
3. [Drying of anhydrous sodium carbonate](#)
4. [Indicator for testing for water hardness](#)
5. [Solution making](#)
6. [Testing Alkanes and Alkenes](#)

Chemical List

1. [Ammonium Nitrate](#)
2. [Ammonium nitrate](#)
3. [Ammonium thiocyanate](#)
4. [Banned chemicals/materials list NSW & ACT](#)
5. [Barium nitrate solutions](#)
6. [Calcium Carbide](#)
7. [Calcium Carbonate](#)
8. [Calcium hydroxide](#)
9. [Chemicals in schools \(formaldehyde, melamine and cyanuric acid\)](#)
10. [Demonstration of phosphorus](#)
11. [Electrophoresis Dyes](#)
12. [Ferrothiocyanate \$\text{Fe}\(\text{SCN}\)_2\$](#)
13. [Gallium Metal](#)
14. [Genetics](#)
15. [GHS Hazard category ratings](#)
16. [Glutaric Acid](#)
17. [Health monitoring requirements](#)
18. [Lead and lead salts](#)
19. [Litmus Paper](#)
20. [Mercury \(II\) Thiocyanate](#)
21. [Organic chemicals](#)
22. [Phenanthroline](#)
23. [Phenylthiocarbamide paper](#)
24. [Potassium bromate](#)
25. [Potassium iodide status and EUDs](#)
26. [Recommended Chemicals for secondary Schools](#)
27. [Sulfuric acid- going brown](#)
28. [Sulfur Hexafluoride](#)
29. [Use of Iron III Nitrate and Zinc Nitrate](#)
30. [Use of lead in ACT schools](#)



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Acetone and polystyrene foam

Acetone and polystyrene foam

Posted by Anonymous on Thu, 2019-05-02 10:44

Acetone and polystyrene foam: Is it suitable and safe in a primary school to conduct the activity in which a foam cup is “dissolved” in acetone? Is this a demonstration of a physical change where the foam is just disintegrated and the gas is released? My concerns are both obviously for the acetone use in an open classroom with primary school students and also if there is anything gaseous/toxic released during the disintegration process.

Voting:•



No votes yet

Year Level:•

6

Laboratory Technicians:•

Showing 1-1 of 1 Responses

Acetone and polystyrene foam

Submitted by sat on 02 May 2019

Suitability for primary schools:

There are two aspects to consider here:

1. **The curriculum application.** This is a complex example of a physical change and not easily reversible. Simple examples of a physical change¹ are recommended for the

primary school level, such as

- a. change of state (e.g. from a solid to a liquid or gas or the reverse)
- b. creation and/or separation of a mixture (e.g. mixing sand with marbles)
- c. physical deformation (e.g. crumpling or tearing paper)

2. **Management of hazardous chemicals in primary schools:** Are there systems in place to ensure that the risks to health and safety are managed? For example: Has a chemical register for hazardous chemicals been established and maintained? Has appropriate information and training been provided for staff? ²

Handling acetone

Acetone is a hazardous chemical. It is highly flammable, in both liquid and vapour form; it causes serious eye irritation and may cause drowsiness or dizziness.³

Safe storage and handling procedures must be followed:

- “Handle in an operating fume cupboard or well-ventilated area.
- Avoid inhaling fumes, vapour or mist.
- Avoid contact with skin and eyes.
- Handle away from heat and other sources of ignition.”⁴

Acetone and polystyrene foam demonstration

Polystyrene is a polymer made up of the monomer styrene⁵. It is a hard, solid plastic used in many appliances.⁶ When polystyrene beads contain an expanding agent and are steam heated, they soften and expand up to forty times their original size to form polystyrene foam which is 98% air.⁷

The Royal Society of Chemistry explains that when polystyrene foam comes into contact with acetone, it is softened and releases the air and therefore collapses. •*“The resulting colloidal gel consists of propanone (acetone) molecules dispersed in a network formed by a tangle of large polystyrene molecules –a similar structure to ordinary jelly in which water molecules are dispersed in a network of protein molecules.”*⁸

This means that this is a physical change because there has been no chemical change to the polystyrene.⁹ Since it is largely air that is released, there is unlikely to be exposure to toxic gases from this source. The greatest risks in this activity are exposure to the acetone and its flammability.

Science ASSIST recommends that this activity is conducted as a demonstration rather than a class activity, observing the following:

- Conduct in a well-ventilated area, such as outside in the open air, away from sources of ignition
- Wear safety glasses and avoid skin contact with acetone
- Provide additional shielding or use a (transparent) secondary container to minimise the likelihood of the acetone splashing as the polystyrene collapses.
- Disposal: Decant the excess acetone from the mixture into a bottle for non-halogenated organic liquid waste. Alternatively, small quantities of waste acetone can be placed in a

shallow vessel in an operating fume cupboard and allowed to evaporate. Transfer the residual gel to a shallow disposable container and place in an operating fume cupboard, and allow the acetone to evaporate. When the residual acetone has evaporated, the polystyrene residue will harden, and this can then be disposed of as general waste.

References

- ¹ '3.6: Changes in Matter - Physical and Chemical Changes', Chemistry Libre text library website, [hyperlink](#) (Updated May 2019)•
- ² 'Hazardous chemicals', Safe work Australia website, <https://www.safeworkaustralia.gov.au/chemicals> (Accessed April 2019)
- ³ Chem Supply. 2015. *Acetone*, Safety Data Sheet, Chem Supply website,• <https://www.chemsupply.com.au/documents/AA0081CH01.pdf>
- ⁴ Science ASSIST. 2017. *Handbook Chemical Management Handbook for Australian Schools –Edition 3* <https://assist.asta.edu.au/resource/4193/chemical-management-handbook-australian-schools-edition-3>
- ⁵ 'What Makes Polystyrene Different from Styrene? It's a Matter of Chemistry', Chemical Safety Facts website, <https://www.chemicalsafetyfacts.org/chemistry-context/makes-polystyrene-different-styrene-matter-chemistry/> (Accessed April 2019)
- ⁶ 'Polystyrene', Chemical Safety Facts website, <https://www.chemicalsafetyfacts.org/polystyrene/> (Accessed April 2019)
- ⁷ Bellis, Mary. 2019. 'Invention of Polystyrene and Styrofoam' ThoughtCo. website, <https://www.thoughtco.com/invention-of-polystyrene-and-styrofoam-1992332> (24 January 2019)
- ⁸ 'Disappearing plastic', Royal Society of Chemistry Learn Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00001721/disappearing-plastic> (July 2016)
- ⁹ Helmenstine, Anne Marie. 2018. 'Physical Changes in Chemistry', ThoughtCo. website, <https://www.thoughtco.com/definition-of-physical-change-605910> (11 April 2018)

Source URL: <https://assist.asta.edu.au/question/4466/acetone-and-polystyrene-foam>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Alkane/Alkene/Bromine Water clean up

Alkane/Alkene/Bromine Water clean up

Posted by Anonymous on Fri, 2018-02-09 12:24

Alkane/Alkene/Bromine Water clean up: My teachers yesterday did a prac on the reactivity of alkanes and alkenes with bromine water. The waste chemical products have been collected for disposal, however do you have any tips as to how to clean up the residual chemicals from the glassware? Thanks!

Voting:•



Average: 5 (2 votes)

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Alkane/Alkene/Bromine Water clean up

Submitted by sat on 14 February 2018

Appropriate waste disposal procedures and cleaning of glassware is an important part of safe laboratory work practices.

In the experiment that you describe, bromine water is used to test whether an organic

compound is unsaturated¹; it is used to distinguish between alkanes and alkenes such as cyclohexane and cyclohexene, and hexane and hexene. As bromine water and many of the alkanes and alkenes used for this type of demonstration are hazardous, it is recommended that micro-techniques be used to minimise the amount of chemical waste that is produced.

Safety data sheets for each chemical used and produced should be consulted for advice on hazards, incompatibilities, disposal procedures and correct PPE.

Hazards of the chemicals used

Bromine water (5%v/v) is a highly reactive, toxic and corrosive solution. It is also an aquatic toxin. Exposure of the eyes, skin and respiratory tract may lead to severe irritation and burns^{1,2,3}.

Alkanes and alkenes such as cyclohexane and cyclohexene, are highly flammable in both liquid and vapour phases, cause skin, eye and respiratory tract irritation, may be fatal if swallowed, and are very toxic to aquatic life^{4,5, 6,7}. Some alkanes can cause drowsiness or dizziness.

All of these chemicals should be handled in an operating fume cupboard.

Waste disposal

- No hazardous organic chemical waste solution from this demonstration should be disposed of down the sink.
- The waste chemical products from these reactions should be carefully collected into a labelled halogenated organic waste bottle for collection by a chemical waste contractor. This should be performed in a fume cupboard wearing appropriate Personal Protective Equipment (PPE) such as chemical resistant (nitrile) gloves, laboratory coat and safety glasses. The waste container should be compatible with the disposed chemicals.

As the waste quantities will be small, additional compatible wastes may be added to the waste bottle. It is important to keep track of the substances added to the waste bottle by recording them on the label. The waste bottle should be stored in a flammable liquids cabinet until ready for collection by a chemical waste contractor.

Glassware cleaning procedure

In organic chemistry glassware cleaning is usually a multi-step process.

1. Rinse the glassware with a small amount of organic solvent such as ethanol or methylated spirits. (Simple alkanes and alkenes have low solubility in water.)
2. These rinsings can be added to the same labelled halogenated organic waste bottle in the fume cupboard.
3. Invert the clean glassware onto paper towel in the fume cupboard and leave for several hours or overnight.

Inverting onto paper towel helps to drain the glassware and helps to evaporate any residual solvent in the fume cupboard (larger surface area). You could line an ice cream container with

paper towel, then invert the glassware into it. Leave the fume cupboard operating until all the residual solvent has evaporated.

After the solvent has evaporated, the paper towel is disposed of as general waste.

- that paper towel in an operating fume cupboard needs to be weighed down, otherwise it can get sucked up into the back of the fume cupboard, rendering it non-operational.
- Finally, wash glassware normally in warm, soapy water, then rinse with water and dry.

References and further reading:

1. Science ASSIST. 2017. • *Science ASSIST Chemical Management Handbook*, Science ASSIST website, <https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au...>
2. Scharlau. 2013. • *Bromine water*, Safety Data Sheet. Please search the product information page of the Chem-Supply website for the latest version: <https://www.chemsupply.com.au>
3. Nuffield Foundation. 2016. • *Handling liquid bromine and preparing bromine water*. • Royal Society of Chemistry website. • <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000683/handling-liquid-bromine-and-preparing-bromine-water?cmpid=CMP00000761>
4. ChemSupply. 2013. • *Cyclohexane*, Safety Data Sheet, ChemSupply website, • <https://www.chemsupply.com.au/documents/EA0071CH2S.pdf>
5. ChemSupply. 2013. • *Cyclohexene*, Safety Data Sheet, ChemSupply website, • <https://www.chemsupply.com.au/documents/EA0071CH2S.pdf>
6. ChemSupply. 2016. • *Hexane*, Safety Data Sheet, ChemSupply website, • <https://www.chemsupply.com.au/documents/HA0181CH33.pdf>
7. Sigma-Aldrich. 2014. • *Hexene*, Safety Data Sheet, Sigma-Aldrich website, <http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang...>

Alkane/Alkene/Bromine Water clean up

Submitted by on 23 March 2018

Very good question and helpful expert answer. In fact I learnt new way of managing the used glassware from organic chemical. Thanks -- Nehal

Source URL: <https://assist.asta.edu.au/question/4257/alkanealkenebromine-water-clean>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Bonding and conductivity

Bonding and conductivity

Posted by Anonymous on Mon, 2016-02-22 15:43

Bonding and conductivity: Our Year 11s had an electrical conductivity practical demonstrated to them, and the molten silver nitrate did not register a charge on the ammeter. The sodium hydroxide did this beautifully. It was not what we were expecting to see. Do you have any suggestions?

Also, once the silver nitrate cooled, it was very difficult to remove it from the crucible. Have you got any suggestions? Also, how should I dispose of the silver nitrate once I manage to get it out of the crucible, bearing in mind it is a tiny amount.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Bonding and conductivity

Submitted by sat on 02 March 2016

Thank you for your question.• Without direct knowledge of your actual activity and how it was conducted, it is very difficult for us to define your problem and identify a solution.• Our

response is therefore somewhat speculative.

Summary Response

We assume from your question that you have set up a simple series electrical circuit of a power supply, a meter (ammeter or voltmeter) and two electrodes that are able to be dipped into the molten liquid that is being heated in a crucible. •

As silver nitrate is an ionic crystalline salt, we would expect, as you did, that as a solid it would not be an electrical conductor, but upon melting, the dissociation of the ions from the crystal lattices would allow them to move, and for the liquid to then become an electrical conductor.

As your investigation did not produce this expected result, then perhaps you could check other possible factors.

- Are you sure that the tested substance was in fact silver nitrate? • Was it correctly labelled?
- Was your electrical circuit properly set up? • Was the ammeter/voltmeter set to the appropriate range so as to measure a small current?
- Was the heated silver nitrate obviously liquid at the time of measurement? • Crystalline silver nitrate has a melting point of 212 deg C, which is readily achieved by heating in a crucible.

Regarding your second question about the management and disposal of the remaining silver nitrate.

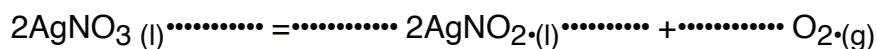
- Best practice for disposal would be to store waste silver nitrate for collection and disposal by a licenced waste disposal contractor. If the silver nitrate is too difficult to remove from the crucible then perhaps you could save it in its entirety for disposal.
- Alternatively, it is suggested that when you successfully conduct this activity, rather than dispose of the silver nitrate, that you consider keeping the crucible with its solidified silver nitrate for reuse in following years. • You could easily store it in a dark container, alongside your other oxidisers, and thereby avoid your disposal issue.
- The cooled silver nitrate is very soluble and should dissolve readily in water. However, as silver is toxic to the aquatic environment, only minor quantities (< 1g) should be disposed of down the sink, with dilution to 1%. • Check with your local water authority for more information about local trade waste acceptance standards. • This method of disposal may be precluded if the school has only a septic system, or is restricted in its water use.

Further information

Silver nitrate has a melting point of 212 deg C. • This is much below that of sodium hydroxide (318 deg C), which you say you successfully tested. • This suggests that failure to adequately melt the silver nitrate may not be the problem. •

Upon further heating and after melting to 440 deg C, a temperature easily achieved with a burner, silver nitrate decomposes. There are two chemical steps.

1. Silver nitrate decomposes to silver nitrite, liberating oxygen gas



2. Silver nitrite further decomposes to silver metal and brown nitrogen dioxide gas (toxic)



Therefore, it is suggested that the silver nitrate be heated cautiously in a fume cupboard to above its melting point, but not so strongly as to lead to its decomposition.

If you are not able to identify a problem from the suggestions, then you may need to begin the activity again using a new pack of silver nitrate. Current reputable suppliers of school chemicals have product batch identifying codes for quality assurance. Alternatively, you could use another (more stable) ionic salt with a suitably low melting point for this activity. Zinc chloride (ZnCl_2), which melts at 293 deg C, is a possible alternative.

The contact details for licenced waste disposal contractors can be found in Science ASSIST's list of [School science suppliers](#).

References

'Demonstration 1: Electrical Conductivity of Solutions', Oklahoma State University website, <https://go.okstate.edu/jgelder/bondpage19.html> (Accessed February 2016)

'Electrolysis of molten zinc chloride', Royal Society of Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000826/electrolysis-of-molten-zinc-chloride?cmpid=CMP00005020> (Accessed February 2016)

'Silver nitrate', Material Safety Data Sheet, Chem-supply website: <https://www.chemsupply.com.au/documents/SL0871CH63.pdf> (September 2011)

'Silver nitrate', Virtual Institute of Applied Science website, http://www.vias.org/genchem/inorgcomp_silvernitrate.html (Accessed February 2016)

'Sodium hydroxide: Chemical information and properties', Chemical Compounds Web Project website, <http://sodiumhydroxide.weebly.com/chemical-information-and-properties.html> (Accessed February 2016)

'Solubility of silver nitrate in water', Salt Lake Metals website, https://saltlakemetals.com/solubility_of_silver_nitrate/ (Accessed February 2016)

'Substance: zinc chloride' Royal Society of Chemistry website, <http://www.chemspider.com/Chemical-Structure.5525.html> (Link updated: December 2017)

Source URL: <https://assist.asta.edu.au/question/3589/bonding-and-conductivity>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Burning Magnesium Ribbon

Burning Magnesium Ribbon

Posted by Anonymous on Wed, 2014-12-03 10:35

Burning Magnesium Ribbon: Are students allowed to burn magnesium ribbon in a Bunsen burner flame using tongs as a class activity or should it just be a teacher demo? I know that people should not look directly at the burning ribbon. Also, is it okay to burn it in a crucible?

Voting:•



No votes yet

Australian Curriculum:•

Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed

Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer

Year Level:•

9

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Answer by labsupport on question Answer by kris.szalai on question Burning Magnesium Ribbon

Submitted by sat on 03 December 2014

I hope the following information helps to address both questions.

Burning Magnesium ribbon in a Bunsen flame:

The flare from most chemicals burned in a Bunsen flame is usually of short duration and therefore is unlikely to pose any real hazard. The exception is burning magnesium ribbon, which burns with a light of high intensity and heat. **Watching a magnesium fire can cause eye damage.**

Burning small pieces of magnesium ribbon held with tongs over a Bunsen flame is recommended to only be done as a teacher DEMONSTRATION not as a class activity—a site-specific risk assessment should be carried out and safety procedures and guidelines followed as detailed below:

- Be aware that burning magnesium produces a lot of heat and a white flame that emits ultraviolet light.
- Wear safety glasses.
- The piece of magnesium ribbon should be no more than 2cm in length.
- Use crucible tongs to hold the piece of magnesium ribbon over the Bunsen burner flame to light it, or suspend the strip of magnesium over the Bunsen burner flame using a laboratory stand and clamp.
- Students should sit no closer than 2-3 m from the flame.
- Students are instructed NOT to look or stare directly at the burning metal, observation should be from the side (i.e., using peripheral vision) due to the risk of eye damage.
- Avoid breathing in the smoke from the burning magnesium ribbon.
- The following information is from the ChemSupply SDS:
 - Highly flammable in the presence of open flames and sparks, or heat
 - Flammable solid. Contact with moisture or water liberates flammable gases
 - Ignites readily, burns with intense white light and heat
 - Watching a magnesium fire can cause eye injury

The burning of magnesium is a reaction between the metal magnesium and oxygen in the air. A chemical change occurs forming a new compound: magnesium oxide.

See the following *Youtube* link demonstrating magnesium reacting with oxygen.
<https://www.youtube.com/watch?v=m2i9jLPXprQ>

Burning of magnesium ribbon in a crucible:

This is a different activity. It is recommended as a class activity, provided a site-specific risk assessment is carried out and the following safety procedures and guidelines are followed:

- Wear safety glasses.
- The magnesium ribbon can be cut into about 15cm lengths before the lesson.
- The reaction is highly exothermic. Particular care should be taken to avoid burns.
- Students must only move the crucible and lid using tongs.
- Students should be discouraged from looking at the magnesium when it is burning and the bright light produced as this can cause eye damage.

- The number of magnesium strips used by students should be limited by the teacher.

This activity is a good way for senior students to demonstrate a combination/oxidation reaction and the conservation of mass in a chemical reaction.

Method

1. Take a piece of magnesium ribbon about 15 cm long and roll it into a tight coil.
2. Weigh an empty crucible with lid and record its mass.
3. Place the coil of magnesium ribbon into the crucible, weigh the crucible, lid and magnesium and record this mass.
4. Place the crucible on a pipe clay triangle on a tripod stand and heat over a bunsen burner.
5. Heat for 1 minute, then carefully lift the lid slightly with tongs. The magnesium will burst into flames as the air reaches it. Do not let any white smoke escape and replace the lid. This will prevent any loss of product (magnesium oxide).
6. Lift the lid periodically over 5 minutes to ensure an adequate supply of oxygen.
7. Let the crucible cool. When it is cool, weigh it. Record the mass of the crucible, lid and magnesium oxide. (Take care that a hot crucible is not placed on a plastic pan top of the balance or the plastic may melt.)

See *Youtube* video demonstrating magnesium reacting with oxygen in a crucible.

<https://www.youtube.com/watch?v=OuFqtxZJRvM>

References

Ahlers, C. (2011). *Expose, excite, ignite an essential guide to whizz-bang chemistry*. Geelong West, VIC: Prof Bunsen Science Publishers.

Cash, S. (2012). *Oxford big ideas. Science 8: Australian curriculum* (1st Ed.). South Melbourne, VIC: Oxford University Press

Cash, S. (2012). *Oxford big ideas. Science 10: Australian curriculum* (1st Ed.). South Melbourne, VIC: Oxford University Press

Chem-supply. 2011. *Safety Data Sheet: Magnesium Ribbon*.
<https://www.chemsupply.com.au/documents/MT0321CHJN.pdf>

Risk Assess; www.riskassess.com.au

Simpson, G. (2000). *Heinemann Science Links 3*. Port Melbourne, VIC: Reed International Books Australia Pty Ltd.

Source URL: <https://assist.asta.edu.au/question/2549/burning-magnesium-ribbon>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical Cell

Chemical Cell

Posted by Anonymous on Tue, 2014-10-14 17:33

Chemical Cell: When making a Chemical Cell (Year 9 Energy-Electricity) using a Zinc electrode and a carbon electrode in Acidified Potassium Dichromate, what molarity should the Dichromate be and how much Sulfuric acid (and what molarity) do I add to it to acidify it?

Voting:



No votes yet

Australian Curriculum:

Energy transfer through different mediums can be explained using wave and particle models

Year Level:

7

8

9

10

Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-2 of 2 Responses

Answer by labsupport on question Answer by labsupport on question Answer by delese on question Chemical Cell

Submitted by sat on 20 October 2014

Thank you for your question. • The members of the ASSIST team have no direct experience with this particular activity. • We are, however, very concerned about the potential use of potassium dichromate in a Year 9 activity because of its extremely hazardous nature. • It is highly toxic, a known sensitiser, and has evidence of carcinogenic and teratogenic effects (1). • In a school science setting, potassium dichromate use would normally be limited to senior chemistry practicals and be under strict supervision. •

If the purpose of the activity is to demonstrate a chemical cell generating a small electric current, then we strongly recommend that another activity using safer chemicals be substituted. • There are many possibilities here including

- Al and Cu electrodes with salt water solution
- Cu and Zn electrodes with copper & zinc sulfate solution •
- Fruit batteries using lemons, kiwi fruit

A web search on electrochemistry experiments will locate useful websites such as those below which include such activities:

- https://web.archive.org/web/20171226234654/http://www.funsci.com/fun3_en... (April 2018; The original site no longer exists. This copy provided by the Internet Archive)
- <http://educyclopedia.karadimov.info/education/chemistryexperiments.htm>

Since your question is about making chemical cells, we hope that this answer has helped.

(1) Safety Data Sheet:

<https://www.chemsupply.com.au/ProdSearch.aspx?Search=potassium%20dichromate&SearchType=co>

Answer by Karin on question Chemical Cell

Submitted by on 17 October 2014

I have never heard of a prac that uses dichromate to make an electro-chemical •cell. Dichromate is toxic and carcinogenic, I wouldn't use it for year 9s. A much safer way of making a cell would be to make the good old Daniell cell, this site has a good write up about it. • http://www.nuffieldfoundation.org/sites/default/files/11_Cells_and_batte... You can substitute the copper and zinc sulfate with copper and zinc nitrate (all 1M solutions), the salt bridge should be made from potassium sulfate or nitrate to correspond with the anion used in the cell. • If the only purpose of the prac is to show students that the cell produces a voltage, you can further increase the safety of the prac by reducing the concentrations of the copper and zinc to 0.1M. •

Source URL: <https://assist.asta.edu.au/question/2506/chemical-cell>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > [Chemicals \(cold pack practical\)](#)

Chemicals (cold pack practical)

Posted by Anonymous on Sat, 2015-09-26 13:37

Chemicals (cold pack practical): I would like use the following chemicals for a cold pack prac: ammonium chloride, ammonium nitrate, magnesium sulfate and sodium thiosulfate.

Are these available? Are there particular safety issues?

Voting:



No votes yet

Year Level:

9

10

Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

chemicals

Submitted by sat on 08 October 2015

Thank you for the question.

Chemical/salt solids which undergo endothermic solution formation with water are suitable to use in a "cold pack making" investigation. The overall process becomes endothermic when

heat is absorbed from surroundings to break up the lattice structures of these salts into individual ions when dissolving in water.

The four inorganic salts mentioned, namely: ammonium chloride, ammonium nitrate, magnesium sulfate and sodium thiosulfate do produce endothermic reactions with water and are listed in Science ASSIST's [list of recommended chemicals for use in science in Australian schools](#).

Availability: Ammonium chloride, magnesium sulfate and sodium thiosulfate are available for purchase from any laboratory chemicals supplier.

Purchase (and supply) of ammonium nitrate is subject to state government regulations since this product is identified as a security sensitive commodity. Quantities only up to 3kg are permitted in schools. In some jurisdictions, supply of ammonium nitrate is subject to certain paper work requirements, such as ordering with an End User Declaration (EUD) and/or applying for an exemption. Therefore, this product may only be available through selected suppliers.

Safety Issues: Before handling any chemical, the Safety Data Sheets (SDSs) must be consulted.

Science ASSIST recommends conducting a site-specific risk assessment before undertaking this activity. We have published an ASSIST information sheet [AIS: Risk management and risk assessment](#), which offers an instructional guide on how to carry out and document a risk assessment using the Science ASSIST [risk assessment template](#).

Science ASSIST also recommends that you store and dispose of these chemicals in accordance with the information in the Safety Data Sheet (SDS) from the manufacturer.

Work with minimum possible quantities of chemicals to keep risks and exposure at low levels. Practice good hygiene; always wash hands before eating, using the toilet or/and if smoking. Wash contaminated clothing and other protective equipment before storing or re-using. Following is some brief hazard and safety information on the chemicals discussed. Please refer to individual SDSs for detailed information on each chemical.

- **Ammonium chloride:** Toxic substance. This product is hygroscopic. Keep container tightly closed. Incompatible with oxidising agents such as ammonium nitrate, and **must** be stored away from them.
- **Ammonium nitrate:** Oxidising solid. Causes serious eye irritation. Harmful to aquatic environment. May intensify fires. Store with other oxidising agents away and separate from other groups of chemicals. This product is hygroscopic. Keep container tightly closed.
- **Magnesium sulfate:** Non-hazardous substance according to GHS. Not classified as a dangerous good. Dust may cause minor skin irritation.
- **Sodium thiosulfate:** Non-hazardous substance according to GHS. Not classified as a dangerous good. Can cause mild irritations (skin/eyes/respiratory). Should handle with caution.

It is recommended that the following PPE is worn for all of the above chemicals: wear safety

glasses, laboratory coat and nitrile gloves and ensure that work is always conducted in a well-ventilated area.

Recommended Substitution: Science ASSIST suggests substitution of ammonium nitrate with the less hazardous chemical Urea. This product can be purchased from any laboratory chemical supplier. Please refer to the links below for an example investigation and a current SDS.

Vernier software and technology. 'An Investigation of Urea-Containing Cold Packs, Investigating Chemistry through Inquiry lab manual'
http://www2.vernier.com/sample_labs/CHEM-I-03-cold_packs_open.pdf (Accessed October 2015)

'Safety Data Sheet: Urea'. November 2014, ChemSupply website
<https://www.chemsupply.com.au/documents/UL0011CH7B.pdf>

References:

'Safety Data Sheet: Ammonium chloride'. February 2012. ChemSupply website
<https://www.chemsupply.com.au/documents/AL0491CH0X.pdf>

'Safety Data Sheet: Ammonium nitrate'. 30 April 2014. Merck Millipore website.
http://www.merckmillipore.com/INTERSHOP/web/WFS/Merck-AU-Site/en_US/-/US...

'Safety Data Sheet: Magnesium sulfate'. June 2014, ChemSupply website
<https://www.chemsupply.com.au/documents/ML0481CH44.pdf>

'Safety Data Sheet: Sodium thiosulfate'. August 2014, ChemSupply website
<https://www.chemsupply.com.au/documents/SA0181CH6W.pdf>

Source URL: <https://assist.asta.edu.au/question/3210/chemicals-cold-pack-practical>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemistry

Chemistry

Posted by Anonymous on Mon, 2014-08-11 11:12

Chemistry: When using 0.5 M NaOH is it advised to use gloves with the students in grade 7/8. We have always used goggles, aprons but not in the practice of using gloves.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by ginny.r.ward on question Chemistry

Submitted by sat on 17 August 2014

Science ASSIST considers that, in most cases, the risk with Year 7/8 students using 0.5 M solution of sodium hydroxide without gloves would not be significant, as long as the hazards are mitigated by minimising the volume of solution required, by the use of reliable safe equipment, such as dropper bottles, and as long as good hygiene procedures are followed.•

However, the risk would increase if the behaviour of students is poor, or if the activity involves frequent handling of the solution. • A local risk assessment will determine whether the risks are so significant as to warrant the wearing of gloves. • The following aspects need to be considered:

Classification of the chemical

A survey of safety data sheets for 0.5M sodium hydroxide from a range of suppliers finds that this chemical is usually assigned to Health Hazard Skin corrosion/irritation Category 1B under the Globally Harmonised System for the Classification of Hazardous Chemicals (the GHS).^[1] • The associated hazard statement is • *H314 Causes severe skin burns and eye damage.* • Inclusion in Skin corrosion/irritation Category 1B means that the substance has been shown to cause irreversible damage to skin on exposure to the substance for more than 3 minutes but less than one hour.^[2]

However, this concentration of 0.5M for sodium hydroxide solutions is at the lower end of the range in this hazard category, and some suppliers have classified 0.5M sodium hydroxide solution as Health Hazard Skin irritation (Category 2), the associated hazard statement being • *H315 Causes skin irritation.* • Skin irritation is defined as “the production of reversible damage to the skin following the application of a test substance for up to 4 hours.”^[2]

Assessing the risk

A risk assessment of the use 0.5 M sodium hydroxide by Year 7/8 students should take into account the volume of the solution required for the activity, the amount of handling of the substance which is involved, e.g. the number of times it is transferred from one vessel to another, and how the solution is provided to students e.g. whether it is in dropper bottles. The risk assessment should also consider the anticipated behaviour of the class and the likelihood that students will follow safety procedures.

Students should be instructed to wash their hands immediately after handling the substance, and immediately if they feel a slimy/slippery sensation on their skin, which would indicate exposure to the sodium hydroxide solution, and to wash their hands at the end of the activity.

The risks may be minimised by modifying the activity so that a smaller volume of sodium hydroxide is used, or so that handling of the substance is reduced, e.g. by the teacher dispensing the required volume for the student. • If the activity allows, a lower concentration of sodium hydroxide could be substituted; a 0.2 M solution of sodium hydroxide is classified as Health Hazard Skin irritation Category 2.

Which gloves?

Natural latex gloves as well as nitrile gloves provide excellent protection for the handling of 0.5M sodium hydroxide solution.^[3]

Hazards associated with wearing gloves

The wearing of gloves when handling chemicals can be counterproductive and lead to less careful behaviour, sometimes called ‘risk compensation’. • Students wearing gloves when

handling chemicals have been observed to touch their faces, hair and writing materials, etc. because they feel that their gloves will protect them. • Wearing gloves to protect against chemicals also introduces the potential for allergic reactions to latex or other materials.

Consideration should also be given to the hazards created by disposing of contaminated gloves.

References

[1] Globally Harmonized System of Classification and Labelling of Chemicals (GHS), •Third revised edition, United Nations, 2009,
http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html

[2] Understanding the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), •*A companion guide to the GHS Purple Book*, •June 2010 Edition, United Nations Institute for Training and Research:
http://cwm.unitar.org/publications/publications/cw/ghs/GHS_Companion_Gui... (Broken link replaced April 2018)

[3] Ansell Occupational Health Care, Chemical Resistance Guide, 7th•Edition, 2003,
http://www.ansellpro.com/download/Ansell_7thEditionChemicalResistanceGui...

Source URL: <https://assist.asta.edu.au/question/2412/chemistry>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemistry Experiment

Chemistry Experiment

Posted by Anonymous on Tue, 2016-06-21 16:09

Chemistry Experiment: Is there an organic practical that uses two of reflux, distillation and liquid-liquid extraction that does not require a fume hood? The most common practical is esterification, but as I understand it that needs a fume hood and probably a water bath, and at present I don't have access to either. Or can I do it without those since it is under reflux?

Voting:•



No votes yet

Australian Curriculum:•

Chemical Sciences

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemistry Experiment

Submitted by sat on 22 July 2016

In Brief

The absence of access to a fume cupboard is very challenging for a secondary science facility because this is required for many chemical procedures. It is recommended that activities

involving reflux, distillation and solvent extraction of organic substances **should be conducted under an operating fume cupboard** due to the hazardous nature of the chemical substances.

Making esters

The preparation of esters can be conducted safely on a microscale level in a well-ventilated room without involving reflux and distillation processes. The Royal Society of Chemistry¹ has a procedure for a microscale method which utilizes safer conditions and smaller volumes of reagents, and which enables characterisation by odours, see:

<https://edu.rsc.org/lcredir/learn-chemistry/resource/res00001743/making-esters-from-alcohols-and-acids>

Water baths

When working with flammable liquids, it is essential that there be no naked flames from Bunsen burners. For heating reactions up to 100°C, water baths can be improvised using a suitable container, such as a glass beaker or metal baking pan, placed upon a hotplate. For efficiency, the water can be heated in a kettle before filling the bath, and the heat maintained with the hotplate.

Reflux

Access to a fume cupboard is recommended for the dispensing of the chemicals and for the refluxing procedure. However, when carried out correctly, the refluxing procedure should release minimal vapours into the lab. Care should be taken to ensure that water is flowing through the condenser; a slow continuous flow of water is sufficient. If the mixture is overheated, vapours may escape from the top of the condenser, in which case, the heating temperature should be reduced. Vapours can also escape if the flask and condenser are not fitted together correctly. A small amount of vacuum grease (silicone grease) applied to the ground glass joint will also help to prevent escape of vapours from this joint.

Safer alternative activities

It has been challenging to find suitable and safer alternatives that do not require the use of a fume cupboard. However, we will research suitable activities and highlight these in the future.

We have previously answered similar or related questions that may be helpful as follows:

- [Reflux and distillation](#) for recommended methods for heating.
- [Chemical waste ester prac](#) and [Organic chemistry](#) for proper disposal methods.

Additional information

Chemicals used and produced in esterification

- Concentrated sulfuric acid is extremely corrosive to skin and eyes and should be handled with great care. Measures should be taken to prevent inhalation of the fumes from the concentrated acid. PPE should be worn and the acid handled in an operating fume cupboard or where there is very good ventilation.

- The alcohols that are mostly used for esterification reactions in schools are methanol, ethanol, propan-1-ol, butan-1-ol, pentan-1-ol, octan-1-ol and iso-amyl alcohol. These alcohols are flammable or combustible and should be kept away from all naked flames and sources of ignition. The alcohol vapours can cause dizziness and drowsiness. Methanol is highly toxic if swallowed or inhaled. They can all cause irritation and most can cause serious eye damage. They all have been assigned various categories of acute toxicity, so should all be handled appropriately. Ensure that all people handling them observe good laboratory hygiene and wash their hands before leaving the laboratory.
- Commonly used carboxylic acids are glacial acetic acid and propionic acid. They are highly corrosive to skin and eyes, and toxic by inhalation.
- The esters formed are flammable or combustible. In general, esters can cause irritation to the eyes and respiratory tract, and may cause drowsiness or dizziness.

References

¹'Making esters from alcohols and acids', Royal Society of Chemistry website.
<https://edu.rsc.org/lcredir/learn-chemistry/resource/res00001743/making-esters-from-alcohols-and-acids> (October 2015)

'Acetic acid, Glacial', Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/AL0091CH0J.pdf> (December 2015)

'Amyl alcohol (Iso)', Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/AL0151CH3H.pdf> (February 2014)

'Butan-1-ol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/BA0121CH1H.pdf> (June 2014)

'Ethanol', Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/EA0431CH89.pdf> (October 2015)

'Methanol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/ML0041CH4F.pdf> (July 2011)

'Pentan-1-ol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/PL0491CH4W.pdf> (August 2011)

'Propan-1-ol', Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/AR1161M.pdf> (April 2011)

'Sulphuric acid', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/SA0081CH72.pdf> (April 2013)



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Combustion reaction

Combustion reaction

Posted by Anonymous on Tue, 2015-11-24 12:05

Combustion reaction: Is there any danger in getting students to burn steel wool in the school laboratory? I'm thinking of Year 10 students. I can think of one problem... What surface should they burn it on? Is a wooden heat mat okay? What is the best way to light it? I've seen it done holding the base of a Bunsen burner, angling it towards the wool to ignite it. Is this okay for students to do? I know the wool needs to be fluffed up to allow enough oxygen to circulate within it.

The reason I ask, is that I need an alternative to burning magnesium. Any help would be greatly appreciated.

Voting:•



No votes yet

Australian Curriculum:•

Different types of chemical reactions are used to produce a range of products and can occur at different rates

Year Level:•

10

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Combustion reaction

Submitted by sat on 15 December 2015

In brief:

There are hazards associated with students burning steel wool. • The main danger of this experiment is the high temperatures that are created in the oxidation process, so students should not touch the hot steel wool. Consideration must also be given to the ignition method, as it is difficult to maintain the burning and collection of all of the resulting products, if this is to be a quantitative activity.

Ignition of steel wool

For the steel wool to “burn”, you are correct that it is better if it is fluffed up to allow sufficient oxygen to encourage the continued combustion of the iron into the middle of the sample. This often requires repeated ignition and rotating the ball of steel wool.

Here are a few methods of ignition that have been used.

- Using a gas lighter ~~the~~ type designed for lighting barbeques, not cigarettes. There is no moving of burning steel wool and no risk of the wool sticking to the lighter. The lighter is designed to be handheld, the risk here is of the students using it to ignite other items in the room.
- Holding the iron wool with tongs in a Bunsen burner flame until it ignites, and then transferring the sample to a heatproof surface. This has the danger that the student may “flick” the sample, if they get a surprise when it ignites, the moving of the wool will also most likely lose some of the product in transit.
- Touching the steel wool with a 9 volt battery. The short circuiting of the terminals across the steel wool produces sufficient heat to ignite it. One possible risk here is that the steel wool melts onto the battery terminal.

Science ASSIST does not recommend ignition with a Bunsen burner by lifting and pointing the flame at the steel wool. • Holding the Bunsen burner has its problems and is not the recommended method of use for the Bunsen.

Conducting an on-site risk assessment looking at the options outlined above will determine your preferred method.

Collection of resulting products

We suggest the use of an evaporating basin or tin lid on a non-combustible protective bench mat (e.g., a cement sheet). • It is best to use a coarse-grade steel wool, which will burn with less sparking and has no loss from pieces flying off that may not be included in the final mass after combustion. Ensure that the steel wool is uncoated and does not contain soap.

For this experiment to give meaningful results, it is important that all the resulting material is collected. The evaporating basin or tin lid should be pre-weighed to determine its mass. The steel wool, once fluffed out, is placed in the evaporating basin or on the tin lid and the total mass is noted and the steel wool mass determined. Allow the evaporating basin or tin lid to

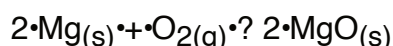
cool before re-weighing to determine the change in mass due to the oxide formation.

Alternatives to using magnesium and steel wool

We have considered other metals, however they are either too hazardous to use in schools or do not burn. See below.

Additional information

Burning magnesium:•In the school science curriculum, magnesium metal is commonly used to demonstrate combustion of metals. Combustion is the reaction of substances with oxygen/air, producing heat and light. • Magnesium is the relatively safer option out of the ignitable metals. The ability of magnesium to combust fully in air to form MgO helps to extend the activity to a quantifiable investigation. ••••••••••

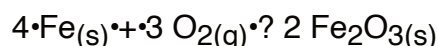


Burning steel wool:•Steel wool is used as an alternative metal for demonstrating a combustion reaction in many published practical activities. However, being a less reactive metal compared to magnesium, steel/iron wool has its limitations. The main difficulty is in maintaining the burning and ensuring that all of the iron has been oxidised.

Below are two sample results, the change in mass is not large so a larger sample piece may give a more measurable change. These results give a return of about 75% yield.

	Test 1	Test 2
Mass of steel wool	1.319g	3.032g
Mass of steel wool/oxide produced	1.415g	3.245g
Change in mass	0.096g	0.213g

When ignited, steel wool will burn in air, allowing students to observe the formation of rust.



However, the combustion of steel wool in air will be incomplete and therefore if the aim is to attempt to determine the empirical formula, it would not be totally satisfactory. Burning iron will most likely form some Fe₃O₄, which is a combination of Fe₂O₃ and FeO.

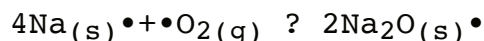
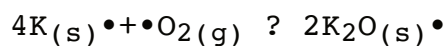
For complete combustion, placing glowing steel wool into an atmosphere of pure oxygen is effective (see video links below). •**This procedure is not recommended as a student activity.**

Combustion reactions of other metals

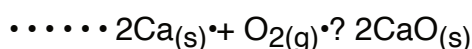
Here are some reactions of other metals with oxygen, **It is not advised to perform these in your school, but search for examples on the internet to show them, if required.**

Different metals react with air at very different intensities, and varying conditions are required for the reaction to occur.

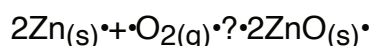
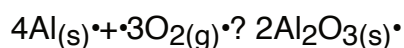
- **Potassium and sodium** are reactive metals and are ignited by gentle heating and burn vigorously in air with a characteristic flame to form metal oxides by combining with oxygen.



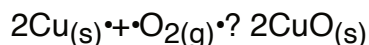
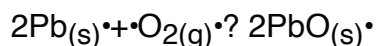
- **Calcium** metal needs strong heating to ignite. It burns vigorously to form its oxide.



- **Aluminium and zinc** burn moderately under strong heating. They cannot be ignited to hold a flame; form oxides.



- **Copper and lead** metals do not burn. They will glow under very strong heating and form oxides.



- **Silver and gold** have no reaction with air.

References

‘Combustion of metals’ University College, Cork website,

<https://web.archive.org/web/20170205133306/https://www.ucc.ie/academic/c...> (Original page no longer exists, this copy made available through the Internet Archives Wayback Machine, November 2017)

‘Combustion of Steel Wool’, Department of Chemistry, University of Washington website

<https://chem.washington.edu/facilserv/lecturedemo/CombustionofSteelWool-UWDept.ofChemistry.html> (Accessed December 2015)

‘Empirical Formula of Iron Oxide’, Science Curriculum by Aaron Keller, Scarborough High School Maine

<http://kaffee.50webs.com/Science/labs/Chem/Lab-Empirical.Formula.Fe2O3.html> (October

2015) Instructions for the determination of the empirical formula of iron oxide
(Hazardous/fiddly. Might be best as a demonstration)

'Iron and oxygen', ChemDemos website, <https://chemdemos.uoregon.edu/demos/Iron-and-Oxygen> (Accessed December 2015) Instructions for burning steel wool in oxygen atmosphere.

Mak, Dr. Kendrew, (n.d) • *Reactions of metals*, • Department of Chemistry, The Chinese University of Hong Kong website,

•
http://resources.edb.gov.hk/gifted/ijso/HKIJSO_TrainingManual/Phase3/Chemistry/Lesson5_ReactionO
• (Accessed December 2015)

'Microscale Gas Chemistry: Experiments with Oxygen', Bruce Mattson's Home Page, Creighton University, <http://mattson.creighton.edu/O2/> (Accessed December 2015)
Instructions for the small scale demonstration of steel wool burning in oxygen atmosphere.

Sconzo, Penney, 2011. • *The Burning Question: A Conversation of Matter Experiment*, • Adam Equipment website,
• http://www.adamequipment.com/education/Documents/experiment_3_R2.pdf

'Steel Wool', YouTube (1:04 min) <https://www.youtube.com/watch?v=bo2Ygyh21KM> (August 2012) (Video clip demonstrating reaction of steel wool in liquid oxygen)

'Steel wool in an oxygen-rich environment –Dazzling demonstrations', YouTube (1:02 min) https://www.youtube.com/watch?v=F_1o0s4G9qA (May 2013)

Source URL: <https://assist.asta.edu.au/question/3384/combustion-reaction>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Determining empirical formula

Determining empirical formula

Posted by Anonymous on Mon, 2014-10-20 18:38

Determining empirical formula: Is it safe to heat copper sulfate powder as an alternative to Barium chloride to determine empirical formula? CLEAPSS tells me not to heat to dryness as decomposition produces toxic and corrosive fumes. What are they? Is it still ok to heat Barium chloride?

Voting:•



No votes yet

Australian Curriculum:•

Chemical Sciences

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by delese on question Determining empirical formula

Submitted by sat on 24 October 2014

While the heating of hydrated copper sulphate is a useful activity to demonstrate a chemical change, along with a colour change, it is not recommended as a method for determining an empirical formula. This is because of the difficulty in removing all of the water of crystallisation by heating, without also decomposing some of the copper sulphate. The use of hydrated barium chloride is preferred, as it will not decompose under laboratory heating conditions. See below for further details and alternative reagents suited to empirical determination experiments.

Dehydration of copper sulphate pentahydrate When copper sulphate pentahydrate is heated, the loss of water of crystallisation proceeds in a stepwise manner. From 30 to 110°C, copper sulphate pentahydrate loses two molecules of water to give the trihydrate, followed by the loss of two more water molecules to give the pale blue monohydrate. Further heating above 150°C gives white anhydrous copper sulphate.

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s}) \rightarrow \text{CuSO}_4 \cdot 3\text{H}_2\text{O}(\text{s}) + 2\text{H}_2\text{O}(\text{g})$
 $\text{CuSO}_4 \cdot 3\text{H}_2\text{O}(\text{s}) \rightarrow \text{CuSO}_4 \cdot \text{H}_2\text{O}(\text{s}) + 2\text{H}_2\text{O}(\text{g})$
 $\text{CuSO}_4 \cdot \text{H}_2\text{O}(\text{s}) \rightarrow \text{CuSO}_4(\text{s}) + \text{H}_2\text{O}(\text{g})$
Decomposition of copper sulphate occurs at about 650°C. The products of decomposition are black copper (II) oxide and sulphur trioxide: $\text{CuSO}_4(\text{s}) \rightarrow \text{CuO}(\text{s}) + \text{SO}_3(\text{g})$ Sulphur trioxide is a highly corrosive substance, which is irritating to the respiratory system. Sulphur trioxide combines with water to form sulphuric acid. The dehydration of copper sulphate pentahydrate would be safely carried out if the salt is heated in an oven. However, when heating is carried out over a Bunsen flame, it is not difficult to decompose at least some of the sample. The dehydration of copper sulphate pentahydrate is more suited to a qualitative demonstration of a reversible reaction, where complete dehydration of the salt is not required.

Dehydration of barium chloride dihydrate Barium chloride dihydrate loses its water of crystallisation when heated to 120°C. Its melting point is greater than 900°C and it therefore can withstand heating over a Bunsen flame. It is, however, more toxic than copper sulphate and its dehydration does not result in a colour change. **Dehydration of copper chloride dihydrate** Klingshirn *et al.* (2008) report a 'greener alternative' experiment for the determination of an empirical formula. Their method uses copper chloride dihydrate which loses its water of crystallisation at 110°C. Klingshirn *et al.* recommend dehydrating the salt in an oven, although the careful use of a hot plate on a low setting would also be appropriate. According to their method, the salt is placed in a crucible which is placed in an oven, with the crucible lid slightly ajar to allow water vapour to escape. The salt is heated for 30 minutes, removed from the oven, allowed to cool, weighed, and then heated for a further ten minutes. It is then removed from the oven, allowed to cool and reweighed to check that there is no further reduction in mass. The stoichiometry of the hydrated salt is then calculated. The anhydrous salt can be rehydrated if left exposed to air overnight. However, the authors (Klingshirn *et al.* 2008), recommend that students carry out a steam rehydration of the copper chloride during lesson time as it adds a valuable and enjoyable aspect to the experiment. Steam rehydration can be achieved by placing the copper chloride on a piece of filter paper on a gauze mat which is supported by a ring and ring stand over a steam bath. This reagent offers the advantage of a dramatic colour change from the blue of the copper chloride dihydrate to the light brown colour of the anhydrate. The experiment also does not generate waste as the copper chloride dihydrate can be re-used.

Oxidation of magnesium to magnesium oxide The formation and reduction of metal oxides can also be employed in experiments to determine empirical formulae. Magnesium oxide can be generated from magnesium ribbon by heating the magnesium in a crucible over a Bunsen flame. The crucible is placed in a pipe clay triangle (with the lid slightly off-centre in order to

expose the metal to air) and is heated until the contents turn grey-white, indicating the transformation of the magnesium to the oxide. The empirical formula of magnesium oxide is then calculated from the difference in the initial mass of the magnesium and that of the magnesium oxide produced. Comprehensive instructions for determining the empirical formula of magnesium oxide in this way can be found at http://www.webassign.net/question_assets/ucscgenchem11/lab_2/manual.html Other empirical formula determinations can be made by observing the reduction of copper oxide with natural gas (Zidick and Weismann, 1973) or methane (Sanger and Geer, 2002). Sanger and Geer (2002) also report an interesting method for the reduction of copper oxide with aluminium foil in hydrochloric acid. **References** Klingshirn, M.A.; Wyatt, A. F.; Hanson, R.M.; Spessard, G. O. *J. Chem. Educ.* **2008**, *85*, p 819. Zidick, C.; Weismann, T. *J. Chem. Educ.* **1973**, *50*, p 717. Sanger, M. J.; Geer, K. *J. Chem. Educ.* **2002**, *79*, p 994. Wiberg, Egon; Wiber, Nils; Holleman, Arnold Frederick, *Inorganic chemistry*, Academic Press., **2001**, p 1263. http://www.webelements.com/compounds/barium/barium_dichloride_dihydrate.html Accessed October 2014. R.C. Weast, (ed.) in *Chemical Rubber Company Handbook of Chemistry and Physics*, CRC Press, Boca Raton, Florida, USA, 60th edition, **1979**. http://www.webassign.net/question_assets/ucscgenchem11/lab_2/manual.html

Source URL: <https://assist.asta.edu.au/question/2511/determining-empirical-formula>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Effect of catalyst and surface area on reaction rate

Effect of catalyst and surface area on reaction rate

Posted by Anonymous on Fri, 2016-09-23 09:27

Effect of catalyst and surface area on reaction rate: One of my teachers is doing the above mentioned prac for Yr 11 Chemistry. She has asked for saturated Oxalic acid solution. We don't have this so can you please let me know what else she can use instead. The prac can be found in Prelim Course CD Work Sheet 14 Module 4.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Effect of catalyst and surface area on reaction rate

Submitted by sat on 03 October 2016

In Brief

The reaction between acidified potassium permanganate and oxalic acid is a common redox reaction used to explain the effect of catalyst on the rate of reaction. During the reaction autocatalysis occurs and the purple pink potassium permanganate solution (MnO_4^-) is reduced to a colourless solution of manganese ions (Mn^{2+}). The catalyst used for this reaction

is usually a saturated solution or a few crystals of manganese (II) sulfate.

There are a number of substitutes for oxalic acid:

- **Rhubarb** contains oxalic acid. Fresh or frozen rhubarb sticks can be used with acidified potassium permanganate to explain both effect of catalysis and surface area on the rate of reaction. Here is a link to a method using rhubarb: [Rates and rhubarb](#)
- Many other vegetables contain oxalic acid, see: [Oxalic Acid Content of Selected Vegetables](#)
- **Glucose**: an aqueous solution of glucose can be used as reducing agent. Glucose will reduce the acidified potassium permanganate solution and the colour will change from purple pink to colourless. Here is a link to an activity using glucose: [Estimating glucose concentration in solution](#).
- You may need to trial the concentration of the oxalic acid substitute required to be used in your activity.

Science ASSIST recommendations:

- A site-specific risk assessment should be conducted
- Suitable PPE such as laboratory coat, closed in shoes and safety glasses should be worn at all times

Safety notes:

- Sulfuric acid is corrosive; causes severe skin burns and eye damages.
- Oxalic acid is corrosive and toxic, harmful in contact with skin and if swallowed. Can cause serious eye damage as well.

Note: Potassium permanganate solution is harmful to aquatic life with long lasting effects. For potassium permanganate disposal, see previously answered questions

Can Potassium Permanganate waste be neutralised? and potassium permanganate

Additional Information

Aqueous solutions of both oxalic acid and glucose can reduce aqueous potassium permanganate solution in the presence of sulfuric acid.

The chemical equation for the reaction between oxalic acid and potassium permanganate is:



Rhubarb leaves are poisonous due to high concentration of oxalic acid and the possibility of anthraquinone glycosides. Rhubarb poisoning occurs when someone consumes the leaves from a rhubarb plant.

References

'Autocatalysis', Science daily website, <https://www.sciencedaily.com/terms/autocatalysis.htm> (Accessed October 2016)

'Estimating glucose concentration in solution', Science and Plants for Schools website, <http://www.saps.org.uk/attachments/article/103/SAPS%20-%20Estimating%20glucose%20concentration%20in%20solution%20-%20Scottish%20Highers.pdf> (Accessed October 2016)

'Oxalic Acid Content of Selected Vegetables', United States Department of Agriculture website, <https://web.archive.org/web/20170206160415/https://www.ars.usda.gov/nort...> (The original page no longer exists, this copy provided by the Internet Archives Wayback Machine, March 2018).

'Oxalic acid, Safety Data sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/OA0071CH4U.pdf> (March 2015)

'Potassium permanganate', Safety Data sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/PL0031CH5L.pdf> (August 2016)

'Rates and rhubarb', Royal Society for Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000745/rates-and-rhubarb?cmpid=CMP00005903> (2016)

'Rhubarb leaves poisoning', U.S. National Library of Medicine website, <https://medlineplus.gov/ency/article/002876.htm> (Accessed October 2016)

'Sulphuric acid', Safety Data sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/SA0081CH72.pdf> (April 2013)

Source URL: <https://assist.asta.edu.au/question/4089/effect-catalyst-and-surface-area-reaction-rate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Flame testing

Flame testing

Posted by Anonymous on Mon, 2016-04-18 09:39

Flame testing: What would be considered safer for Year 8 students attempting flame testing of chemicals? Using a small quantity of solid chemical in a flame on a metal loop, or a chemical solution sprayed into the flame? Or would this be better carried out as a teacher demonstration?

Voting:•



Average: 5 (1 vote)

Australian Curriculum:•

Differences between elements, compounds and mixtures can be described at a particle level

Year Level:•

8

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Flame testing

Submitted by sat on 02 May 2016

Answer edited 26/07/2016 to include link to the recently developed SOP: [SOP: Demonstrating the flame test using a PET bottle and video presentation.](#)

In brief

There are a number of different methods that could be used to show the colours of various cations, each having its own risks. These risks include handling hazardous chemicals or chemical solutions. The various cations that can be observed include: lithium, calcium, sodium, barium, copper and potassium, usually in the form of their chloride salts. Some of these are classified as having significant health hazards or acute toxicity, so careful handling is required. Methods that generate significant, uncontained levels of aerosols in the laboratory are not recommended, and in particular, we do not recommend the spraying of the solution into the flame for student activities. **We advise against methods using flammable liquids.**¹

Any method employed requires a site-specific “risk assessment” to be performed. This should take into account the skills and behaviour of the students, as well as the learning outcome, to decide which method is considered most appropriate and whether to conduct the flame test as a teacher demonstration or a student activity.

If this activity is to engage the interest of students, then we suggest that a teacher demonstration may be the most appropriate approach for this activity for Year 8 students, with a student activity perhaps better suited for more meaningful curriculum applications in later years.

Different methods

Below are some methods that could be considered; they are listed in order, with the first being the preferred method, due to containment of the chemicals used. It is suggested that the different chemicals are set up in different stations around the classroom for methods 1–3, to minimise the opportunity for cross-contamination.

1. Flame test using PET bottle method.

Science ASSIST has developed an SOP and an accompanying video demonstration which describes this method, see [SOP: Demonstrating the flame test using a PET bottle and video presentation](#). In brief, a Bunsen burner is fitted into the neck of a 2 L soft drink bottle with a hole for the Bunsen tubing and another hole for a garden spray bottle, which contains the aqueous test solution (~0.5–1.0 M). A fine mist is sprayed from the spray bottle into the air intake of the Bunsen burner. The colour of the flame changes to the characteristic colour of the cation in the spray bottle.

The advantage of this method is that the majority of the sprayed cation solution (many of which contain 'heavy metals') is contained within the experimental setup, minimising the spread and inhalation of aerosols in the laboratory environment. It also provides for the containment and collection of any overspray, which can be collected and reused. It also produces a longer-lasting colour in the flame for observation with the naked eye or with a spectroscope.

2. Flame test using wooden paddle-pop sticks/toothpicks (or similar)

- a. Wooden paddle-pop sticks or toothpicks are soaked in distilled or deionised water

overnight. The following day, a stick is removed and dipped into the solid chemical to be tested. It is then passed through a blue Bunsen flame allowing the solid to burn and produce a colour change in the flame. A different stick is used for each chemical.

- b. Wooden paddle-pop sticks or toothpicks are soaked overnight to a depth of about 1 cm of the stick in a concentrated (1–2 M) aqueous solution of the cation to be tested. The following day, the sticks are removed and passed through a blue Bunsen flame and the flame colour observed.

Disadvantages of these methods.

- The production of only a brief flash of colour, which may be missed by inexperienced students and cannot be observed with a spectroscope.
- The possibility that the stick may ignite and interfere with the flame colour.
- The solid chemical, when heated, may spit over the bench and students.
- Aerosols produced from the cation solutions are not contained and may be spread throughout the laboratory.
- The possibility that some students may handle sticks soaked with chemical with bare hands.

3. Flame test using a wire loop method

An inoculating loop made from either platinum or nichrome wire is generally used. The metal loop is first cleaned by dipping into either concentrated or high molarity HCl followed by rinsing in deionised water. The cleaned loop is then dipped either into the solid chemical or a solution of the chemical to be tested and then passed through the blue flame of a Bunsen burner. The flame colour is observed.

Disadvantages of this method

- Nichrome wire will always produce a trace of orange/yellow colour in the Bunsen flame, regardless of how well it is cleaned, which can mask the colour of the cation used.
- Platinum wire is much better than nichrome wire but is very expensive.
- The production of only a brief flash of colour, which may be missed by inexperienced students and cannot be observed with a spectroscope.
- Solid chemical may spit over the bench and students when heated.
- Aerosols produced from the cation solutions are not contained and would spread throughout the laboratory.
- It is not recommended for Year 8 students to use concentrated HCl to clean the wire loops. As concentrated HCl produces the best cleaning result, cleaning should be carried out by the technician at the beginning and end of the activity.

4. Flame test spraying directly into a Bunsen flame with a spray bottle

A fine mist of the test chemical in an aqueous solution is sprayed directly into a blue Bunsen flame from a spray bottle and any colour change observed. **This is the least recommended method and should only be conducted as a teacher demonstration.**

Disadvantages of this method.

- No control over where the spray will go.
- Aerosols produced from the cation solutions are not contained and would be spread throughout the laboratory. Whilst this could be performed in a fume cabinet, there would still be an overspray that requires a thorough clean-up.
- The production of only a brief flash of colour, which may be missed by inexperienced students and cannot be observed with a spectroscope.

References

¹ 'Safety Alert Rainbow Demonstration' American Chemical Society website.
<https://institute.acs.org/lab-safety/education-and-training/safer-experiments/flame-test.html>
 (Accessed April 2016)

'Barium chloride' Safety Data Sheet. Chem Supply website,
<https://www.chemsupply.com.au/documents/BL0271CH19.pdf> (February 2014)

'Calcium chloride' Safety Data Sheet. Please search the product information page on the Chem Supply website for the latest version: <https://www.chemsupply.com.au>•

'Copper (II) chloride' Safety Data Sheet. Chem Supply website,
<https://www.chemsupply.com.au/documents/CL0041CH28.pdf> (August 2013)

'Lithium chloride' Safety Data Sheet. Chem Supply website,
<https://www.chemsupply.com.au/documents/LL0361CH3S.pdf> (August 2015)

'Potassium chloride' Safety Data Sheet. Chem Supply website,
<https://www.chemsupply.com.au/documents/PL0541CH58.pdf> (November 2015)

'Sodium chloride' Safety Data Sheet. Chem Supply website,
<https://www.chemsupply.com.au/documents/SL0461CH69.pdf> (May 2013)

Flame testing

Submitted by on 26 July 2016

Dear Teresa, Thanks for the answer to the question. The answer will be definitely helpful to lot of users as it is very common experiment in chemistry. Can you please provide the link to the Science ASSIST SOP for the same in the answer if ready and available for use? Thanks With regards Nehal Trivedi

Source URL: <https://assist.asta.edu.au/question/3752/flame-testing>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Formation of crystals

Formation of crystals

Posted by Anonymous on Mon, 2015-08-03 09:16

Formation of crystals: Hi. Is copper sulfate recommended for crystal making in high schools+ thought that it was no longer permissible to heat copper sulfate in school laboratories. I have suggested that potassium aluminum sulfate is a safer and cheaper alternative.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Formation of crystals

Submitted by sat on 12 August 2015

Both chemicals are considered safe to use with students from Years 7-12 ⁽¹⁾ if proper controls are put into place to deal with the hazards. Students should wear safety glasses and avoid contacting the materials with the skin. Hands should be washed immediately after completing

the activity and students should not be allowed to take the crystals home. It is recommended that any crystals formed are recycled for future use.

There are many substances that can be used to grow crystals in school science labs. Common examples include copper (II) sulfate and aluminium potassium sulfate (potash or common alum). However, sugar and salt could also be used. A comparison of copper (II) sulfate and aluminium potassium sulfate shows the following:

	copper (II) sulfate	aluminium potassium sulfate
Signal word	Warning	Warning
Pictogram Hazard	Health hazards Environmental	Health hazards
Hazard phrases	Harmful if swallowed Causes skin irritation Causes serious eye irritation Very toxic to aquatic life Very toxic to aquatic life with long lasting effects	Harmful if swallowed Causes skin irritation Causes serious eye irritation May cause respiratory irritation Repeated exposure may cause skin dryness and cracking
ADG	9	NA
Poisons schedule	S6	NA

Both have identified hazards, however aluminium potassium sulfate is less hazardous to the environment than copper (II) sulfate and is not a scheduled poison.

Copper (II) sulfate is commonly used as a fungicide, herbicide, and pesticide. It will produce striking, blue, diamond-shaped crystals in the laboratory.

The heating of copper (II) sulfate, is relatively safe to do if it is in a solution form. More hazards arise when the solid chemical is heated. If copper (II) sulfate is heated to decomposition (above ~250 °C), then there are irritating copper oxide fumes and the corrosive gaseous sulfur trioxide is produced. The temperatures involved in crystal making are less than 100 °C, nowhere near hot enough to cause decomposition.

Nevertheless, the heat from a Bunsen burner is in excess of that required for crystal making

and rapid evaporation from copper (II) sulfate solutions can result in hazardous fumes. Therefore, we recommend using hotplates or water baths where possible for these activities to prevent the heating of the salt solutions to boiling point. We also recommend that the work area is well-ventilated.

Aluminium potassium sulfate (potash or common alum) is found in industrial, medicinal, cosmetic and food products and is widely used as a preservative in food processing. It can produce large clear crystals in the laboratory.

The solubility of aluminium potassium sulfate increases significantly with temperature. At 25 °C, the solubility is about 14g/100mL, whereas at 100 °C, this increases to about 160g/100mL. Therefore, 100 mL of hot, saturated solution may cool to give an excess of over 140g of alum, which would be unlikely to precipitate as large, well-formed crystals.

Note: The purchase of some technical grade chemicals e.g. copper (II) sulfate may be an issue as some contain impurities, which will need to be filtered when recycling for reuse.

Background information

Using chemicals to grow crystals is a common activity in school science laboratories. Crystals are solids that form when molecules join together in a regular repeating pattern. You can easily grow crystals by adding a crystal-forming chemical to hot water to form a saturated solution and wait for the water to cool or evaporate.

The following are some different crystal-growing activities.

- i. Based on the solubility characteristics of the salt (available from a chemical data book), specify the amount of a solid for students to dissolve, the volume of water to use and the temperature to which the water should be heated (i.e., less than 100 °C)
- ii. Provide the class with a saturated solution to which students add a specified amount of the solid and heat until it is dissolved. For example, the dissolution of 2-3 teaspoons of alum in 40-50 mL of a saturated alum solution will, with good technique, give a single crystal of alum.
- iii. Provide the class with a saturated solution in which a seed crystal will grow with the slow evaporation of the water (see <https://spark.iop.org/growing-crystal-alum-or-copper-sulfate> **Link Updated September 2021**).
- iv. Instruct students to dissolve as much solid as possible in a known volume of hot water. This method is commonly suggested, however, it does not produce good results for all salts. Depending on the salt, it can lead to a much-too-concentrated solution that will not produce very nice crystals, such as with alum. However, it may work well for some salts where there is not such a large variation in their solubility versus temperature, such as sodium chloride or copper (II) sulfate. The following links also provide good information on crystal growing.

<https://www.raci.org.au//document/item/1862>

http://www.iucr.org/_data/assets/pdf_file/0005/15863/20_US.pdf

Science ASSIST recommends a risk assessment be conducted prior to the use of any

chemicals, and all appropriate control measures be identified and implemented. Science ASSIST has developed a one-page risk assessment template, see [Risk Assessment Template](#)

References:

(1) 'Recommended list of chemicals for science in Australian schools' Science ASSIST website. </resource/3052/list-recommended-chemicals-science-australian-schools>

'Safety Data Sheet: Copper (II) sulfate', January 2013 Chemwatch.

'Safety Data Sheet: Aluminium potassium sulfate' March 2014, Chemwatch.

Formation of crystals

Submitted by on 05 August 2015

It is toxic to heat the solid copper sulfate, however for crystallisation we gently heat the saturated solution then add another spatula of solid (teacher can do this part), then pour an amount into a small glass petri dish (preferably an old one with plenty of scratches - site of crystallisation) This method gives some pretty impressive large crystals. if you don't want to heat at all pour a small amount of saturated copper sulfate into a glass petri dish and seed with a tiny amount of solid or previously made crystals.

Source URL: <https://assist.asta.edu.au/question/3053/formation-crystals>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Fuels

Fuels

Posted by Anonymous on Tue, 2015-09-08 13:08

Fuels: I have been asked to provide diesel, kerosene, methanol and ethanol to be used in spirit burners for an evaluation on different fuels. Is it safe to do so? I am particularly concerned about the diesel.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Fuels

Submitted by sat on 17 September 2015

The short answer is yes, under controlled circumstances this practical activity is safe to conduct, however we do not recommend the use of diesel. In addition we recommend limiting the number of methanol and kerosene burners to one per class. It is important to perform a risk assessment, considering the equipment used i.e. the spirit burner as well as the fuels used.

Spirit Burners:

There are some important safety aspects to be considered when using spirit burners. There is a potential, if good practices are not observed, that the flame may travel back into the burner and/or an explosive air-fuel mixture may be generated.

Here are some safety instructions for the use of spirit burners:

- Observe standard laboratory safety practice such as long hair tied back and wearing safety glasses
- Check that the burner is a well-constructed clear glass vessel so that the level of the fuel can be seen
- **Ensure that the wick fits tightly in the neck of the wick holder and that the wick holder fits firmly in the burner.** If the wick is loose or the holder is not fitting firmly, there is the possibility that the flame may burn back into the bottle.
- Label the spirit burner with the fuel that will be used
- Fill the burner using a funnel, to avoid spills and do this in an operating fume cupboard with no sources of ignition. Students should **not** refill the burners.
- Wipe any excess fuel from the outside of the burner.
- **Burners should be filled to more than half full.** Keeping the volume of fuel in the bottle above 50% will help to avoid an explosive air fuel mixture in the bottle. To avoid having to use a larger volume of the fuel to maintain the less than 50% air ratio, an inert object like some glass beads or marbles could be added to the flask.
- Spirit burners should be upright when lighting and not be moved when alight
- **They should be used in a well ventilated room**
- At the conclusion of the activity, empty the unused fuel into a labelled screw capped storage bottle and allow any residue in the spirit burner to evaporate in an operating fume cupboard.
- Do not store the spirit burners with fuel in them because they do not provide a vapour tight seal
- Do not have the stock bottles of fuels in the classroom during the activity

Fuels:

The next consideration is the flammability of the fuels. Methanol, ethanol and kerosene are all classed as flammable liquids, while diesel is classified as combustible. Vapours from flammable liquids can form explosive mixtures with air. These vapours can also travel to a source of ignition and flash back to its point of generation. The lower the flashpoint the more easily these liquids can be ignited.

The flashpoint of the fuel is the temperature at which sufficient vapour is produced to maintain a flame.¹ The flash point for methanol is 12°C; methylated spirits 13°C; ethanol is 13°C, kerosene about 38°C, while for diesel it is about 56 °C. Kerosene and diesel are both products of crude oil generally separated by fractional distillation, hence not being pure substances an exact flash point cannot be given. Kerosene generally consists of carbon chains of 12 to 15 carbon atoms while diesel is in the next range being 16 to 19 carbon atoms.

Methanol: Highly flammable and toxic alcohol. It is toxic by inhalation, as well as ingestion

and via the skin, so MUST be dispensed using an operating fume cupboard and wearing relevant PPE such as safety glasses, laboratory coat, gloves and closed in shoes. This is the most volatile out of all these fuels. Explosions have been reported using this fuel in spirit burners, but this appears to be when the above safety measures have not been observed.²

Ethanol: Highly flammable alcohol.

Methylated spirits: Highly flammable, this is generally about 95% ethanol and commonly used in camping spirit burners. This is a good suggestion for evaluating a fuel source. Note: some manufacturers include methanol in the composition of this fuel.

Kerosene: A well-established heating and lighting fuel, kerosene is usually coloured blue and has a distinctive smell. Combustion produces a complex mixture of gases, such as carbon dioxide and carbon monoxide, water, airborne solids and organic compounds.

The above fuels would be suitable for this activity, however it **must be conducted in a well ventilated room, following all the above mentioned safety instructions for using spirit burners. In addition we recommend limiting the number of methanol and kerosene burners to one per class.**

Diesel: Due to the flash point of diesel being so high, it may not ignite under normal room conditions where the temperature is around 20°C, so it may not work well anyway. Combustion of diesel also produces a complex mixture of products such as ?toxic ?and/or ?irritating ?fumes,? ?smoke ?and ?gases ? including ?carbon ?monoxide,? ?carbon ?dioxide ?and ?oxides ?of ? nitrogen as well as organic compounds, including benzene-derivatives and polycyclic aromatic hydrocarbons.? It is worth noting that in 2012 the International Agency for Research on Cancer reclassified diesel engine exhaust as carcinogenic to humans (Group 1).

Whilst burning diesel may not be identical to the emission from diesel motors, there is sufficient concern to recommend that diesel is not used in this science activity. In addition the safety data sheet states that it is intended for use only in a closed system. Therefore Science ASSIST does not recommend the use of diesel in this activity.

References:

¹ 'Flammable & Combustible Liquids –Hazards'. Canadian Centre for Occupational Health and Safety website. <http://www.ccohs.ca/oshanswers/chemicals/flammable/flam.html> (Accessed 16/09/2015)

² CLEAPSS. 2006. *L195 Safer chemicals, safer reactions*. CLEAPSS. Uxbridge UK.

CLEAPSS. 2006. *L195 Safer chemicals, safer reactions*. CLEAPSS. Uxbridge UK.

'Flammable & Combustible Liquids –Hazards'. Canadian Centre for Occupational Health and Safety website. <http://www.ccohs.ca/oshanswers/chemicals/flammable/flam.html> (Accessed 16/09/2015)

'Kerosene' Encyclopaedia Britannica website. <https://www.britannica.com/science/kerosene>

(Accessed 16/09/2015)

'Measuring heat energy of fuels'. Nuffield Foundation website.

<http://www.rsc.org/education/teachers/Resources/aflchem/resources/64/64%...> (Accessed 25/7/2016).

'Safety Data Sheet: Ethanol' October 2010. Chem Supply.

<https://www.chemsupply.com.au/documents/EL0431CH89.pdf>

'Safety Data Sheet: Kerosene' December 2011. Recochem.

http://www.recochem.com.au/files/downloads/Kerosene_Blue_Nov11.pdf

'Safety Data Sheet: Methylated spirit' June 2011. Chem Supply.

<https://www.chemsupply.com.au/documents/MT0071CH88.pdf>

'Safety Data Sheet: Methylated spirit' February 2017. Recochem.

http://www.recochem.com.au/files/downloads/Methylated_Spirits_v9.pdf (Link Updated November 2021)

'Safety Data Sheet: Methanol' July 2011. Chem Supply.

<https://www.chemsupply.com.au/documents/ML0041CH4F.pdf>

'Safety Data Sheet: Shell diesel' April 2015. Viva Energy Australia.

<http://www.csinfosafe.com/vivaenergy/>

Workplace Health and Safety Queensland. 2012. '*A guide for flammable and combustible liquids*' Queensland Government. (Original resource no longer available, the following is made available by the Internet Archive's Wayback Machine.)

<https://web.archive.org/web/20170702154050/https://www.worksafe.qld.gov....>

Source URL: <https://assist.asta.edu.au/question/3155/fuels>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > HCl + NH₄OH Reaction

HCl + NH₄OH Reaction

Posted by Anonymous on Fri, 2016-08-26 08:53

HCl + NH₄OH Reaction: Hi, could you please advise me about a demo of HCl and NH₄OH fumes mixing? Is it safe enough to put 30 ml (or less?) of each into separate petri dishes in the fume hood? Can the fume hood be turned off for 10 seconds for better visibility of the NH₄Cl and then turned back on again?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

HCl + NH₄OH Reaction

Submitted by sat on 31 August 2016

We understand that you are trying to demonstrate the diffusion of the two gases, which react when they come together to form solid ammonium chloride. The concentrated solutions of HCl and NH₄OH are both corrosive and should be handled in an operating fume cupboard.

Many models of fume cupboards have a purge system that keeps the fan running after it has been switched off to allow any residual hazardous vapours/fumes in the cupboard to be

removed. Therefore, it may not be possible to turn off the fume cupboard for 10 seconds. In addition, we are not sure for your procedure whether 10 seconds would be sufficient time to see the reaction, even if you were able to turn off the fan in the fume cupboard.

Alternate method: We recommend an alternative way of demonstrating this reaction see: <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000682/diffusion-of-gases-ammonia-and-hydrogen-chloride?cmpid=CMP00005016>

The concentrated corrosive solutions will still need to be handled wearing appropriate PPE (lab coat, closed-in shoes, safety glasses and nitrile gloves) and in an operating fume cupboard, but due to the reaction being contained in a closed vessel, it can be taken out of the fume cupboard to show students. Another benefit is that smaller quantities of the concentrated solutions can be used. Cleaning up should be conducted in the fume cupboard: the cotton buds/balls can be placed in a beaker of water to dilute the reagents before disposal and the tube can also be rinsed using water.

Reference:

'Diffusion of gases - ammonia and hydrogen chloride', Royal Society of Chemistry website. <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000682/diffusion-of-gases-ammonia-and-hydrogen-chloride?cmpid=CMP00005016>. October 2015.

Source URL: <https://assist.asta.edu.au/question/4037/hcl-nh4oh-reaction>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Lightning in a test tube

Lightning in a test tube

Posted by Anonymous on Thu, 2015-08-20 15:08

Lightning in a test tube: I have a teacher who is planning on performing the 'lightning in a test tube' demonstration in the school lecture theatre. The experiment involves layering ethanol on top of sulfuric acid in a test tube and then dropping some potassium permanganate crystals into the sulfuric acid. I would prefer it to be performed in a fume cupboard.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Lightning in a test tube

Submitted by sat on 25 August 2015

Science ASSIST strongly advises against this demonstration being performed in a school. The risks are too high and the demonstration is not able to be adequately controlled.

Each of the chemicals involved in this activity has its own particular significant hazards.

- Ethanol: flammable liquid
- Sulfuric acid: corrosive acid
- Potassium permanganate: oxidising agent

Sulfuric acid reacts with potassium permanganate to form manganese (VII) oxide (Mn_2O_7) [also called manganese heptoxide], which is explosive and reacts violently with the ethanol. Significant risks of explosion or fires or both are foreseeable and cannot be controlled, so the risk assessment would conclude that **the risks of the demonstration are significant and cannot be adequately controlled** at the moment and **therefore should not be conducted**.

An alternative method for demonstrating this reaction in a controlled way can be found on the Royal Society of Chemistry Education in Chemistry website: <https://edu.rsc.org/eic> and search for 'Balls of fire'

The Queensland Department of Education and Training has produced a safety alert on the topic of unpredictable experiments, which is worth reading: see <https://education.qld.gov.au/> and search for 'Unpredictable science experiments' and 'Science experiments, investigations and activities'

Note: a risk assessment should be conducted for each practical activity, taking into consideration aspects including staff training, student skills and behaviour, staff/student allergies, school facilities and whether it is permitted in your jurisdiction.

References:

'Balls of fire' 2014. Royal Society of Chemistry Education in Chemistry website. <https://edu.rsc.org/eic> and search for 'Balls of fire'

'Unpredictable experiments'. (2014). Queensland Department of Education and Training website. **Note: This information was updated in August 2018 See** <https://education.qld.gov.au/> and search for 'Unpredictable science experiments' and 'Science experiments, investigations and activities'

9/12/2019 Answer edited to provide additional notes (in red) and instructions for accessing links

Source URL: <https://assist.asta.edu.au/question/3109/lightning-test-tube>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > making ionic compounds

making ionic compounds

Posted by Anonymous on Fri, 2015-05-08 14:40

Making ionic compounds: I need help to understand the products we ended up with when we ran this practical.

Fresh solutions of sodium sulphide 0.1M and copper (II) chloride -0.1M were made up and 10 ml of each were mixed together as described in the practical.

The precipitate formed was black, but when filtered, the filtrate was yellow! Once the filtrate was evaporated off, the crystals remaining in the watch glass were sodium chloride.

What would the yellow colour be due to? The expected products of the reaction are copper sulfide crystals and sodium chloride solution i.e. not a yellow solution.

I would appreciate any help. Thanks.

Voting:•



No votes yet

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

making ionic compounds

Submitted by on 14 October 2021

We have had tried this prac, it gave us tint green precipitate instead. what happened to this reaction? Saying the sodium sulfite and copper chloride are aged stock.

making ionic compounds prac from Pearson Science 9 p19

Submitted by sat on 27 May 2015

Summary Answer

This reaction is a typical example of a double displacement reaction whereby an aqueous solution of sodium sulfide reacts with an aqueous solution of copper (II) chloride to give copper (II) sulfide (black shiny crystals) and aqueous sodium chloride (a colourless solution). Sometimes, instead of a colourless filtrate, a yellow solution may be obtained, which occurs because of the decomposition of solid sodium sulfide to hydrogen sulfide.

Sodium sulfide is a yellow, yellow-pink or white solid flake with a sulfurous (rotten egg) smell which contains at least 30% water. Crystalline sodium sulfide is hygroscopic and absorbs moisture from air to form hydrogen sulfide. Discolouration of the solid occurs with time. When sodium sulfide is dissolved in water, hydrolysis occurs and the sulfide solution develops the characteristic rotten-egg odour. Dissolving an ageing sodium sulfide solid in water will result in more hydrolysis of the anion compared to a fresh sample. Instead of colourless, a yellow aqueous solution of sodium sulfide is observed. This solution has a strong sulfurous smell and the yellow colour fades with time.

When this sodium sulfide solution is made to react with copper (II) chloride solution, a black precipitate (copper (II) sulfide) in a yellow solution is formed. Filtration results in a yellow filtrate, which contains aqueous sodium chloride and sulfide/polysulfide ions in equilibrium.

Recommendations

Science ASSIST strongly recommends precipitating out the sulfide ions from the filtrate before performing evaporation. These ions can be removed through reaction with aqueous silver nitrate solution:

To the filtrate, add 0.1 M silver nitrate solution drop wise, until no further black precipitate is formed, filter the mixture and evaporate the filtrate to get the sodium chloride crystals.

Warning: If the filtrate containing sulfide ions is heated, the sulfide ions will be oxidized to sulfur dioxide, a very toxic and corrosive gas.

Science ASSIST also recommends:

- using a fume hood and appropriate PPE while preparing the copper (II) chloride and sodium sulfide solution,
- storing sodium sulfide in a tightly closed secondary containment container in the fridge,
- ensuring proper disposal of all chemicals involved in this experiment, and
- using the Risk Assessment Template for schools developed by Science ASSIST (see [Risk Assessment Template](#)).

Disposal of waste chemicals

- The sulfides of copper and silver should be kept in the heavy metal wastes (solid) disposal bottle, which then should be disposed of by a licensed waste disposal contractor.
- Old degradable samples of solid sodium sulfide should also be disposed of by a licensed waste disposal contractor.
- Waste sodium sulfide solution should be treated with dilute ferric chloride solution to precipitate the sulfide ions as ferric sulfide, and then neutralized with sodium carbonate solution.
- The solid ferric sulfide is collected by either Buchner or gravity filtration, and when dry, placed in the heavy metal waste disposal bottle. The filtrate can be disposed of down the sink.

Alternative reactions

Due to the toxic and corrosive nature of sodium sulfide, other safer chemicals can be used to illustrate “Making Ionic compounds” such as:

- Reaction between aqueous solutions of copper (II) chloride and sodium phosphate.
- Reaction between aqueous solution of copper (II) chloride and sodium hydroxide.
- Reaction between aqueous copper (II) chloride and potassium carbonate.

References

Agarwal, Jyotsna 2012. ‘Effect of absorbability of iron contents by precipitated barium sulphate in the commercial crude sodium sulphide’ *International Journal of Science and Technology*, Volume 2 No.10, October 2012,
<https://web.archive.org/web/20170810141246/http://ejournalofsciences.org...> (Original source no longer exist, replaced with Internet Archive version July 2018).

‘Inorganic chemistry/Qualitative analysis/test for anions’ May 2015, Wikibooks website
https://en.wikibooks.org/wiki/Inorganic_Chemistry/Qualitative_Analysis/Tests_for_anions

‘Safety Data Sheet: sodium sulphide’, 28 May 2013 Chem-Supply website
<https://www.chemsupply.com.au/documents/ST0191CH6R.pdf>

‘Standard Operating Procedures For Handling, Storage and Disposal of Sodium Sulfide’ October 2013, Drexel University Department of Safety and Health website
https://www.materials.drexel.edu/media/129527/sop_0026_-_sodium_sulfide.pdf

Source URL: <https://assist.asta.edu.au/question/2820/making-ionic-compounds>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Making Nylon

Making Nylon

Posted by Anonymous on Mon, 2015-02-16 15:35

Making Nylon: It has now been 14 years since I was in a high school classroom, but in those 'good old days' we could do an experiment to make nylon 6,6. I am writing some tasks at the moment but don't want to include this in my tasks if OH&S regulations now mean this can no longer be done by students. So, can you let me know if it is still an experiment that is acceptable. The experiment involves decanedioyl dichloride in cyclohexane being floated on an aqueous solution of 1,6-diaminohexane.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Making Nylon

Submitted by sat on 17 February 2015

Thank you for your question about the safety of preparing nylon.

The preparation of nylon is a classic reaction, which has been demonstrated to audiences since the late 1950s.^[1,2] The reaction is a reliable one and, although the ingredients are

hazardous, the product can be handled safely after washing it to remove any reagents.

Science ASSIST recommends that this reaction be carried out as a **demonstration only**, due to the corrosive and toxic nature of the reagents. The reaction should only be performed in a running fume cupboard and PPE (lab coat, gloves, safety glasses and closed shoes) should be worn throughout the procedure.

There may be circumstances where it is safe for senior students to carry out the reaction themselves, such as where the class is small and can be relied on to follow safe practices, and where there is sufficient fume cupboard space. The risks can be further minimised by providing the reagents as pre-prepared solutions, and by reducing the scale of the reaction (e.g., 5–10 mL of each solution per group). Science ASSIST recommends using a nonhalogenated solvent, such as cyclohexane, to dissolve the adipoyl or sebacoyl chloride if the reaction is conducted as a student activity. A site-specific risk assessment will determine if it is safe to do this reaction as a class activity or only as a demonstration.

Safety and Handling Considerations

The reaction uses an aqueous solution of hexamethylenediamine (1,6-diaminohexane) and a solution of either adipoyl chloride (hexanedioyl chloride) or sebacoyl chloride (decanedioyl chloride) in an organic solvent. The reaction using adipoyl chloride gives nylon 6,6 as the product, while nylon 6,10 is the product from the reaction with sebacoyl chloride.

While the *J. Chem. Educ.* article^[1] from 1959 describing ‘The nylon rope trick’ recommended using a carbon tetrachloride solution of sebacoyl chloride, more recent procedures use less hazardous solvents such as dichloromethane,^[3,4] hexane,^[3] cyclohexane^[4] or heptane^[5,6] as the organic solvent.

Both adipoyl chloride and sebacoyl chloride are corrosive and can cause severe skin burns and eye damage. They hydrolyse on exposure to moisture in the air to produce hydrochloric acid and should therefore be protected from moisture during storage. Sebacoyl chloride is toxic in contact with skin. Bottles of these substances should be checked periodically, and if decomposition is observed, then the bottle should be disposed of via a licenced disposal company. It is not recommended to store solutions of these substances in organic solvent as this may hasten their decomposition.^[1]

Hexamethylenediamine is corrosive and can cause severe skin burns and eye damage and respiratory irritation. It is readily biodegradable and poses a low bioaccumulation risk. Hexamethylenediamine is hygroscopic and should be protected from moisture during storage. The diamine is a solid at room temperature (m.p. ~40°C), but is generally melted when required for use. To melt the solid, the bottle is placed in a plastic bag in a warm water bath (temperature < 80°C to avoid the generation of irritating fumes). Hexamethylenediamine is stable in aqueous solution and can be stored thus.^[1]

Dichloromethane is categorised as a Category 2 carcinogen (suspected of causing cancer). It can cause skin irritation and serious eye damage. Dichloromethane residues should be stored as halogenated organic waste and disposed of via a licenced disposal company. Science ASSIST has developed a List of Recommended Chemicals for schools, and dichloromethane has been accessed as being safe for use in Australian schools (Updated 12 September 2016).

The nonhalogenated organic solvents hexane, heptane and cyclohexane are highly flammable, can cause skin irritation and are toxic to aquatic life. Waste hydrocarbon solutions should be stored as nonhalogenated waste and disposed of via a licenced disposal company.

The nylon product should be washed with 50% ethanol then water to remove any residual salts or solvent.

Any unused solutions should be stirred together until no further polymerisation occurs. If an excess of the diamine has been used, then a dilute solution of adipoyl chloride (or sebacoyl chloride) should be added in small increments to the stirred mixture until no further polymerisation is observed. The nylon produced can be washed of any reagents and disposed of in the general rubbish. The layers can then be separated using a pipette (small volumes) or a separating funnel (larger volumes). The aqueous layer should be neutralised and washed down the sink and the organic layer stored as halogenated organic waste in the case of dichloromethane or otherwise as nonhalogenated organic waste.

Notes on variations of the procedure

If dichloromethane is used as the solvent for the diacyl chloride (adipoyl chloride or sebacoyl chloride), then the organic layer is the lower layer and the nylon rope is drawn through the aqueous solution. Using a nonhalogenated solvent, with the diacyl chloride solution as the top layer, is reported to lead to a product with a 'sticky quality'.^[1] However, the advantage of using a less toxic solvent would compensate for this drawback.

While some procedures use a 1:1 mixture of the diamine and diacyl chloride,^[3-6] most of the procedures cited use the diamine in a 2-3-fold excess of the number of moles of the diacyl chloride. According to Bieber,^[7] an excess of the diamine ensures that when the polymer has a terminating acyl chloride group, the reaction with the diamine will be fast, thus reducing the length of time the growing polymer is vulnerable to hydrolysis which would lead to chain termination. For the same reason, it is also recommended that care be taken to ensure that the diacyl chloride solution is well-mixed in order to avoid a high concentration of this reagent at the interface.^[7] [Science ASSIST has not had an opportunity to test this particular variation, but using a hydroxide solution containing one equivalent of the diamine at twice the concentration of the diacyl chloride, if successful, would meet the above requirements and also minimise the amount of unreacted diamine at the end of the reaction.]

In the procedures cited, which include bases such as sodium carbonate^[1,7] or sodium hydroxide,^[1,3,4,7] the base is used in a 2.5-4-fold excess of the number of moles of the diacyl chloride. An excess of base allows the hydrogen chloride byproduct to be consumed quickly, with the diamine then free to participate in the reaction rather than act as a base.^[7]

References

1. Morgan, Paul W., Kwolek, Stephanie L., *J. Chem. Educ.*, **36**, 182 (1959)
2. Morgan, Paul W., *J. Chem. Educ.*, **42**, 12 (1965)
3. Elfick, John (Editor), *School Science Lessons, Topic 9*, School of Education, University of Queensland, http://www.uq.edu.au/_School_Science_Lessons/topic09.html (Accessed Feb 2015).
4. Clarke, John (Editor), *Exploring Chemistry Stage 3*, Science Teachers Association of W.A., Daniels Printing Craftsman, Osbourne Parke, W.A.(2009).
5. Personal communication (September 2014), D. Tranthim-Fryer, Senior Chemist & Research Officer, ChemCentre, Curtin University, Bentley W.A.
6. *Nylon Synthesis: How to make nylon –Nylon Rope Trick* , <https://www.thoughtco.com/how-to-make-nylon-608926> (Accessed Feb 2015)
7. Bieber, Theodore I., *J. Chem. Educ.*, **56**, 409 (1979)

Source URL: <https://assist.asta.edu.au/question/2657/making-nylon>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Making Polyurethane foam

Making Polyurethane foam

Posted by Anonymous on Tue, 2015-05-19 13:05

Making Polyurethane foam: Could someone please tell me where I can find instructions for a Year 11 chemistry prac for making polyurethane foam?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Making Polyurethane foam

Submitted by sat on 09 June 2015

The preparation of polyurethane foam is an interesting and worthwhile demonstration of polymerisation. We have detailed some instructions below, but first it is important to be aware of the hazards that are involved. Polyurethane foam is prepared from components which are commonly available commercially in two parts:

- **Part A is a mixture of polyol, an amine and a silicone surfactant.** This is a manageable hazard, it is a combustible liquid and is classified as a Category 3 irritant and a Category 2 corrosive.

- **Part B is a diisocyanate mixture. This kind of chemical can present a serious risk if not handled safely and responsibly.** The diisocyanate component is also a combustible liquid. Diisocyanates are classified as Category 1 respiratory and skin sensitizers. Exposure to diisocyanates may cause sensitisation after chronic exposure, or after a large single exposure. The sensitisation effects may lead to an allergic reaction upon further exposure to diisocyanates. The effect may be life threatening and may be permanent.

We therefore advise that all precautions be taken to avoid any respiratory or skin exposure to the diisocyanate component when carrying out this reaction.

A site-specific risk assessment should be conducted before carrying out the activity. See the Science ASSIST [Risk Assessment Template](#). We recommend that the reaction should not be conducted in the presence of any student or staff member who has a history of respiratory allergies.

Safe Handling

We recommend that this activity be conducted as a **teacher demonstration only** in a working fume cupboard, taking all precautions to prevent skin and respiratory exposure to the diisocyanate component with the following safe handling precautions.

1. The preparation of polyurethane foam should be conducted in a running fume cupboard.
2. PPE including safety glasses, a laboratory coat and gloves (nitrile gloves provide good protection) should be worn.
3. The workstation in the fume hood should be covered with a large disposable plastic bag to catch any overflow or spillage caused by the expansion of the foam.?
4. Disposable containers and tools should be used.
5. Pour approximately 20 mL of liquid Part A in a disposable plastic cup and label it cup A.
6. Add a few drops of food dye to cup A, if desired, and stir the mixture with a wooden stirrer.
7. The volume of Part B should be about equal or slightly less than that of Part A to ensure that all of the diisocyanate is completely consumed. Therefore, pour slightly less than 20 mL of liquid Part B into the second disposable plastic cup and label it cup B.
8. Add the contents of cup A to cup B and stir thoroughly with the wooden stirrer until the foam begins to expand.
9. Any unused diisocyanate component should be mixed well with sufficient of Part A to completely consume the diisocyanate component.
10. Observe the foam as it expands 25-30 times its original volume.
11. The foam products should be left to cure in the running fume cupboard, or outside, for 24 hours after preparation to avoid exposure of personnel to fumes of the diisocyanate.
12. This condensation polymerization reaction is exothermic and the cup will get warm. Do not touch the foam until it is completely hardened.
13. The hardened foam, used disposable cups, wooden stirrer and large plastic bag can be disposed of with regular waste.

Storage of components

- **Part A: Polyol component:** The polyol component can be appropriately stored with

organic liquids.

- **Part B: Diisocyanate component:** This component should be stored in a cool dry place with general chemicals. The container of the diisocyanate component should be kept tightly sealed to protect it from atmospheric moisture.

Note: Diisocyanates react with water to produce carbon dioxide and an insoluble polymer. The carbon dioxide generated from this reaction could rupture the container given sufficient exposure to water.

It is recommended that neither part is kept for a period of longer than 3 years.

References:

'Polyurethane Foam System, Part A' Safety Data Sheet, March 2014, Flynn Scientific Inc. website, <https://www.flinnsci.com/globalassets/flinn-scientific/all-free-pdfs/sds...>

'Polyurethane Foam System, Part B' Safety Data Sheet, March 2014, Flynn Scientific Inc. website•https://www.flinnsci.com/sds_607.6-polyurethane-foam-system-part-b/sds_607.6/• (Link Updated July 2019)

'Polyurethane Flexible Foams' New Zealand Institute of Chemistry website• <https://nzic.org.nz/app/uploads/2017/10/10G.pdf> (Link updated: 18 June 2018)

'Material Safety Data Sheet 4,4'-MDI' September 2014, Sigma-Aldrich website <http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang...>

'Preventing Asthma and Death from Diisocyanate Exposure DHHS' Publication no. 96-111 (1996). The National Institute for Occupational Safety and Health (NIOSH) website, <https://www.cdc.gov/niosh/docs/96-111/>

U.S. Environmental Protection Agency 2011, *Methylene Diphenyl Diisocyanate (MDI) and Related Compounds Action Plan [RIN 2070-ZA15]*. US EPA website <http://www.epa.gov/sites/production/files/2015-09/documents/mdi.pdf> (accessed January 2016).

Source URL: <https://assist.asta.edu.au/question/2849/making-polyurethane-foam>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Making Sherbet

Making Sherbet

Posted by Anonymous on Mon, 2015-03-16 18:16

Making Sherbet: Can you tell me if any safety precautions are required for the sherbet activity, which allows students to create an acid-base reaction in their mouth? Is the recipe below okay to use for this activity?

Making Sherbet:

Ingredients

- 3 tablespoons Citric Acid
- 1 tablespoon Bicarbonate Soda
- 7 tablespoons Icing Sugar

You will need a very dry sieve, tablespoon, bowl and airtight storage container

Directions

- All equipment and ingredients must be absolutely dry for the sherbet to work effectively
- Sift the icing sugar into a bowl
- Add citric acid and bicarbonate of soda and mix well
- Grind the contents to a fine powder with the back of a spoon
- Store in an airtight container

Voting:



No votes yet

Australian Curriculum:

Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer

Year Level:

9

Senior Secondary

Showing 1-1 of 1 Responses

Making Sherbet

Submitted by sat on 17 March 2015

Making sherbet is a fun way to demonstrate physical and chemical change as well as an acid-base reaction for junior science students.

Firstly, it is important to conduct a site-specific risk assessment. Science ASSIST has developed a one page risk assessment template that may be useful. See [Risk Assessment Template](#).

In making sherbet, it is important to consider the following.

- The ingredients used are suitable, but should not have been in general use in the science area, so they should not have had the opportunity to be contaminated by chemicals. It is best to use newly purchased ingredients to ensure that they are not contaminated.
- In sieving these ingredients, care should be given to minimise the dust, so consider the age and skills of the students. [Hint: It may be best to crush the bicarb before adding to the icing sugar.]
- This activity should be conducted in a suitable room, such as the home economics room, and definitely not in a science laboratory. (Handling, preparing, storing or consuming food or drink for consumption in the laboratory is not allowed.)

The links below have variations on making sherbet:

<https://www.questacon.edu.au/outreach/programs/science-circus/activities/fizzy-sherbet>

<https://blog.doublehelix.csiro.au/infinately-scaling-sherbet-recipe/> (Link Updated November 2021)

Source URL: <https://assist.asta.edu.au/question/2708/making-sherbet>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Measuring corrosion of iron Yr 12 EEI

Measuring corrosion of iron Yr 12 EEI

Posted by Anonymous on Mon, 2016-05-09 23:57

Hi,

I'd like to get ideas/techniques on how students can measure the amount of rust produced when a nail (iron) corrodes.

In the past years, students have weighed the nails before and after the corrosion, and the difference was assumed to be the amount of rust formed. Would it be better to scrape off the rust as well and weigh the nail without the rust to get a more correct measurement of the mass of rust formed? The main issue I have with this method, is that it will not take into account the dissolved iron ions, which are also products of the corrosion. This leads me to the next question: Can I tell my students to disregard the dissolved iron ions if they wish to do this technique?

To measure the dissolved iron ions, more specifically Fe^{2+} ions, is it correct to use redox titration with permanganate ion? My students did this last year and found that there wasn't enough Fe^{2+} ions in the solution to get a decent amount of permanganate titre (endpoint was reached after 3-5 drops!), and so we've had to dilute the permanganate solution, which then makes the colour fainter and the endpoint was harder to detect. I thought this technique was promising because students can take samples of their solutions at different days and check for any trends.

I've also tried using a conductivity meter to measure the change in the amount of dissolved ions after corrosion, but it wasn't very successful, mainly because the probe we were using didn't pick up the range of microseimens in the solutions.

Can you please comment on the techniques I've described whether or not we are on the right track. If yes, how can we modify it to get better results? Are there any other techniques that you can suggest that students can use?

I saw an interesting article in the RSC website: <http://www.rsc.org/learn-chemistry/resource/res00000453/how-much-air-is-used-up-during-rusting?cmpid=CMP00005146> - it measures the change in volume of air (oxygen) after rusting. Do you think this is a suitable technique to measure the extent to which the oxidation of Fe occurred? (Taken from the point of view of how much oxygen was used if iron is in

excess instead of measuring the product produced.) In the method, the iron (steel wool) was not placed in the water to rust. Will this method still work should we decide to drop the steel wool in the water? I'm guessing not, because then the oxygen will come from the dissolved oxygen in water...

Thanks in advance. Sorry it was such a long one. :)

Voting:•





No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Showing 1-1 of 1 Responses

Answer by sue monteath on question Measuring Corrosion of Iron-Yr12 EEI

Submitted by sat on 14 May 2016

The answers to this long question are answered in-situ to provide proper context (Ed).

I'd like to get ideas / techniques on how students can measure the amount of rust produced when nail (iron) corrodes.

In past years, students have weighed the nails before and after corrosion, and the difference was assumed to be the amount of rust formed. Would it be better to scrape off the rust as well (Yes ~~but~~ students should be aware that it is possible that some Fe (s) will be scraped off as well) and weigh the nail without the rust to get a more correct measurement of the mass of rust formed? Another option is to filter the solution and then completely dry and measure the rust that has separated from the nail. The main issue I have with this method is that it will not take into account the dissolved iron ions which are also products of the corrosion. This leads me to my next question: can I tell my students to disregard the dissolved iron ions if they wish to do this technique?

To measure the dissolved iron ions, more specifically Fe^{2+} ions, is it correct to use redox titration with permanganate ion? My students did this last year and found that there wasn't enough Fe^{2+} ions in the solution to get a decent amount of permanganate titre (endpoint was reached after 3-5 drops!), and so we've had to dilute the permanganate solution, which then makes the colour fainter, and the endpoint was harder to detect. I thought this technique was promising because students can take samples of their solutions at different days and check for any trends. Rather than use a 50 mL burette, it would be possible to use smaller volumes and dilute. This, plus weighing the scraped and filtered iron oxide, would be more accurate.

I've also tried using a conductivity meter to measure the change in the amount of dissolved ions after corrosion, but it wasn't very successful, mainly because the probe we were using didn't pick up the range of microseimens in the solutions. Agreed, this mostly doesn't have the sensitivity required.

Can you please comment on the techniques I've described whether or not we are on the right track. If yes, how can we modify them to get better results? Are there any other techniques that you can suggest that students can use?

I saw an interesting article in the RSC website: <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000453/how-much-air-is-used-up-during-rusting?cmpid=CMP00005146> - it measures the change in volume of air (oxygen) after rusting. Do you think this is a suitable technique to measure the extent to which the oxidation of Fe occurred? (Taken from the point of view of how much oxygen was used if iron is in excess, instead of measuring the product produced.) In the method, the iron (steel wool) was not placed in the water to rust. Will this method still work should we decide to drop the steel wool in the water? I'm guessing not, because then the oxygen will come from the dissolved oxygen in water. **Yes - most of the oxygen would come from the dissolved oxygen, but there are ways to measure dissolved oxygen (DO) in water. You could do this as well as the Fe_2O_3 collection, but it would require controlling the DO (so no exposure of the rusting solution to air at all - plus the temperature would need to remain constant). This would be difficult to do but would be possible using sealed containers that have no air bubbles.**

Source URL: <https://assist.asta.edu.au/question/3807/measuring-corrosion-iron%E2%80%9412-eei>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Microscale Chemistry

Microscale Chemistry

Posted by Anonymous on Fri, 2019-05-24 14:25

Microscale Chemistry: Can you provide some information on microscale chemistry please?

Voting:



No votes yet

Year Level:

7

8

9

10

Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Microscale Chemistry

Submitted by sat on 24 May 2019

Microscale chemistry is the scaling down in size of practical chemistry. Microscale activities require using smaller quantities or volumes of chemicals and also simpler equipment, such as spotting plates, multiwell (culture) plates, laminated grid sheets, and smaller test tubes. Drops rather than millilitres of reagents and a few grains rather than a few grams of a solid chemical are generally used. Sometimes it may mean working in a drop of water on an acetate sheet.

The chemical waste for these activities is not significant and most can be wiped up with paper towel or tissue and disposed of in the general waste.

Many procedures require some dexterity, so it may be necessary to start with some simple activities first and a skills assessment of the students might be required.

Science ASSIST recommends the use of microscale techniques in chemistry where applicable and outcomes are not compromised. Microscale chemistry has the benefits of quicker reaction times and:

- Reduced materials
- Reduced costs
- Reduced risk - there is less contact with hazardous chemicals
- Reduced chemical waste
- Reduced preparation and clean-up time
- Reduced reliance on traditional glassware.
- Reduced storage requirements.

About microscale chemistry:

- 'Microscale chemistry', Education in chemistry website, <https://edu.rsc.org/eicredir/feature/microscale-chemistry/2020192.article> (March 2007)
- 'Microscale Chemistry from the UK', Microchemuk website, <https://microchemuk.weebly.com/4-about-microscale.html> (Updated January 2020)
- 'Microscale chemistry revisited', Education in chemistry website, <https://edu.rsc.org/eicredir/feature/microscale-chemistry-revisited/2020193.article> (May 2012)
- 'What is Small-Scale Chemistry?' National Small-Scale Chemistry Center website, http://www.smallscalechemistry.colostate.edu/what_is_ssc.html (Accessed May 2019)
- 'Why Small-Scale Chemistry?' National Small-Scale Chemistry Center website, http://www.smallscalechemistry.colostate.edu/why_ssc.html (Accessed May 2019)

Examples of microscale chemistry activities:

Royal Australian Chemical Institute:

'Chemical Education Group', RACI website, <https://www.raci.org.au/branches/vic-branch/chemical-education-group586> (Accessed 15 May 2019) Scroll down the page to find 'An Effective Way to Introduce Many Chemical Concepts Using a Stereomicroscope'

Royal Society of Chemistry:

'Microscale Chemistry: experiments in miniature', Learn Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00001976/microscale-chemistry-book> (Accessed May 2019) A book is available for purchase or scroll down the page to access the links to download the experiments for free.

UK STEM Learning Centre:

‘Microscale Chemistry’, STEM learning website. •

<https://www.stem.org.uk/resources/collection/4034/microscale-chemistry> (Accessed May 2019) This has a number of activities from the Royal Society of Chemistry and requires the user to create an account to access resources

Worley, Bob, CLEAPSS Advisor:

Youtube videos, <https://www.youtube.com/channel/UCPotDWzaKehdDRW5TI71PPw/videos>. •

This has several examples of microscale chemistry, many of which, Bob presented at CONASTA 67 in Sydney 2018. In particular view the microscale version of elephant’s toothpaste, i.e. Mouse’s toothpaste with an interesting addition using a glowing splint; and many examples of microscale chemistry in a drop of water.

Other examples of micro and small scale chemistry activities

Buthlezi, Thandi; Dingrando, Laurel; Hainen, Nicholas; Wistrom, Cheryl and Dinah Zike. nd. *Chemistry small-scale laboratory manual –Student Edition*. McGraw Hill Glencoe: New York. EPDF website <https://epdf.pub/queue/chemistry-small-scale-laboratory-manual.html>• (Accessed May 2019)

Mattson, Bruce and Michael P. Anderson. 2017. *Microscale Gas Chemistry*, 2017 Web Version, Creighton University website, http://mattson.creighton.edu/Microscale_Gas_Chemistry.html (Accessed May 2019) [Answer edited 12 June 2019 to include this example)

‘Small Scale Selector Page’, This has 80 links to small scale activities. University of Nebraska-Lincoln website,•

<https://web.archive.org/web/20191021113110/http://dwb5.unl.edu/CHEM/Smal...> (Original resource no longer available, this version provided by the Internet Archive April 2021)

Note: Science ASSIST has not trialled these activities and the onus is upon the school to determine the suitability of the activity and to conduct their own risk assessment and implement relevant safety procedures.

Source URL: <https://assist.asta.edu.au/question/4483/microscale-chemistry>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Mixing of alcohols

Mixing of alcohols

Posted by Anonymous on Mon, 2016-07-11 15:52

Mixing of alcohols: an IB student would like to investigate the effect in heat energy of mixing methanol and ethanol or ethanol or propanol or ethanol and butanol, is this safe? I read SDS and it doesn't provide any information regarding this query. Hope you can help. Many thanks

Voting:•



No votes yet

Year Level:•

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Mixing of alcohols

Submitted by sat on 13 July 2016

Methanol, ethanol, propan-1-ol and butan-1-ol are aliphatic alcohols and belong to the same homologous series. Members of the same homologous series have similar chemical properties because they possess the same functional group. For alcohols the functional group is the hydroxyl group (-OH). These are small simple alcohols, with only one functional group, and are compatible in mixtures and if heated or combusted. Therefore, mixtures are safe to use and can easily be made and Science ASSIST recommends the following:

- carry out a site specific risk assessment see the Science ASSIST Risk Assessment Template
- refer to Safety Data Sheets (SDSs) of all the alcohols used in the experiment
- wear suitable PPE such as laboratory coat, gloves, safety glasses and closed in shoes
- conduct this experiment under an operating fume cupboard or in a well-ventilated room, investigating the enthalpy change of one mixture at a time.

Safety notes

- For safety instructions for the use of spirit burners see a previous question on Fuels.
- For more information about the toxicity of the alcohols see a previous question on Toxic alcohols

Methanol, ethanol, propan-1-ol, and butan-1-ol are widely used as fuels because of their high octane rating, which increases fuel efficiency and also as they can be synthesized biologically or chemically.

References

'Alcohol fuel', Saylor Academy website, <https://resources.saylor.org/wwwresources/archived/site/wp-content/uploads/2011/06/Alcohol-Fuel.pdf> (Accessed July 2016)

'Alcohols', BBC Bitesize GSCE Chemistry website, <https://www.bbc.co.uk/bitesize/guides/zyf82hv/revision/1> (Accessed July 2016)

'Aliphatic', Illustrated Glossary of Organic Chemistry, UCLA Chemistry and Biochemistry website, <http://www.chem.ucla.edu/~harding/IGOC/A/aliphatic.html> (Accessed July 2016)

'Bioalcohols', biofuel.org.uk website, <http://biofuel.org.uk/bioalcohols.html> (Accessed July 2016)

'Functional Group', Illustrated Glossary of Organic Chemistry, UCLA Chemistry and Biochemistry website, http://www.chem.ucla.edu/~harding/IGOC/F/functional_group.html (Accessed July 2016)

'Homolog', Illustrated Glossary of Organic Chemistry, UCLA Chemistry and Biochemistry website, <http://www.chem.ucla.edu/~harding/IGOC/H/homolog.html> (Accessed July 2016)

'Octane rating (octane number)', Illustrated Glossary of Organic Chemistry, UCLA Chemistry and Biochemistry website, http://www.chem.ucla.edu/~harding/IGOC/O/octane_rating.html (Accessed July 2016)

Source URL: <https://assist.asta.edu.au/question/3933/mixing-alcohols>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > pH Probe

pH Probe

Posted by Anonymous on Thu, 2015-07-16 11:35

pH Probe: Can anyone suggest a pH probe with data logging function/capabilities for use with our senior science groups?

Looking for any feedback on models you may have used, before I go out and buy one of our own.

Any and all feedback is much appreciated.

Voting:•



No votes yet

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

pH Probe

Submitted by sat on 24 July 2015

There are many pH probes commercially available to use in schools. See the [School science suppliers](#)

for more information on suppliers of general science equipment, and also those that specialize in data loggers. Science ASSIST does not specifically recommend any one brand of data loggers. It does, however, provide the following information for consideration when selecting a pH probe for use with a data logger. It is also recommended that the references listed are consulted for more detailed information.

Background Information

The pH of a solution is a measure of the hydrogen ion (H^+) concentration of the solution. Solutions with a high concentration of H^+ have a low pH (i.e., acidic) and solutions with a low concentration of H^+ ions have a high pH (i.e., basic).

The pH probe measures the pH of a solution on a scale from 0 to 14, with 0 being the most acidic, 7 being neutral and 14 being the most basic. The probe consists of a pH electrode that requires special attention regarding its use and storage. Also, as pH is dependent upon the temperature, probes usually have an in-built temperature sensor. For those pH probes with a data logging capability, the measurements are continuously recorded and displayed by a connected computer, iPad, tablet or dedicated data logger. The selection of a pH probe will depend upon physical aspects of the probe as well as the specifications of the probe and the data logger that it will be connected to. Consideration should also be given to the ongoing care and maintenance of the probe.

Physical Aspects

Science ASSIST recommends that, before purchasing a pH probe, the following physical aspects should be taken into consideration.

- **Body Material:** There are 2 common choices for body material: non-conductive glass and epoxy (polymer). Glass body probes are able to withstand higher temperatures, but epoxy body probes are more durable, generally costs less than glass probes, and are probably best for school student use.
- **Types of electrodes:** The electrodes in pH probes can either be gel-filled or refillable. Most schools use gel-filled Ag-AgCl combination pH electrodes because they require less maintenance and resist high pressure. However, these sealed pH electrodes have a limited life since the chemicals inside are used up and are not replaceable.
- **The pH electrode bulb:** The bulb end is usually glass and may have a conical or spherical shape. The cone-shaped bulb has a larger surface area, thereby providing a faster reading, and is easier to clean and maintain. It lasts longer and is often cheaper as well.
- **Submersible or water resistant design:** Submersible pH probes can be used in water-testing applications.
- **Data loggers:** These are electronic devices that receive process and store data from various sensors such as a pH probe. Probes have an important role in the data logger process as they generally send a signal to an interface, which is linked to a computer, tablet or stand-alone system. There are a range of data loggers available. Some are portable and can be taken into the field, whilst others are stationary in the lab and are connected via an interface to a computer. The pH probe is used in conjunction with a data logger and consideration should also be given to the type of data logger it will be

connected to. The following factors should be considered.

- **Ease of use:** Ensure that the data logger is simple to use and assemble and does not require complex programming.
- **Durability:** Robust data loggers last longer.
- **Battery life:** Ensure that the data loggers have a long battery life
- **Incompatibility between different manufacturers:** Probes and data loggers are generally not interchangeable between manufacturers, although some brands may have conversion kits to enable the use of existing probeware. It is probably best for schools to select the same manufacturer for all their data logging requirements, from a cost as well as an operating point of view.
- **Software compatibility:** Software is usually Windows® or Mac-based and should be able to perform quick and easy tasks such as configuring parameters and offloading data.
- **Measurement Accuracy:** Accuracy specifications may vary widely among different types of data loggers. Be sure to look for charts that indicate accuracy over an entire measurement range.
- **Resolution:** This is the number of increments of a value a data logger is capable of reporting. Consult an experienced data logger supplier who will be able to help you determine which product will best meet your needs.
- **Portability:** There are some portable stand-alone data loggers that can easily be used on field trips. Collected data can be easily offloaded to a computer via a USB interface.

Recommended Specifications

Science ASSIST also recommends that pH probes with the following specifications should be considered:

- Range: 0 to 14 pH
- Accuracy: ± 0.1 – 0.2 pH units (after calibration)
- Resolution is a very important feature of pH probes and should be around 0.01 pH.
- Maximum Sample Rate: 50 Hz
- Operating Temperature Range: -4°C to 80°C
- Response time: 90% of final reading in 1 second
- Isopotential pH: pH 7 (point at which temperature has no effect)

Care and Maintenance of the pH probe

One of the most common reasons for a pH probe to not work properly is that it is not properly calibrated or because it is dirty, clogged or coated with sample. Regular cleaning and calibration of the probe will restore performance and prolong the useful life of the electrode. The probe should be stored in the recommended pH storage solution between measurements. The glass bulb can be cleaned by soaking it in warm deionised water. Read the manufacturer's user manual for long-term storage and calibration.

Note: It should not be stored in distilled or deionised water and should not be allowed to dry out. Long-term exposure to pure water may damage the special glass membrane/bulb.

Probes should be rinsed after each reading and between samples with distilled or deionised

water. To remove excess water, the end of the probe should be blotted gently with lint-free paper. The glass membrane of the probe should never be directly touched, as oils from the skin will damage the electrode.

Note: It is best to avoid the use of multiple probes in the same solution as they can electrically interfere with one another and result in erroneous readings. In addition, the probe should never be wiped, as wiping can create a static charge, which may also result in erroneous readings.

Perhaps registered users of this site may like to submit helpful feedback.

References

Frost, Roger 2002. *The IT in Science book of Data logging and control*. IT in Science, Cambridge http://oer.educ.cam.ac.uk/w/images/a/a0/Data_Logging_and_Control.pdf

Lovatt, P 2009. *Data logging: Applications, advantages and disadvantages*. Physog website: <https://web.archive.org/web/20170121064310/http://physog.co.uk/pluginfil...> (Original web page not available, this copy made available by the Internet Archive's Wayback Machine, April 2018)

'PASPORTpH Sensor-PS-2102' Pasco website:
<https://www.pasco.com/products/sensors/pasport/ps-2102> (Link Updated September 2021)

'pH Electrodes Information' HIS Engineering360 website
https://www.globalspec.com/learnmore/sensors_transducers_detectors/analytical_sensors/ph_orp_electrodes
(Accessed July 2015)

'PH/ORP Sensor Primer' Phidgets website,
https://www.phidgets.com/docs/PH/ORP_Sensor_Primer (Accessed 17 June 2015)

'pH Sensor' Vernier Software & Technology website
<https://www.vernier.com/products/sensors/ph-sensors/ph-bta/> (Accessed July 2015)

'pH Sensor', Vernier website <http://www2.vernier.com/booklets/ph.pdf> (27 December 2006)

Roberson, Peter 2004. *Using data loggers* Uniserve, University of Sydney website
<https://web.archive.org/web/20180319233723/http://science.uniserve.edu.a...> (Link updated February 2019 with a copy from the Internet Archive).

'The Best pH Electrode for Your Application', Hanna Instruments website
http://www.hannainst.com/usa/electrode_choosing.cfm (Accessed July 2015)

Source URL: <https://assist.asta.edu.au/question/3004/ph-probe>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Potassium dichromate in the determination of alcohol content in wine

Potassium dichromate in the determination of alcohol content in wine

Posted by Anonymous on Mon, 2016-04-11 09:46

Potassium dichromate in the determination of alcohol content in wine: A prac for the determination of alcohol content in wine has been suggested for our Year 12 chemistry students. The prac asks for 0.04 M $K_2Cr_2O_7$. Is this solution okay for the students to use? I have viewed the MSDS for potassium dichromate and am also wondering about the fertility and other health risks to the lab technician in preparation of these solutions. Thanks.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Potassium Dichromate in the determination of alcohol content in wine

Submitted by on 18 April 2016

I use Potassium Dichromate in our wine analysis unit. To limit the risks to students and staff I have located a supplier for a liquid solution of 0.04M potassium Dichromate and the students

add this to their conical flasks, (after a demonstration), with much care and the use of a bottle top dispenser. Jacqui Burton jburt1182@eq.edu.au

Potassium Dichromate in the determination of alcohol content in wine

Submitted by sat on 19 April 2016

Recommendations for the use of dichromate salts by students

It is important to consider the risks involved prior to using chemicals. Science ASSIST recommends that the use of potassium dichromate or sodium dichromate solution (? 0.1 M) should be restricted for Year 12 students to only small-scale **qualitative** purposes where only a few drops of solution or micro quantities are used, so that exposure to the chemical is kept at a minimum. For example, the use of dichromate salts as solutions (~ 0.1 M) are used to demonstrate the oxidation of alcohols and to illustrate the application of Le Chatelier's Principle in aqueous solutions.

Hazardous properties of dichromate salts

Dichromate salts are toxic, irritants and corrosive. They are also classified as Group 1 carcinogens by the IARC,¹ i.e., they are carcinogenic to humans. Dichromate salts can affect the respiratory tract, gastrointestinal tract and immune system and can also damage fertility or the unborn child. They are sensitisers, i.e., they can cause an allergic reaction, and are toxic for the environment.

Exposure to dichromate salts can be minimised by using the reagents in micro quantities, as solutions of low concentration, and by handling the solutions for only a short period of time.

Preparation of solutions of dichromate salts

To avoid the handling of the very hazardous solid chemical, and particularly to minimise laboratory technicians' exposure to potassium dichromate, Science ASSIST recommends the purchase of commercially available dilute (e.g., 0.1 M) potassium dichromate solution, rather than the solid chemical.

However, if you are considering using the pure chemical to prepare solutions, then Science ASSIST recommends the following guidelines should be adhered to.

- A site-specific risk assessment should be conducted before using chromium (VI) salts. See the Science ASSIST [Risk Assessment Template](#).
- Suitable PPE such as protective clothing, nitrile gloves, closed-in shoes and safety glasses should be worn.
- The chemical should only be used under an operating fume cupboard.
- Always wash hands immediately after handling the chemical.
- Pregnant women should carefully consider the risks before proceeding.
- Stocks of sodium and potassium dichromate should be kept to a minimum and only one bottle of either the sodium or potassium salt should be stored at any one time.

- Store the chemical in a cool, dry, well-ventilated area in suitable tightly closed containers protected from direct sunlight, moisture, heat and all sources of ignition.
- Keep the container away from incompatible chemicals (See SDS for details).
- Prepare 0.1 M solution of potassium/sodium dichromate in distilled water and keep in a properly labeled and tightly closed bottle. This solution can then be used to prepare solutions of lower concentrations.
- See previous questions related to chromates:
 - Chemical disposal
 - Dichromic acid glass cleaner waste
 - Chemical Cell

Use of dichromate solutions for larger scale activities

The use of potassium and sodium dichromate solutions for larger-scale, analytical activities such as titrations or for preparative-scale oxidations is not recommended as the risks associated with the high degree of exposure (large volume and time), coupled with the logistics and cost of waste disposal and clean-up outweigh the educational benefits. The drawbacks of using dichromate salt solutions for titrations are:

- the titration requires fairly large quantities of dichromate solution;
- titration techniques need skills and practice and students will need to exhibit much care to avoid skin contact during the titration procedure (A high standard of clean up would also be required to remove any spilt solution.);
- the activity would generate large quantities of contaminated glassware which would then need to be carefully rinsed to remove the hazardous chromium residues;
- the activity would also generate large volumes of waste, and as dichromate solutions are not permitted to be flushed down the sink, the employment of a licensed chemical waste disposal contractor would be required to dispose of the waste generated.

Alternative activities

Determination of the alcohol content of wine

In a school laboratory, the alcohol content in wine can be determined by a distillation process followed by the use of a hydrometer.

The wine is first distilled to give a distillate of ethanol and water, leaving behind sugar and other impurities. Water is then added to make up the ethanol-water solution to the original volume of wine. A hydrometer is then used to determine the density of the ethanol-water mixture. Using reference tables of ethanol-water mixture densities, the percentage alcohol can then be calculated and expressed as a percentage volume per volume. For a procedure,² see Alcohol content by distillation and using hydrometers.

Determination of the tannin content in wine

A suitable titration exercise using wine would be to determine the tannin content in red wine using potassium permanganate solution in the presence of indigo carmine solution as indicator. The amount of potassium permanganate used in the titration can be used to determine the amount of tannin in wine. For a procedure,³ see Tannin Content in Wine.

Note: Tannins are the naturally occurring polyphenols found in fruit skins, seeds, leaves and plants which give wines their characteristics bitterness, dryness and astringency. Red wines contain more tannin, although white wines can gain tannin from being aged in wooden barrels. Tannins act as a natural antioxidant to protect the wine and that is why some wines age so well.

References

¹ International Agency for Research on Cancer, Monograph 'Chromium (VI) compounds', Volume 100C, 2012 <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100C-9.pdf> (Updated July 2018)

² 'Determination of Alcohol Content of Wine by Distillation followed by Density Determination by Hydrometry'. Sirromet, Senior Chemistry website <http://seniorchem.com/1.%20Alcohol-Content-by-distillation.pdf> (Accessed April 2016)

³ 'Chapter 20. Vintage Titrations: Tannin in Wine' in The Royal Society of Chemistry. 1995. *In Search of more Solutions: More Ideas for Problem Solving Activities*, RSC: London. Learn Chemistry website <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000585/vintage-titrations-tannin-in-wine> (Accessed April 2016)

'Alcohol Determination by Distillation Process'. Monash Scientific website, <http://www.monashscientific.com.au/AlcoholDeterminationIDistillationProcedure.htm> (Accessed April 2016)

'Potassium dichromate' Material Safety Data Sheet, Chem Supply website, <https://www.chemsupply.com.au/documents/PL0181CH5A.pdf> (Aug 2011)

'Potassium dichromate' Safety Data Sheet, Agros Organics, Fisher Scientific website, <https://www.fishersci.com/msds?productName=AC197760050> (April 2014)

'The Differences Between Red and White Wines: Methods and Materials'. St Lawrence College website, <https://web.archive.org/web/20190729172345/http://web2.slc.qc.ca:80/jmc/...> (Original weblink no longer available, this version sourced from the Internet Archive March 2021)

'What Is A Tannin? A Guide To Tannins'. *Vinepair* website, <https://vinepair.com/wine-101/guide-to-tannins/> (Accessed April 2016)



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Precipitation reaction (sodium hydroxide and barium nitrate)

Precipitation reaction (sodium hydroxide and barium nitrate)

Posted by Anonymous on Thu, 2015-11-19 18:50

Precipitation reaction (sodium hydroxide and barium nitrate): I wonder if you can help me out with another confusing chemical reaction we have observed in our lab.

When sodium hydroxide was added to barium nitrate we expected a clear solution as the WACE chemistry data sheets and our MSDS for barium hydroxide indicate that it is soluble, as are all nitrates.

However a white precipitate formed.

Can you tell me what is going on?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

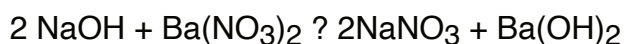
Laboratory Technicians

Answer by Poonam hosany on question Precipitation reaction

Submitted by sat on 23 November 2015

In brief

Theoretically, when an aqueous solution of 0.1 M sodium hydroxide reacts with an aqueous solution of 0.1 M barium nitrate, there should be no visible change as colourless aqueous solutions of sodium nitrate and barium hydroxide are produced.



The majority of time, a faint white precipitate of barium hydroxide is formed. Barium hydroxide is slightly soluble in water and can produce a solution with a concentration of around 0.1 M at room temperature; barium hydroxide above 0.1 M will be insoluble. The formation of the faint white precipitate can be due to:

- barium hydroxide being moderately soluble in water;
- the concentration of barium hydroxide produced is close to the maximum concentration required for precipitation to occur;
- any inaccuracies that may have happened during the preparation of the reactants;
- the possible presence of carbonate ions in the sodium hydroxide solution forming a barium carbonate precipitate.

Science ASSIST recommendations

- Use solutions of lower concentration to avoid precipitation of barium hydroxide. When using 0.05 M aqueous solutions of barium nitrate and sodium hydroxide, a clear solution is formed ~~no~~ visible change.
- Ensure that the sodium hydroxide solution used is fresh. Over time, sodium hydroxide solutions may absorb atmospheric carbon dioxide to form carbonate ions and may even precipitate out as sodium carbonate around the neck of the bottle. Barium may react with the carbonate ions to form solid barium carbonate, which is not soluble.
- Substitute barium nitrate for a group 1 nitrate to get a clear solution or to magnesium or calcium nitrate to get a white precipitate.
- Substitute the use of test tubes for this activity and use either an acetate sheet with a table printed on it, Or, spotting tiles to reduce the amount of chemical wastes produced. This method only uses one drop of each reactant and the acetate sheets/spotting tiles can simply be washed. This avoids the need to either treat or collect chemical waste for disposal.
- Keep all containers and bottles sealed when not in use.

Additional Information

Going down group 2, the solubilities of hydroxide increases:

Metal	Solubility of hydroxide
-------	-------------------------

Magnesium	Insoluble
-----------	-----------

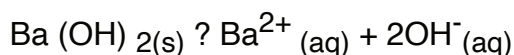
Calcium	Insoluble
---------	-----------

Strontium	Sparingly soluble
-----------	-------------------

Barium	Moderately soluble
--------	--------------------

Radium	Soluble
--------	---------

The solubility product (K_{sp}) is a numerical measure of solubilities. The K_{sp} of barium hydroxide at 25°C is $5 \times 10^{-3} \text{ mol}^3\text{dm}^{-6}$. From the K_{sp} , the maximum concentration of Ba^{2+} and OH^- ions that can be mixed before a precipitate forms can be determined.



If X is the number of moles of $\text{Ba}(\text{OH})_2$ that dissolves before precipitate forms then;

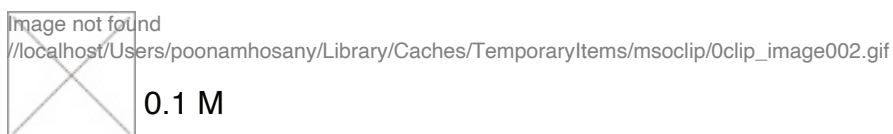
Concentration of $\text{Ba}^{2+} = X$

Concentration of $\text{OH}^- = 2X$

$K_{sp} = [\text{Ba}^{2+}][\text{OH}^-]^2 = 4X^3$ Where $[] = \text{Concentration}$

$$4X^3 = 5 \times 10^{-3}$$

$$X = 0.107 \text{ M}$$



$$0.1 \text{ M}$$

A salt is considered:

Insoluble—if it dissolves in water to give an aqueous solution with a concentration less than 0.01 mol/L

Slightly soluble—if it dissolves in water to give an aqueous solution with a concentration between 0.01 mol/L and 0.1 mol/L .

Soluble—if it dissolves in water to give an aqueous solution with a concentration greater than 0.1 mol/L .

This is an arbitrary scale used in WACE. Values obtained from the above calculations, show that barium hydroxide is just between soluble and slightly soluble salts and will give precipitate at high concentration.

Source URL: <https://assist.asta.edu.au/question/3369/precipitation-reaction-sodium-hydroxide-and-barium-nitrate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Precipitation reactions

Precipitation reactions

Posted by Anonymous on Mon, 2019-06-24 14:33

Precipitation reactions: I am looking for precipitate reactions that have the least impact on the environment but are also dramatic. Do you have any suggestions?

Voting:•



No votes yet

Year Level:•

8
9
10

Laboratory Technicians:•

Showing 1-1 of 1 Responses

precipitation reactions

Submitted by sat on 24 June 2019

Have you considered conducting precipitate reactions using microscale techniques? The use of micro quantities of chemicals can enable the demonstration of many chemistry principles with no compromise of outcomes and with minimal impact on the environment.

A simple way to demonstrate precipitation reactions, instead of using test tubes, is to use a laminated A4 page with a grid printed on it, or to place a page with a grid printed on it inside a plastic sleeve. One drop of two different dilute (0.1M) solutions can be added together and

observed for the formation of a precipitate. • For an example of this, see 'Microscale reactions of positive ions with sodium hydroxide', Learn Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000757/microscale-reactions-of-positive-ions-with-sodium-hydroxide?cmpid=CMP00005906> (July 2016). The chemical waste for these activities on the plastic sheet is not significant and can be wiped up with a paper towel or tissue and disposed of in the general waste.

I also refer you a previous question that we answered regarding microscale chemistry where we provided a number of links, see <https://assist.asta.edu.au/question/4483/microscale-chemistry>

In particular I draw your attention to the YouTube videos by Bob Worley a CLEAPSS advisor, as he has a number of videos showing very dramatic reactions in a drop of water. • He uses a method which clearly demonstrates **dissolving**; **diffusion** and then **precipitation**. For example:

- '**Lead iodide ppt**', YouTube (1:13 min) <https://youtu.be/tlkzoPzsaNU>. This reaction is quite spectacular with the formation of the distinct yellow precipitate as a line. Note: this activity uses solid chemical and should be conducted as a demonstration and projected onto a screen (e.g. using a document camera) or showing this YouTube video. See safety notes for using lead nitrate below.
- '**Iron thiocyanate complex no magnet**', YouTube (0:38 min) <https://youtu.be/jo4Kz8-FqVo>. This reaction is quite spectacular with the formation of a distinct red iron thiocyanate complex as a line.
- '**Iron thiocyanate complex with magnet**', YouTube (1:16 min) <https://youtu.be/mS1o9Dn7nRM>. This is an extension of the iron thiocyanate complex with distortion of the 'line' due to the magnetic effect.
- '**Iron(III) nitrate with sodium hydroxide**', YouTube (1:48 min) https://youtu.be/tG6_KBg4nZs. This is extremely visual due to the addition of bromothymol blue indicator and the formation of a distinct brown precipitate.

For details on this method, see 'Precipitates', YouTube (1:17 min) https://youtu.be/9zYcE35_Vsw

'Four ways to do a microscale precipitation reaction' can be found here

1. Add one drop of a chemical solution on an acetate sheet and then on top of this drop, add one drop of a different chemical solution and observe if a precipitate forms.
2. Add one drop each of two different chemical solutions, side by side on an acetate sheet and then mix the two drops together and observe if a precipitate forms.
3. Add two drops of distilled water side by side on an acetate sheet and then add a tiny amount of two different solid chemicals to each drop. Mix each drop and then combine the two drops
4. Add one drop of distilled water on an acetate sheet. Using fine pop sticks (The thin coffee type sticks or toothpicks) push a tiny amount of solid chemical into opposite sides of the drop, then wait, after a short time, you should see a line appear, where the two solutions 'collide' and form a line where a precipitate has formed

The 4th and last method clearly demonstrates **dissolving**; **diffusion** and then **precipitation**.

An alternate way to place the solid chemicals into the one drop of distilled water for these precipitation activities is to:

- Dampen the ends of pointed wooden splints or two toothpick/cocktail sticks and hold them in each hand.
- Dip the damp sticks into each solid provided so that there is a little attached to the stick.
- Insert the sticks into the opposite ends of the drop so that the solids come off and dissolve.
- This could be organised as different stations for different precipitates around the room to minimise the setup of solid chemicals

Other examples of microscale chemistry in a drop

- For an example of a diffusing neutralisation in a drop of distilled water with a drop of universal indicator see 'Diffusing neutralization x4 Copy', YouTube (1:04 min) https://youtu.be/_GIXMUsCPXA

For an example of a microscale reaction for metal displacement observing silver nitrate reacting with copper wire see 'Silver nitrate reacting with copper wire', YouTube (0:20 sec) <https://youtu.be/bj1Bjh0VbvU>.

We suggest that you trial this using 1-2 drops of 0.1M silver nitrate on an acetate sheet/plastic sleeve protector and place a bare (not coated) copper wire half-way into the droplet. This could even be filmed using a mobile phone with a magnifying lens added.

The chemical waste for these activities in drops of water is not significant and can be wiped up with a paper towel or tissue and disposed of in the general waste. This assumes safe chemical handling, good laboratory practices and in particular ensuring that hands are washed at the end of the laboratory session.

Safety notes for using lead nitrate: Only solutions 0.5M or lower are recommended for use by year 7-12 students¹. Small quantities should be used for short amounts of time, wearing appropriate PPE such as gloves and safety glasses. Good laboratory hygiene such as cleaning up any spills, no eating or drinking in laboratories and washing hands at the end of all laboratory sessions should also be implemented.²

References:

¹Science ASSIST. 2017. *List of recommended chemicals for science in Australian schools*, 'Notes' Tab, note C, Science ASSIST website, <https://assist.asta.edu.au/resource/3052/list-recommended-chemicals-science-australian-schools>

²'Use of lead in ACT schools', Science ASSIST Q&A, Science ASSIST website, <https://assist.asta.edu.au/question/4070/use-lead-act-schools> (September 2016)

Source URL: <https://assist.asta.edu.au/question/4490/precipitation-reactions>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Reaction between iron and sulfur

Reaction between iron and sulfur

Posted by Anonymous on Thu, 2016-04-28 22:18

Reaction between iron and sulfur: When we conduct the reaction between Fe and S, it seems to create SO_2 , which is toxic, and sometimes I smell H_2S . Are we allowed to carry out this reaction in the lab? Also, could you please clarify the reaction between FeS and acid? My understanding is that it produces H_2S . Is it okay to do this reaction outside?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by Poonam hosany on question Reaction between iron and sulfur

Submitted by sat on 28 April 2016

Fe and S: The reaction between iron fillings and sulfur powder demonstrates the exothermic reaction of two elements to form the compound iron (II) sulfide (FeS). This reaction is usually used to illustrate elements, mixtures and compounds. This reaction generates sulfur dioxide gas, which is toxic and corrosive and small quantities can trigger asthma attacks. Therefore, Science ASSIST recommends that this reaction be conducted as a **teacher demonstration only** and be carried out in an operating **fume cupboard**.

The equation for this reaction is $\text{Fe}_{(\text{s})} + \text{S}_{(\text{s})} \rightarrow \text{FeS}_{(\text{s})}$ and requires Fe and S in a 7:4 ratio by mass. The homogeneous mixture of iron fillings and sulfur powder is heated in a crucible with the lid on using a Bunsen burner. The lid prevents the sulfur vapour from escaping and possibly catching fire. If the sulfur catches fire, then sulfur dioxide gas will be evolved. At the end of the reaction, a hard black residue of iron (II) sulfide is formed at the bottom of the crucible. Iron (II) sulfide can be discarded into the general wastes container, as it is not considered hazardous.

Science ASSIST recommends the following for this reaction.

- A site-specific risk assessment should be conducted, see the Science ASSIST [Risk Assessment Template](#).
- Conduct as a teacher demonstration in an operating fume cupboard.
- Sulfur is an irritant and people handling it should avoid contact with skin, eyes and clothing.
- Suitable PPE, such as laboratory coat, closed-in shoes and safety glasses, should be worn. Latex or nitrile gloves are suitable for handling sulfur.
- Sulfur is a flammable solid and the crucible lid should be properly placed so as to prevent combustion.
- Inspect and discard any chipped or cracked crucible, as it may break during heating, resulting in spillage of hot material.

FeS and acid: This reaction generates hydrogen sulfide gas, which is flammable and toxic and small quantities can trigger asthma attacks. Therefore, Science ASSIST recommends that this reaction be conducted as a **teacher demonstration only** and be carried out in an operating **fume cupboard**. This is preferable to conducting the activity outdoors because the fume cupboard is a controlled environment, whereas weather conditions can be unpredictable outside.

The equation for this reaction is $\text{FeS}_{(\text{s})} + 2 \text{HCl}_{(\text{aq})} \rightarrow \text{H}_2\text{S}_{(\text{g})} + \text{FeCl}_{2(\text{aq})}$

Science ASSIST recommends the following for this reaction.

- A site-specific risk assessment should be conducted, see the Science ASSIST [Risk Assessment Template](#).
- Conduct as a teacher demonstration in an operating fume cupboard.
- Suitable PPE, such as laboratory coat, latex or nitrile gloves, closed-in shoes and safety glasses, should be worn.
- React a small amount of iron (II) sulfide (0.1 g) with 5 mL of 0.5 M hydrochloric acid. The hydrogen sulfide gas generated during the reaction will be extracted by the fume cupboard fan.
- The reaction mixture should be left in the fume cupboard until the reaction is complete,

and then added to water and the resulting liquid disposed of down the sink with dilution. Any unreacted iron (II) sulfide residue can be disposed of in the general waste.

References

'Iron and Sulfur Reaction' Royal Society of Chemistry website,
<https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000713/iron-and-sulfur-reaction?cmpid=CMP00005161> (Accessed April 2016)

'Hydrogen sulfide hazards'. Safety and health topics. OSHA website
<https://www.osha.gov/SLTC/hydrogensulfide/hazards.html> (Accessed April 2016)

'Iron filings' Safety Data Sheet, Chem Supply website,
<https://www.chemsupply.com.au/documents/IT0141CH38.pdf> (February 2016)

'Iron (II) Sulfide' Safety Data Sheet, Chem Supply website,
<https://www.chemsupply.com.au/documents/IT0161CH3A.pdf> (September 2012)

OSHA. 2005. *Hydrogen sulfide fact sheet*. OSHA.
https://www.osha.gov/sites/default/files/publications/hydrogen_sulfide_fact.pdf

'Sulfur' Safety Data Sheet, Chem Supply website,
<https://www.chemsupply.com.au/documents/SL0061CH71.pdf> (Aug 2014)

Source URL: <https://assist.asta.edu.au/question/3771/reaction-between-iron-and-sulfur>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Reflux and distillation

Reflux and distillation

Posted by Anonymous on Thu, 2015-04-30 11:46

Reflux and distillation: How should solutions be heated when using quickfit apparatus to perform reflux or distillation? Are Bunsen burners still allowed? We do not have any heating mantles.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

reflux and distillation

Submitted by sat on 13 May 2015

When performing reflux and distillation using Quickfit apparatus (standard taper ground-joint glassware) in a school, the safest and most practical method for heating reactants with boiling points below 100° C is the use of a water bath. When heating reactants with boiling points above 100° C, a heating mantle with a correctly fitting flask or a sand bath can be used. A Bunsen burner, or any other naked flame, is not advisable, unless heating non-flammable liquids.

Reflux and distillation:

Reflux and distillation are common techniques used in school chemistry classes. Quite often, these experiments require the heating of flammable organic solvents, whilst occasionally distillation is used to separate non-flammable inorganic solutions. The most common experiments are in carbon chemistry – refluxing of an organic reaction – esterification of carboxylic acids and the use of distillation to purify an ester and make boiling point (BP) determinations.

The flammable organic solvents that are used for these reactions include alcohols such as ethanol, methylated spirits, propan-1-ol and butan-1-ol. Most of the esters that are produced would fall into the highly flammable through to combustible classifications. All of these chemicals require careful handling especially in respect to exposure to heat sources. The major concern is the presence of flammable vapours in the vicinity of any naked flame. Vapours from organic solvents are heavier than air and can travel long distances along a bench or floor.

It is important to keep all naked flames and static discharge sources away from flammable organic solvents. Schools should ensure that they **DO NOT** use a Bunsen burner for heating a reaction when there are flammable organic solvents present, even with reflux or distillation setups. The Bunsen provides a very high heat source that could very quickly ignite organic solvents and vapours. It is also difficult to evenly distribute heat around any reaction flask with a Bunsen and there is a risk of cracking the reaction vessel and releasing the contents.

Recommended methods for heating flammable liquids:

Water Bath:

This is the recommended method for heating reactions up to 100° C using Quickfit apparatus during reflux or distillation procedures. For distillation, a water bath generally has to be 15° C higher than the boiling point of the liquid being distilled. It is important to check that the liquid you are distilling is suitable for this heat range. A water bath can be simply prepared by heating a beaker or pan of water using a hot plate. It is important to use a container large enough to hold the reaction flask and provide a buffer of water between the outside of the reaction flask and the beaker or container. This technique is recommended for the following reasons.

1. Absence of a naked flame.
2. Overheating is prevented.
3. Even and controllable heating is provided for both round bottom and pear-shaped flasks.
4. If the reaction flask were to crack, then the spilled contents would be captured and diluted in the water bath minimising the risk of ignition. It should be noted that the surface of the hotplate is a potential ignition source, if an organic solvent were spilt directly onto it and its flash point¹ exceeded. Never heat an organic solvent in an open container on a hotplate.
5. This technique is suitable for temperatures up to 100° C and is adequate for the majority of reactions conducted in school chemistry labs.

Steam bath:

A steam bath can be constructed using a vessel of water heated over a hotplate. Alternatively, electrically heated steam baths can be purchased through science equipment suppliers. These are fitted with constant water level devices and overlapping concentric rings, which can be removed according to the size of the vessel being heated. The 'in-line' style is useful for the classroom situation. Steam baths can be used to heat low-boiling liquids and are suitable for heating flammable liquids.

Heating Mantle:

This is the recommended method for heating solutions over 100° C using Quickfit apparatus during reflux or distillation procedures. Heating mantles are the best option for these temperatures as long as the flask is the **correct size to fit the mantle**. They are designed to be used with a properly fitted round-bottomed flask. A heating mantle that is not the right size will have poor contact with the reaction flask and the heating temperature will be very difficult to control. Care needs to be taken as the inside surface is a potential ignition source if an organic solvent were spilt directly onto it and the solvent's flash point exceeded. A heating mantle is an expensive piece of laboratory equipment.

Sand Bath:

This is also a method that can be used for heating solutions over 100° C using Quickfit apparatus during reflux or distillation procedures. An iron or steel container is filled with clean, dry, washed sand and placed onto a hotplate. Do not use glass containers, as there is a risk of them cracking under the high heat. The reaction flask is placed into the sand which conforms to the shape of the flask. The sand conducts heat from the hotplate to the reaction vessel. The sand at the bottom of the bath will be hotter than the sand at the top. The flask can be raised or lowered in the sand bath to the desired temperature. Even heating is provided by this method. The temperature is monitored by a thermometer that is inserted into the sand. Sand baths can be heated to temperatures greater than 250° C. A disadvantage is that they take a long time to heat up and cool down. In addition, they can be very heavy and present a manual handling hazard. Avoid spilling any water into the bath, as this can result in hot sand being splattered out causing injury. There are bath surrounds that can be purchased that sit on top of the hotplates as a safety measure.

Other methods for heating flammable liquids:

There are other types of heating sources available in laboratories, such as oil baths and heat guns. However, these are less likely to be used in school science labs.

Oil Bath:

Oil baths are used for temperatures above 100° C. The bath is usually magnetically stirred and heated on a hotplate. Silicon oil and mineral oil are the two most common oils used. Silicon oils are non-flammable, do not give off unpleasant odours, and are very stable. Mineral oil is much less expensive, but is flammable. It should not be heated above 175° C. The silicon fluids are probably the best liquids for oil baths, but they are very expensive for general use.

In general, oil baths are difficult to handle. Electrically heated oil baths are available but are expensive. The following precautions need to be taken:

- The mineral oil should not be overheated, as it will smoke. If the flashpoint of the oil is reached, it can catch on fire.
- If heating over a hotplate, then you need to use a metal pan. A glass container may crack spilling the contents onto the hotplate.
- Oil baths should be mixed to prevent hot spots.
- Do not overfill as oil expands in volume when heated.
- Be careful not to tip over the hot oil, use a laboratory jack to support and raise or lower the bath.
- Do not allow water or any volatile into the hot oil, the water will boil and may splatter the hot oil out.

Heat Guns:

These get to very high temperatures very quickly (up to 500° C). They operate by sucking air across red-hot heating elements thereby increasing ignition risks in the presence of flammable organic solvents. The nozzle of a heat gun during operation is also an ignition source. Never use them near flammable liquids or environments containing flammable vapours. In addition, even heating is difficult to achieve by this method. They are generally used in the laboratory when a short burst of heat is required, and not as a heat source for reactions or distillations.

Use of Bunsen Burners:

A Bunsen burner should only be used to heat non-flammable liquids. Examples of distillations when Bunsen burners are safe to use include: steam distillations of essential oils, ink solutions, sea water and copper (II) sulfate solutions.

Safety Considerations:

Other safety issues that need to be considered with refluxing and distillation techniques to prevent accidents that could expose any flammable chemical to the heat source include the following.

- Check that any glassware used is free from chips or cracks.
- Keep Quickfit joints lubricated with a thin layer of vacuum grease and make sure they are firmly clamped with special joint clips/clamps, which are available through science equipment suppliers.
- Add boiling chips to the reaction liquid before heating to produce smooth boiling and prevent superheating.
- **Never heat a closed system** as the build up of gas may cause an explosion. Always check that there are no blockages between the mixture and the top of the condenser.
- Provide good ventilation and be aware that naked flames should not be lit until the reaction has totally cooled, equipment disassembled and removed from the lab and no vapours are present.
- Never use a flat-bottomed flask. A round-bottomed flask is better to use, as it is less likely to crack.
- The reaction flask should not be more than half-filled with the reaction mixture.

- Use proper disposal methods for all wastes.

Science ASSIST recommends that a risk assessment be conducted and SDSs consulted for all chemicals used and produced. The risk assessment should also be conducted for all equipment used in the reflux and distillation procedures. Science ASSIST has developed a one-page risk assessment template that may be useful. See [Risk Assessment Template](#).

Glossary:

Distillation:

Distillation is a technique used to purify and separate a liquid mixture. It is based on the different boiling temperatures of liquids. The liquid with the lower boiling point evaporates first (most volatile) and the vapours are then condensed back into liquid form in a sequence from lower to higher boiling points. The temperature is usually maintained at the boiling point of the lower boiling component of the mixture. Simple and fractional distillation is commonly used in school labs.

Reflux:

Reflux is a technique generally used to prevent the loss of any volatile reagent and solvent by evaporation. It is usually carried out at a constant elevated temperature. In school science laboratories, reflux is commonly used for the synthesis of esters where a mixture consisting of an alcohol, carboxylic acid and a small amount of concentrated sulphuric acid (catalyst) is heated in a vessel fitted with a water-cooled condenser to prevent loss of volatile material.

Quickfit glassware:

Specialised, interchangeable, borosilicate glassware, which have been designed with precision manufactured joints that fit together quickly and easily, providing good seals. Quickfit is a brand name and the glassware comes in many shapes and sizes. Quickfit glassware is commonly used for distillation and reflux techniques in chemistry laboratories.

References:

Committee on Prudent Practices in the Laboratory, 2011 '*Prudent Practices in the Laboratory*' The National Academies Press: Washington D.C. <https://www.nap.edu/read/12654/page/159>

CR Scientific LLC, Proper Heating of Retorts and Flasks.
<http://www.crsscientific.com/properheating.html>

'Distillation', Wikipedia <https://en.wikipedia.org/wiki/Distillation> (2015)

'Flammable Liquid Safety' Flinn Scientific website
<https://www.flinnsci.com/media/396137/flammableliquidsafety.pdf> (2011)

Gelosa D. and Sliepcevich A. 'Chemical laboratory techniques' *Fundamentals of Chemistry*, Vol. 1 Encyclopedia of Life Support Systems <http://www.eolss.net/sample-chapters/c06/e6-11-02-01.pdf> (Accessed April 2015)

Mohrig, Jerry R; Noring Hammond, Christina; Schatz, Paul F. 2010 *Techniques in Organic Chemistry* W.H. Freeman and Co: England

https://www.academia.edu/4490991/Techniques_in_Organic_Chemistry

NSW Department of Education and Communities '*Chemical Safety in Schools (CSIS)*' resource package. NSW DEC website <https://education.nsw.gov.au/> DEC Intranet, login required.

National Occupational Health and Safety Commission 1990 '*Industrial Organic Solvents*' Australian Government Publishing Service: Canberra

<http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents...>

'Reflux', Wikipedia <https://en.wikipedia.org/wiki/Reflux> (2014)

Standards Australia. 2006. AS 2243.2-2006 Safety in laboratories - chemical aspects

Source URL: <https://assist.asta.edu.au/question/2802/reflux-and-distillation>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Rusting of steel wool using vinegar

Rusting of steel wool using vinegar

Posted by Anonymous on Fri, 2016-03-18 15:34

We are doing the rusting of steel wool with vinegar experiment with our Year 8 students. There are various versions of this experiment on the net, this is one example:
<http://www.sciencekids.co.nz/experiments/steelwoolvinegar.html>

Our students are given a range of liquids (water, salt water, vinegar, oil, and soft drink) to investigate which liquid produces the greatest temperature increase and the largest amount of rust. Our method is: soaking the steel wool in the liquid, removing the steel wool and squeezing and flicking off as much of the liquid as possible. The steel wool is then wrapped around the bulb of a thermometer. A paper towel is then wrapped around the steel wool ball and held in place with a rubber band. The temperature is recorded for 10 minutes.

The steel wool in vinegar produces a rise in temperature, sometimes the temperature goes above 50 °C. None of the other liquids show any temperature increase. After 10 minutes, students unwrap the steel wool and observe any changes. The steel wool in vinegar always looks rusty and the paper towel is stained. The salt water and soft drink sometimes produce brown staining on the paper towel, but no visible change to the actual steel wool. The other liquids don't produce any change.

I have run some additional experiments to find out what is really happening. I have used hydrochloric acid and sulfuric acid at various concentrations, I have also tried sodium hydroxide and bleach. None of these solutions produce a significant amount of rust and no visible change to the steel wool. The acids produced some staining of the paper towel, the bases did nothing. The sulfuric acid produced a small rise in temperature from 25 to 28 °C. I have also tried 5% acetic acid (same concentration as the vinegar), this produced almost as much rust as the vinegar and a temperature rise to just over 40 °C.

The success of the experiment depends on how much liquid is removed from the steel wool after soaking. The more liquid removed, the higher the temperature and the greater the amount of "rust". Nothing happens if the steel wool is too wet.

I have the following questions about this experiment.

1. Safety: The steel wool smells really bad after it is removed from the vinegar. It smells a bit like a combination of foul eggs and fish. I thought maybe the steel wool contained some iron sulfides. The fishy smell may indicate amines. What are the gases (smell) produced, are they toxic?
2. Why is it only vinegar that produces such a large temperature increase and a large amount of "rust"?
3. Why doesn't the experiment work when the steel wool is too wet?
4. What are the actual products of the reaction with vinegar. I have a feeling they could be a combination of iron acetates and oxides. I suspect the hydrochloric acid produces chlorides and the sulfuric acid produces sulfates. Maybe these reactions are less exothermic than the acetates. Or maybe the vinegar acts as a catalyst?

I would be very grateful if you could answer some of these questions.

Voting:•



Average: 5 (1 vote)

Year Level:•

8

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by Poonam hosany on question Rusting of steel wool using vinegar

Submitted by sat on 04 April 2016

The steel wool and vinegar rust experiment is a great example to illustrate the highly exothermic rusting process. The most appropriate way to perform this experiment is to place steel wool and a thermometer in a covered beaker to get an initial stable temperature. Then the thermometer is removed and the steel wool allowed to soak in vinegar for 1 minute. The steel wool is then removed from the vinegar and all excess liquid squeezed out. The steel wool is then wrapped around the thermometer and both are placed in the covered beaker. The temperature increase is then recorded until a maximum temperature is reached.

As you suggest, steel wool can contain sulphur as an impurity. Vinegar (4-5% acetic acid)

has a characteristic pungent smell and often contains sulphides as preservatives. During the steel wool-vinegar rust experiment, a pungent and foul rotten-egg smell is observed, which is due to the generation of hydrogen sulfide (H_2S) gas. When the steel wool is allowed to soak in the vinegar, the rotten-egg smell sharpens and during the rusting process the smell is even more prominent due to the high temperature.

Hydrogen sulfide can be detected at very low levels; its threshold detection concentration (0.008 ppm^1) is at least 500 times below the level at which it can cause adverse health effects.

¹ Hydrogen sulfide is a toxic gas, however, at low concentrations, health significant effects would not be expected, although the smell may cause annoyance or anxiety. At concentrations of 2-4 ppm, people may experience eye irritation and in sensitive individuals such as asthmatics, respiratory irritation may occur.¹ Chronic exposure to low concentrations may lead to headache, fatigue and nausea. Hydrogen sulfide is broken down in the air and with low-level exposure, any that is absorbed is rapidly metabolised and does not accumulate in the body.¹

Dry steel wool does not rust because of its microscopic oil coating. During the manufacture of steel wool, oil is put onto the cutting tools to minimise the fire hazard by reducing friction. When soaked in vinegar, the acetic acid removes the protective coating on the steel wool and the iron is able to rust. Acetic acid is a hydrophylic (polar) solvent. Due to its moderate dielectric constant, it can dissolve non-polar compounds such as oil and is widely used as a degreaser. Mineral acids such as hydrochloric acid and sulfuric acid, though stronger than acetic acid, are not able to remove the protective coating at low concentrations and therefore the rusting process is slower, less exothermic and the yield is smaller. If the steel wool is soaked in 2 M sulfuric acid or hydrochloric acid for a longer period of time, then the mineral acids will be able to break down the protective oil coating and react with iron to give iron (II) sulphates or chlorides and liberate hydrogen gas.

Once the protective layer is removed, excess vinegar is squeezed out so as to expose the iron to the atmospheric oxygen. When the steel wool is wet, the liquid seeps into the iron's tiny gaps and serves as an electrolyte to allow the electrons from oxygen to gravitate towards the iron. If the steel wool is too wet, the reaction will be less exothermic and yield less rust. This is because the acetic acid from the vinegar will react with the iron from the steel wool to form iron acetate and hydrogen gas.

The products obtained from the steel wool-vinegar experiment is mainly rust-brown, a reddish-brown solid and unreacted iron. As long as the steel wool is not left immersed in the vinegar, iron acetate is not formed and this can be easily confirmed by a simple reaction with ammonium hydroxide solution. Some distilled water is added to the solid product, and 5 mL of the suspension formed is transferred to a test tube and 5 mL of 0.1M ammonium hydroxide is added. The absence of a green precipitate (iron (II) hydroxide) confirms that iron acetate is not present.

Science ASSIST recommends the following when doing this experiment.

- Suitable PPE should be worn when handling steel wool, such as: protective clothing, nitrile gloves and safety glasses.
- Ensure that there is good ventilation in the laboratory when conducting the experiment.

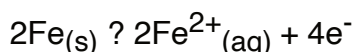
- Keep the steel wool in its original packaging away from electrical outlets or other sources of electricity or flame. (Note: Incomplete combustion of steel wool will produce carbon monoxide, a toxic gas.)
- Store the steel wool in a cool, well-ventilated area away from incompatible chemicals such as acids and strong oxidizing agents.
- Keep the exposure to the steel wool to a minimum and minimise the quantities kept in work areas.

Additional Information

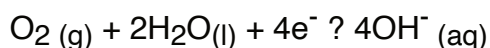
The **rusting** of iron is a redox chemical process that takes place when the metal is exposed to water, oxygen and an electrolyte. The corrosion process is complex and proceeds through the formation of the hydrated oxides, $\text{Fe}(\text{OH})_3$ or $\text{FeO}(\text{OH})^2$. The final product of the process, the reddish brown solid we know as 'rust', is composed of the hydrated iron oxide, $\text{Fe}_2\text{O}_3 \cdot n\text{H}_2\text{O}$.

The 2 distinct chemical reactions in the corrosion process are:

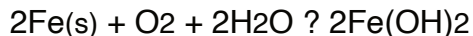
1. Anodic oxidation and dissolution of iron



2. Cathodic reduction of oxygen



The overall equation is:



The iron (II) hydroxide is further oxidised to give the final red product, rust, $\text{Fe}_2\text{O}_3 \cdot n\text{H}_2\text{O}$.

Vinegar contains significant amounts of polyphenols (antioxidant plant chemicals) and minute traces of minerals such as potassium, sodium, calcium and vitamins as well as sulfites in the form of preservatives. The acetic acid in vinegar is formed as a by-product of the fermentation process involving yeasts, harmless microorganisms which convert natural sugars to alcohol under specific conditions, and bacteria of the genus 'Acetobacter' which convert the alcohol to acid.

Steel wool is made up of low-grade carbon steel wire, commonly known as mild steel. Mild steel is a low-cost material with a composition of 0.05-0.25% carbon, 98-99% of iron, 0.6-0.9% manganese and up to 0.4% silicon. Residual elements such as nickel, chromium, aluminium, molybdenum and copper may be present in addition to impurities such as phosphorus and sulfur.

Steel wool is a biodegradable material and is commercially available in 8 different grades or thicknesses from coarse to extra fine. The finer the metal, the less harsh it is. The 8 different grades are listed in the table below.

Grade	Number	Common Uses
-------	--------	-------------

Coarse	3	Paint and varnish removal, removing paint spots from resilient floors, cleaning glass blocks
Medium coarse	2	Removing scratches from brass, removing paint spots, removing rust and dirt from garden tools.
Medium	1	Cleans glazed tiles, removing stains from wood floors, cleans cast and wrought iron.
Medium fine	0	Brass finishing, cleaning tile, removing paints and varnishes and stubborn finishes
Fine	00	With linseed oil sanitizes high-gloss finishes
Extra fine	000	Removes paint spots or stains from wooden floors, cleans polished metal such as aluminium, smoothes finishes between coats, cleans vinyl and tiled floors
Super fine	0000	Final rubbing of finish, stain removal, antique restoration, polishes bright metals and removes dirt from glass

.

The Dielectric Constant (?) or relative permittivity, is a dimensionless constant that indicates how easily a material can be polarized by imposition of an electric field on an insulating material. As a measure of solvent polarity, a higher ? indicates that the solvent has a higher polarity, and therefore a greater ability to stabilize charges.³

Water, being a very polar solvent, has a high dielectric constant of 80 at 20 °C. For non-polar solvents such as hexane and cyclohexane, ? is close to 2, while for acetic acid, ? is 6.2.⁴

References

¹Western Australia Department of Health. 2009. *Environmental Health Guide –Hydrogen Sulphide and Public Health*, Western Australia Department of Health website

<http://www.public.health.wa.gov.au/cproot/2652/2/11548%20hydrogen%20sulphide>

² ‘Some chemistry of iron’, University of The West Indies website, <http://wwwchem.uwimona.edu.jm/courses/iron.html> (Accessed April 2016)

³ ‘Dielectric constant’, Illustrated Glossary of Organic Chemistry, University of California

website,

http://www.chem.ucla.edu/~harding/IGOC/D/dielectric_constant.html (Accessed April 2016)

⁴ 'Solvent' Wikipedia website <https://en.wikipedia.org/wiki/Solvent> (Accessed April 2016)

'Acetic Acid' Wikipedia website https://en.wikipedia.org/wiki/Acetic_acid (Accessed March 2016)

'Grades and Applications of Steel Wool' International Steel website,

<https://steelwooldirect.com/grades-and-applications/> (Accessed March 2016)

'How Steel Wool is Made'. Volume 6 Madehow.com website,

<http://www.madehow.com/Volume-6/Steel-Wool.html> (Accessed March 2016)

'Steel Wool' Safety Data Sheet, Fisher Scientific website,

https://www.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-s/S25586.pdf (June 2015)

'Versatile Vinegar' The Vinegar Institute website, <https://versatilevinegar.org/faqs/> (Accessed March 2016)

'What about Vinegar' Paleoleap website, <https://paleoleap.com/what-about-vinegar/> (Accessed March 2016)

'Workplace Exposure Standards for Airborne Contaminants', Safe Work Australia website, December 2011,

<http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents...>

'Your Guide to Vinegar' Australian Health Food website <https://www.healthyfood.com/ask-the-experts/is-vinegar-healthy/> (Accessed March 2016)

Source URL: <https://assist.asta.edu.au/question/3684/rusting-steel-wool-using-vinegar>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Safe concentration of HCl for Year 8 students to use?

Safe concentration of HCl for Year 8 students to use?

Posted by Anonymous on Wed, 2017-08-09 10:23

Safe concentration of HCl for Year 8 students to use?: A year 8 textbook has an activity which includes an example for a colour change (blue litmus paper with HCl added to it). The teacher thinks this is a bit boring and has asked me to look into an alternative colour change reaction. As the 4 examples of a chemical reaction all involved HCl I decided to look for a colour change reaction involving HCl. One of the reactions I am looking at is the reaction of concentrated HCl with $\text{CuSO}_4 \cdot 6\text{H}_2\text{O}$. This gives a lovely colour change from blue to green $[\text{CuCl}_4]^{2-}$. Excess NH_3 solution can then be added to give a lovely deep blue/purple $[\text{Cu}(\text{NH}_3)_4(\text{OH})_2]$.

So far I have been able to get the CuSO_4 solution to change colour to the green $[\text{CuCl}_4]^{2-}$ using 6M HCl (with conc. HCl obviously been approx 12M). I am concerned about the students using 6M HCl. The 6M HCl would be in a Stuhl dropper bottle, it would be in the fumehood and the students would have all their PPE on. Do you think it is safe for the students to do the reaction if closely supervised by myself and the staff member, or should it be a demonstration only? Just out of curiosity, what molarity of HCl would you consider to be safe for students to use?

Can you suggest an alternative colour change reaction involving HCl at a lower concentration?

Voting:



No votes yet

Australian Curriculum:

Chemical change involves substances reacting to form new substances

Year Level:

8

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Safe concentration of HCl for Year 8 students to use?

Submitted by sat on 13 September 2017

Firstly, it is important to assess the risk of each activity conducted considering

- The use of safe operating procedures
- The equipment and how it will be used
- The chemical(s) used, their concentration and how they will be used
- By-products, chemical waste and any other waste produced
- The students' skill-level, behaviour, and ability to follow instructions
- A Risk Assessment Template developed by Science ASSIST can be accessed [here](#)

We recommend that the 6M HCl be used by the teacher as a demonstration only and not by Year 8 students. Science ASSIST considers that up to 2M HCl is sufficient for most general chemistry activities and recommends using the lowest concentration that delivers the desired outcome.

An alternative activity to demonstrate a colour change could be to use another pH indicator, such as universal indicator, which would change from green to red. Alternatively, students could make a pH indicator (e.g. from red cabbage, red onion, blueberries, beetroot or red or blue flowers etc.) to investigate colour changes, see [Acids and bases](#). Flinn Scientific have produced a nice video on this see <https://www.youtube.com/watch?v=vFjK8Tt-z8g>

References:

Flinn Scientific. 2012. 'Natural Indicators'. <https://www.youtube.com/watch?v=vFjK8Tt-z8g> (Accessed September 2017)

'Acids and bases'. Science ASSIST website. <https://assist.asta.edu.au/resource/2373/acids-and-bases> (Accessed September 2017)

Source URL: <https://assist.asta.edu.au/question/4222/safe-concentration-hcl-year-8-students-use>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Tollens Test

Tollens Test

Posted by Anonymous on Thu, 2016-08-11 14:55

Tollens Test: For Year 12 chemistry, the teachers wanted to demonstrate the silver mirror, also called Tollens test. The process goes like this:

- 1) 10 ml of a mixture of glucose with a bit of tartaric acid is poured into a flask.
- 2) 10 ml of ammonium nitrate and 10 ml silver nitrate are mixed together. This mix is then added to the flask.
- 3) 10 ml of strong sodium hydroxide is then added to the flask.

This whole mixture is swirled gently and a silver mirror from deposited silver forms on the glass. Usually.

In this case, this did not happen. I mixed the silver nitrate and ammonium nitrate a few days before, keeping the silver nitrate out of light to preserve it. The glass was clean. Despite all this, no silver mirror was formed. There was only a mild darkening of the glass.

Would anyone know what happened, and why?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

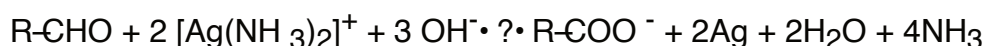
Tollens Test

Submitted by sat on 05 September 2016

In brief:

Tollen's reagent is an alkaline solution containing a silver-ammonia complex, which is used in organic chemistry to test for the presence of aldehydes. In this reaction, the aldehyde is oxidized to the corresponding carboxylic acid and the silver ion is reduced to metallic silver, which deposits as a thin film on the inner surface of the glass and is commonly known as a silver mirror. There are a number of possible causes for the Tollen's Test activity not working as expected. Not having a scrupulously clean glass surface is one of them, but also impurities in the mix that would act as nuclei for very fine particles to precipitate onto other than the surface of the glass. • Metallic silver deposits appear as dark grey to black if they are rapidly formed and are very fine grained for example, silver on photographic film looks black rather than metallic shiny silver. • The darkening could also be due to silver oxide (a stage of the process), which has not been chemically reduced to metallic silver. The feasibility of this reaction also depends on the freshness of the Tollen's reagent.

The general equation for the silver mirror test is:



Safety Notes:

- Tollen's reagent should never be prepared in advance as ammoniacal silver solutions are hazardous and can explode on standing. Any unused solution should be deactivated as soon as possible and within two hours.
- There are a number of chemical hazards to be aware of when preparing the diluted solutions for this activity. Many of the concentrated solutions used are corrosive, may cause respiratory irritation and can cause severe skin burns. •
- Silver ions are harmful for aquatic organisms and release to the environment should be avoided.

Science ASSIST recommends the following:

- A site-specific risk assessment should be conducted.
- Prepare the diluted solutions in an operating fume cupboard.
- Conduct this activity in a well-ventilated room.
- Suitable PPE such as a laboratory coat, closed-in shoes, gloves and safety glasses should be worn at all times.
- Use scrupulously clean glassware. •
- Immediately dispose of wastes generated as described below.

Additional Information

Cleaning glassware:

1. Thoroughly scrub the glassware with soapy water and then rinse well with distilled water.
2. Wear appropriate PPE such as closed-in shoes, rubber or neoprene gloves, safety glasses and laboratory coat.
3. Using a dropper, rinse the glassware with 2-3 mL of concentrated nitric acid under an operating fume cupboard.
4. Discard the nitric acid used in a beaker and rinse the glassware thoroughly with distilled water.
5. Dilute the concentrated nitric acid by carefully adding it to a large volume of water. Neutralize the solution with sodium bicarbonate to a pH of between 6-8 and flush down the sink.

Wastes disposal:

Residual reaction mixture

Residues from the reaction should not be stored as they can form explosive compounds on standing.

Small quantities: the residues should be diluted with a large volume of water and flushed down the sink.

Larger quantities: treat as for surplus Tollen's reagent.

Deactivation of Tollen's reagent

Surplus Tollen's reagent should be deactivated within two hours of preparation as follows:

- Dilute any unused Tollen's reagent 20:1 with water.
- While stirring frequently, slowly add 1M hydrochloric acid solution until the pH reaches 2.
- The addition of hydrochloric acid is exothermic; cool in a water bath if necessary.
- Silver chloride will precipitate out at pH 2. Collect the silver chloride by filtration and allow to dry. Place in a suitable labelled container and store for collection by a licenced chemical waste disposal contractor.
- Neutralise the filtrate with sodium bicarbonate to a pH within 6-8 and flush down the sink.

Removal of silver deposit from glassware:

The thin layer of silver formed can be removed from the silvered glassware using concentrated nitric acid in an operating fume cupboard and wearing suitable PPE.

- Nitrogen dioxide, a toxic gas, is evolved during the process.
- Add the concentrated nitric acid (2-3 mL for one test tube) drop wise to the glass vessel. A Pasteur pipette can be used to ensure that the acid covers the inside surface so that all of the precipitated silver is dissolved.

- To the resulting solution, slowly add saturated sodium chloride solution and white silver chloride will precipitate out. Add the sodium chloride solution slowly until there is no further precipitation of silver chloride.
- Collect the silver chloride precipitate by filtration and allow to dry. Place in a suitable labelled container and store for collection by a licenced chemical waste disposal contractor.
- Neutralise the filtrate with sodium bicarbonate to a pH of between 6-8 and flush down the sink.

Recipes for Tollen's Test:

Tollen's Test using ammonium nitrate:

The purchase of ammonium nitrate is regulated according to state and territory legislation.

For ammonium nitrate regulations, please see the previous question [Ammonium Nitrate](#)

We have tested the following concentrations and procedure and can confirm that it works:

- The recommended concentration for the reagents are: 0.5 M glucose solution, 0.5 M aqueous silver nitrate solution, 1.5 M aqueous ammonium nitrate solution and 2.5 M aqueous sodium hydroxide solution.
- Mix the aqueous silver nitrate and ammonium nitrate solutions just before conducting the experiment.
- Reduce the volume of each reagent used to 2 mL and use a test tube for the experiment.
- Carefully shake the test tube containing the glucose mixture to ensure maximum coverage.

Here is a link to another method using ammonium nitrate:

- 'Tollens' Test –Silver Mirror' The Ohio State University website, <https://u.osu.edu/cbcdemolab/files/2016/02/Tollens-Test-14tw3a0.pdf> (Accessed August 2016)

Tollen's Test using ammonia

There are alternative methods, which do not involve the use of ammonium nitrate. We have tested the following procedure and can confirm that it works:

- To 50 mL of 0.1 M aqueous silver nitrate solution add concentrated ammonium hydroxide solution drop wise. A brown precipitate of silver (I) oxide is formed.
- Continue adding the ammonium hydroxide solution until a clear solution is formed.
- To the resulting clear solution add 25 mL of 0.8 M potassium hydroxide solution followed by the addition of ammonium hydroxide solution drop wise until the solution becomes clear.
- To a clean, dry test tube add 2.5 mL 0.5 M of glucose solution. Carefully shake the test tube to ensure that the entire surface is covered with the glucose solution.
- Add 12.5 mL of the freshly prepared Tollen's reagent to the glucose solution. The solution turns yellow, brown, then cloudy and dark and silver will begin to form on the

inner surface of the test tube.

Here are some links to other alternative methods:

- 'A giant silver mirror experiment' Royal Society of Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000822/a-giant-silver-mirror-experiment?cmpid=CMP00004158> October 2015.
- Flinn Scientific, Inc. 2010. *The Mirrored Flask*, Flinn Scientific website, <https://www.flinnsci.com/media/395452/cf10145.pdf>
- 'Tollen's Test (Silver Mirror)', North Carolina State University website, <https://ncsu.edu/project/chemistrydemos/Organic/TollensTest.pdf> (Accessed August 2016)

Helpful Tips:

- It may be helpful to place the glucose solution in the glassware first, stopper and shake it to ensure that the entire inside surface is covered. The other ingredients are then added.
- Sometimes it is helpful to warm the mixture to get a silver mirror. This can be achieved by running the test tube/vessel under warm water from a tap, or using a warm water bath.

Background information

Monosaccharides are the simplest carbohydrates and are the building blocks from which all bigger carbohydrates are made. Glucose is a monosaccharide and a reducing sugar. The characteristic property of a reducing sugar is that it generates one or more compounds containing an aldehyde group in aqueous solution. • Glucose reacts with water to give an open-chain form containing an aldehyde group.

References

'Ammonium hydroxide, Safety Data Sheet. Please search the product information page on the Chem-Supply website for the latest version: <https://www.chemsupply.com.au>

'Ammonium nitrate' Safety Data Sheet, Merck Millipore website, http://www.merckmillipore.com/INTERSHOP/web/WFS/Merck-AU-Site/en_US/-/US... (Broken link fixed, October 2018).

'A giant silver mirror experiment', Royal Society of Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000822/a-giant-silver-mirror-experiment?cmpid=CMP00004158> (October 2015)

Flinn Scientific, Inc. 2010. *The Mirrored Flask*, Flinn Scientific website, <https://www.flinnsci.com/media/395452/cf10145.pdf>

'Introducing Aldehydes and ketones', Chemguide website,
<https://www.chemguide.co.uk/organicprops/carbonyls/background.html> (Accessed September 2016)

'Monosaccharide', Biology Online website,
<https://www.biologyonline.com/dictionary/Monosaccharide> (Accessed September 2016)

'Nitric acid, Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/NL0011CHGO.pdf> (November 2012)

'Potassium hydroxide, Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/PL0121CH5H.pdf> (September 2014)

'Reducing sugar', OChemPal, website, <http://www.ochempal.org/index.php/alphabetical/q-r/reducing-sugar/> (Accessed September 2016)

'Silver nitrate', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/SL0871CH63.pdf> (September 2011)

'Tollens' Test –Silver Mirror' The Ohio State University website,
<https://u.osu.edu/cbcdemolab/files/2016/02/Tollens-Test-14tw3a0.pdf> (Accessed August 2016)

'Tollen's Test (Silver Mirror)', North Carolina State University website,
<https://ncsu.edu/project/chemistrydemos/Organic/TollensTest.pdf> (Accessed August 2016)

Waddell, Dave. 2015. *Laboratory Waste Management Guide*, Local Hazardous Waste Management Program in King County, <http://www.labwasteguide.org/>

Source URL: <https://assist.asta.edu.au/question/4020/tollens-test>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Toxic Alcohols in Spirit Burners to test Fuel Efficiency

Toxic Alcohols in Spirit Burners to test Fuel Efficiency

Posted by Anonymous on Fri, 2016-06-10 12:36

Toxic Alcohols in Spirit Burners to test Fuel Efficiency: We have a year 10 chemistry investigation in which students are provided with six alcohols in spirit burners. Their task is to investigate the usefulness of different alcohols as fuels. Each class is provided with four sets of the spirit burners containing each of the six fuels. The fuels concerned are:

Methanol, HEXAN-1-OL, Ethanol, Propanol, butanol, and pentanol. I am concerned about the safety of using Methanol and Hexanol as they are both toxic. Is there an appropriate substitute or is it safe to proceed with the above? I have recommended students follow basic safety such as PPE, spill kit on hand, limit the quantity of alcohol in each burner and number of burners per class (I am concerned about the risk of explosions), good ventilation, etc. Can you please suggest any additional safety procedures to ensure this investigation is carried out as safely as possible?

Voting:•



No votes yet

Year Level:•

10

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Toxic Alcohols in Spirit Burners to test Fuel Efficiency

Submitted by sat on 21 June 2016

In brief:

Under controlled circumstances this practical activity is safe to conduct. However the quantity of spirit burners: four sets of six alcohols per class equals 24 spirit burners, which is a considerably high number and would be associated with risks such inadequate ventilation for a class with 25 students. Oxygen from the room is used up during the combustion reactions and there is an increase in the level of carbon dioxide gas, which can lead to headache, dizziness and fatigue. Science ASSIST strongly recommends that this experiment be conducted as a teacher demonstration or by dividing the class into six groups, with each group investigating one alcohol under an operating fume cupboard or in a well-ventilated room.

Fuel efficiency can be investigated by determining the heat of combustion of fuels such as alcohols using spirit burners. When alcohols are burnt in oxygen, a large amount of heat is released and the reaction is said to be exothermic.

All the alcohols mentioned are safe to use in the spirit burner and Science ASSIST recommends the following:

- carry out a site specific risk assessment see the Science ASSIST [Risk Assessment Template](#)
- refer to Safety Data Sheets (SDSs) of all the alcohols used in the experiment
- wear suitable PPE such as laboratory coat, gloves, safety glasses and closed in shoes.

Safety notes:

- for safety instructions for the use of spirit burners see a previous question on [Fuels](#). In particular, note the requirement to keep the burners filled to more than half full.
- Some additional features to consider regarding the selection of high quality spirit burners:
 - **Quality of glass:** look for robust uniform thickness, not badly blown items with obvious flaws in the glass
 - **Shape:** ie squat form that is not easily toppled. • Many are too narrow in the base.
 - **Quality of the metal screw on wick holder:** this should form a good seal with both the glass and the wick so that in the event of toppling, the spirit does not rapidly leak out and catch fire. • Many options fail badly here.
 - **A tight fitting extinguishing cap:** that fits over the wick and extinguishes the flame.
- methanol, ethanol, propan-1-ol, butan-1-ol, pentan-1-ol and hexan-1-ol are all flammable liquids with a range of flash points and any experiment involving combustion is potentially hazardous. Keep all the alcohols away from ignition sources. The alcohol vapours can cause dizziness and drowsiness.
- methanol is highly toxic if swallowed and can cause liver damage and blindness. Propan-1-ol, butan-1-ol and pentan-1-ol are harmful if swallowed and hexan-1-ol is toxic. They can all cause irritation and most can cause serious eye damage. They all have been assigned various categories of acute toxicity, so should all be handled appropriately and ensure that all people handling them observe good laboratory hygiene and wash their

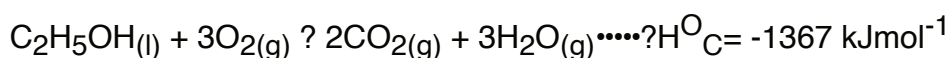
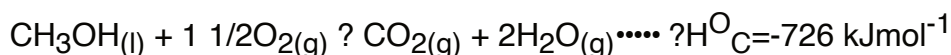
hands before leaving the laboratory.

- Methanol and ethanol burn with a nearly colourless flame that is difficult to see in strong light. Ensure that the flame is extinguished before topping up the spirit burner.

Additional Information

Methanol, ethanol, propan-1-ol, butan-1-ol, pentan-1-ol and hexan-1-ol are all aliphatic alcohols with the general formula $C_nH_{2n+1}OH$ where n is greater than or equal to 1. The functional group is the hydroxyl group ($-OH$). Alcohols are good fuels as they burn in oxygen to give a large amount of heat. The standard enthalpy change of combustion of a compound is the heat change that occurs when 1 mole of a substance is completely burned in oxygen under standard conditions (at 1 atmosphere pressure and at $25^\circ C$).

The equations for the combustion of methanol and ethanol are:



A known mass of alcohol is burned in a spirit burner and the heat released is transferred to a copper can containing a known volume of water. From the resulting temperature rise, the enthalpy of combustion of ethanol can be calculated. As the number of carbon atoms increases the enthalpy change of combustion becomes more negative.

$$\Delta H_C^\circ = \text{Mass} \times \text{Specific heat capacity} \times \text{Rise in temperature}$$

$$\dots\dots\dots = mc\Delta T$$

During this experiment the volume of water used and the distance between the wick of the spirit burner and the bottom of the calorimeter should be kept constant.

References

'Butan-1-ol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/BA0121CH1H.pdf> (June 2014)

'Butan-1-ol', Please visit the Sigma-Aldrich website for their latest Safety Data Sheet:•
<https://www.sigmaaldrich.com/AU/en>

'Hexan-1-ol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/HL0101CHIM.pdf> (February 2016)

'Hexan-1-ol', Please visit the Sigma-Aldrich website for their latest Safety Data Sheet:•
<https://www.sigmaaldrich.com/AU/en>

'Methanol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/ML0041CH4F.pdf> (July 2011)

'Pentan-1-ol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/PL0491CH4W.pdf> (August 2011)

'Propan-1-ol', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/AR1161M.pdf> (April 2011)

Source URL: <https://assist.asta.edu.au/question/3870/toxic-alcohols-spirit-burners-test-fuel-efficiency>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Use of Liquid Nitrogen

Use of Liquid Nitrogen

Posted by Anonymous on Thu, 2016-04-14 14:53

Use of Liquid Nitrogen: Are there any restrictions to using liquid nitrogen in school laboratories? If appropriate storage is sourced and safety procedures are followed, can teachers perform liquid nitrogen demonstrations?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Use of Liquid Nitrogen

Submitted by sat on 27 April 2016

Thank you for your excellent question.

Summary response

Yes, demonstrations using liquid nitrogen may be conducted by suitably trained science teachers and technicians who are competent in the handling of cryogenic materials. Such use is subject to a detailed local risk assessment, and to following established procedures for the procurement, storage, use and disposal of the material. Note: It is important that schools adhere to any policies regarding the use of liquid nitrogen that may apply in their school systems.

Further details

Science ASSIST is in the process of developing a Standard Operation Procedure (SOP) for handling liquid nitrogen, which will be published on the Science ASSIST website soon. The following information summarises the greater detail that the SOP provides.

Main hazards associated with the use of liquid nitrogen

- **Potential for cryogenic (cold) burns:** Liquid nitrogen boils at minus 196 degrees C, so contact with the skin and eyes is to be avoided. Appropriate PPE would include:
 - enclosed goggles or face shield;
 - thermal or leather gloves (e.g., welding gloves that can be easily removed in the event of splashes entering a glove);
 - long-sleeved shirt with the cuffs worn outside of the gloves;
 - closed leather boots or shoes that are easily removable in the event of a splash entering a boot or shoe;
 - long pants with the cuffs outside to prevent splashes entering a boot or shoe.
- **Potential for asphyxiation:** Due to depletion of oxygen levels in the air as the nitrogen boils there is a danger of asphyxiation. Liquid nitrogen has a very high “volume expansion ratio”, that is, the boiling of a volume of liquid nitrogen creates a much greater volume of gas. Storage and demonstration activities must be conducted in well-ventilated rooms. Although nitrogen gas has the same density as air (of which it is the major component) at the same temperature, the nitrogen generated from the boiling liquid is much colder and denser than the air that it is being released into, and so it can pool in low-lying areas unless ventilated.

Procurement, transport, storage and disposal

- Procurement: Liquid nitrogen is inexpensive and readily available from gas supply sources.
- Liquid nitrogen must be transported in an open vehicle (an open truck or trailer) and not in a closed vehicle. It is recommended that schools arrange delivery and collection of the container by the gas supply company.
- Liquid nitrogen must be transported and stored in a “Dewar”, an open-necked vessel purpose-designed for such cryogenic materials. Gas supply companies hire these out at a nominal cost and it is recommended that schools make use of this service. Dewars are available in various sizes, and to minimise handling issues, sizes of 5 or 10 litres are recommended. This volume would be suitable for school demonstration purposes over several days. Liquid nitrogen must not be transported or stored in domestic vacuum

flasks.

- Liquid nitrogen dewars should be stored in a secure, dry, cool, well-ventilated place away from heavy traffic and combustible materials. They should be stored upright on a firm level floor and secured to prevent tipping or falling.
- Surplus liquid nitrogen can be disposed of by allowing it to boil off either in an operating fume cupboard, or in an open, well-ventilated place. It must not be poured down sinks or drains.

Demonstration activities with liquid nitrogen

All demonstrations should be subject to a well-documented risk assessment.

Unsuitable demonstration activities include:

- activities conducted close to the face or skin of the demonstrators and audience,
- activities that involve boiling-liquid-expanding vapour explosions (BLEVEs).

There is an unacceptable risk of showering spectators with liquid nitrogen splashes or other cryogenic matter.

Suitable demonstration activities include:

- cryogenic freezing, or embrittlement, of organic materials such as flowers, fruit or eggs;
- cryogenic freezing, or embrittlement, of other materials such as rubber bands, stoppers, tubing, marshmallows, soft drink cans;
- demonstrating the contraction and expansion of gas with extreme temperature change, such as using air-filled balloons;
- demonstrating the effects resulting from boiling liquid nitrogen;
- testing of various insulating materials;
- demonstrating magnetic field effects at cryogenic temperatures.

Further details of these will be given in the Standard Operating Procedure: Handling Liquid Nitrogen.

References

Air Liquide Australia. 2013. *Material Safety Data Sheet AL613. Nitrogen, refrigerated liquid N₂*. Revised edition 5, Air Liquide website, <http://docs.airliquide.com.au/msdsau/AL613.pdf> (1 March 2013)

University of Queensland. 2007. *Liquid Nitrogen: Guidance for Safe Storage and Handling*, University of Queensland website, <http://sci-s03.bacs.uq.edu.au/sib/sib-news/november07/Liquidnitrogenguidance.pdf> (February 2007)

'Handling and storage of liquid nitrogen', Monash University website, <https://www.monash.edu/ohs/info-docs/safety-topics/chemical-management/h...> (Broken link fixed April 2018).

University of South Australia. 2020. *Safe Use of Liquid Nitrogen (and other Cryogenic Fluids)*, WHS Guideline, Version 1.5, <https://i.unisa.edu.au/siteassets/human-resources/ptc/files/guidelines/s...>

(Link updated March 2020)

Source URL: <https://assist.asta.edu.au/question/3744/use-liquid-nitrogen>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Use of Sodium in Schools

Use of Sodium in Schools

Posted by Anonymous on Thu, 2014-10-09 13:54

Use of Sodium in Schools: Is sodium still allowed to be used in secondary schools in Australia for demonstration purposes?

Voting:•



No votes yet

Australian Curriculum:•

Different types of chemical reactions are used to produce a range of products and can occur at different rates

Chemical Sciences

Year Level:•

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Answer by kris.szalai on question Use of Sodium in Schools

Submitted by sat on 13 October 2014

Thank you for your question. Sodium can be used in secondary schools in Australia as a

teacher demonstration of the reactivity of alkaline metals. It is an exciting, memorable and engaging demonstration for students that can be performed safely with the appropriate procedures in place.

NB. Sodium has a DG Class: 4.3, Hazard symbols: Dangerous When Wet and Corrosive. Refer to current SDS for Risk and Safety Statements.

Sodium metal reacts rapidly with water forming a colourless solution of sodium hydroxide (NaOH) and Hydrogen gas (H₂). The resulting solution is basic because of the hydroxide, which can be illustrated by using a few drops of phenolphthalein in the water. The sodium will leave a pink trail behind it as it reacts. The reaction is: $2\text{Na(s)} + 2\text{H}_2\text{O} \Rightarrow 2\text{Na}^+ + 2\text{OH}^- + \text{H}_2\text{(g)}$

The reaction is highly exothermic. During the reaction, the sodium may catch fire, may spray out molten sodium metal and the hydrogen gas may ignite, so it is imperative that proper safety precautions be used when conducting this demonstration. The demonstration should be undertaken by trained personnel in conjunction with a current safety data sheet (SDS) and a site-specific risk assessment.

Safety Precautions:

- To protect observers, the reaction can be carried out behind a Perspex safety screen with students at a safe distance away.
 - PPE (i.e., gloves and safety glasses) should be worn. Sodium metal causes severe burns on eye or skin contact.
 - While wearing gloves, use a dry spatula or scalpel blade to remove a rice-grain-sized piece of sodium (3mm³) from pieces stored in oil by cutting on a dry clean surface such as a glass petri dish. Whilst cutting, quickly point out that the shiny sodium metal surface rapidly darkens due to reaction with air and moisture.
 - Return the unused sodium to the oil and seal the container. Sodium needs to be stored under liquid paraffin or kerosene to prevent a reaction with oxygen or water vapour.
 - Use a thick glass pneumatic trough or large Pyrex beaker filled with water to within 1cm of the top so there is minimal space for the air/hydrogen mixture to accumulate.
 - Use tongs or tweezers to drop the piece of sodium into the water.
 - Use wire gauze to cover the beaker or trough during the reaction to stop pieces of sodium from escaping.
 - After the sodium has reacted completely, the petri dish, scalpel and tweezers should be placed in the water in the beaker or trough to make sure there is no residual sodium left.
 - The remaining hydroxide solution can be flushed away with water down the drain.
- Continue to wear eye protection and PPC when disposing of the reaction.

Answer by Dathanas on question Use of Sodium in Schools

Submitted by on 14 October 2014

Yes

Source URL: <https://assist.asta.edu.au/question/2498/use-sodium-schools>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Whoosh bottle

Whoosh bottle

Posted by Anonymous on Mon, 2019-07-29 13:19

Whoosh bottle: Is using isopropanol as a fuel safer than using ethanol or methanol?

Voting:•



No votes yet

Laboratory Technicians:•

Showing 1-1 of 1 Responses

Answer by labsupport on question Whoosh bottle

Submitted by sat on 29 July 2019

The 'Whoosh bottle' activity demonstrates the combustion of an alcohol/air mixture. It is conducted using a 20L polycarbonate bottle with a narrow neck. When the fuel mixture is ignited it releases a large amount of energy accompanied by flames and a 'whoosh' sound.

This is a high-risk activity as the bottle has been known to explode^{1,2}, fires have been caused³ and injuries have resulted under certain conditions.

Consideration is required as to whether the educational outcomes outweigh the risks and if you are permitted to conduct this in your school jurisdiction. The Queensland safety alert Unpredictable science experiments⁴ contains safety principles to consider in determining whether alternative teaching resources, such as online videos, should be used.

It is important before and after the viewing of a high-risk activity, to carefully discuss the risks associated with such an activity and to discourage students from experimentation outside the school setting, to reduce the likelihood of injury.

There are reports of explosions occurring where

- a glass bottle has been used^{5,6}
- the flammable liquid has sat in the bottle and possibly settled⁷ or
- the flammable liquid has been placed into a warm bottle⁷
- methanol has been used²

If this demonstration is to be conducted, it should only be performed by staff who are trained in the handling of flammable liquids. Science ASSIST recommends strict adherence to the following safety measures and procedure:

- **Never use glass bottles**
- **Never enrich the bottle with oxygen**
- **A written risk assessment be approved by a HoD or HOLA**
- **It is only performed as a demonstration** (See references for a link to 'Safety Guidelines for Chemical Demonstrations').
- **Use only 70% isopropanol** (also known as isopropyl alcohol, sec-propyl alcohol, propan-2-ol or 2-propanol^{8,9}), due to its lower vapour pressure. It is less volatile than other alcohols and will therefore react less vigorously (and will be a slower, and arguably more enjoyable, reaction to watch).

Note: Science ASSIST **does not recommend** the use of other alcohols or fuels (including methylated spirits because the combustion products of the additives may be uncertain and/or hazardous) and **strongly advises against** the use of methanol due to its toxic properties.

The use of 'rubbing alcohol', which are 99% isopropanol (with appropriate dilution) or 70% isopropanol and 30% water^{9,10} are suitable. It is essential that you consult the relevant Safety Data Sheet to determine its suitability. Some formulations may be ethanol based and/or include additional hazardous components.¹¹

- **Trial the activity first without an audience** if the demonstrator is unfamiliar with this activity.
- **Always ensure that the polycarbonate bottle is in good condition**, no glazing, frosting or cracking. Only use cylindrical bottles (not rectangular bottles)⁷.
- **Always use a cool dry bottle** if more than one demonstration is to occur, have several bottles ready. If a flammable liquid is placed into a hot bottle, a flash-back can occur, causing a fire.^{12,7}
- **Always use a safety screen**, perform in a location with good ventilation, a high ceiling of at least 2.5-3m above the top of the bottle and not under smoke/heat detectors or any combustible materials
- **Ensure** the demonstrator is wearing PPE (laboratory coat, safety glasses and closed in shoes)
- **Ensure** spectators are more than 4 metres away and are wearing safety glasses
- **Ensure** that a fire extinguisher and fire blanket are close by and that you know how to

use them

- **Measure the amount of alcohol** used and pour out the excess alcohol and remove from the area. Always keep the stock bottle of alcohol in a different area well away from this demonstration
- **Use a taper attached to a metre ruler** and light away from the bottles to enable a safe distance between the demonstrator and the bottle
- **Mark the bottle** as “not suitable for storing water for human consumption” (So that it is not inadvertently recycled)

Procedure:

(We suggest conducting the demonstration in a darkened area to enhance the visual effect.)

1. Make sure the bottle is completely dry.
2. Add 25mL of isopropanol to the bottle and roll the bottle to coat the inside, pour out any excess and remove from the area. Wipe up any spill from the outside of the bottle.
3. Place the bottle behind a safety shield.
4. Light a taper and hold it over the neck of the bottle via a metre ruler to provide a safe distance.
5. The isopropanol combusts with a whoosh sound and a yellow flame.
6. Allow the bottle to cool, rinse out with water and completely dry before reuse.

References

[1] CLEAPSS. 2010. *Bulletin 137-Spring 2010*

<https://science.cleapss.org.uk/login.aspx/?returnto=/resource/bulletin-137-spring-2010.pdf>
(Login required)

² SSERC. 2018. ‘Whoosh bottle alert’, *SSERC Bulletin 262*, Spring 2018, p. 16, SSERC website, <https://www.sserc.org.uk/publications/bulletins/262-spring-2018/>

³ ‘Experts: Little oversight of Minn. classroom science labs’, Minnesota Public Radio website, <https://www.mprnews.org/story/2011/12/11/class-lab-safety> (11 December 2011)

⁴ ‘Unpredictable science experiments’, Safety Alert, Education Queensland website, <https://education.qld.gov.au/initiativesstrategies/Documents/unpredictable-science-experiments.pdf> (August 2018)

⁵ Howell, J. Emory. 2001. ‘Initiating Proactive Safety Leadership’, *JChemEd*, Vol. 78:1, January 2001, p.9, ACE Publications website, <https://pubs.acs.org/doi/pdf/10.1021/ed078p9>

⁶ Nuffield Foundation, n.d. ‘The ‘whoosh’ bottle demonstration red risk assessment’, The Royal Society for Chemistry website, <https://www.rsc.org/redirect/des-index.asp?path=globalassets/18-events/risk-management/example---the-whoosh-bottle-demonstration-red-risk-assessment.pdf&episerver=true>

- ⁷ "'Whoosh Bottle" and safety discussion', University of Waterloo website, <https://uwaterloo.ca/chem13-news-magazine/march-2015/feature/whoosh-bottle-and-safety-discussion> (March 2015)
- ⁸ ACI Labscan. 2017. *Propan-2-ol*, Safety Data Sheet, Chem Supply website, <https://www.chemsupply.com.au/documents/LC1162M.pdf> (12 December 2017)
- ⁹ Recochem. 2017. *Isopropyl alcohol*, Safety Data Sheet, Diggers website, https://diggersaustralia.com.au/wp-content/uploads/2016/07/Cons_IPA_Jul1... (Link updated November 2021)
- ¹⁰ 'Isocol Rubbing Alcohol 345ml' Safety Data Sheet, AboutFaceOnline website, https://aboutfaceonline.com.au/wordpress/wp-content/uploads/2016/07/Isocol_MSDS_2015.pdf (17 July 2015)
- ¹¹ Rubbing alcohol', Wikipedia, https://en.wikipedia.org/wiki/Rubbing_alcohol (Accessed July 2019)
- ¹² 'Whoosh bottle', Flinn Scientific website, <https://www.flinnsci.ca/whoosh-bottle/dc10573/> (2016)
- Flinn Scientific, 2016. *Methyl Alcohol Safety*, Safety Fax, Flinn Scientific website, <https://www.flinnsci.com/api/library/Download/762ec945eb5744518e71a014f92818cb> (6 June 2016)
- 'Safety Guidelines for Chemical Demonstrations', Division of Chemical Education, Inc. of the American Chemical Society website, <https://www.divched.org/sites/ched/files/2020-05/safetyguidelinesforchem...> (Link updated September 2021)
- 'The 'whoosh' bottle demonstration', RSC Learn chemistry website, <https://edu.rsc.org/experiments/the-whoosh-bottle-demonstration/708.article> (Link Updated October 2021)

Source URL: <https://assist.asta.edu.au/question/4503/whoosh-bottle>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Biodiesel

Biodiesel

Posted by Anonymous on Wed, 2019-04-17 15:09

Biodiesel: Do you have a method or advice that you can recommend for making biodiesel? I am concerned about the safety and waste disposal aspects.

Voting:•



No votes yet

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Biodiesel

Submitted by sat on 17 April 2019

Biodiesel is a renewable fuel and seen as an alternative to petroleum diesel.¹ Biodiesel is produced by reacting an alcohol, usually methanol, with a vegetable oil or animal fat in the presence of a catalyst. Commonly used catalysts include potassium hydroxide or sodium hydroxide. The chemical reaction is called *transesterification* and the products formed are methyl esters (the biodiesel) and glycerol. There are several possible methods for making biodiesel in the school science laboratory.

We recommend the method and scale available through the BBSRC² based upon the one published by CLEAPSS³, for the following reasons:

- The activity is conducted on a small scale, only 10mL vegetable oil, which means lower risks and minimal chemical waste
- Potassium hydroxide is preferred over sodium hydroxide because it has a higher solubility in methanol.
- The preparation of the potassium hydroxide/methanol solution is conducted in a fume cupboard by the teacher or technician. The stock solution aliquots are delivered in small stoppered test tubes for student use. This method is very effective at reducing the risks of exposure to these hazardous chemicals.

We recommend that if an extension activity for burning the biodiesel is to be conducted, that one of the following methods are used in a fume cupboard.

- Use a spirit burner
- Place a small wad of mineral wool soaked in 2mL of the biodiesel in a crucible^{3,4}. Set alight with a long-nose gaslighter
- Place 2-5mL of the biodiesel in a tea light candle, which has had the paraffin wax removed⁵. Set alight with a long-nose gaslighter.

SAFETY NOTES:

- Methanol and potassium hydroxide have significant hazards.
 - Methanol is toxic and flammable.
 - Potassium hydroxide is highly corrosive.
- The preparation of the potassium hydroxide/methanol solution does take some time to dissolve, so it is best prepared in a fume cupboard by the teacher or technician:
 - using a magnetic stirrer,
 - allowing enough time, and
 - making up only the quantity required.
- It is essential that students are made aware of the significant hazards and mitigate the risk of exposure by following their teacher's instructions, specifically:
 - Wearing safety glasses or goggles and nitrile gloves.
 - Inserting the stopper as soon as they have added the potassium hydroxide methanol solution.
 - Inverting the test tube carefully, rather than shaking the test tube. This will reduce the likelihood of the methanol squirting out. (Note: If the contents of the tube spill out and contaminate the gloves, then following normal good practice, the gloves should be removed and students should then wash their hands.)
- The combustion of any diesel fuel produces sooty smoke and toxic gases. Exposure to

these products should be avoided, especially by asthmatics or anyone who is allergic to petrochemicals or the smoke produced from their combustion.

Waste Disposal

The transesterification reaction, which is used to produce biodiesel, produces methyl esters of fatty acids (the biodiesel), with glycerol as the main by-product. The reaction mixture will form two layers. The top layer contains the biodiesel as well as some unreacted vegetable oil (triacylglycerols), some methanol, glycerol and other contaminants. The bottom layer contains glycerol, methanol, methoxide salt, soap (saponified fatty acids) and hydroxide. The ratio of biodiesel to glycerol in the product is about 10:1 by mass.

There are methods to treat both the biodiesel and the glycerol by-product for disposal, however these are generally time consuming and not practical for the school setting.⁶

Unused biodiesel must be kept for a licenced chemical waste disposal contractor because of the contaminants in it. It can be combined with other non-halogenated organic waste. Whether kept separate or combined, a label should be affixed on the side of the bottle stating the contents.

If the reaction is carried out on a small scale so that only very small amounts of glycerol are produced, then the glycerol layer can be washed down the sink. Glycerol is miscible with water and biodegradable, however it has a high oxygen demand (i.e. oxygen in the water body will be consumed as the glycerol degrades) and so, larger quantities should not be washed to waste. Larger quantities of glycerol should be stored for collection by a licenced waste disposal contractor.

References and further reading

¹ 'What is biodiesel?', Bioenergy Australia website, <https://www.bioenergyaustralia.org.au/about/fuel/> (Link updated October 2019)

² MacLean, Tristan. 2014. *Practical Biofuel Activities for School Engagement and Outreach*, Activity 1D Biodiesel production pp25-30, Biotechnology and Biological Sciences Research Council (BBSRC). Available for download at 'Practical biofuel activities', Biotechnology and Biological Sciences Research Council (BBSRC) website, <https://bbsrc.ukri.org/engagement/schools/keystage5/practical-biofuel-activities/#intro> (Accessed April 2019)

³ CLEAPSS. 2007. *Making biodiesel*, CLEAPSS website, <http://science.cleapss.org.uk/Resource/PS067j-Making-biodiesel.pdf> (Login required)

⁴ 'The preparation of biodiesel from rape seed oil –or other suitable vegetable oils worksheet', Learn Chemistry, RSC website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00002209/making-biodiesel> (Accessed April 2019)

⁵ 'Preparation & Combustion of Biodiesel', American Chemical Society website, <https://highschoolenergy.acs.org/content/hsef/en/how-do-we-use-energy/biodiesel.html> (Accessed April 2019)

⁶ 'Biodiesel Safety and Best Management Practices for Small-Scale Noncommercial Use and Production', Sustainable Agriculture Research and Education (SARE) website, <https://www.sare.org/Learning-Center/SARE-Project-Products/Northeast-SARE-Project-Products/Biodiesel-Safety-and-Best-Management-Practices-for-Small-Scale-Noncommercial-Use-and-Production/> (2008)

•

Australian Government, Department of the Environment, Water, Heritage and the Arts. n.d. *Why we should recycle used motor oil*, Australian Government, Department of the Environment, Water, Heritage and the Arts website, <https://www.awe.gov.au/system/files/resources/7fdcea7e-62bd-49f8-9e19-e5d12267ec6c/files/fs-why-recycle.pdf> (Accessed April 2019)

'Biodiesel part 1 –Teacher Notes, Biodiesel part 1 –Student Notes, Biodiesel part 2 –Teacher Notes, 'Biodiesel part 2 –Student Notes', Chemical Education Group webpage, Royal Australian Chemical Institute website. (Accessed April 2019. Link no longer available July 2020)

'Biofuel Chemistry: How they Burn?', Biofuel UK website <http://biofuel.org.uk/how-do-biofuels-burn.html> (Accessed April 2019)

'Fuels', Q&A Science ASSIST website, <https://assist.asta.edu.au/question/3155/fuels> (September 2015)

'Toxic alcohols in spirit burners to test fuel efficiency', Q&A, Science ASSIST website, <https://assist.asta.edu.au/question/3870/toxic-alcohols-spirit-burners-test-fuel-efficiency> (June 2016)

Traviss N. 'Breathing easier? The known impacts of biodiesel on air quality', *Biofuels*, 2012;3(3):285-291. doi:10.4155/bfs.12.22
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3622266/> (See the executive summary at the end on biodiesel vs diesel)

'Waste Management in Biodiesel Production', eXtension website, • <https://articles.extension.org/pages/27660/waste-management-in-biodiesel-production> (26 March 2012)

'What are biofuels?', Bioenergy Australia website, <https://www.bioenergyaustralia.org.au/about/fuel/> (Link updated October 2019)

Source URL: <https://assist.asta.edu.au/question/4436/biodiesel>

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Broken Max Min Thermometer

Broken Max Min Thermometer

Posted by Anonymous on Thu, 2017-08-24 11:04

Broken Max Min Thermometer: We have some max min mercury thermometers here, and yesterday one of them was broken by a cleaner. The broken thermometer gives off an overpowering odour, it was extremely strong and resulted in the evacuation of an office as we couldn't initially identify where the smell was coming from. It smells like something is burning and the office is still very smelly today as some of the liquid spilled onto the carpet. We have used mercury decontaminant to neutralise any mercury that may have spilt and will dispose of the thermometer via a licensed waste contractor.

Mercury is obviously odourless, so we are wondering what the smell might be? Is it something we need to be concerned about in terms of people breathing in the fumes? There is no manufacturer labelled on the thermometers, so we don't have a contact to ask for an SDS.

The only thought we have had is perhaps the thermometer also contained an alcohol or solvent of some kind that gives off an odour, but none of our science teachers know what it could be. I have done a little research and thought perhaps it could be Oil of Creosote?

Thank you.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Broken Max Min Thermometer

Submitted by sat on 09 September 2017

Regarding the clean-up of the broken thermometer, we have the following comments:

- We are not sure what the overpowering odour was, but your emergency response was correct to evacuate the affected room, especially if the fluid was creosote.
- As your research has shown you, maxima minima thermometers usually have an alcohol in them and without having access to the manufacturers' information, it is difficult to know, what the fluid actually is.
- We have previously answered some questions regarding the clean-up of mercury. For detailed information please see
 - Mercury Spills: disposal of mercury
 - Mercury Thermometer: disposal of mercury thermometers
- Given that mercury and an unknown alcohol or solvent has spilled onto carpet, which is a porous material, it will be considered hazardous waste and should be removed and disposed of. You may need to get some professional assistance with this.
- Different states have different government organisations that may be able to help you. For example, the NSW Office of Environment and Heritage has a webpage dedicated to this type of question see <https://www.environment.nsw.gov.au/questions/broken-mercury-thermometer-spill>
- If you have several intact similar thermometers, it may be wise to dispose of them as well via a hazardous waste disposal contractor, to prevent a repeat of this incident.
- When replacing thermometers, we recommend purchasing non-mercury thermometers.

References:

"I have broken a mercury thermometer. How do I clean up the spill?" NSW Office of Environment and Heritage website. <https://www.environment.nsw.gov.au/questions/broken-mercury-thermometer-spill> (Accessed August 2017)

"Creosote" TOXFAQs. 2002. Agency for Toxic Substances and Disease Registry website. <https://www.atsdr.cdc.gov/toxfaqs/tfacts85.pdf> (Accessed September 2017)

"Physics Theory: Thermometers". Syvum Technologies website. <https://www.syvum.com/cgi/online/serve.cgi/squizzes/physics/thermometers...> (Accessed September 2017)

"Six's Maximum and Minimum Thermometers" Weather for schools website. <http://www.weatherforschools.me.uk/html/maxmin.html> (Accessed September 2017)

"Six's thermometer" The free dictionary website. <http://encyclopedia2.thefreedictionary.com/Maximum+minimum+thermometer>

(Accessed September 2017)

"Six's thermometer" Oxford Reference Website.

<http://www.oxfordreference.com/view/10.1093/oi/authority.20110803100509453> (Accessed September 2017)

Source URL: <https://assist.asta.edu.au/question/4231/broken-max-min-thermometer>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Calcium Metal

Calcium Metal

Posted by Anonymous on Mon, 2015-08-24 11:13

Calcium Metal: Can you please tell me how I can safely dispose of a very small amount of Calcium metal, which has not been used for a long time. The outside of the can has become rusty, so I have placed it inside another container.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

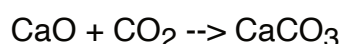
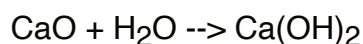
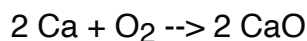
Showing 1-1 of 1 Responses

Calcium Metal

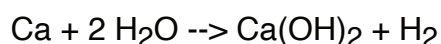
Submitted by sat on 02 September 2015

Calcium is usually supplied in the form of dry granules. However, in the past, calcium has also been available as granules under paraffin oil. If you have waste calcium under paraffin oil, we recommend that you dispose of it via a licenced waste disposal contractor.

Over time, calcium metal will react with oxygen in the air to give calcium oxide, which can then absorb water to give calcium hydroxide, or react with carbon dioxide to give calcium carbonate. The calcium oxide, hydroxide and carbonate all form a white coating on the surface of the metal pieces.



To destroy waste calcium metal, it is recommended that the calcium be added to water in portions in the ratio of 1g per 100mL.^[1,2] The mixture should be stirred until the reaction is complete.



Calcium metal reacts with water to give calcium hydroxide and hydrogen gas. Hydrogen gas is flammable, and therefore it is important to carry out this reaction in a well-ventilated area or in an operating fume cupboard. Slow addition of the calcium to the water will also help to avoid a build up of hydrogen gas.

As the calcium is added to water and calcium hydroxide is formed, this will give a white precipitate, as calcium hydroxide is not very soluble. If the calcium has degraded to the practically insoluble calcium carbonate, this will also give a white precipitate when it is added to water.

When the reaction is complete (no further evolution of hydrogen gas), neutralise the solution with dilute hydrochloric acid (2-5M) to between pH 6 and 8. The pH can be measured using universal indicator, or another pH indicator such as phenolphthalein, or pH paper, or with a pH meter. After neutralisation with hydrochloric acid, the solution should be clear and can be disposed of down the sink. 200 mL of 5M hydrochloric acid will theoretically neutralise a solution prepared using 20 g of pure calcium metal.

Take care not to overshoot the neutral point, by adding the acid slowly while monitoring the pH, and using a lower concentration of acid when the pH is getting close to the endpoint. Hydrochloric acid is a suitable acid to use for the neutralisation step because it gives a solution of soluble calcium chloride. Acetic acid (ethanoic acid) is also suitable for neutralising calcium hydroxide solution. Sulfuric or citric acid are not suitable for this purpose as they would give the much less soluble salts calcium sulfate and calcium citrate respectively.

We recommend disposing of calcium by this method in small batches (10-20 g) of the metal, slowly adding this quantity of the metal to water in a large beaker or a bucket. Alternatively, or for large amounts of waste calcium, or where the calcium is stored under oil, the waste metal

can be disposed of via a licenced chemical disposal contractor.

References

1. Fink, R. C., Lunn, G. and Sansone, E. B., Destruction of Hazardous Chemicals in the Laboratory (3rd edition), John Wiley and Sons, **2012**, p. 39.
2. Lunn, G. and Sansone, E. B., Safe disposal of highly reactive chemicals, J. Chem. Educ., **1994**, 71, p. 972.

Source URL: <https://assist.asta.edu.au/question/3120/calcium-metal>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Calcium oxide disposal

Calcium oxide disposal

Posted by Anonymous on Fri, 2016-03-11 12:31

Calcium oxide disposal: Hi. Can anyone tell me how to dispose of some very old calcium oxide. The container is all swollen and the date on the bottle is Dec 1988.

CSIS says it can be disposed of to landfill, I was just wondering if someone can confirm if that's correct.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Calcium oxide disposal

Submitted by sat on 30 March 2016

In brief

Thank you for your question. From your provided information, it sounds like you have a fairly large quantity of waste calcium oxide and its degradation products, calcium hydroxide and calcium carbonate. This quantity would be cumbersome to treat and dispose of on-site, and therefore, we recommend that you store the bottle and arrange for its collection by a licenced waste disposal contractor. We have been advised¹ that, as waste calcium oxide poses a corrosive hazard, it should be collected for disposal, rather than disposed of to landfill. For small quantities of calcium oxide waste, we believe that its treatment and disposal could be easily managed at your school site.

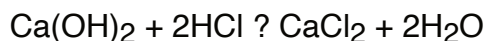
Small quantities: treatment and disposal

Wear PPE (safety glasses, closed-in shoes, lab coat, nitrile gloves) and carry out the work in a fume cupboard.

1. **Use as a soil conditioner:** We recommend slowly adding and mixing the calcium oxide waste into a large container of water, for example, a bucket. This will ensure that any remaining calcium oxide will react with the water and be converted to calcium hydroxide, commonly called slaked lime. Add it slowly as the chemical reaction of calcium oxide and water is exothermic. Calcium hydroxide is not very soluble in water, so this will form a white slurry. The slurry will also include some calcium carbonate that has resulted from the reaction over time of the calcium oxide with atmospheric carbon dioxide.

The resultant material can be applied as garden lime at a suitable dose rate. Slaked lime is commonly used as a pH adjuster for acidic soils.

1. **Dispose of as a neutral solution:**² Slowly add the waste calcium oxide to a large volume of water at the rate of about 5 g of calcium oxide to 100 mL of water (approximately 5%). As noted in **1** above, the calcium oxide should be added slowly because the reaction is exothermic. This will form a slurry of calcium hydroxide/calcium carbonate. Slowly, and with stirring, add dilute hydrochloric acid (1-2 M) until a near-neutral pH is attained (pH 6-8). The pH can be tested with pH paper, Universal Indicator solution or a pH probe. Wash the solution down the sink with further dilution. Hydrogen chloride neutralises the calcium hydroxide according to the equation:



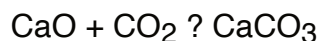
Additional information

Calcium oxide, also known as “quick” or “burnt” lime, has traditionally been manufactured through a “lime burning” process of heating limestone (calcium carbonate) in kilns to decompose it into calcium oxide and carbon dioxide.



Calcium oxide has a limited shelf life as it reacts readily with both the moisture and the carbon dioxide in the air, forming calcium hydroxide and calcium carbonate respectively. Its rate of

degradation depends on factors such as its exposure to air, and the temperature and humidity. The date of your container (1988) and the fact that it is very swollen would indicate that these reactions are well advanced, and that much of your original calcium oxide will by now have been converted to calcium hydroxide and calcium carbonate.



Calcium oxide is corrosive and can cause severe skin burns and eye damage. Calcium hydroxide is corrosive and can cause serious eye damage and respiratory and skin irritation. Calcium carbonate is not classified as hazardous.

References

1. Assistance from ChemCentre, Curtin University of Technology, Bentley WA, March 24, 2016.

2. Armour, M. 2003. *Hazardous Laboratory Chemicals Disposal Guide*, Third Edition, CRC Press: New York, p 123.

'Calcium carbonate', Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/CL0091CH1K.pdf> (April 2015)

'Calcium hydroxide', Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/CL0111CH1M.pdf> (July 2013)

'Calcium oxide', Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/CL6251CH1O.pdf> (March 2014)

'Fact sheet: Soil conditioners', ABC Gardening website, <https://web.archive.org/web/20180216043649/http://www.abc.net.au/gardeni...> (Broken link replaced with a copy from the Internet Archive's Wayback Machine, March 2018).

'What are the uses of slaked lime?', Ask.com website, <https://www.reference.com/world-view/uses-slaked-lime-982a5a52435493f2> (Link Updated August 2021)

'What is lime?', GCSE Science website, <http://www.gcsescience.com/rk20.htm> (Accessed March 2016)

Source URL: <https://assist.asta.edu.au/question/3665/calcium-oxide-disposal>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Can Potassium Permanganate waste be neutralised?

Can Potassium Permanganate waste be neutralised?

Posted by Anonymous on Fri, 2016-08-12 13:42

Can potassium permanganate waste be neutralised? I noticed in a previous question you mentioned the importance of ensuring potassium permanganate does not go down the sink because it is toxic to aquatic organisms. Your recommendation was for potassium permanganate waste to go to a chemical waste treatment facility. I was wondering if in fact the potassium permanganate can be neutralised by first acidifying it then reacting it with a non-hazardous, non-dangerous oxalate (eg potassium oxalate). Correct me if I am wrong, but from what I gather the products from this reaction are all non-hazardous and are able to be disposed of down the sink (manganese, salt and water from acid reacting with the oxygen, carbon dioxide gas).

Looking forward to your response.

Voting:•



Average: 5 (1 vote)

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Can Potassium Permanganate waste be neutralised?

Submitted by sat on 31 August 2016

In brief

Permanganate waste can be treated by reducing the permanganate ions, MnO_4^- , to manganese (II), Mn^{2+} . The manganese is then in a form which is soluble and does not have the strong oxidising properties of permanganate. Nevertheless, manganese in any form can potentially be harmful for the aquatic environment. In general, water authorities in Australia have low acceptance limits for manganese ions. However, as schools mostly use only low concentrations of permanganate in solution ($< 0.1\text{M}$), reducing the permanganate to manganese (II) and flushing the solution down the sink with dilution may be acceptable for small quantities on an infrequent basis (e.g. once per year).

The 'standard' method for treating permanganate waste is to use either sodium bisulfite (NaHSO_3) or sodium metabisulfite ($\text{Na}_2\text{S}_2\text{O}_5$) as the reducing agent to reduce permanganate to manganese (II).^{1,2} Oxalic acid will also reduce permanganate to manganese (II), however the reduction may not be so efficient, as the reaction is slower than with other reagents and may require warming.^{3,4} Alternatively,⁵ the reduction can be carried out under conditions which will reduce permanganate to manganese (IV) as manganese dioxide, MnO_2 , which is also less reactive than permanganate. As manganese dioxide is insoluble, it will form a precipitate, which should be collected and stored for disposal via by a licenced chemical waste contractor.

For larger quantities of surplus permanganate solutions, we recommend either arranging for its collection by a licensed waste contractor or, if time and resources allow, by reducing the permanganate to manganese dioxide which should then be stored for collection.

Additional information

Manganese is ubiquitous in the environment and is an essential nutrient for plants, animals and microorganisms. While there is a wide range in tolerance to manganese, it can be significantly bioconcentrated by aquatic organisms⁶ and some terrestrial plants such as legumes⁷ and members of the Ericaceae family,⁶ and toxic effects have been observed in sensitive species even at manganese concentrations as low as 1mg/L .⁶

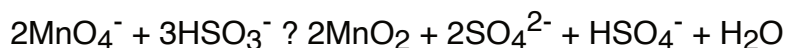
Manganese is in the +7 oxidation state in the permanganate ion, making it a powerful oxidising agent. As well as the hazard associated with manganese itself, permanganate is a very reactive chemical, and therefore its release to the environment should be avoided. Treatment of waste permanganate by its reaction with a reducing agent generates a less hazardous form of manganese.

In general, water authorities in Australia accept manganese at the concentration of 10 mg/L or less. Taking into consideration the low concentrations and quantities of permanganate used in schools, we suggest that disposing of small quantities of manganese (II) solutions down the

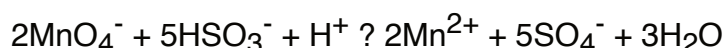
drain on an infrequent basis, such as once per year, would be acceptable. However, trade waste acceptance limits and policies vary between water catchment regions, and your local water authority should be consulted for advice specific to your region.

The pathway taken in the reaction of permanganate with a reducing agent is dependent on the pH.^{8,9}

Under near neutral to slightly alkaline conditions, permanganate is reduced to manganese (IV), which precipitates from solution as black manganese dioxide, MnO₂.^{8,9}

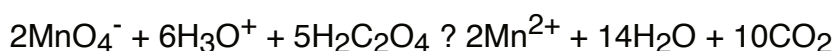


Under acidic conditions, permanganate is reduced to manganese (II), giving a colourless to faint pink solution.^{1,8,9}



Unlike permanganate and manganese dioxide, manganese (II) is not regarded as an oxidant, and is the most stable of the manganese oxidation states in neutral solution and under environmental conditions.^{6,7,8}

Using oxalic acid as the reducing agent under acidic conditions, manganese (II) and carbon dioxide are produced.^{3,4}



We have not found any reference to the use of oxalic acid as a reducing agent for treating permanganate waste, however, nor can we find any strong argument against doing so. Both reagents are fairly inexpensive. Compared with bisulfite, oxalic acid is more hazardous to health, but less so for the environment, as it will biodegrade. The reaction of permanganate with sulfite is fast, whereas the reaction with oxalic acid may take up to 20 minutes and may require warming.^{3,4}

For small quantities, we suggest the following procedure:^{1,2}

To treat 500mL of 0.1M KMnO₄ solution:

1. Acidify the permanganate solution by addition of dilute sulfuric acid (e.g for the given quantity, add 10 mL of 2M sulfuric acid).
2. Prepare a solution of ~10% sodium bisulfite (NaHSO₃) by dissolving 10 g of the salt per 100mL of water. (Alternatively, prepare the solution using sodium metabisulfite (Na₂S₂O₅), also from 10 g of the salt per 100mL). 300 mL of bisulfite solution should be sufficient to treat the given quantity of permanganate solution.
3. Working in a fume cupboard, slowly, and with stirring, add the bisulfite solution to the permanganate solution. The resulting solution should become colourless. If permanganate still remains, add a further portion of bisulfite solution. Flush the solution down the sink with further dilution.

In the procedure of Lunn and Sansone,⁵ the permanganate ion is reduced under basic conditions. The reduced manganese ions are allowed to air-oxidise to give manganese

dioxide, which is then collected by filtration and stored.

To treat 100 mL of 5% permanganate solution:¹⁰

1. Add the permanganate solution to 100 mL of 2M sodium hydroxide solution.
2. To this solution add 10 g of sodium metabisulfite.
3. If, after stirring, the permanganate colour remains, add a further small portion of sodium metabisulfite.
4. Stir the mixture for 30 minutes, then collect the precipitated manganese dioxide by filtration. Allow the filter cake to dry, place into a suitable labelled container and store for collection.
5. Neutralise the filtrate to within pH 6-8, then dilute with an equal volume of water and flush down the sink.

Related questions that we have previously answered:

potassium permanganate

References

1. Armour, M.-A. 2003. *Hazardous Laboratory Chemicals Disposal Guide*, Third Edition, CRC Press, Florida, p. 509.
2. 'Procedures for the laboratory-scale treatment of surplus and waste chemicals', in Chapter 7, 1998. National Academy of Sciences *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, National Academy of Sciences Press, Washington, p. 170.
3. Steffel, M.J. 1990. 'Reduction of Permanganate: A Kinetics Demonstration for General Chemistry', *Journal of Chemical Education*, 1990, 67(7), p. 598.
4. Kovacs, K. A., Grof, P. Burai, L., Riedel, M. 2004. 'Revising the Mechanism of the Permanganate/Oxalate Reaction', *Journal of Physical Chemistry A*, 2004, 108, 11026-11031.
5. Lunn, G., Sansone, E.B., 2012. *Destruction of Hazardous Chemicals in the Laboratory*, Third Edition, John Wiley and Sons, p. 405.
6. Hoew, P.D., Malcolm, H.M. and Dobson, S. 2004. 'Manganese and its compounds: environmental aspects', Concise International Chemical Assessment Document 63, International Program on Chemical Safety website, World Health Organisation, <https://inchem.org/documents/cicads/cicads/cicad63.htm> (Accessed August 2016)
7. 'Manganese compounds', Hazardous Substances Database Record, Toxnet website, Toxicology Data Network, <https://www.nlm.nih.gov/toxnet/index.html> (October 2008)
8. 'Manganese Compounds' in Ullman's Encyclopedia of Industrial Chemistry, Sixth Edition, John Wiley & Sons, 2002.
9. Pearson, R. S. 1988. 'Manganese Color Reactions', *Journal of Chemical Education*,

1988, 65(5), 451-452.

10. Adapted from Lunn and Sansone's procedure, reference 5.

Source URL: <https://assist.asta.edu.au/question/4021/can-potassium-permanganate-waste-be-neutralised>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical clock practical - waste disposal

Chemical clock practical - waste disposal

Posted by Anonymous on Thu, 2015-05-21 12:28

Chemical clock practical: My chem teacher would like to do a chemical clock prac with ferric nitrate and sodium thiosulfate, using metal ions as catalysts. See <http://www.nuffieldfoundation.org/print/3007>. How should I best dispose of the end products?

Voting:•



No votes yet

Year Level:•

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

chemistry

Submitted by sat on 30 June 2015

We have sought the advice of water authorities across Australia on the most appropriate way to dispose of the waste from this experiment.• Taking into consideration the total volume of waste water generated by a school, and assuming that the science labs have a neutralisation/dilution tank installed, the waste from this experiment should be sufficiently dilute to dispose of down the sink.• Additionally, as this would be a senior chemistry activity, it would only be conducted once or twice per year and the mass load of chemicals produced

would be very small. • Schools in rural or remote areas without access to deep sewerage should consult their local water authority for specific advice for their region.

Based on a class of 30 students working in pairs, we calculated the concentrations of the metal ions and sulfur species in the waste solutions from this activity and compared this data against the trade waste acceptance criteria from water authorities around Australia. •

While the concentrations of the metal ions in the waste solutions would be within the accepted levels for trade waste, the concentration of sulfur species would be in excess of that accepted by water authorities. The more stringent criteria for the acceptance of waste sulfur are required because of the potential for sulfur oxyanions to be reduced by bacteria to the toxic and corrosive hydrogen sulfide, which can create a health hazard for water authority workers and corrode the pipework.

We considered the overall volume of waste water produced per day in a school, based on conservative estimates^[1,2] of the volume of water consumed per student per day. • Most science labs in schools would also have a neutralisation or dilution tank installed so that all waste water from science would be retained in the tank before entering the school's internal sewerage system. • Waste water in the dilution tank feeds slowly into the other waste streams from the school and thus is further diluted.

Taking these factors into consideration, we calculated that the sulfur waste produced would be diluted to an acceptable concentration. • The mass load for one class carrying out this activity would also be very small. • We assume that this activity would be carried out by senior chemistry classes, and therefore would only be conducted once or twice per year for a particular school.

For experiments which generate concentrated waste solutions of metal ions, we advise that the waste should not be disposed of down the sink, but should be stored for collection by a licenced waste disposal contractor. • Alternatively, the metal ions can be precipitated and the solid precipitate stored for collection. • Science ASSIST is working toward the development of general guidelines for managing chemical waste.

REFERENCES

1. Water in our school: How water efficient is my school?, Resources for Teachers and Students, Sydney Water: <http://alternate.sydneywater.com.au/SW/education/index.htm> •

2. Schools Water Efficiency Program, Datalogger curriculum module, Resources and educational materials for teachers and students, State Government of Victoria, page 6, www.barwonwater.vic.gov.au/vdl/A5799074/Schools%20Water%20Efficiency%20P...



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical disposal

Chemical disposal

Posted by Anonymous on Thu, 2016-07-21 11:37

Chemical disposal : Hi I would like to dispose of a couple of things , how can I treat them for disposal ,

Copper Nitrate solution

diluted hydrogen peroxide solutions

orthophosphoric acid

iron thiocyanate solution

Thanks very much

Voting:



No votes yet

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemical disposal

Submitted by sat on 10 August 2016

Treating chemical waste is useful in order to minimise the volume of the waste or

reduce/eliminate its hazards. However, consideration should be given as to whether this is economical in terms of the time and chemical resources required. Waste treatment methods include (i) neutralisation of acids or bases, (ii) evaporation of water from aqueous salt solutions, (iii) precipitation or displacement of metal ions from solution and (iv) reduction of oxidising agents. For the specific chemicals you mention, we provide the following suggestions:

Copper nitrate solution

Copper salts are toxic for aquatic organisms and should not be released to the environment, but stored for collection by a licenced waste disposal contractor.

Waste copper compounds can be stored with waste copper residues, toxic inorganic waste or heavy metal waste. If storing as mixed waste, you should check the SDSs of the chemicals in the mixture to make sure they are compatible.

We suggest the following methods for the treatment/disposal of waste copper nitrate solution:

1. Store in solution form in a labelled bottle for collection by a licenced waste contractor
2. Allow the solution to evaporate, without heating, in a fume cupboard. **Do not evaporate to dryness.** Place the resulting solid/sludge in a labelled container and store for collection.

We advise against heating solutions of nitrates to evaporate the water, particularly if they are contaminated, as this could pose a fire or explosion hazard. Overheating of the salt may also lead to decomposition and the generation of toxic oxides of nitrogen.

3. Precipitate the copper ions from solution as either copper hydroxide or copper carbonate, by addition of either sodium hydroxide or sodium carbonate, respectively. Depending on the method used, this type of procedure can be problematic as gelatinous products may be produced which are difficult to evaporate or filter.

Forming the carbonate rather than the hydroxide is reported to give a product which has better filtering qualities.¹ According to the reported procedure,¹ the copper solution should be added to a 1.1-1.5x excess of carbonate solution, to give basic copper carbonate, or $\text{Cu}_2\text{CO}_3(\text{OH})_2$, which has the same formula as malachite. The resulting mixture should be allowed to age for about 4 days so that crystals of basic copper carbonate can form. The precipitate should then be the green colour of malachite. The precipitate is collected by suction filtration, dried and stored for collection as copper or heavy metal waste. The filtrate, a very dilute solution of copper ion, can be flushed down the sink with dilution.

Note that this method produces a less hazardous salt, but is time consuming and still requires disposal by a chemical waste disposal contractor.

Diluted hydrogen peroxide

Waste hydrogen peroxide solutions can be treated by diluting to less than 1% w/w and flushing down the sink.

Orthophosphoric acid

Small quantities can be neutralised with a solution of sodium carbonate to within pH 6-8, and flushed down the sink with dilution. If the acid is fairly concentrated, add it slowly to an equal volume of water before neutralising.

Large quantities should be stored for collection by a licenced waste disposal contractor.

Iron thiocyanate solution

The thiocyanate ion is much less hazardous than the cyanide ion, but is still regarded as harmful to aquatic organisms.

Small quantities of thiocyanate solution of low concentration (e.g. 0.001M) may be flushed down the sink. Larger amounts should be stored in a labelled bottle for collection by a licenced waste contractor. The volume of the solution can be reduced by allowing it to evaporate, without heating, in an operating fume cupboard. We advise against heating the solution, as to do so may risk generating very toxic hydrogen cyanide gas. It is possible to treat thiocyanate with an oxidising agent to transform it into cyanate and sulfate. However, we also do not recommend attempting this due to the risk of hydrogen cyanide gas being released.

Additional information:

See previous question with general information regarding the management of chemical waste:

[Laboratory Chemicals and Waste Management/Setup](#)

References

¹Hsu, C.T., 'Precipitation of basic copper carbonate from cupric sulphate and sodium carbonate solutions', Journal of Applied Chemistry, 6(2), **1956**, 84-88

'Copper (II) nitrate', safety data sheet.

<https://www.chemsupply.com.au/documents/CL0591CH29.pdf> (September 2015)

'Hydrogen peroxide 3%', safety data sheet.

<https://www.chemsupply.com.au/documents/HL0041CHIF.pdf> (November 2015)

'Phosphoric acid, 85%', safety data sheet.

<https://www.chemsupply.com.au/documents/PA0001CH4S.pdf> (September 2014)

Source URL: <https://assist.asta.edu.au/question/3960/chemical-disposal>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical disposal (chromium)

Chemical disposal (chromium)

Posted by Anonymous on Thu, 2015-07-16 14:57

Chemical disposal (chromium): I have a small amount of potassium dichromate and potassium chromate to be disposed. What is the best way to do this?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemical disposal

Submitted by sat on 25 July 2015

Whether you have these substances in solid form or in solution, we recommend that you store them for collection by a licenced waste disposal contractor.

Chromium (VI) compounds, such as dichromate and chromate salts, are classified as Category 1 Carcinogens and are toxic to the environment and should be handled with care. Appropriate PPE including chemical-resistant gloves, such as nitrile gloves should be worn when handling these substances and an operating fume cupboard should be used where possible.

Water authorities in Australia accept low concentrations of small quantities of chromium salts in waste water; the washing and rinsing water used in removing Cr residues on contaminated glassware would be unlikely to exceed these limits and should be acceptable to discharge to sink.

The chromium ions can be precipitated from solution as the much less hazardous chromium (III) hydroxide,^[1] but we generally wouldn't recommend doing this, due to the hazards involved and because the resulting chromium (III) precipitate would still have to be collected by a waste disposal contractor.

Reference

1. Karale, R.S., Wadkar, D.V., Nangare, P.B., *Removal and recovery of hexavalent chromium from industrial waste water with due consideration to cost optimization*, Journal of Environmental Research and Development, 2(2), 2007, p. 209.

Source URL: <https://assist.asta.edu.au/question/3006/chemical-disposal-chromium>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical disposal of Sudan 3

Chemical disposal of Sudan 3

Posted by Anonymous on Thu, 2018-11-01 14:02

Chemical disposal of Sudan 3: What are the requirements for disposal of Sudan 3?

Voting:•



No votes yet

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemical disposal of Sudan 3

Submitted by sat on 01 November 2018

Sudan III is

- a biological dye that is used to test for fats, oils and waxes
- not soluble in water and is typically made up in a 70% solution of ethanol (or methylated spirits)
- classified as non-hazardous, however when in 70% ethanol is classified as hazardous due to the flammability of the ethanol.

Dyes, indicators and stains

It is important to be aware that dyes, indicators and stains may not be very pure, particularly in

very old samples. Through their manufacture, they may contain hazardous impurities. Some dyes may be metabolised in the body to substances which are harmful. Sometimes there is limited or incomplete information regarding the hazards. Therefore, great care should be exercised when handling all dyes, indicators and stains.

Students should only use dilute solutions of dyes, indicators and stains; where the hazard is greatly reduced.

Therefore, although Sudan III is classified as non-hazardous, it should be handled with great care.

Disposal of Sudan III

Disposal of Sudan III depends upon whether it is in solid form or in solution and the quantity involved.

- A small quantity of Sudan III in dilute (up to 0.5%) solution (say <20ml) used in science classes can be washed to waste
- Larger quantities of Sudan III in solution should be saved for disposal by a licenced chemical waste contractor
- In solid form, care should be taken to avoid generating or inhaling dust and to avoid skin contact. It should be saved for disposal by a licenced chemical waste contractor

References:

CLEAPSS. 2016. *CLEAPSS Hazcards, Number 32 Dyes, indicators and stains*, CLEAPSS website, <http://science.cleapss.org.uk/Resource/HC032-Dyes-indicators-and-stains.pdf> (Member login required)

CLEAPSS. 2013. *CLEAPSS Student Safety Sheets, Number 70 Dyes and indicators*, CLEAPSS website, <http://science.cleapss.org.uk/Resource/SSS070-Dyes-and-indicators.pdf>

NSW Department of Education and Training. 1999. '*Chemical Safety in Schools (CSIS)*' resource package. Sydney: NSW

Scharlau. 2013. *Sudan III, C.I. 26100, for microscopy*, Safety Data Sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/SL0901CH7Q.pdf> (Updated December 2019)

Chem-Supply. 2019. *Sudan 3*, Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/SL0901CH7Q.pdf>

Source URL: <https://assist.asta.edu.au/question/4329/chemical-disposal-sudan-3>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical waste and septic systems

Chemical waste and septic systems

Posted by Anonymous on Fri, 2018-10-26 13:08

Chemical waste and septic systems: I have been working in the education department for the last eight years, and have recently started working one day a week in a small school.

They have a very old septic system with no known chemical pit.

The school is in a pristine environment and I'm concerned about what I shouldn't be putting down the sink, even with the very small volumes used.

Is there a known resource available for this situation?

Voting:

Cancel rating



No votes yet

Rate

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemical waste and septic systems

Submitted by sat on 26 October 2018

You are correct that septic systems require special considerations when considering the discharge from school science areas. We are not aware of any resource that specifically addresses this situation. However, we can provide some links to general resources and waste minimisation strategies.

Septic systems work using anerobic microbes and physical settling process to clarify the

waste water. The addition of excessive water or very acid or alkaline solutions can dilute or destroy the microbes. Many laboratory chemicals are hazardous to the environment. Anything chemical that is toxic or hazardous to the environment such as those classified as a Dangerous Goods class 6 or 9, should definitely not be disposed down the sink.

Science ASSIST recommends that no chemical waste should be disposed of into a septic system as it has the potential to disrupt the bacterial processes within the system and harm the environment. It would be acceptable for the rinsing of glassware of most water-soluble chemicals to be disposed in the septic system as it would involve only trace amounts of chemicals. Very small quantities of acids/bases could be diluted and neutralised, but the total volume of liquid should not be excessive. It would be wise to place caution notices advising of this above the sinks in the laboratories.

The best approach is to minimise the amount of waste produced and arrange for all hazardous waste to be disposed by a chemical waste contractor. As far as practicable, we suggest conducting activities on a microscale where possible to reduce the quantity of chemical waste produced,

General information regarding septic tanks

The following documents are generally written to address requirement for households and may contain state specific requirements. They explain how septic systems work and may have some general comments regarding waste that is unsuitable for septic systems that could be applied to schools.

- Government of Western Australia Department of Health. 2011. *Understanding Septic Tank Systems*, Shire of Esperance website, <https://www.esperance.wa.gov.au/sites/default/files/publication/files/un...>
- Government of Western Australia Water and Rivers Commission. 2000. *Water quality protection guidelines no 8 Mining and mineral processing laboratory waste discharge*. Government of Western Australia Department of Water and Environmental Regulation website, https://www.water.wa.gov.au/__data/assets/pdf_file/0012/4224/10141.pdf
- SA Department of Health. 2008. *Maintenance of septic tank systems. Wastewater fact sheet*, SA Health website, <http://www.sahealth.sa.gov.au/wps/wcm/connect/91200f04-89a8-4aaa-87d9-55...>
- ‘Septic Tank Regulations’, A&A Worm Farm website, <https://www.wormfarm.com.au/septic-tank-regulations/> (Accessed 26 October 2018)
- NSW Department of Local Government. 2000. *The Easy Septic Guide*, NSW Office of Local Government website, <https://www.olg.nsw.gov.au/wp-content/uploads/Easy-septic-guide.pdf> (Link updated May 2020)

Waste Minimisation strategies

These documents contain ways of minimising and handling hazardous waste in school science laboratories:

- American Chemical Society. 2002. *Less is Better: Guide to minimizing waste in laboratories*. American Chemical Society website, <https://www.acs.org/content/dam/acsorg/about/governance/committees/chemi...>

- Flinn Scientific. 2017. *Reducing Chemical Waste*. Flinn Scientific website, <https://www.flinnsci.ca/api/library/Download/92969b10341a4a75a893ea32fc2...>
- Morrison, Kendra A. 2006. *Hazardous Waste Management for School Laboratories and Classrooms*. US EPA website, <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100JR1S.PDF?Dockey=P100JR1S.PDF>
- National Research Council (US) Committee on Prudent Practices in the Laboratory. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards: Updated Version*. Washington (DC): National Academies Press (US); 2011. 8, Management of Waste. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK55885/>
- Science ASSIST. 2015. Q&A: Hazardous waste. Science ASSIST website, <https://assist.asta.edu.au/question/3243/hazardous-waste>
- Science ASSIST. 2016. Q&A: Laboratory Chemicals and Waste Management/Setup. Science ASSIST website, <https://assist.asta.edu.au/question/3903/laboratory-chemicals-and-waste-...>
- Washington State Department of Ecology. 2003. *Step-by-Step Guide to Better Laboratory Management Practices*. Montana Tech website, https://www.mtech.edu/env_health_safety/chem_lab/docs/Step_by_step_guide...

Source URL: <https://assist.asta.edu.au/question/4340/chemical-waste-and-septic-systems>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemical Waste from Ester Prac

Chemical Waste from Ester Prac

Posted by Anonymous on Fri, 2015-03-27 06:57

Chemical Waste from Ester Prac: I have previously been asked to dispose of the chemical waste from the ester prac by evaporating it on an absorbent material and disposing of this to landfill. I have now been asked to store the waste in an organic waste bottle for collection at a later date. CSIS talks about disposal of esters in the case of a spill, but is not specific about waste disposal.

I have begun decanting this waste into a large glass bottle. However, this morning when I opened it, there was a large rush of gas from the bottle. Is this normal? It did concern me somewhat and I was pleased I had opened it in the fume cupboard.

My question is: what is the correct way to dispose of this waste?

Voting:•

Cancel rating



No votes yet

Rate

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemical Waste from Ester Prac

Submitted by sat on 16 April 2015

In brief: The best practice for disposing of organic waste is to transfer it to an appropriately labelled bottle for collection by a licenced waste disposal contractor. If the experimental procedure involves washing the ester reaction mixture with sodium carbonate solution, then

any gas generated in the stored mixture is likely to be carbon dioxide produced from the reaction of the sodium carbonate and the acid catalyst or unreacted carboxylic acid.

Best practice would be to store the organic layer in a separate bottle from the aqueous layer. However, if the layers are difficult to separate, then it would be reasonable to transfer both layers to the same waste bottle. Glassware which is contaminated with any of the organic compounds used or produced can be rinsed with a small amount of ethanol with the rinse solution being added to the organic waste bottle.

While it is not prohibited in Australia to evaporate volatile waste in a fume cupboard, it is not considered best practice, as this introduces untreated waste into the atmosphere (this method of waste disposal is prohibited in the U.S.A.).

Please see the general answer to ester disposal for further information at this link: [organic chemistry](#).

Source URL: <https://assist.asta.edu.au/question/2741/chemical-waste-ester-prac>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Copper sulfate waste

Copper sulfate waste

Posted by Anonymous on Fri, 2018-05-04 18:10

Copper sulfate waste: I normally send all my waste liquids to be disposed of by a disposal company. However, I am starting to process it, to reduce the waste.

My question: Once the copper sulfate solution has been treated with Sodium Carbonate and the clear liquid is decanted, what do you do with the solid? Do you send it away with a disposal company, or place it with normal refuse?

Voting:



No votes yet

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Copper sulfate waste

Submitted by sat on 04 May 2018

If you are treating your copper sulfate solution with sodium carbonate, you will need to save the solid copper carbonate waste for collection by a chemical waste disposal contractor.

There are other methods noted in the Science ASSIST [Chemical Management Handbook for Australian Schools - Edition 1](#). (See pdf page 65) You may prefer to consider the method (ii)

(ii) Immerse steel wool in the solution, and thus displace the copper ions. Decant the supernatant from the precipitated copper and flush down the sink. Dispose of the copper

metal residue as general waste.

Source URL: <https://assist.asta.edu.au/question/4314/copper-sulfate-waste>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Disposal of agar with silver nitrate

Disposal of agar with silver nitrate

Posted by Anonymous on Thu, 2019-03-28 15:25

Disposal of agar containing silver nitrate: How should I dispose of an agar plate containing silver nitrate? It was used to create crystals with a piece of zinc. (I put 0.8g of agar in 50mL of deionized water with 10mL of 0.1M AgNO_3 and divided it into 3 Petri dishes each with a strip of zinc metal.)

Voting:•



Average: 5 (1 vote)

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Disposal of agar with silver nitrate

Submitted by sat on 28 March 2019

Background:

A more reactive metal will displace a less reactive metal from its compound. The less reactive metal will coat the surface of the more reactive metal.¹ This activity is used to demonstrate a metal displacement reaction between zinc metal and silver ions with the formation of silver crystals. The silver nitrate solution is mixed into molten agar prior to setting in a Petri dish.

Zinc metal is placed into the agar, where the zinc displaces the silver out of the agar. Solid silver crystals form around the zinc metal and a small portion of the solid zinc dissolves into the agar to form zinc ions. This means that you may have both silver and zinc ions in the agar.

Disposal:

- The silver crystals can be scraped off the zinc metal and placed into your heavy metal waste container for collection.
- The zinc metal strip can be cleaned and kept for further use
- The amount of zinc and silver ions in the agar mix would be considered trace amounts and therefore are able to be disposed in general waste.

Science ASSIST recommends the use of microscale techniques, where possible. This has the advantages of reducing the risks involved in certain activities and reducing the production of chemical waste.

An example of a microscale reaction for copper displacing silver from a silver nitrate solution can be seen in the video 'Silver nitrate reacting with copper wire', YouTube (0.20 sec) <https://youtu.be/bj1Bjh0VbvU> •

- Use 1-2 drops of 0.1M silver nitrate on an acetate sheet/plastic sleeve protector
- Place a bare (not coated) copper wire half way into the droplet.
- Watch the development of silver crystals on the copper wire. It could be filmed using a mobile phone with a magnifying lens added.
- The quantity of chemical waste is not significant and can be wiped up with a paper towel or tissue and disposed of in the general waste.

References and further reading

¹ 'Metals', KS3 Chemistry, BBC Bitesize website, <https://www.bbc.co.uk/bitesize/guides/zqwmxnb/revision/3> (Accessed March 2019)

'Displacement reactions between metals and their salts', LearnChemistry –Royal Society of Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000720/displacement-reactions-between-metals-and-their-salts?cmpid=CMP00005017> (October 2015)

'Microscale chemistry', Education in chemistry website, <https://edu.rsc.org/eicredir/feature/microscale-chemistry/2020192.article> (March 2007)

'Microscale chemistry revisited', Education in chemistry website, <https://edu.rsc.org/eicredir/feature/microscale-chemistry-revisited/2020193.article> (May 2012)

Source URL: <https://assist.asta.edu.au/question/4440/disposal-agar-silver-nitrate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Disposal of Ammonium Thiocyanate

Disposal of Ammonium Thiocyanate

Posted by Anonymous on Wed, 2016-10-26 15:48

Disposal of Ammonium Thiocyanate: Please can you tell me how to safely dispose of Ammonium Thiocyanate which has started to liquefy?

Voting:•



No votes yet

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Disposal of Ammonium Thiocyanate

Submitted by sat on 31 October 2016

Ammonium thiocyanate is classified as a Poison Schedule 5 and is harmful to aquatic organisms. Ammonium thiocyanate, which has started to liquefy should be disposed of by a licenced chemical waste disposal contractor. In the meantime, it should be stored segregated from incompatible chemicals.

We have previously answered related questions which have additional information that you may find helpful:

[Ammonium thiocyanate](#) regarding storage suggestions

Chemical disposal regarding disposal of a few chemicals including iron thiocyanate

Chemical Storage Timeframes regarding shelf life of chemicals

Laboratory Chemicals and Waste Management/Setup regarding general information

Reference

'Ammonium thiocyanate', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/AA0101CH17.pdf> (February 2014)

Source URL: <https://assist.asta.edu.au/question/4116/disposal-ammonium-thiocyanate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Disposal of potassium permanganate and glycerol reaction

Disposal of potassium permanganate and glycerol reaction

Posted by Anonymous on Fri, 2019-08-09 17:40

Disposal of potassium permanganate and glycerol reaction: How do I safely dispose of the products of the exothermic reaction between potassium permanganate and glycerol conducted in a mortar and pestle? I am not sure of the quantities used, so how do I know if there are any unreacted chemicals present that may still self-ignite?

Voting:•



No votes yet

Year Level:•

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

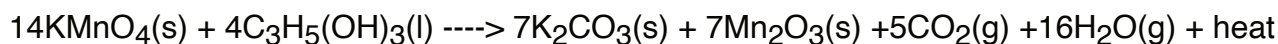
Showing 1-1 of 1 Responses

Disposal of potassium permanganate and glycerol reaction

Submitted by sat on 09 August 2019

The reaction of potassium permanganate and glycerol:

This reaction is an example of a spontaneous exothermic reaction in which glycerol is oxidised to carbon dioxide and water (as steam) by potassium permanganate. The reaction may take some time to start, but as heat is produced the reaction speeds up, with the main reaction being:



Other manganese species are thought to be produced in the reaction, such as Mn(VI) as green potassium manganate, and Mn(IV) as black manganese oxide.

As it is difficult to determine if there are unreacted chemicals present, we recommend quenching the reaction mixture with water. •This can be done by submerging the reaction vessel in a container of water (e.g. an ice cream container).

Given that you are not aware of the quantities of the reactants, if the water is coloured a deep pink it is likely that there is an excess of potassium permanganate. It is good practice to reduce the permanganate to a less reactive species, such as Mn(II) or Mn(IV).

Disposal of products if this has been conducted on a large-scale:

Reduce the manganese species to manganese dioxide and save for disposal by a chemical waste disposal contractor as follows:

- Wear PPE (i.e. closed in shoes, lab coat, safety glasses, nitrile gloves)
- Place the container (or bucket) in a spill tray in a fume cupboard.
- Add to this a reducing agent such as dilute hydrogen peroxide (3-6%) or a dilute (10%) solution of sodium metabisulfite or sodium sulfite.
 - Add the reducing agent in portions and allow time between additions for the reaction to proceed.
- The manganese should precipitate as black manganese dioxide. Collect the precipitate by filtration, allow it to dry, and store as manganese waste.
- Neutralise the filtrate solution to within pH 6-8 and wash down the sink.

Disposal of products if this has been conducted on a small scale and to clean the residue from reaction vessels:

- Wear PPE (i.e. closed in shoes, lab coat, safety glasses, nitrile gloves)
- Place the container (bucket) in a spill tray in a fume cupboard.
- To the solution containing manganese and glycerol waste, add dilute (e.g. 1-2M) sulfuric acid so that the pH is below 3.
- Add to this a reducing agent such as dilute hydrogen peroxide (e.g. 3-6%) or a dilute (10%) solution of sodium metabisulfite or sodium sulfite.
 - Add the reducing agent in portions and allow time between additions for the reaction to proceed.
 - Continue to add portions of the reducing agent until the solution becomes clear.
 - (The aim is to reduce the manganese species to Mn(II), as a pale pink solution of manganese sulfate, MnSO_4 .)•
- The solution of manganese sulfate can then be neutralised to within pH 6-8 and washed

down the sink.

- If treating a large quantity of the manganese residue, the Mn(II) solution should be disposed of gradually over several days. Alternatively, the Mn(II) ions can be precipitated as manganese carbonate as follows. Transfer the Mn(II) solution into a beaker or other suitable vessel. Slowly add sodium carbonate solution until there is no further precipitate of white manganese carbonate. Note that the carbonate solution will also react with the acid, and carbon dioxide will effervesce. Collect the precipitate by filtration, allow to dry, and store for collection as manganese waste or heavy metal waste. Neutralise the supernatant solution to within pH 6-8 and wash down the sink.

Recommendations for conducting this activity:

If your school chooses to conduct this activity, we recommend using the method and scale available through the Royal Society of Chemistry¹ for the following reasons:

- The activity is conducted on a small scale, using about 2-3 g potassium permanganate and 1 mL glycerol
- The reaction occurs on a metal lid or a foil pie dish (on a bench protector), which is easy to treat and dispose of.

Safety Notes:

- Students and teacher should wear safety glasses
- This should be conducted in a fume cupboard or a well-ventilated area with safety screens to protect both the teacher and the students, under a high ceiling of at least 2.5-3m above the reaction and not under smoke/heat detectors or any combustible materials.
- It is important that the products of this reaction are not discarded into the general waste, as this has been known to ignite later.

References and further reading

¹'Spontaneous exothermic reaction', Royal Society of Chemistry website, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000742/spontaneous-exothermic-reaction?cmpid=CMP00005910> (September 2016)

Flinn Scientific. 2017. *The Reaction of Potassium Permanganate with Glycerin*. Flinn Scientific website, <https://www.flinnsci.ca/api/library/Download/4ebf31df9511493db327d5d958512ef4>

Source URL: <https://assist.asta.edu.au/question/4458/disposal-potassium-permanganate-and-glycerol-reaction>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Disposal of silver nitrate solid

Disposal of silver nitrate solid

Posted by Anonymous on Tue, 2015-07-21 11:22

Disposal of silver nitrate solid: I have collected silver nitrate solution in a winchester and decanted it off, ready to evaporate the solution, so that I am left with just the solid waste. When I read the MSDS, it is vague as to the disposal procedure, just saying it cannot be put in with regular waste, nor into the drains. If I have to store it for collection from a company, can you tell me the best way to store the solid waste?

Voting:•



Average: 5 (1 vote)

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Disposal of silver nitrate solid

Submitted by sat on 26 July 2015

The silver nitrate waste can be stored in the same kind of container as it is supplied, i.e. a glass reagent bottle. The waste bottle should be stored with other oxidising agents or, alternatively, along with other waste chemicals, but segregated from incompatible chemicals

with secondary containment (i.e. bunded).

A note on evaporating waste nitrate solutions:

Nitrate salts have the potential to decompose explosively when subjected to heat or shock, some decomposing to give the toxic brown gas nitrogen dioxide. Contamination of nitrate salts with organic substances (e.g. alcohols) or combustible materials can also be dangerous. Therefore, we advise against the heating of waste nitrate solutions to hasten evaporation.

Recommended treatment of waste silver nitrate solution:

A safer alternative to evaporation of the silver nitrate solution is to precipitate the silver as silver chloride by addition of sodium chloride solution, as follows:

1. Prepare a saturated solution of sodium chloride. If you know the concentration and volume of the silver nitrate solution, you can calculate the number of moles of silver in solution. Sodium chloride will react in a 1:1 ratio with the silver ions to give silver chloride. Multiply the number of moles of silver nitrate by 58.44, the molecular weight of sodium chloride. Then multiply this number by 1.5, so that you have an excess of sodium chloride in solution; this will facilitate the precipitation of the silver chloride. Weigh out this amount in grams of sodium chloride and dissolve it in a minimum amount of distilled water. If you don't know how much silver you have in solution, use an excess of a saturated solution of sodium chloride.
2. Slowly and without stirring, add the sodium chloride solution in portions to the silver nitrate solution. With each addition of sodium chloride solution, formation of a white precipitate of silver chloride should be observable until all of the silver has been consumed. (Slow addition of the sodium chloride allows larger particles of the precipitate to form, which makes it easier to collect the solid by filtration). Continue to add the remainder, or an excess, of the sodium chloride solution, and allow the resulting mixture to settle.
3. The silver chloride precipitate can be collected by Buchner filtration or by gravity filtration, dried, and stored for collection by a licenced waste disposal contractor.
4. The filtrate is a solution of sodium nitrate and sodium chloride and can be washed down the sink.

When choosing a waste container, consider the following:

- The type of container should be appropriate for the Dangerous Goods Class of the chemical being disposed of.
- The container should be leak-proof.
- Do not use empty food containers, or household containers for chemical waste.
- Waste containers should have a well-fitting screwcap lid, not a snap-on lid or stopper.
- Never store waste corrosive materials in a metal container.
- If the waste can potentially generate gases during storage, the container must be sealed with a vented cap.

When using old stock chemical containers as waste containers:

- The container should be thoroughly washed, rinsed and dried.

- Ensure that the waste chemical is not incompatible with the original contents of the container (check the SDSs for incompatibilities). The original label should not be removed until the bottle is relabelled as a waste bottle, in order to avoid such incompatibilities.
- Remove the old label before applying the new one; do not just add another label to the bottle.
- Old empty containers which contained substances which are very water-soluble and of low hazard are suitable for use as waste containers.
- Never use the container of an acutely toxic or highly reactive chemical as a waste container. These should be stored for collection by a waste disposal contractor.

Labelling waste bottles

The label of a waste bottle should include

- the product identifier (e.g. 'Waste silver nitrate')
- any hazard statements and hazard pictograms consistent with the GHS classification of the chemical.

According to the Safework Australia Model Code of Practice on Labelling of Workplace Hazardous Chemicals, if possible, the label of a waste bottle should also include:

- the identity of any known or likely hazardous constituents or impurities and their proportions (for example, 'contains chromium VI, 5%', or 'may contain trace levels of organic peroxides')
- relevant precautionary statements
- relevant first aid and safety directions
- any other information that may assist identification of the hazardous waste and its associated hazards.

Storage of Chemical Waste

- Store the chemical waste according to its hazard, along with other compatible chemicals.
- If you have a separate storage area specifically for chemical waste, secondary containment should be used to segregate incompatible chemicals.
- Chemical waste should not be stored for long periods as the chemicals are unlikely to be pure and therefore their reactivity is unpredictable and as there may be degradation of the waste container. Science ASSIST recommends as a general rule that chemical waste not be stored for more than one year.

References:

'Chemical Waste Management' The University of Vermont website
[http://www.uvm.edu/safety/lab/chemicalwaste#Sink Disposal](http://www.uvm.edu/safety/lab/chemicalwaste#Sink%20Disposal) (Accessed July 2015)

'Chemical Waste Operating Procedure' November 2014. Sustainability website of the University of Queensland. https://sustainability.uq.edu.au/files/745/pro_ChmWste.pdf (Link updated November 2017)

'Code of Practice for Labelling of Workplace Hazardous Chemicals'. March 2015. Safework Australia website.
<http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/labelling-hazardous-chemicals-cop>

Source URL: <https://assist.asta.edu.au/question/3017/disposal-silver-nitrate-solid>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Endothermic reaction disposal of products

Endothermic reaction disposal of products

Posted by Anonymous on Fri, 2017-08-25 11:00

Endothermic reaction disposal of products: How can I dispose of the products of the reaction between Ammonium thiocyanate and barium hydroxide?

Thanks

Voting:



No votes yet

Year Level:

7

8

9

10

Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Endothermic reaction disposal of products

Submitted by sat on 13 September 2017

When solid ammonium thiocyanate is reacted with solid barium hydroxide it produces barium thiocyanate, ammonia and water¹.



This is an interesting endothermic solid-solid reaction which is probably best carried out as a demonstration so that the temperature change can be clearly observed¹.

Some publications say to wash the products all to waste², however without knowing the quantity you need to dispose of and that we are considering barium salts and thiocyanate, this requires further consideration.

Barium thiocyanate is classified as a Dangerous Goods class 6.1 Toxic as well as an S6 Scheduled Poison³. The thiocyanate anion is hazardous to the aquatic environment.

If the reaction is carried out infrequently as a demonstration, then washing the products down the sink may be acceptable, depending on factors such as the reaction scale and the acceptance limits of the local water authority. If the reaction has been conducted as a class activity, then we suggest that you store the products in a suitably labelled container for disposal by a licenced chemical disposal contractor. See our School science suppliers list for contact details of some chemical waste disposal contractors.

We recommend that schools consider the use of microscale reactions and techniques in the classroom. If the activity has been conducted on a microscale, then it would be permissible to dispose of the products to waste water.

An alternative to the ammonium thiocyanate reagent is to use ammonium chloride, which gives barium chloride in the reaction with barium hydroxide and thus avoids the hazard of the thiocyanate anion^{4,5}:



Barium chloride is also classified as a Dangerous Goods class 6.1 Toxic as well as an S6 Scheduled Poison⁶. The products of this reaction can be transferred to a suitably labelled container and stored for collection by a licenced waste disposal contractor. Alternatively, the barium ions can be precipitated from solution as barium sulfate by addition of sodium sulfate solution, then collected by filtration and allowed to dry. Small quantities of barium sulfate can be disposed of as general waste; larger quantities should be transferred to a labelled container and stored for collection.

We have previously answered some questions regarding the disposal of thiocyanate: see

- <https://assist.asta.edu.au/question/4116/disposal-ammonium-thiocyanate>
- <https://assist.asta.edu.au/question/3960/chemical-disposal>

Another related Q&A that contains good general advice for chemical waste disposal is Laboratory Chemicals and Waste Management/Setup

It is important to find out from your local authority regarding what chemical waste is permitted

or not permitted to be disposed of to your waste water system. A previous answer has links to various state authorities: see organic chemistry

References:

- ¹ "Counting Bonds in a Cool Reaction". 2016. Flinn Scientific website.
<https://www.flinnsci.ca/api/library/Download/cdf5ba6a59ab490cb1cc3b490a151846>
(Accessed August 2017)
 - ² Endothermic Reaction Demonstration. ThoughtCo. Website.
<https://www.thoughtco.com/endothermic-reaction-demonstration-604251> (Accessed August 2017)
 - ³ "Barium thiocyanate Safety Data Sheet". 2015. Sigma Aldrich website.
<http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang...>
(Accessed August 2017)
 - ⁴ "Endothermic solid-solid reactions" Royal Society of Chemistry Website.
<https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000739/endothermic-solid-solid-reactions?cmpid=CMP00005021> (Accessed September 2017)
 - ⁵ 'Endothermic Reactions of Hydrated Barium Hydroxide and Ammonium Chloride' University of California website. <http://www-chem.ucsd.edu/undergraduate/teaching-labs/demos/demo45.html> (Accessed September 2017)
 - ⁶ "Barium chloride Safety Data Sheet". 2014. ChemSupply website.
<https://www.chemsupply.com.au/documents/BL0271CH19.pdf> (Accesses September 2017)
- "Microscale chemistry –what and why?" Scottish Schools Education Research Centre (SSERC) website.
<https://web.archive.org/web/20170930175606/http://www.sserc.org.uk/chemi...> (Original page no longer exists, this page made available through the Internet Archive's Wayback Machine, April 2018)

Source URL: <https://assist.asta.edu.au/question/4232/endothermic-reaction-disposal-products>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Ethylene glycol disposal

Ethylene glycol disposal

Posted by Anonymous on Fri, 2017-11-17 13:57

Ethylene glycol disposal: I have small quantities,(less than 50mL of each) of 20%, 30% & 50% ethylene glycol solutions and would like to know the best way to dispose of them?

Authored 2017-07-20

Voting:•



No votes yet

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Ethylene Glycol disposal

Submitted by sat on 20 November 2017

We are aware that you have very small quantities of ethylene glycol solutions. If you are likely to repeat the activity and if the solutions are not contaminated, then you could suitably label and keep the solutions for the next time you conduct the activity.

Ethylene glycol is a scheduled poison and is classified as toxic¹. Although the threat it poses to aquatic organisms is low,² water authorities we contacted^{3,4} do not recommend that it be disposed of down the sink. One authority⁴ advises that the substance has a high biological/chemical oxygen demand and can therefore potentially affect waste water treatment processes⁴. Ethylene glycol has household and industrial applications as an

antifreeze/coolant; manufacturers of the substance recommend that with respect to disposal, it is considered hazardous waste^{5,6}.

Some options for disposal are:

- reuse as antifreeze;
- deposit it at a recycling collection point or alternatively, at a nearby automotive workshop which has the capacity to recycle it.
- contacting local waste facilities or the environmental protection agency for your state/territory⁷.

In the absence of these options, the ethylene glycol solution can be transferred to a labelled container and stored for collection by a licenced chemical waste disposal contractor⁸.

References

- ¹ ChemSupply. 2014. *Ethylene Glycol*, Safety Data Sheet, ChemSupply website, <https://www.chemsupply.com.au/documents/EA0071CH2S.pdf>
- ² Concise International Chemical Assessment Document 22 ETHYLENE GLYCOL: Environmental aspects•
http://www.inchem.org/documents/cicads/cicads/cicad_22.htm#PartNumber:1 (Accessed November 2017)
- ³ TasWater. 2017. Personal communication.
- ⁴ SA Water. 2017. Personal Communication.
- ⁵ Department of the Environment and Blue Environment Pty Ltd. 2015. *Hazardous Waste in Australia*, Australian Government Department of the Environment and Energy website, <http://www.environment.gov.au/system/files/resources/9ae68d42-d52e-4b1d-...> •(Accessed November 2017)
- ⁶ 'Hazardous waste', Better Health Channel website, <https://www.betterhealth.vic.gov.au/health/healthyiving/hazardous-waste...> (August 2014)
- ⁷ 'Household Chemical CleanOut'. NSW EPA Website. <http://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/household...> •(Accessed November 2017)
- ⁸ Science ASSIST. 2017. *Science ASSIST Chemical Management Handbook*, Science ASSIST website, <https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au...>

Source URL: <https://assist.asta.edu.au/question/4217/ethylene-glycol-disposal>

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Laboratory Chemicals and Waste Management/Setup

Laboratory Chemicals and Waste Management/Setup

Posted by Anonymous on Fri, 2016-06-24 08:56

Laboratory Chemicals and Waste Management/Setup: I am seeking reading material/documents that will help me in regards to the 'Chemical Waste Setup' required. What I need to know is also what type of chemicals go into what type of container, eg: acids into a corrosives container, ethanol into a flammable waste container. In particular, could you please advise how to treat the waste of Cobalt Chloride, Copper Chloride, Strontium Chloride, Lithium Carbonate - can you please advise what chemicals they can be mixed and disposed of with.

Voting:•



Average: 5 (1 vote)

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Laboratory Chemicals and Waste Management/Setup

Submitted by sat on 01 August 2016

General considerations

Careful consideration is required for the disposal of any hazardous chemical.

- **Consult the Safety Data Sheet:** The safety data sheet (SDS) for a chemical should be checked for the correct Personal Protective Equipment (PPE) to be worn and for any specific advice on disposal procedures.
- **Chemical incompatibility:** If storing waste as mixed waste, incompatible chemicals should not be placed in the same bottle. Information about the incompatibilities of a chemical can be found in the safety data sheet, Section 10: Stability and Reactivity. See the References for other sources of this information.
- **Container type:** A bottle or container of the same material as that in which the chemical is supplied is suitable for the storage of waste. Old chemical containers which are in good condition and have been thoroughly cleaned can be used for storing waste. Metal containers are generally not recommended for the storage of waste due to their reactivity and potential to corrode. Containers which have previously contained highly toxic waste should not be re-used, but should be disposed of via a licenced waste contractor.
- **Local policies and guidelines:** Disposal guidelines from your school jurisdiction, organisations such as your local council, water authority or the Environment Protection Authority (EPA) in your state/territory should also be considered.

Disposal methods

The following options can be considered for disposing of laboratory chemical waste.

- **Store as solid or liquid waste and arrange for collection** by a licenced waste disposal contractor. This method of disposal applies to many organic liquids, heavy metal salts, and mercury waste as well as larger volumes of chemicals and any unknown chemicals.
- **Recycle** if safe and manageable. For example, copper sulfate or alum can be recovered by recrystallisation or evaporation of the solution. Crystals from class crystal-growing activities can be reused in the preparation of solutions.
- **Landfill.** Small quantities of non-hazardous solid chemicals such as sugars, or salts in which both the anion and cation are non-hazardous can be disposed of as general waste
- **Wash to waste.** Dilute solutions of small quantities of water-soluble, non-hazardous chemicals are accepted by most water authorities. These chemicals must be non-toxic to aquatic organisms. Unknown chemicals should never be put down the sink.
- **Treat the waste** to minimise the volume or reduce/eliminate the hazard, and dispose of the products accordingly. Consideration should be given as to whether this is economical in terms of the time and chemical resources required. Waste treatment methods include (i) neutralisation of acids or bases, (ii) evaporation of water from aqueous salt solutions, (iii) precipitation or displacement of metal ions from solution (iv) reduction of oxidising agents.

Segregation of chemical waste

All chemical waste requiring disposal by a licenced waste disposal contractor, should be collected into waste bottles which are correctly labelled, segregated from incompatible

chemicals and stored securely.

Surplus, old or out of date chemicals are best kept in their original containers. Where chemical containers are degraded, these are best placed into secondary containment, which could be as simple as a strong zip lock plastic bag, if suitable.

Mixed waste: Ensure that only compatible chemicals are contained together. It is good practice to record what and how much of it you have put in the bottle, such as by attaching a label to the outside of the bottle on which to record each addition, or by keeping an electronic record (e.g. an Excel spreadsheet) which can be printed when compiling a waste manifest in preparation for waste collection.

Halogenated and non-halogenated solvents: These two categories of solvent are stored separately to avoid any chemical incompatibilities and hence, dangerous reactions. Also, depending on the waste contractor, the treatment methods they use may be less expensive for solvent in which there is no halogen component.

The following categories of waste can be stored as mixed waste:

- Organic liquid waste, non-halogenated
- Organic liquid waste, halogenated
- Aqueous waste; toxic inorganic substances, heavy metal mixtures
- Solid waste; toxic inorganic residues, heavy metal mixtures
- Aqueous waste, dilute acids
- Aqueous waste, dilute alkalis

The following waste can be stored separately:

- Lead residues
- Copper residues
- Nickel residues
- Chromium residues
- Zinc residues
- Silver residues

- Mercury residues
- Concentrated acid (a separate container for each acid)

- Note: **Do not** mix a concentrated acid with any other chemical.

Regarding the specific chemicals that you have mentioned:

- **Acids**
 - **Small quantities** can be diluted, neutralised and washed to waste.

Common reagents for the neutralisation of acids include dilute sodium hydroxide solution, or solutions of sodium bicarbonate or sodium carbonate or solid calcium carbonate. Carbonates have the advantage that neutralisation is indicated by the cessation of effervescence of carbon dioxide. The pH can be monitored with pH paper or indicator solution or a pH probe.

Waste should be neutralised to within pH 6-8. The neutral solution can then be flushed down the sink with dilution.

- **Large quantities** should be stored in a suitably labelled container in secondary containment, or bunding, which is able contain the entire contents in the event of the container breaking.
- As noted above, concentrated acids should not be mixed with other chemicals
- **Ethanol**
 - **Small quantities** can be diluted to below 24% and washed to waste, as the alcohol is miscible with water.
 - **Large quantities** should be stored as non-halogenated organic waste.
- **Cobalt chloride, copper chloride, strontium chloride and lithium carbonate**
 - These chemicals are all toxic to either people and/or the environment and should therefore be disposed of by a licenced chemical waste disposal contractor.
 - They can either be stored separately or with waste toxic inorganic substances.
 - For pure chemicals, keep in their original containers if possible.
 - Solutions can be evaporated in the fume cupboard and the salts stored as solids. If heating a solution to evaporate, in order to avoid decomposing the salt, heat only at low temperature in a fume cupboard and do not evaporate to dryness.

Assessing the risk and minimising waste

A risk assessment should be conducted prior to any activity using chemicals to identify all hazards and wastes produced. Science ASSIST has produced a one page risk assessment template for use, see [ASSIST Risk Assessment Template](#).

It is good practice to minimise the chemical waste that is produced wherever possible. It can be instructive for students to assess the chemical waste produced as part of their laboratory activity. Suggestions for minimising chemical waste:

- purchase small quantities so as not to stockpile, and use chemicals only as required
- consider the use of microscale reactions and techniques in the classroom
- regularly dispose of old or out of date chemicals via licenced waste contractors; do not allow them to accumulate

Science ASSIST has answered similar related questions see:

[Calcium Metal: disposal of calcium metal](#)

[Chemical disposal: disposal of potassium dichromate](#)

[Chemical Waste from Ester Prac: disposal of organic waste \(esters\)](#)

[chemistry: disposal of metal ions and sulfur species](#)

Disposal of silver nitrate solid: disposal of silver nitrate solid

Mercury Spills: disposal of mercury

Mercury Thermometer: disposal of mercury thermometers

organic chemistry: disposal of organic waste (esters)

Organic waste: disposal of halogenated and non-halogenated organic waste

potassium permanganate: disposal of potassium nitrate

risk assessment: disposal of sodium thiosulfate and hydrochloric acid

SOP: Hazardous waste: General guidance of waste including chemical waste

Sulfur disposal: disposal of sulfur

waste chemical disposal: general information on chemical waste

More detailed information for each chemical in our List of recommended chemicals for science in Australian schools will be provided in the (future) Chemical Management Handbook.

References

Duffus, J. 2002. 'Heavy metals'-A meaningless term? (IUPAC Technical report) *Pure Appl. Chem.*, Vol. 74: 793-807. <http://publications.iupac.org/pac/2002/pdf/7405x0793.pdf>

Pohanish, R.P., Greene, S.A. 2009. *Wiley Guide to Chemical Incompatibilities*, Third Edition, John Wiley and Sons Inc.

Queensland Department of Education. 2020, *Guideline for Managing Risks with Chemicals in DoE Workplaces*. Queensland DoE website.
<https://mpe.education.qld.gov.au/initiativesstrategies/Documents/guideli...> (Link updated May 2021)

Urban, P., Bretherick, L. 2009. *Bretherick's Handbook of Reactive Chemical Hazards, Volumes 1 and 2*, Seventh Edition, Elsevier Ltd.

Source URL: <https://assist.asta.edu.au/question/3903/laboratory-chemicals-and-waste-managementsetup>

Published on *ASSIST* (<https://assist.asta.edu.au>)

[Home](#) > Mercury Spills

Mercury Spills

Posted by Anonymous on Wed, 2015-03-11 15:06

Mercury Spills: We have a small amount of mercury in a thick-walled test tube, which only comes out once a year and is handled by the teacher. I do not have a spill kit for this. I was wondering where do I buy one, or can I make one up? Also, what would be the procedure in the event of a mercury spill. I know evacuation would be a must, but that is all I know. I have also been thinking about placing this glass test tube in an appropriate plastic bottle to avoid a spill.

Any recommendations would be appreciated.

Voting:•



Average: 5 (2 votes)

Year Level:•

7
8
9
10

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Mercury Spills

Submitted by sat on 23 March 2015

Mercury is a fascinating element and observation of its properties is a worthwhile experience for students. However, mercury is an extremely toxic substance and therefore it is important to minimise any risks involved in its storage and handling.

Mercury storage

Science ASSIST recommends that only a small amount of mercury be stored in a school and that this only be used for demonstration purposes. • A sample of 25 mL or less should be sufficient for demonstrating the properties of mercury. • The sample should be kept in a tightly sealed glass vessel which has a flat base. • The glass vessel should be stored within a second container, in case the first vessel fails. • A polycarbonate bottle with a screwcap lid would be suitable as a secondary container as polycarbonate is strong, non-reactive and transparent so as to allow observation of the mercury.

The mercury should not be removed from the sealed glass vessel and every effort should be made to prevent inappropriate use of the mercury sample.

To transfer a sample to more suitable vessel, PPE (latex or nitrile gloves, safety glasses or goggles, closed shoes, lab coat) should be worn and the procedure conducted in a running fume cupboard. • Ensure that the workspace is clear and uncluttered and that both vessels are stable (a test tube or very light vessel can be placed in a larger beaker or held with a clamp/retort stand). • Carefully transfer the mercury using a pipette (e.g. a disposable plastic pipette). • After all the mercury has been transferred, and the new vessel sealed tightly, the original container and pipette and any other contaminated materials should be double bagged and labelled 'DANGER: Elemental Mercury Waste' and stored for collection.

•

Mercury Spill Kit

Yes, we recommend that you have mercury spill provisions available in the unlikely event of a spill of your small quantity. • We recommend that you have the following two inexpensive clean-up options in place, which are readily available to Australian schools.

- Mercury Spill Kit. • This comprises a plastic storage jar with a cap that has a collecting sponge to collect the mercury globules. • When the cap is screwed back on to the container, it compresses the sponge and deposits the globules in the storage container. • The cap and sponge are then available to collect further globules. • The mercury waste can then be stored for collection by a licensed chemical waste contractor. • This would be the best response in the event of a small spill such as a broken thermometer. • The kit is a Bel Art product and is available from Bel Art and other reputable suppliers. • <https://www.belart.com/mercury-collector.html> ••
- One of the following.
 - Powdered sulphur,
 - Mercury decontaminant powder available from chemical suppliers. • These contain substances such as sulphur or zinc, which react with the mercury to form less volatile compounds. •• A lime-sulphur mixture is listed in the Chem-Supply chemical range and is available from the Chem-Supply retail companies across Australia. • <https://www.chemsupply.com.au/mt056-500g>

Sprinkling of these powders has the effect of coating the surface of the mercury and reducing the generation of mercury vapours which constitutes the health hazard until the spill can be properly collected. • They would be used for larger spills, or where the mercury has spilt into cracks or crevices or onto a porous surface for which the Spill Kit sponge is not fully effective. • Sulphur-containing powders allow easier visualisation of the mercury drops due to the reaction of mercury with sulphur to form brown mercury (II) sulphide. • The reaction with sulphur is slow, and therefore the powder should be left to react for 24 hours. • Care should be taken to avoid inhalation of powdered sulphur as it can cause irritation of the eyes, nose and throat. •

In case of a larger spill, it is important to have on hand the following PPE and clean up tools:

- PPE: latex or nitrile gloves, safety glasses or goggles
- waste containers e.g. heavy walled polyethylene bottle with a screwcap lid and/or plastic zip-lock bags
- a second container large enough to accommodate the waste container(s)
- eye dropper, Pasteur pipette or syringe (without the needle)
- adhesive tape
- paper towel
- flashlight
- rigid cardboard, such as index cards
- plastic dustpan

Mercury spill response procedure (larger spill, up to 25 mL)

1. **Evacuate the area and restrict access to personnel who are involved in the clean up. • Ensure that no one walks through the spill site, as this could spread the mercury to other areas.**
2. **All equipment and materials used to clean up a mercury spill should be regarded as hazardous waste and disposed of via a licensed chemical waste contractor. • Do not dispose of mercury waste or contaminated materials in the general rubbish.**
3. **Turn off any air conditioning or heating systems. • Close doors and windows to internal areas.**
4. **Open doors and windows to the outside. • Use fans to direct air from the spill site to the outside.**
5. **Wear PPE: gloves, safety glasses or goggles, closed shoes.**
6. **Use paper towel to pick up any broken glass and place this in the waste container.**
7. **Use the index card or similar to sweep and combine the drops of mercury. • Roll the mercury onto a piece of paper and place in the waste container.**
8. **Collect small drops with the eye dropper, Pasteur pipette or syringe and squeeze the collected mercury onto a damp paper towel or transfer directly to the waste container.**
9. **Use the flashlight at a low angle to detect any remaining mercury droplets.**
10. **Collect any fine mercury droplets by blotting the area with adhesive tape.**

11. **Sprinkle fine sulphur or mercury decontaminant powder over the area, particularly where the mercury has spilt into cracks or crevices. Allow 24 hours for the powder to react and collect the residues, again using an index or similar card or plastic dustpan.**
12. **Place the waste container within the second container and seal tightly to prevent the escape of mercury vapour. Seal the container in a plastic bag and label this as 'DANGER: Elemental Mercury Waste' and dispose of via a licensed chemical waste contractor.**
13. **Where the mercury has contaminated porous materials such as clothes or carpet, remove the contaminated material and double bag. Mark as 'DANGER: Elemental Mercury Waste' and dispose of via a licensed chemical waste contractor.**
14. **Continue to ventilate the spill area to the outside for at least 48 hours.**

These measures should be effective for most mercury spills of up to 25 mL. If a larger spill occurs or if the spill is more complex, for example, if the spill site is inaccessible or includes porous materials which cannot easily be decontaminated, then professional assistance should be sought.

Mercury Hazards

The main route of exposure to mercury is by inhalation of the vapour. Mercury vapour is easily absorbed via the lungs into the bloodstream and even low level chronic exposure to mercury vapour can cause damage to organs and the nervous system. Children are particularly vulnerable to the effects of mercury as their nervous system is not yet fully developed.

What not to do

- **Do not use a domestic vacuum cleaner to vacuum up mercury. This will blow mercury droplets into the air and permanently contaminate the vacuum cleaner.**
- **Never use a brush or broom to sweep up mercury as this will fragment the mercury into small drops which are difficult to see and which can vaporise more easily.**
- **Do not dispose of mercury waste or contaminated materials in the general rubbish.**
- **Do not dispose of mercury down the drain as mercury is toxic to aquatic life and also, if disposed of in this way, would likely contaminate the sink area and continue to emit vapours.**

•

References

- Baughman, Thomas, A., *Elemental Mercury Spills*, Environmental Health Perspectives, 114 (2), 2006, p. 147.
- Kulshrestha, M.K., Aw, T.C., *Occupational Medicine*, 46 (1), 1996, p. 91.
- University of New South Wales, *Mercury Spills Procedure*, 2013, <https://www.gs.unsw.edu.au/policy/documents/HS305.pdf>

- University of Melbourne, •*Environmental Health & Safety Manual*, 2015 •
<http://www.chemistry.unimelb.edu.au/safety>
 - U.S. Government Agency for Toxic Substances and Disease Registry, Atlanta USA,
•*Don't Mess With Mercury*, <http://www.atsdr.cdc.gov/dontmesswithmercury/> (Accessed August 2015).
-

Mercury Spills

Submitted by on 23 March 2015

Thanks for that, very clear guidelines for us to follow.

Source URL: <https://assist.asta.edu.au/question/2706/mercury-spills>

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Mercury Thermometers

Mercury Thermometers

Posted by Anonymous on Wed, 2015-05-13 14:33

Mercury Thermometers: how do we dispose of mercury thermometers?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Mercury Thermometer

Submitted by sat on 20 May 2015

A licenced waste disposal contractor is required to dispose of any mercury or mercury compounds. Although the mercury may be fully enclosed within the thermometer, the toxicity of mercury means there is no other way to dispose of it. These thermometers, as long as they are intact, do not pose any immediate concern. However, if they are put into use, there is a high likelihood that they could be broken, which would create a hazard. Mercury thermometers, which are no longer required and that are not broken, should be collected and securely stored in a container to protect them from damage until collection by a licenced waste disposal contractor.

If any thermometer has been broken, then care needs to be taken to collect the spilt mercury and glass. Information for collecting the spilt mercury can be found in an earlier Science ASSIST document on dealing with mercury spills and disposal, which can be found at [Mercury Spills](#). In summary, the mercury must be collected using a mercury spill kit, sealed, labelled and stored for collection by a licenced waste disposal contractor.

Alternative thermometers

Alcohol thermometers are recommended for use in schools for the temperature range 0° C to 110° C. Whilst mercury thermometers are more accurate, in most circumstances, such precision is not required for secondary school practicals.

Digital or non-contact varieties of thermometers are recommended in place of the clinical mercury thermometers.

Other alternatives are data-logger style temperature probes or sensors.

Reference:

ASTA, Science ASSIST. 2015. *Mercury Spills*. Science ASSIST website.
[/question/2706/mercury-spills](#)

Source URL: <https://assist.asta.edu.au/question/2832/mercury-thermometers>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > organic chemistry

organic chemistry

Posted by Anonymous on Thu, 2015-03-26 17:32

Organic chemistry: Could someone please advise about the safe storage and disposal of esters.

I haven't been able to find Australian references. One USA site said esters with a carbon-chain length of less than 5 can be disposed down (an American) sink. However, what about the situation in Australia, and NSW in particular?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

organic chemistry

Submitted by sat on 16 April 2015

In brief: It is best practice to dispose of laboratory waste in a controlled manner. For ester preparation activities, the best practice is to store the waste in appropriately labelled bottles for collection by a licenced waste disposal contractor.

Although it is not prohibited in Australia to use a fume cupboard to evaporate waste, we advise against this practice as it introduces untreated waste into the environment.

Preparation and properties of esters

In schools, ester preparation often involves mixing a few drops of an alcohol and a similar amount of a carboxylic acid in a test tube, along with an acid catalyst such as concentrated sulphuric acid, and then heating the mixture in a water bath. The odour of the ester may then be observed by wafting fumes from the test tube or by pouring the mixture onto a small amount of water in a beaker and observing the odour from the ester layer which forms on top of the water.

On a larger scale, after heating the reaction mixture and allowing it to cool, the mixture may then be transferred to a separating funnel and washed with sodium carbonate solution to remove the acid catalyst as well as any unreacted carboxylic acid.

In school ester preparation activities, depending on the length of the carbon chain, the esters produced may be categorised as highly flammable, flammable or combustible. The alcohols used are also flammable and many are irritating to the skin and respiratory system. While esters often have a sweet fruity aroma, the component acids and alcohols can smell very unpleasant. Esters vary in their miscibility with water according to their chain length and structure.

Disposal of esters

We have researched the trade waste acceptance standards in all of the Australian states and territories and consulted directly with five water authorities. In general, the accepted concentrations for organic compounds are very low (e.g., from 1mg/L to 30 mg/L for saturated hydrocarbons). Flammable substances are specifically prohibited from being discharged to the sewerage system, as are water-immiscible liquids. The only carboxylate anion specified by any of the water authorities is acetate, which is accepted at the concentration of 300 mg/L in the ACT.

If the esters are prepared in test tubes, and not washed or added to water, then the entire contents of the test tubes should be transferred to a non-halogenated organic waste bottle and stored for collection by a licenced waste disposal contractor.

If the ester is washed with water or carbonate solution, then the composition of the aqueous layer would depend on the miscibility of the reagents used and ester(s) produced in the activity. In WA and NSW, small amounts of water-miscible organic substances from science laboratories are allowed to be discharged down the sink as long as there is appropriate dilution. In these states, any aqueous layers produced in ester preparation activities could be neutralised and then washed down the sink with lots of water.

We expect that the concentration of these substances in the aqueous layer would exceed the

accepted limits in other jurisdictions. Therefore, in these cases, we recommend that the aqueous layer be transferred to a separate waste bottle labelled as 'Dilute aqueous waste' and stored for collection via a licenced waste disposal contractor.

Best practice, would be to store the organic layer in a separate bottle to the aqueous layer. However, if the layers are difficult to separate, then it would be reasonable to transfer both layers to the same waste bottle.

Glassware contaminated with any of the organic compounds used or produced can be rinsed with a small amount of ethanol with the rinse liquid being added to the organic waste bottle. If any gas is produced from the stored mixture, it is likely to be carbon dioxide produced from the reaction of the sodium carbonate and the acid catalyst or unreacted carboxylic acid.

It is good practice to keep track of the substances which are added to a waste bottle. One way to do this is to attach a blank label onto the back of the waste bottle. Each time waste is added to the bottle, the names of the substances added can be recorded on the label. When the bottle is full, then the hand-written label can be replaced with a printed label containing this information.

Alternative Activity

Some schools use gourmet jelly beans to experience the aroma of esters; see the esters experiment alternative, Esters –A tasty investigation <http://www.labnetwest.asn.au/experiments/>. Do remember to use a non-science room for all activities where foods are consumed.

Links to some information specific to states and territories

Note:•Some states have multiple water authorities responsible for trade waste. Ensure that you are looking at the correct authority for your region.

ACT: 'Liquid trade waste', icon water website, <https://www.iconwater.com.au/developers-and-renovators/liquidtradewaste.aspx> (Accessed 24/08/2020)

NSW: 'Liquid trade waste', NSW Department of Planning, Industry and Environment website, <https://www.industry.nsw.gov.au/water/water-utilities/regulatory-assessments/liquid-trade-waste> (Accessed 24/08/2020) •

NT: 'Trade Waste', Power and Water Corporation website, <https://www.powerwater.com.au/developers/water-development/trade-waste> (Accessed 24/08/2020)

Qld: 'Trade waste', Urban Utilities website, <https://urbanutilities.com.au/business/business-services/trade-waste> (Accessed 24/08/2020)

Qld: •Trade Waste Guidelines: City of Gold Coast website, <https://www.goldcoast.qld.gov.au/files/sharedassets/public/pdfs/brochure...> (Link Updated September 2021)

SA: 'Trade waste management', SA Water website, <https://www.sawater.com.au/my-business/trade-waste/trade-waste-management>

(Accessed 24/08/2020)

Tasmania: 'Trade Waste and your business', TasWater website,
<https://www.taswater.com.au/customers/businesses/trade-waste> (Accessed 24/08/2020)

Victoria: 'Trade waste agreements in Victoria', CleanaWater website,
<https://cleanawater.com.au/information-centre/trade-waste-agreements-in-victoria> (Accessed 24/08/2020)

Victoria: 'Trade waste' Barwon Region Water Corporation,
<https://www.barwonwater.vic.gov.au/water-and-waste/trade-waste> (Accessed 24/08/2020)

Victoria: 'Trade Waste' City West Water website,
https://www.citywestwater.com.au/business/trade_waste (Accessed 24/08/2020)

Victoria: 'Trade Waste', Goulburn Valley Water website,
<https://www.gvwater.vic.gov.au/business/trade-waste> (Accessed 24/08/2020)

Victoria: 'Commercial trade waste', Gippsland Water website,
<https://www.gippswater.com.au/commercial/general-information/commercial-trade-waste>
(Accessed 24/08/2020)

Victoria: 'Manage trade waste', South East Water Corporation website,
<https://southeastwater.com.au/business/trade-waste/>

Victoria: 'Trade Waste' Yarra Valley Water website, <https://www.yvw.com.au/help-advice/trade-waste> (Accessed 24/08/2020)

WA: 'Trade waste', Water Corporation website, <https://www.watercorporation.com.au/Help-and-advice/Trade-waste/> •

[Links edited 25/08/2020 to update with current links]

Source URL: <https://assist.asta.edu.au/question/2737/organic-chemistry>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Organic waste

Organic waste

Posted by Anonymous on Wed, 2015-04-29 12:30

Organic waste: Students are investigating the reactions and properties of organic compounds from Heinemann Chemistry 2 VCE units 3 & 4. The waste will be minimal but we have no waste collection for this type of experiment in place to date.

Can I store the resultant waste together for collection?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Organic waste

Submitted by sat on 15 May 2015

The brief answer to your question is yes, you can store the resultant waste together while

waiting for collection and disposal by a licenced chemical disposal contractor. However, there are some other options rather than collecting all in one container. It is important that a risk assessment is performed prior to undertaking this, or any other practical activity, taking into account disposal method for waste products.

This practical activity uses small volumes of the organic chemicals: cyclohexane, cyclohexene, hexane, ethanol and *tert*-butyl chloride along with iodine, potassium permanganate, potassium hydroxide, silver nitrate, sodium hydrogen carbonate, glacial acetic acid, dilute nitric acid and concentrated and dilute sulphuric acid. The SDS for cyclohexane states that it should not be allowed to enter waterways, this then removes the option of diluting and disposing to the sewerage. It is not illegal in Australia to allow volatile waste to evaporate to the atmosphere in a fume cupboard, however, this is not the best practice that Science ASSIST recommends.

The recommendation in the textbook is for all of the organic waste to be collected in a waste container in the fume cupboard. Whilst this is acceptable considering the chemicals involved, it is an option to separate the halogenated organic waste from the non-halogenated waste. The term 'halogenated' refers to the presence of halogens such as iodine and chlorine. In addition, part D of the practical activity contains an organic acid, which can be diluted, neutralised and flushed to waste.

The best practice for disposing of this, and other organic waste, is to collect it in a labelled waste collection bottle and have it collected by a licenced chemical disposal contractor. In this case, the ideal collection process is in two containers.

1. **Halogenated organic waste:** Products from parts A and B of the activity result in halogenated organic waste, which is more difficult and expensive to dispose of (than non-halogenated waste). The best option here is to collect these wastes (Part A and B) in one container labelled as halogenated waste.
2. **Non-halogenated organic waste:** Products from Part C of the activity could be collected in a second labelled container as non-halogenated waste. However, with the small quantities involved here, it may be more practical to be collected with waste from Parts A and B and all disposed of as halogenated waste.
3. Part D could be diluted, neutralised, and flushed down the sink with water.

It is good practice to keep track of the substances which are added to a waste bottle. One way to do this is to attach a blank label to the back of the waste bottle. Each time waste is added to the bottle, the names of the substances added can be recorded on the label. When the bottle is full, then the hand-written label can be replaced with a printed label containing this information.

Further information can be found in answers to similar questions: [organic chemistry](#) or [Chemical Waste from Ester Prac.](#)

References:

Commons, Penny 2012 'Heinemann Chemistry 2 Student Workbook (2e) 2nd edition, Pearson Australia (fully updated for the 2013-2016 VCE study design).

Chemwatch 2013 Safety Data sheet: Cyclohexane

Source URL: <https://assist.asta.edu.au/question/2798/organic-waste>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > [potassium permanganate](#)

potassium permanganate

Posted by Anonymous on Mon, 2015-05-04 16:48

Potassium permanganate: I would like to know how to dispose of potassium permanganate 0.02M solution. The MSDS states it is not a hazard but that it must not be put down the drain.

The MSDS for potassium permanganate 0.02M states:

2. HAZARDS IDENTIFICATION 2.1 GHS Classification: Not a dangerous substance or mixture according to the Globally Harmonised System (GHS).

6.2 Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

13. DISPOSAL CONSIDERATIONS 13.1 Waste treatment methods: Product Offer surplus and non-recyclable solutions to a licensed disposal company.

Voting:•



No votes yet

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

potassium permanganate

Submitted by sat on 25 May 2015

In response to the following comment:

Just to clarify, the response says the solution can be stored for future use and to take care as it can deteriorate. If you are not sure of the molarity of the solution, is it worthwhile holding onto? Secondly, if the solution deteriorates, how long will it be viable and when it does deteriorate does it still need to be collected by a licensed contractor?

Dealing with each question separately:

Q1. If you are not sure of the molarity of the solution, is it worthwhile holding onto?

Molarity can be established by titrating with oxalic acid. Please follow the steps for the student activity “standardising potassium permanganate solution” in the student experiment manual. (If the solution has visibly deteriorated, that is, there is a change in colour or if visible particles/suspensions present etc. it is not suitable for use and not worthwhile attempting above step.)

Once the molarity is established, you may decide to calculate and adjust it as per your need. However, if the solution has been stored for a long time and/or if you have added more potassium permanganate solids to an existing solution to adjust molarity, it is recommended to boil the solution for 10 minutes, as you do when making it fresh, and then filter the solution through glass wool to remove any MnO_2 , which would catalyse the decomposition of the MnO_4^- ion; and store them in dark bottles, wrapped in Al foil away from light.

Therefore, it is worthwhile to store surplus potassium permanganate solutions for future use.

Q2. Secondly, if the solution deteriorates, how long will it be viable and when it does deteriorate does it still need to be collected by a licensed contractor?

It is not possible to state an exact shelf life for this type of solution. Many schools use one-year-old solutions most of the time, not even needing to adjust molarity. It all depends on how you made it, and how you stored it.

Due to environmental concerns, responsible practice for waste or surplus permanganate solutions to be disposed of is through a licensed contractor. Even though partially deteriorated, it is still an oxidising agent, and Mn^{2+} ions present in solution from decomposed MnO_4^- are a threat to the aquatic environment.

potassium permanganate

Submitted by sat on 17 May 2015

Safety Data Sheets (SDSs) are the best general source of information available for any chemical, and they should be consulted as a first step in assessing the risk associated with disposal.

Due to toxicity to the aquatic environment, potassium permanganate solution should not be allowed to enter drains or waterways. Therefore, the safe and recommended practice for disposal of this solution is through a licensed waste disposal contractor.

Alternatively, this solution can be stored for future use. Care should be taken when preparing and storing since potassium permanganate solutions are not stable and decompose when reducing agents are present. It is affected by light and is best stored in an amber glass bottle. An additional measure to exclude light is to wrap the bottle in aluminium foil.

Background information:

A dilute solution of potassium permanganate is not classified as hazardous in general. It is used as an oxidising agent, a disinfectant, as an anti-algal agent, in metal cleaning, in tanning, bleaching, and as a preservative for fresh flowers and fruits.

However, potassium permanganate is very toxic to the aquatic environment, which is why it is not suitable for being disposed of down the sink and into waterways.

Most toxicity tests have been carried out using soluble Mn(II) salts. Potassium permanganate is a highly soluble salt containing Mn(VII) ions. For example:

- For algae and protozoa, there is a wide range of toxicity values: the most sensitive species are marine diatoms and freshwater algae being affected by amounts as low as 1.5 mg manganese/litre.
- Aquatic invertebrates are affected by amounts ranging from 0.8 to 1389 mg manganese/litre.
- A significant reduction in survival and hatching of crab embryos at ≥ 0.01 mg manganese/litre in seawater was found.
- Fish are affected at levels from 2.4 to 3350 mg manganese/litre.
- Significant embryonic mortality was observed in trout eggs at 1 mg manganese sulfate/litre.
- A single embryo-larval test was identified for amphibians at 1.4 mg manganese/litre.

Read more at <https://incchem.org/documents/cicads/cicads/cicad63.htm> 7.2 Toxicity to the aquatic environment.

References:

ChemCentre, Curtin University, Bentley W.A. May 2015. With assistance from the Scientific Services Division. Personal communication

Howe, P.D, Malcolm, H.M, Dobson, S. 2004 'Manganese and its compounds: Environmental aspects' WHO: Geneva <https://incchem.org/documents/cicads/cicads/cicad63.htm>

'Manganese and compounds' Australian Government Department of Environment website <http://www.npi.gov.au/resource/manganese-compounds> (Accessed May 2015)

https://www.who.int/ipcs/publications/cicad/cicad63_rev_1.pdf



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > risk assessment (thiosulfate)

risk assessment (thiosulfate)

Posted by Anonymous on Thu, 2015-07-30 13:37

Risk assessment (thiosulfate): Do you have a RA for the reaction of 0.1M sodium thiosulfate with 2M hydrochloric acid, especially the cleaning up and disposal.

Voting:•



Average: 5 (2 votes)

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

risk assessment

Submitted by sat on 12 August 2015

For anyone who wishes to carry out their own site-specific risk assessment for any science activity, we have published an ASSIST information sheet [AIS: Risk management and risk assessment](#) which offers an instructional guide on how to carry out and document a risk assessment using the Science ASSIST [risk assessment template](#). We do not carry ready-made risk assessments for specific activities carried out in schools.

Prior to conducting any science activity it is good practice to go through the four-step process of:

1. Identifying the hazard
2. Assessing the risk
3. Implementing the control measures
4. Monitoring and reviewing the effectiveness of the control measures

For the simplicity of answering the question, we shall deal here with the chemicals used and produced in this activity.

Chemical	1.Hazard	2.Assess the risk	3.Implement control measures	4.Review effectiveness of control measures Ø
0.1 mol/L sodium thiosulphate	body tissue irritant	Low	Wear safety glasses and lab coat	Low
2 mol/L hydrochloric acid	corrosive to eyes and skin	Medium	Wear safety glasses and lab coat	Low
sulphur dioxide gas	skin and eye irritant	Medium	Carry out this reaction in a well-ventilated area and wear safety glasses and lab coat	Low

Ø Ask this question: 'Are the risks effectively controlled?'

DISPOSAL:

Left over reaction mixtures from this activity consist of solid sulfur and other sulfur species and some unreacted reactants, such as excess hydrochloric acid in the waste mixture. It is suggested that used glassware is cleaned using a bottle brush and detergent and then rinsed (or wash in a dish washer) as soon as possible to reduce the likelihood of a film of sulfur drying on the glassware.

The best practice for dealing with this waste is to:

1. Neutralise the collected waste with a carbonate, such as a solution of sodium carbonate or solid sodium carbonate or calcium carbonate (marble chips) in portions, until all the acid has been depleted by bubbling off as carbon dioxide in a fume hood. This can be determined by using an indicator such as universal indicator to achieve a pH of between 6-8.

2. Once neutralised, the solids in the waste mixture should be filtered out before flushing the filtrate down the sink. A funnel with a wad of cotton wool is adequate for this purpose. This way all the sulfur species present in solution are removed together with other insoluble matter.
3. The separated insoluble matter with sulfur products can be disposed of together with general waste given that the quantities produced in this activity are relatively small. Please refer to our previous response on [sulphur disposal](#) for further information.

Disposal of relatively small quantities:

If the class size is very small and the quantity of waste is small, then the amount of sulfur residue would be negligible and there would be only a small amount of excess hydrochloric acid in the waste mixture, then we advise that waste from this activity could be diluted further with plenty of water before disposing of down the sink.

References:

Flinn Scientific Inc. 2009. 'Rate of Reaction of Sodium Thiosulfate and Hydrochloric Acid' CHEM FAX publication, no: 91860 <https://www.flinnsci.com/media/622120/91860.pdf>

'Safety Data Sheet: sulfur', August 2014. Chem-Supply website <https://www.chemsupply.com.au/documents/ST0061CH71.pdf>

Source URL: <https://assist.asta.edu.au/question/3044/risk-assessment-thiosulfate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Sulfur disposal

Sulfur disposal

Posted by Anonymous on Wed, 2015-03-18 13:00

Sulfur disposal: Could you please advise on the procedure for disposing of sulfur, specifically sulfur mixed with iron filings and HCl.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Sulfur disposal

Submitted by sat on 27 March 2015

Disposal of Sulfur:

Sulfur powder, whilst it is a designated hazardous substance, a flammable solid and a dust inhalation hazard in particular circumstances, has a hazard level considered to be towards the low end of the scale.• Indeed, it is widely sold in garden shops as a soil conditioner to lower

the pH of alkaline garden soils. •

The recommended disposal is via a licenced chemical waste disposal company. Details for suitable companies can be found on the [School science suppliers](#) list. However, if quantities are small and are not contaminated with other substances, then responsible disposal as a soil conditioner could be considered. Dosage rates advised for soil treatment are commonly in the range of 25 to 100 grams of sulfur per square metre when dug into the top 10 cm. Therefore, if disposing by burial in soil, we recommend that you operate within these limits.

[Please note:• as a general principle we do not endorse the disposal of laboratory chemical wastes either by local burial or in general refuse.• We do so in this case only after careful consideration and risk assessment of the particular substances.]

Disposal of sulfur mixed with iron filings and HCl:

From the given details, we are deducing that the material for disposal is the residue from a series of student investigations about the separation of a mixture of sulfur powder and iron filings, with the dissolving of the iron in hydrochloric acid being one of the steps in this investigation. • If so, then the process would be for the hydrochloric acid to dissolve the metallic iron, and to leave the sulfur as a solid that could be filtered out and thus separated. •

Please respond to us with further details if these assumptions are not correct, or if this response does not fully meet your particular circumstances.

In assessing disposal methods, it is of course not possible for you to have a residue with both iron filings and hydrochloric acid, as these will react chemically until either one or the other is used up. • So we assume that your mixture contains sulfur and either an excess of iron filings or an excess of hydrochloric acid. • We will address both possibilities. • We also assume that the waste quantities are relatively small and are derived from small-scale student activities.

- For a mixture of sulfur powder and iron filings, if the mixture is not suitable for storage for reuse, then it can be put aside for chemical waste collection. Or, if the quantity is relatively small, it could be safely disposed of by burial. • Metallic iron is extremely widespread throughout our environment and in this form not hazardous. The iron filings would soon rust to hydrated iron oxide, and the sulfur would, in time, react to lower the soil pH. •
- For a mixture of sulfur and hydrochloric acid, we suggest that you first neutralise the excess hydrochloric acid. • This is easily done through reacting it with a carbonate. • Marble chips (CaCO_3) or sodium hydrogen carbonate (NaHCO_3) would be cheap options for this. • You will know when the reaction is complete as the bubbling off of carbon dioxide will stop, indicating that the acid has been depleted. • Once neutralised, the solids can be filtered out (a funnel with a wad of cotton wool is adequate for this), the solutions can then be flushed down the sink. • The solid sulfur can then be stored for later collection, or if quantities are relatively small, disposed of by burial, as above.

References:

Directions for the use of sulfur as a soil conditioner:•
<https://greenlifesoil.com.au/gardening/minerals-fertilizers>•

Chem-supply. 2014. *Safety Data Sheet Sulfur*
<https://www.chemsupply.com.au/documents/ST0061CH71.pdf>

Wilkinson, S. 2015. Science Business Manager, Scientific Services Division, ChemCentre.
Western Australia. Personal communication.

Source URL: <https://assist.asta.edu.au/question/2720/sulfur-disposal>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > waste chemical disposal

waste chemical disposal

Posted by Anonymous on Tue, 2014-11-11 09:53

Waste chemical disposal: We are in western Sydney and are looking for an economical way of disposing of both solution and solid chemical waste and surplus chemicals .

Voting:•



No votes yet

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Answer by ritasteffe on question waste chemical disposal

Submitted by sat on 13 November 2014

All schools have a responsibility to dispose of their chemical waste in a safe and environmentally responsible manner. In NSW the Environmental Protection Authority (EPA) administers the management of chemical waste.

<http://www.epa.nsw.gov.au/pesticides/chemicalmgt.htm> **If you are a DEC school in NSW:**

You need to follow specific advice on disposal of chemical waste in accordance with the Chemical Safety in Schools (CSIS) package. The following sections should be consulted:
Section 1.8: •Managing Chemicals Section 3: •Curriculum Support Documents 3.2 Science Appendix E: •Disposal of waste chemicals (A table of chemical brokers and suppliers is listed

who can assist you with the disposal of chemicals). At this time the cost is borne by the school. Appendix E also contains some advice on re-using, recycling and reprocessing chemicals as well as flow diagrams on how to treat different types of chemicals for disposal. There are also specific instructions for the disposal of individual chemicals as well as Sydney Water limits for disposal of liquid wastes to sewers. It has been confirmed by NSW DEC that CSIS is currently under review and that the feasibility of a state contract with a licensed waste contractor will be considered sometime in the future. Sydney Water has also published a document on acceptance standards of trade wastewater to the wastewater system for its industrial customers. This may also be of assistance.

<http://www.sydneywater.com.au/web/groups/publicwebcontent/documents/docu...> • **If you are not a DEC school in NSW:** Below is a list of a few licensed waste contractors that are able to service western Sydney. Cleanway Environmental Services 1300 785 003

www.cleanway.com.au Toxfree 9833 4399 www.toxfree.com.au Solveco 9833 7035

<http://www.solveco.com.au/> Schools should obtain quotes from several different providers to compare costs and service provided. The cost of disposal can possibly be lowered if several schools in your area arrange to have their waste chemicals collected by the same company on the same day. Some companies may allow the transport fee to be negotiated. Before engaging a contractor, we suggest you review the chemicals you have for disposal to consider whether any of the waste material can be used in another process or treated safely in-house for re-use, recycling or disposal to the sewer. This may minimise the amount of chemicals required for collection and hence reduce the cost of disposal. The SDS sheet for individual chemicals should be consulted for appropriate disposal methods. **General Disposal**

Considerations: As far as possible, schools should aim to minimise the quantities of chemical waste produced. Chemical waste should be disposed of by a licenced waste contractor. See the Science ASSIST list of suppliers for contact details. </resource/664/school-science-suppliers>. The cost of disposal is determined by weight and chemical class with the addition of a transport fee, EPA levy and GST. Contractors generally require the chemical waste to be in secure containers with compliant labels and incompatible wastes segregated. They may have their own template for a manifest of chemicals for disposal which usually includes:

- the name of each chemical (proper shipping name);
- the UN number, dangerous goods class and sub risk, if applicable, packaging group;
- size (volume) of the actual container;
- type of container (e.g., glass, plastic, metal) plus the actual volume of chemical in each of the containers;
- number (quantity) of containers;
- total quantity (kg or L);
- any unknown chemicals should be labelled as unknown.

The manifest can be emailed to the contractor to obtain a quote. Whilst waiting for pick up, store and segregate incompatible waste chemicals safely in approved store rooms or chemical storage cabinets. Schools must check with their own authorities regarding regulations in their area. The Water Corporation of WA provides information regarding guidance for laboratory chemical waste. Whilst the specific advice is for WA it contains some good information regarding chemicals of major concern, waste avoidance and waste minimisation, as well as some best management practices. See•

<https://www.watercorporation.com.au/home/business/trade-waste/trade-waste-in-your-business/labratory-chemical-waste>

Science ASSIST will be developing detailed guidelines for chemical waste disposal in the near future.

Source URL: <https://assist.asta.edu.au/question/2518/waste-chemical-disposal>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Zinc Nitrate

Zinc Nitrate

Posted by Anonymous on Fri, 2016-03-18 09:34

Zinc Nitrate: Hi, My bottle of zinc nitrate has liquid in it and the bottle has expanded. It does not look right.

HELP!

Voting:



No votes yet

Year Level:

7

8

9

10

Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Zinc Nitrate

Submitted by sat on 19 March 2016

Zinc nitrate is deliquescent, which means that it absorbs water from the air and dissolves in that water to become a liquid. This is very likely what has happened to your container of zinc

nitrate. The extra volume has caused the bottle to expand. This chemical is no longer suitable for use and, because it is considered a heavy metal, should be disposed of by a licenced chemical waste disposal company.

Science ASSIST recommends the following.

- Wear appropriate PPE (safety glasses, laboratory coat, gloves and closed-in shoes) when handling zinc nitrate and zinc nitrate solutions.
- Place your current container into secondary containment, such as a larger plastic container, or at least a heavy-duty plastic bag in case the container splits and the contents spill.
- Arrange for disposal by a licenced chemical waste disposal company, because it is a heavy metal and not suitable for disposal via landfill or via the water sewerage system.
- Always purchase and store chemicals in small quantities. Consider storing hygroscopic or deliquescent chemicals in a desiccator to prevent the absorption of water from the air. Zinc nitrate should be stored with other oxidising agents away from combustible materials and reducing agents.
- Monitor the condition of all your chemicals and their containers to ensure that they are in a good and stable condition.

Source URL: <https://assist.asta.edu.au/question/3676/zinc-nitrate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Bromine Water

Bromine Water

Posted by Anonymous on Thu, 2016-05-19 11:11

Bromine Water: I have been asked to make up bromine water for testing its reaction with hydrocarbons. I know that this is very toxic and requires an S7 Poisons Permit. Would the alternative "bromine water" made by adding a few drops of commercial bleach to a 0.5 M solution of potassium bromide still work for this experiment?

Voting:•



Average: 5 (2 votes)

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Bromine Water

Submitted by on 01 June 2016

Far easier and safer is to purchase already prepared Bromine Water from your chemical supplier. Be sure to follow all the above answered safety precautions when handling and transferring into dropper bottles for students to use. Store in refrigerator in original packaging.

Bromine Water

Submitted by sat on 27 May 2016

In brief

You are correct that bromine water is toxic, is classified as a S7 Poison, and in WA requires a permit to purchase. Bromine water is also corrosive. It can be prepared by the displacement of bromide ions in solution by the addition of bleach as you have described. This method will be effective for the activity you mentioned.

Bromine water

- is classified as a Schedule 7 poison, Dangerous Goods class 8 and subsidiary risk of 6.1;
- carries the GHS pictograms GHS05 (Corrosion) and GHS06 (Skull and crossbones);
- is a clear orange liquid with a characteristic pungent irritating odour;
- is corrosive and an oxidiser, can cause severe eye damage and skin irritation, and emits toxic fumes, which should not be inhaled.

Before undertaking the preparation of bromine water, Science ASSIST recommends the following:

- carry out a site-specific risk assessment;
- refer to Safety Data Sheets (SDSs) of bromine water and all reactants used;
- be familiar with the following safety notes and disposal information.

Safety notes

- **Perform the preparation of the bromine water and the entire investigation in an operating fume cupboard wearing relevant PPE, such as gloves, safety glasses, laboratory coat and closed-in shoes.**
- **Avoid inhaling any of the chemicals used or produced.**
- **If any chemicals come into contact with your skin, immediately wash the affected area with copious amounts of water.**
- **prepare only the volume of bromine water that is needed.**

Laboratory preparation of bromine water

Notes

- When purchasing bleach, ensure that it only contains sodium hypochlorite and does not have other additives such as thickeners or other chemicals. If possible, purchase a 5% solution, but if purchasing a home brand, which is of a lower concentration, be aware that a larger quantity may be required. Add sufficient bleach to a 0.5 M aqueous solution of potassium bromide to produce a deep orange colour.
- The formation of bromine from a mixture of bleach and a bromide salt has been shown to be an acid-catalysed reaction^[1]. Acidification of the mixture (e.g., with dilute sulfuric

acid) may therefore give a higher yield of bromine under otherwise constant conditions.

Disposal

- **Part A** (which uses aqueous potassium permanganate solution and hydrocarbons): The wastes produced should be collected separately into a labelled organic wastes disposal bottle.
- **Part B** (which uses bromine water and hydrocarbons): The wastes produced should be collected separately into a labelled halogenated organic wastes disposal bottle.
- Both waste disposal bottles should be tightly closed and stored in a flammable liquids cabinet. As the quantities will be small, they can have additional compatible wastes added and then should be disposed of through a waste disposal company.
- **Excess bromine water** should be reduced to bromide ions in solution by a reaction with sodium thiosulfate. Either add sodium thiosulphate solution in small portions or add and dissolve sodium thiosulphate crystals, a few at a time, until the solution becomes colourless then dispose of in the sink with plenty of water.
- **Glassware:** Collect the used test tubes from each part separately. Rinse the test tubes with some water that is then disposed of in appropriate wastes bottles. Leave the test tubes under an operating fume cupboard for a few hours before washing them as per normal.

Additional Information

Alternative method for the laboratory preparation of bromine water

(This method prepares chlorine water first and then bromine water)

40 mL of bleach

40 mL of 1 M sulfuric acid

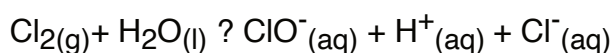
Potassium or sodium bromide crystals

Procedure

- Add the 40 mL of sulfuric acid to the bleach solution. Dilute the resulting mixture with distilled water and make up to 100 mL. This is **chlorine water**.
- Gradually, add potassium bromide (or sodium bromide) crystals to the prepared chlorine water and stir, until a deep orange coloured solution is formed. This is **bromine water**.

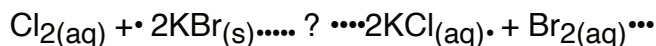
The theory behind preparing bromine water using bleach and a bromide salt is that chlorine is more reactive than bromine and will readily displace Br^- ions from an aqueous bromide solution to produce bromine water.

Hypochlorite ions (ClO^-) and chlorine are in equilibrium in water, and in the presence of acid, the hypochlorite ions are readily reduced to chlorine gas, as the reverse reaction is favoured.



The resulting chlorine is reacting with the bromide which dissolves into the solution.

Chlorine water + potassium bromide ? potassium chloride + bromine



Licencing requirements

There is variation across Australia concerning the licencing and permit requirements for the purchase, use and resale of Schedule 7 poisons. Western Australia requires a permit to purchase and possess Schedule 7 poisons for a specific use but not to resell. For more information on permit requirements in different jurisdictions see website, <https://www.tga.gov.au/australian-state-territory-regulatory-controls-schedule-7-poisons>

References

‘Application forms –licences and permits for medicines and poisons’, WA Department of Health website, https://ww2.health.wa.gov.au/Articles/A_E/Application-forms-licences-and-permits-for-medicines-and-poisons (Accessed May 2016)

‘Australian State & Territory regulatory controls on Schedule 7 poisons’, Department of Health TGA website, <https://www.tga.gov.au/australian-state-territory-regulatory-controls-schedule-7-poisons> (8 September 2014)

‘Bromine water, saturated solution’, Safety Data Sheet. Please search the product information page on the Chem-Supply website for the latest version: <https://www.chemsupply.com.au>

‘Chlorine and bromine water production’, LABNETWEST website, <http://www.labnetwest.asn.au/experiments/> (Accessed May 2016)

‘Frequently asked questions –licences and permits for medicines and poisons’, WA Department of Health website, https://ww2.health.wa.gov.au/Articles/F_I/Frequently-asked-questions-licences-and-permits-for-poisons-and-medicines (Accessed May 2016)

Occidental Chemical Corporation. 2014. *Sodium hypochlorite handbook*. Oxychem website. <https://www.oxy.com/OurBusinesses/Chemicals/Products/Documents/sodiumhypochlorite/bleach.pdf>

‘Problems and solutions –recipes. Bromine water’, WA Regional Technicians Group, <https://web.archive.org/web/20170219043724/http://www.rtg.wa.edu.au/solu...>

(link changed to an archived copy on the Internet Archive's Wayback Machine in July 2017)

‘Sodium Hypochlorite Solution 8-12.5% avail. Chlorine’, Safety Data Sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/ST0441CH6G.pdf> (May 2013)

‘Sulfuric acid and chlorine bleach reaction’, eHow website, <https://sciencing.com/sulfuric-acid-chlorine-bleach-reaction-6521382.html> (Accessed May 2016)

[1] Kumar, K., Margerum, D.W. 1987. Kinetics and mechanism of general-acid-assisted

oxidation of bromide by hypochlorite and hypochlorous acid. *Inorganic Chemistry* 26: 2706-2711. <https://pubs.acs.org/doi/abs/10.1021/ic00263a030>

Source URL: <https://assist.asta.edu.au/question/3830/bromine-water>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Copper Sulfate Crystals

Copper Sulfate Crystals

Posted by Anonymous on Tue, 2016-11-15 10:55

Copper Sulfate Crystals: Is there a way to re-use copper (II) sulfate crystals to make another saturated solution?

Voting:•



Average: 5 (1 vote)

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Copper Sulfate Crystals

Submitted by sat on 23 November 2016

In Brief:

Recycling and reuse of chemicals can be considered if safe and appropriate to minimise the generation of chemical waste. It is often possible for waste from one process to be used for

another.

In the school science laboratory copper (II) sulfate crystals made by students can be reused to make new copper (II) sulfate solutions.

Depending on the size of the crystals you may need to crush them into smaller pieces to allow them to easily dissolve in the solvent (water). Solutions made from recycled crystals may contain impurities if using technical grade chemicals or dust or other contaminants from the environment from the crystal making process. These impurities may be an issue and can be filtered out before use. Solutions made from recycled copper (II) sulfate crystals would not be suitable for senior analytical experiments.

Preparation of copper (II) sulfate crystals for reuse:

- Ensure the working area is well ventilated.
- Small crystals of copper (II) sulfate (less than 5mm in size) can be placed directly into deionised water and stirred to dissolve.
- Large crystals can be crushed gently in a mortar and pestle to smaller crystals to enable better dissolving. This process should be conducted in a fume cupboard. Alternately larger crystals can be allowed to dissolve in sufficient water over several hours.
- Heating the copper (II) sulfate solution can help with the dissolution. An increase in temperature will allow more copper (II) sulfate to dissolve and at a faster rate. It is relatively safe to heat the solution to a temperature around 50-60⁰C. The use of a hot plate or water bath is appropriate as long as the temperature is monitored. Take care not to inhale fumes from a heated solution, therefore this is also best conducted in a fume cupboard.
- The solubility of copper (II) sulfate pentahydrate is 317g/L water at 20⁰C¹. It is recommended that you weigh the copper (II) sulfate crystals to determine the approximate volume of water required to make a saturated solution.
- If required filter the solution to remove any undissolved solid and any impurity that may be present.

Safety:

- Copper (II) sulfate is a skin and serious eye irritant and is toxic by ingestion and inhalation. Avoid contact with eyes and skin and breathing dust.
- Wear appropriate PPE such as safety glasses and nitrile or latex gloves.
- Do not place solutions down the sink as copper (II) sulfate is toxic to aquatic life.
- Waste solutions can be evaporated to reduce the volume.
- Copper ions can be displaced with steel wool and then the solid copper can be disposed of in the regular waste.

Science ASSIST recommends a risk assessment be conducted prior to the use of any chemicals, and all appropriate control measures be identified and implemented. Science ASSIST has developed a one page risk assessment template, see [Risk Assessment Template](#)

Science ASSIST has previously answered some related questions see:

Formation of crystals

SOP: Hazardous waste

Laboratory Chemicals and Waste Management/Setup

References:

¹'Copper sulfate' Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/CL0681CH2B.pdf> (March 2014)

'3.5 Solutions and crystals' Basic Science & Technology website. 3.5 Solutions and crystals - Basic Science & Technology (Accessed November 2016)

Jones, J. 'Crystals' Royal Australian Chemical Institute website,
<https://web.archive.org/web/20170301234313/https://www.raci.org.au/docum...> (Link replaced to a link to an archived copy from the Internet Archive March 2021)

Source URL: <https://assist.asta.edu.au/question/4152/copper-sulfate-crystals>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Drying of anhydrous sodium carbonate

Drying of anhydrous sodium carbonate

Posted by Anonymous on Thu, 2016-06-09 13:44

Drying of anhydrous sodium carbonate: I am about to standardise a sodium hydroxide solution but I have been wondering about the recommended temperature and time for drying anhydrous sodium carbonate as the first step in the process.

I have always done it for many hours at a high temperature, but recently I've been told on good authority that it just needs to be at 60 degrees C for an hour and that the higher temperature would cause decomposition.

Some sources say 270 degrees for 30 minutes and others have recommended 100 degrees C.

Would you please advise me of the temperature and time?, with some definitive references?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Drying of anhydrous sodium carbonate

Submitted by sat on 24 June 2016

In brief:

Anhydrous sodium carbonate is a common primary standard used in senior high school chemistry. This substance can absorb moisture whilst in storage after opening the original sealed container. Therefore it is a standard recommended practice to dry the chemical to eliminate this moisture before using as a primary standard in titrations.

After reviewing several references, we recommend heating sodium carbonate in an oven in the range of 250-300°C, with 270°C as an optimum temperature for at least 30 minutes. This is best done spread evenly in a shallow dish, such as a watchglass or an evaporating dish. Cooling the heat dried sample and storing it until it is required in a desiccator is important to eliminate re-absorption of moisture. Note that after placing the heated salt in the desiccator, venting of the desiccator may be required to release the pressure of heated air. Further assurance of elimination of all the moisture can be achieved by repeating the heating /cooling and weighing to a constant mass.

Alternative methods:•If there is no access to an oven at 270°C, heat in an oven at 110°C for at least an hour. As the monohydrate is reported to lose water at 100°C⁶•and as water boils at 100 °C, heating at 60°C for an hour may not effectively remove absorbed water. Another alternative is to heat over a Bunsen burner for 30 minutes.

Decomposition of sodium carbonate:•Reputable sources suggest that decomposition of sodium carbonate begins at 400°C and occurs at its melting point of 851°C. References suggest that decomposition of sodium carbonate is unlikely to occur when heated over a Bunsen burner.

Additional information:

The following information was sourced:

Heating sodium carbonate:

- From Armarego and Chai (2009): analytical grade sodium carbonate should be heated at 260-270°C for 30 minutes and then allowed to cool in a desiccator.¹
- The Joint FAO/WHO Expert committee on Food additives describes the preparations of Test Solutions for volumetric analyses. For preparation of sodium carbonate it specifies drying at 270°C for 1 hour. (p244, 288)²
- The Food and Agriculture Organisation of the United Nations produced a monograph of sodium carbonate recommended to heat to 70°C first and then to raise to 250-300°C³
- Asakai, T. Ogura, T. Murayama, M and Tanaka, T. (2008) concluded that the optimum drying conditions are at 300°C for 2 hours.⁴
- Newkirk, A.E. and Aliferis (1958) noted the recommended drying temperature of sodium carbonate is in the range 250°C to 300°C, whilst also stating that it is thermally stable close to its melting point of 851°C.⁵
- From The Merck Index (2013): sodium carbonate monohydrate will become anhydrous when heated at 100°C.⁶
- The Creative-chemistry website suggests heating over a Bunsen burner for 30 minutes or in an oven at 110°C for an hour.⁷

Decomposition of sodium carbonate:

- Newkirk and Aliferis point out that, for drying sodium carbonate, the upper temperature limit of 300°C is the same as the temperature at which sodium carbonate begins to react with silica. They suggest that reports of sodium carbonate having decomposed below 800°C, might in fact be cases where it has reacted with the container in which it was heated.⁵
- The NCBI states that sodium carbonate begins to decompose at 400°C and forms carbon dioxide and toxic Na₂O.⁸
- The University of California, Davis ChemWiki states that apart from Lithium, the rest of the Group 1 carbonates do not decompose at laboratory temperatures.⁹
- The Chemguide website states that apart from Lithium, the rest of the group 1 carbonates don't decompose at Bunsen burner temperatures.¹⁰
- The Royal Society of Chemistry and the Nuffield Foundation developed a class activity to investigate the decomposition of carbonates, which confirms the relative difficulty of decomposing sodium or potassium carbonate.¹¹

References:

- ¹•Armarego, W.L.F., Chai, C.L.L. 2009. •*Purification of Laboratory Chemicals*, 6th•Edition, Butterworth-Heinemann
- ²•Joint FAO/WHO Expert Committee on Food Additives. 2006. •*Combined compendium of food additive specifications. Volume 4 Analytical methods, test procedures and laboratory solutions used by and referenced in the food additive specifications*, •FAO JECFA Monographs 1. FAO: Rome. FAO website, •<https://www.fao.org/3/a0691e/a0691e.pdf>
- ³•‘Sodium Carbonate’, FAO website, <http://www.fao.org/food/food-safety-quality/scientific-advice/jecfa/jecf...> (Broken link updated July 2018)
- ⁴•Asakai, T. Ogura, T. Murayama, M and Tanaka, T. 2008. ‘Investigation of Drying Conditions for High-Purity Sodium Carbonate’. •*Bunseki Kagaku* (57) 49-53. J-STAGE website, •https://www.jstage.jst.go.jp/article/bunsekikagaku/57/1/57_1_49/_article
- ⁵•Newkirk, A.E. and Aliferis, I. 1958. ‘Drying and decomposition of sodium carbonate’, •*Analytical Chemistry*, 30, 982-984 •DOI:•10.1021/ac60137a031. ACS Publications website, •<https://pubs.acs.org/doi/abs/10.1021/ac60137a031>
- ⁶•O’Neil, Maryadele J. 2013. •*The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals : Edition 15*, RSC Publishing, p 1537.
- ⁷•Saunders, N. 2003. •*Volumetric Analysis 1. To make a standard solution of sodium carbonate*, •Creative Chemistry website, •<https://www.creative-chemistry.org.uk/documents/N-ch1-35.pdf>•(Link updated June 2019)

⁸.'Sodium carbonate', National Center for Biotechnology Information (NCBI) website, •
<https://pubchem.ncbi.nlm.nih.gov/compound/10340#section=Information-Sources>•(Accessed June 2016)

⁹.'Group 1 Compounds', UC Davis ChemWiki website, •
http://chemwiki.ucdavis.edu/Core/Inorganic_Chemistry/Descriptive_Chemistry/Elements_Organized_by_Block/Elements/Group_1%3A_The_Alkali_Metals/2Reactions_of_the_Group_1_Elements/Group_1_C
•(Accessed June 2016)

¹⁰.'Some compounds of the group 1 elements', Chemguide website, •
<http://www.chemguide.co.uk/inorganic/group1/compounds.html>•(Accessed June 2016)

¹¹.'Thermal decomposition of metal carbonates', LearnChemistry, Royal Society of Chemistry website. •<https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000450/thermal-decomposition-of-metal-carbonates?cmpid=CMF00005971>•(Accessed June 2016)

Source URL: <https://assist.asta.edu.au/question/3869/drying-anhydrous-sodium-carbonate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Indicator for testing for water hardness

Indicator for testing for water hardness

Posted by Anonymous on Wed, 2016-05-04 13:11

Indicator for testing for water hardness: Hi , We need some assistance in preparing Eriochrome Black (Mordant Black) indicator for an EEL testing water hardness.

We have in the past prepared this stain using 0.2g of the indicator powder in 15 mls of NH_3 and then added 5 mls of ethanol.

We found that the Eriochrome Black did not dissolve fully and are wondering if someone has an alternative procedure, or could our ammonia possibly be past its use by date.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Indicator for testing for water hardness

Submitted by sat on 17 May 2016

In brief

Eriochrome Black T (or Mordant Black 11) is used in complexometric titrations to indicate the endpoint of a water hardness titration. Eriochrome Black T (Mordant Black 11), which is a solid brown-black powder with a faint metallic sheen, is soluble in water and slightly soluble in ethanol ^[i].

We are not sure why your Eriochrome Black did not fully dissolve. One reference suggests that ammonia solution ($\text{NH}_4\text{OH} = \text{NH}_3$ in H_2O) has a shelf life of 2 years when stored at 25 °C. ^[ii] However, even if the concentration of ammonia reduces slightly due to loss of ammonia gas from the solution, we think it unlikely to affect the solubility of the Eriochrome Black.

Alternative methods: We found the following alternative methods for using Eriochrome Black as an indicator.

1. **Dry powder form:** Grind and mix 1 g of the solid Eriochrome Black T with 100 g of sodium chloride. Add about 0.2 g of this solid mixture to the titration flask for each titration. ^[iii]
2. **In ethanol:** 1% (w/v) solution. Dissolve 1.0 g of Eriochrome Black T in 80 mL 95% ethanol. Make up to 100 mL with 95% ethanol. ³
3. **In ethanolamine/ethanol:** Dissolve 0.2 g of Eriochrome Black T in 15 mL of triethanolamine and then add 5 mL of absolute ethanol. ^[iv]
4. **Substitution:** Use Calmagite in place of Eriochrome Black T. Dissolve 0.05 g of Calmagite in sufficient distilled water and make up to 50 mL. ^[v] ^[vi]
5. **In ethanol/hydroxylamine hydrochloride:** Dissolve 0.5 g of Eriochrome Black T in 50 mL 95% ethanol. Add 4.5 g hydroxylamine hydrochloride. Make up to 100 mL with 95% ethanol. ^[vii]

Notes

- Schools will need to check if the chemicals to be used are approved for use in their jurisdiction.
- Hydroxylamine hydrochloride, triethanolamine and calmagite are not currently on the Science ASSIST [List of recommended chemicals for science in Australian schools](#). Hydroxylamine hydrochloride is corrosive and toxic ^[viii]; less hazardous chemicals are recommended.
- Science ASSIST has not trialled the different methods for this activity.

Additional information

Shelf life: Eriochrome Black T solution has a short shelf life. Ideally it should be prepared fresh in minimal quantities on the day of testing. Excess Eriochrome Black T indicator solution should be collected for removal by specialist waste disposal contractors. It is harmful to marine life and should not be flushed into waterways.

The dry powder mixture has a long shelf life.

The pH of the reaction: The reaction needs to be conducted within the pH range of 7–11. Therefore, prior to titrating, the test solutions are adjusted to pH 9–10 with the addition of ammonia/ammonium chloride buffer to the titration flask when adding Eriochrome Black T.

- **Ammonia/Ammonium chloride buffer solution:**^[ix] Dissolve 6.75 g ammonium chloride (NH_4Cl) in 57 mL of 25% ammonia solution. Make up the solution to 100 mL with distilled water.

Water hardness is a measure of the amount of calcium and magnesium salts dissolved in water.^[x] It can be determined by performing a complexometric titration with a complexing agent such as ethylenediaminetetraacetic acid (EDTA) in the presence of an indicator such as Eriochrome Black T.^[xi]

When blue Eriochrome Black T indicator is added to a water sample, it forms a red-coloured Ca-Mg-Eriochrome Black T complex.^[xii] When EDTA is added dropwise from a burette, the complexing agent binds to the Ca^{2+} and Mg^{2+} ions in the water sample. When all the metal ions have been complexed with EDTA, the Eriochrome Black T molecules are liberated and change colour to steel blue.¹² The colour change of the solution to blue indicates the end point of the titration.

Useful websites

<http://www.titrations.info>

<http://www.instruction.greenriver.edu/kmarr/Chem%20161/Chem%20161%20Labs...>

References

[i] 'Eriochrome Black T', Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/EL0241CHHU.pdf> (October 2015)

[ii] Sigma Aldrich. 2003. *Ammonium Hydroxide, ACS Reagent*, Sigma Aldrich website, <https://www.sigmaaldrich.com/deepweb/assets/sigmaaldrich/product/documents/374/461/a6899pis.pdf> (3 February 2003)

[iii] CLEAPPS. 2011. *The CLEAPPS recipe book*. CLEAPPS website, <http://science.cleapss.org.uk/Resource-Info/All-CLP-Recipe-Sheets.aspx> (updated March 2017) (login required)

[iv] 'Determination of Total Calcium and Magnesium Ion Concentration'. University of Canterbury website. http://www.canterbury.ac.nz/media/documents/science-outreach/magnesium_c... (August, 2017)

[v] 'Complexometric titration - methods of the end point detection'. Titrations info website. <http://www.titrations.info/complexometric-titration-end-point-detection>

(Accessed May 2016)

[vi] 'Experiment #6 Complex-Formation Titrations with EDTA.' Villanova University website.
<http://www40.homepage.villanova.edu/michael.spritzer/1502Expt6.htm> (Accessed May 2016)

[vii] Eriochrome Black T Solution Preparation. *Ehow* website.
<https://sciencing.com/eriochrome-black-solution-preparation-8457364.html> (Accessed May 2016)

[viii] 'Hydroxylamine hydrochloride', (August 2015). Please visit the Sigma-Aldrich website for the latest version of their Safety Data Sheet: <https://www.sigmaaldrich.com/AU/en>

[ix] 'Determination of water hardness' Odinity Research Database website.
<https://www.odinity.com/determination-water-hardness/> (Accessed May 2016)

[x] 'Determination of water total hardness by complexometric titration'. Titrations info website.
<http://www.titrations.info/EDTA-titration-water-hardness> (Accessed May 2016)

[xi] 'General information about complexometric titration'. Titrations info website.
<http://www.titrations.info/complexometric-titration> (Accessed May 2016)

[xii] S.K Engineering Academy.2012-2013. *Unit 1, Water Technology*, S.K Engineering Academy website <http://sk4education.com/engineering/Question/1.pdf>

Source URL: <https://assist.asta.edu.au/question/3795/indicator-testing-water-hardness>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Solution making

Solution making

Posted by Anonymous on Sat, 2016-04-02 08:56

What's the equation you use to make a solution from a solid? For example, I have copper sulfate in a solid powder but need it as a solution.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Answer by ginny.r.ward on question Solution making

Submitted by sat on 07 April 2016

In brief

A commonly used expression for the concentration of a solute in solution is molar concentration or molarity. Molarity is defined as the number of moles of solute dissolved in

one litre of solution, and has the unit mol/L, denoted by upper case M. When preparing a solution where the concentration is expressed as a molarity, the formula to use is

$$m = c \times V \times M$$

where:

m = mass of solute (in grams)

c = concentration of solute (in moles per litre)

V = volume (in litres)

M = molecular weight (or molar mass) of solute (in grams)

The molecular weight can be found on the bottle label, or in a data book or safety data sheet (SDS), or by adding together the atomic weights of all of the atoms which appear in the chemical formula of the substance. If you are using a hydrated salt, the water(s) of hydration must be included in the calculation of the molecular weight.

Example: Preparation of 1 litre of a 0.5 M copper (II) sulfate solution

Starting with copper (II) sulfate pentahydrate, ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), we have

Molecular weight = $M = 63.55 + 32.06 + (4 \times 15.99) + 5 \times ((2 \times 1.008) + 15.99) = 249.68 \text{ g}$

Concentration = $c = 0.5 \text{ M}$

Volume = $V = 1 \text{ L}$

The quantity of the solid copper sulfate pentahydrate required is therefore

$$\begin{aligned} m &= c \times V \times M \\ &= 0.5 \times 1 \times 249.68 \\ &= 124.84 \text{ g} \end{aligned}$$

The copper sulfate should be added to about half to two-thirds of the final solution volume (about 500–650 mL) of distilled water in a large beaker, and stirred until dissolved. Gentle heating will speed up the dissolution of the salt. The solution can then be transferred to a measuring cylinder or volumetric flask and distilled water added to make up the volume to 1 litre.

The solution can also be prepared directly in a volumetric flask. The final volume should be measured with the solution and vessel at room temperature, as this is the temperature at which volumetric glassware is calibrated. If heating the solution, a beaker or conical flask should be used rather than a volumetric flask, as heating volumetric glassware may affect the calibration.

Solutions of copper sulfate can degrade due to hydrolysis of the copper (II) ion with the formation of a precipitate of copper (II) hydroxide ($\text{Cu}(\text{OH})_2$). The presence of this precipitate is indicated by a cloudiness in the solution. The copper sulfate solution can be stabilised by addition of a 0.1 M sulfuric acid solution in small aliquots (1–5 mL) until the solution becomes clear.

Additional information

Example: Preparation of 250 mL of a 0.2 M solution of sodium carbonate, starting with the anhydrous salt (Na_2CO_3). Before performing the calculation, we convert the volume, 250 mL, to litres, i.e. 0.25 L.

$$\text{Molecular weight} = M = 105.99 \text{ g}$$

$$\text{Concentration} = c = 0.2 \text{ M}$$

$$\text{Volume} = V = 0.25 \text{ L}$$

The quantity of the solid sodium carbonate required is therefore:

$$\begin{aligned} m &= c \times V \times M \\ &= 0.2 \times 0.25 \times 105.99 \\ &= 5.30 \text{ g} \end{aligned}$$

Example: As in the previous example, but with the monohydrate, i.e. 250 mL of a 0.2 M solution of sodium carbonate, starting with sodium carbonate monohydrate ($\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$).

$$\text{Molecular weight} = M = 124.00 \text{ g}$$

$$\text{Concentration} = c = 0.2 \text{ M}$$

$$\text{Volume} = V = 0.25 \text{ L}$$

The quantity of the solid sodium carbonate monohydrate required is therefore:

$$\begin{aligned} m &= c \times V \times M \\ &= 0.2 \times 0.25 \times 124.00 \\ &= 6.20 \text{ g} \end{aligned}$$

The mole

The mole is a unit used to describe the amount of a chemical species. It can be used to describe the amount of atoms, molecules, ions, electrons, etc. The number of the species in one mole is 6.022×10^{23} (Avogadro's number). The abbreviation of mole or moles is *mol*.

The use of the term *mole* in chemistry is analogous to how the word *dozen* is used in everyday language. For example, one dozen apples is 12 apples, while one mole of apples would be 6.022×10^{23} apples.

The weight in grams of one mole of a substance is the molecular weight, or molar mass, of

that substance. To determine the number of moles, n , in a given quantity of a substance, divide the given quantity of the substance by the molecular weight:

$$n = (\text{mass of substance (g)})/(\text{molecular weight (g)}) \text{ mol}$$

or

$$n = m/M$$

Molarity

The unit for molar concentration is *molarity*, which has the symbol M , and the dimensions, *moles per litre*.

$$\text{molar concentration} = c = (\text{number of moles})/(\text{volume}) \text{ mol/L}$$

or

$$c = n/V$$

The symbol M is pronounced 'molar'; for example, '1 M ' is pronounced 'one molar', and 'a 2 M solution' is pronounced 'a two molar solution'.

Note that the equation $c = n/V$ can be rearranged if you want to find the volume of a solution of known concentration, which will give you a certain number of moles of the solute.

$$V = n/c$$

Or, if you want to find the number of moles of solute in a certain volume of a solution of known concentration

$$n = c \times V$$

Percentage concentration

The concentration of a solution can also be expressed as a percentage concentration, usually either as %w/v or %v/v and also sometimes as %w/w.

Where the solute is a solid, the percentage concentration would usually be prepared as the percent weight per volume, or %w/v:

$$\%w/v = (\text{mass of solute (g)})/(\text{volume of solution (mL)}) \times 100\%$$

Another way of expressing this is:

$$\%w/v = \text{mass of solute (g) in 100 mL of solution.}$$

For example, a 2% w/v solution of sodium chloride would be prepared from 2 g of sodium chloride dissolved in water and made up to a volume of 100 mL.

Where the solute is a liquid, the percentage concentration can be prepared as the percent

volume per volume, or %v/v:

$$\%v/v = (\text{volume of solute})/(\text{volume of solution}) \times 100\%$$

Alternatively,

$$\%v/v = \text{volume of solute (mL) in 100 mL of solution.}$$

For example, a 5% v/v aqueous solution of ethanol would be prepared by taking 5 mL of pure ethanol and diluting this with water to a volume of 100 mL.

Weight percent is often used in aqueous commercial preparations, for example, in concentrated solutions of acids. A weight percent concentration has the advantage that the solution can be prepared independently of temperature considerations.

$$\%w/w = (\text{mass of solute})/(\text{mass of solution}) \times 100\%$$

Alternatively,

$$\%w/w = \text{mass of solute (g) in 100 g of solution.}$$

Concentration in grams per litre

Concentration can also be expressed as grams of solute dissolved in one litre of solution.

Example: Preparation of 300 mL of a sucrose solution of concentration 5 g/L.

As only 300 mL of solution is required, only a fraction of the 5 g will be needed. To find the quantity of sucrose required, the concentration is multiplied by the fraction of litres required:

$$\begin{aligned} m &= 5 \text{ g/L} \times 0.3 \text{ L} \\ &= 1.5 \text{ g} \end{aligned}$$

This amount of sucrose is weighed out and dissolved in enough water to make up the volume to 300 mL.

Answer by nehal.trivediasta on question Solution making

Submitted by on 05 April 2016

Hi Patricia,

In simple terms, for the calculation of preparing chemical solution from a solid chemical,

The following information/data are required

1. Molecular weight (in grams) of the chemical solid you are going to use, which should be available on the label of the container

2. concentration of solution to be prepared
3. Total volume of the solution to be prepared
4. Assay % of chemical solid mentioned in the label (for simplicity I assume it is 100% and will not mention it in the calculation)

Assuming you wish to prepare 0.1M 500 ml copper sulfate

1. concentration - 0.1 Molar copper sulfate as C1
2. volume - 500 ml as V1
3. molecular weight - of copper sulfate pentahydrate solid 249.68 gms as W1
4. weight of the copper sulfate solid required as W2

The following formula will help in the actual calculation -

the required weight W2 of the chemical to be taken for solution preparation is equal to product of (W1, V1 and C1) divided by 1000

i.e. Formula

$$W2 = (W1 \times V1 \times C1) / 1000$$

$$= (249.68 \times 500 \times 0.1) / 1000$$

$$= 12.4850 \text{ gms}$$

that means weigh out 12.4850 gms of copper sulfate pentahydrate and dissolve it in distilled water and then make it up to 500ml to make 0.1 molar of copper sulfate solution.

I hope it assists.

Regards

Nehal Trivedi



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Testing Alkanes and Alkenes

Testing Alkanes and Alkenes

Posted by Anonymous on Wed, 2016-10-19 11:50

Testing Alkanes and Alkenes: Year 12 are testing for Alkanes and Alkenes and they need acidified Potassium Permanganate solution. How do I prepare this solution?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Testing Alkanes and Alkenes

Submitted by sat on 21 October 2016

In brief

Acidified potassium permanganate solution can be used to differentiate between alkanes and alkenes. Alkenes will react with potassium permanganate solution in the presence of sulfuric acid while alkanes will not. During the reaction with an alkene the permanganate ions (MnO_4^-) are reduced to manganese (II) ions (Mn^{2+}), resulting in the purple solution becoming colourless, while the alkene is oxidized to a diol.

Preparation of acidified potassium permanganate: Students can prepare their own acidified potassium permanganate solution by adding 2 mL of 0.01 M aqueous potassium permanganate solution to a test tube followed by 1 mL of 2 M sulfuric acid. Then use 1 mL of the acidified potassium permanganate solution to react with 1 mL of the alkane or alkene.

Science ASSIST recommendations:

- A site-specific risk assessment should be conducted
- Conduct this activity in an operating fume cupboard or in a well-ventilated room.
- Suitable PPE such as laboratory coat, closed in shoes, gloves and safety glasses should be worn at all times

Safety notes:

- Sulfuric acid is corrosive; causes severe skin burns and eye damage.
- Potassium permanganate solution is harmful to aquatic life with long lasting effects
- Alkanes and alkenes are highly flammable; keep away from ignition sources and heat.
- Most commonly used alkanes are hexane and cyclohexane: both are skin irritants and can cause drowsiness or dizziness.
- Most commonly used alkenes are hexene and cyclohexene: avoid contact with skin and it is harmful if swallowed and if inhaled.

Wastes disposal

- At the end of the activity collect the wastes generated from the two reactions into a non-halogenated organic waste bottle. Store the waste bottle for collection by a licensed waste disposal contractor. It is important to keep track of the substances, which are added to a waste bottle. Attach a blank label onto the back of the waste bottle. Each time waste is added to the bottle, record the names of the substances added on the label. When the bottle is full, then replace the hand-written label with a printed label containing this information.
- For potassium permanganate disposal, see previously answered questions Can Potassium Permanganate waste be neutralised? and potassium permanganate

Additional information

A better way to test for the presence of an alkane or alkene is to use bromine water. For more information see previously answered question Bromine water

References

'Hexane', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/HA0181CH33.pdf> (February 2016)

'Cyclohexane', Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/LC1033M.pdf> (April 2011)

'Cyclohexene', Safety Data Sheet, Chem-Supply website
<https://www.chemsupply.com.au/documents/CL0731CH2D.pdf>

(July 2013)

'Hexene', Safety Data Sheet, Sigma-Aldrich website

<http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang...> (May 2014)

'Chemical waste from ester prac', Question to Science ASSIST website,

<https://assist.asta.edu.au/question/2741/chemical-waste-ester-prac?search-id=fe93952>

(March 2015)

Science Teachers • Association of WA. 2014. *Exploring chemistry Year 11: Experiments, investigations and problems*, STAWA, Perth WA, p 108.

•

Source URL: <https://assist.asta.edu.au/question/4102/testing-alkanes-and-alkenes>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Ammonium Nitrate

Ammonium Nitrate

Posted by Anonymous on Thu, 2015-11-26 09:24

Ammonium Nitrate: Hi. Wondering if anyone uses ammonium nitrate for senior chemistry? Have a teacher who has requested some ammonium nitrate for making rockets? Not sure if it is a banned substance for schools, or if limitations are in place for having it. Any info on this would be useful. Thanks.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Ammonium Nitrate

Submitted by sat on 10 December 2015

Rockets: Making ammonium nitrate rocket fuel in the school lab is very hazardous and **Science ASSIST strongly advises against conducting this activity** and instead recommends the use of commercially available rocket kits and engines. To locate a supplier see [School science suppliers](#).

Senior chemistry: Ammonium nitrate is included in the Science ASSIST [List of recommended chemicals for science in Australian schools](#)

, with use restricted for Year 11 and 12 students. It has applications to show endothermic reactions, as well as in a saturated solution for use as a salt bridge. Science ASSIST recommends substituting ammonium nitrate with less hazardous chemicals, for example:

- solubility of salts: use sodium or potassium nitrate;
- endothermic reactions: use sodium thiosulphate or potassium iodide.

Ammonium nitrate regulations: Ammonium nitrate is a chemical of high security concern and is a precursor chemical to the manufacture of explosives. Where it occurs in solid form in concentrations above 45%, it is also referred to as security sensitive ammonium nitrate (SSAN). Its use and availability are regulated by individual state and territory legislation.

Ammonium nitrate is not a banned chemical for schools. Some states permit SSAN in quantities up to 3 kg in schools where there is a curriculum requirement, however an end user declaration (EUD) and/or applying for exemption may be required before purchasing.

Solutions of ammonium nitrate are permitted in all jurisdictions. Schools in NSW, Victoria, WA and Qld do not require a licence to store up to 3 kg of ammonium nitrate. Schools in Tasmania can apply for an exemption for a licence to store up to 3kg of ammonium nitrate. Schools in South Australia and ACT require a licence to store any amount of solid ammonium nitrate.

Additional information

See previous question about ammonium nitrate: [Ammonium nitrate](#)

See AIS: [School science area security](#)

References

'Ammonium nitrate', Work Safe Queensland website, <https://www.worksafe.qld.gov.au/safety-and-prevention/hazards/hazardous-chemicals/specific-hazardous-chemicals/ammonium-nitrate> (29 June 2015)

Chemical Emergency Preparedness and Prevention Office, United States Environmental Protection Agency. 1997. *Explosion hazard from ammonium nitrate*. National Service Center for Environmental Publications (NSCEP) website, <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100BH59.PDF?Dockey=P100BH59.PDF> (December 1997)

Science ASSIST. 2015 *List of Recommended Chemicals*. Science ASSIST website: <http://assist.asta.edu.au> (Accessed October 2015)

West Australian Department of Mines and Petroleum, 2004, *Ammonium nitrate guidance note No. 2. Storage*, DMP website,

http://www.dmp.wa.gov.au/Documents/Dangerous-Goods/DGS_SRS_AmmoniumNitrateGuidanceNoteStorage.pdf

Ammonium Nitrate

Submitted by on 29 November 2015

Making rockets?? That is a concern. If the substance is banned would depend on your institution (what state? Public or private?) restrictions. In NSW DoE Ammonium Nitrate is a controlled substance to only Year 11 and 12 students or teacher use and its just in any explosive capacity (such as a rocket motor) is explicitly banned. The only rocket motors we are allowed to use are the commercially packaged ones from Estes and there are also size limits on their use. All these rules are outlined in the CSIS policy for NSW DoE schools. Also as a side note, Ammonium Nitrate is a controlled substance by the Federal Police so care needs to be taken with who has access to stock supplies and what uses are permitted with stocks held. Hope that helps.

Source URL: <https://assist.asta.edu.au/question/3390/ammonium-nitrate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Ammonium nitrate

Ammonium nitrate

Posted by Anonymous on Fri, 2015-07-31 16:20

Ammonium nitrate: Hi, Has anyone else had any trouble with ammonium nitrate absorbing water? Mine has become a clear mixture of liquid and crystals. The crystals are a solid lump that needs to be prodded to separate. It was suggested by one of my teachers to place it in the oven to dry it out. I'm not in favour of doing this procedure, and so I won't be taking his advice.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Ammonium nitrate

Submitted by on 20 August 2015

There was a NSW directive to dispose of ammonium nitrate in excess of 3kg in 2006 by using

it as a fertiliser on school grounds. You should not subject it to any heat.

You can easily substitute for the cation and anion, however, if using for endothermic reactions, use sodium nitrate instead.

Ammonium nitrate

Submitted by sat on 12 August 2015

Before handling a chemical, the first port of call **must** be to consult the Safety Data Sheets (SDSs), which contain important safety information. The following is information about ammonium nitrate taken from a Safety Data Sheet.

- Ammonium nitrate is hygroscopic and absorbs water from the atmosphere. If kept at high humidity, ammonium nitrate can dissolve in the water it has absorbed due to its deliquescent nature. Therefore it should be stored in a cool dry place. It could be stored in a desiccator to prevent it absorbing moisture from the surrounding air and coalescing into a large solid lump.
- Ammonium nitrate is also a powerful oxidiser, so it should also be kept away from heat, hot surfaces, open flames, combustible materials and other sources of ignition.
- Ammonium nitrate is not combustible, however, being a strong oxidant, it can intensify the development of a fire involving combustible materials such as rags, wooden articles, clothing and plastics. It can also cause skin corrosion.
- When ammonium nitrate is heated, it decomposes to give off toxic gases. In an open, well-ventilated space, it decomposes completely to give nitrous oxide, ammonia and nitric acid with white fumes and vapours. If heated in confinement (e.g. in an oven), or in the presence of contaminants or both, ammonium nitrate will decompose to give brown toxic fumes of nitrogen dioxide.
- In extraordinary circumstances, ammonium nitrate can detonate as an explosive. Factors such as contamination or confinement can increase the explosive sensitivity of ammonium nitrate. Thus, ammonium nitrate is widely used in the manufacture of explosives.
- Ammonium nitrate is also known as Security Sensitive Ammonium nitrate (SSAN) and is therefore subject to state government legislation. Under this legislation, it is only permitted in schools in quantities up to 3kg and in some jurisdictions is subject to certain paperwork requirements, such as applying for an exemption and/or ordering using an End User Declaration (EUD).

When ammonium nitrate has absorbed moisture, it is very challenging to dry it out.

Science ASSIST **strongly advises not to heat** ammonium nitrate under any circumstances because of the hazards of decomposition or explosion, which could be triggered by contamination and other factors.

Recommendations

Science ASSIST recommends that you do one of the following with your deliquesced ammonium nitrate.

- Remove the excess solution from the salt and greatly dilute the solution so that it can be spread on the garden as a fertiliser. Weigh the remaining mass and treat it as the dry salt in making up a solution. E.g. approximately 2M or 4M depending upon the amount. This can always then be diluted further if required.
- Dissolve most of it in a limited amount of distilled water at 20° C to form a saturated solution. Given that ammonium nitrate has a solubility of 150 g/100 mL at 20°C, a saturated solution can be calculated to be approximately 18.7 M. Keep this as a saturated solution and use for the purposes of a salt bridge, or dilute as required.

Science ASSIST also recommends

- **Safe handling:** Ammonium nitrate should only be used in a well-ventilated area and proper PPE such as protective clothing, nitrile rubber gloves and safety glasses should be worn.
- **Alternative chemical:** In jurisdictions where ammonium nitrate is not permitted, or to avoid the difficulties of storage, consider alternatives such as ammonium salts and nitrate salts that can be used instead of ammonium nitrate.

References

Cagnina Stefania, Patricia Rotureau and Carlo Adamoa. (2013). 'Study of Incompatibility of Ammonium Nitrate and its Mechanism of Decomposition by Theoretical Approach'• *Chemical Engineering Transactions*.•Vol 31. <http://www.aidic.it/cet/13/31/138.pdf> (accessed November 2016)

Department of Mines and Petroleum, (2013), Safe storage of solid ammonium nitrate –code of practice (3rd edition): Resources Safety, Department of Mines and Petroleum, Western Australia. •

http://www.dmp.wa.gov.au/documents/Code_of_Practice/DGS_COP_StorageSolidAmmoniumNitrate.pdf

'Material Safety Data Sheet: ammonium nitrate', (30 April 2014) Merck Millipore website. • http://www.merckmillipore.com/INTERSHOP/web/WFS/Merck-AU-Site/en_US/-/USD/ProcessMSDS-Start?PlainSKU=MDA_CHEM-101188&Origin=PDP•(Link updated, July 2019).

'Material Safety Data Sheet: ammonium nitrate', (2 December 2014) Fisher Scientific Website• <https://www.fishersci.com/msds?productName=A676212>

'Material Safety Data Sheet: ammonium nitrate solution', (1 February 2013) Calamco Website• http://calamco.com/pdf/ammonium_nitrate_msds.pdf

Source URL: <https://assist.asta.edu.au/question/3051/ammonium-nitrate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Ammonium thiocyanate

Ammonium thiocyanate

Posted by Anonymous on Mon, 2016-08-22 07:55

Ammonium thiocyanate: Ammonium thiocyanate is becoming a liquid too fast. I kept it away from the light, but still had no results, and have also bought new jar recently.

Hence, I would like to ask for any other solutions to keep it dry, I thought about suing a desiccator but am not sure. Thanks.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Ammonium thiocyanate

Submitted by sat on 02 September 2016

You are correct that ammonium thiocyanate is hygroscopic and deliquescent, which means that it absorbs water from the air and dissolves in the water to become a liquid. We recommend that your school store your new bottle in a desiccator, ensuring that no incompatible chemicals are stored in the desiccator along with it.

Hygroscopic solids can be protected from moisture in the air by storage in a desiccator along with a desiccant. There is quite a range of substances which can be used as desiccants, however, taking into consideration safety, availability and ease of handling, we recommend silica gel. Silica gel is available as self-indicating, which means that it will change colour with the absorption of water. Silica gel can also be regenerated by drying in an oven at 105–120° C for 2–3 hours.

It is also important to protect ammonium thiocyanate against the light, as you are aware. It usually comes in a light-resistant container and your chemical store should not have direct sunlight entering, both of which would minimise the exposure to light.

We have previously answered a related question see:

[Chemical Storage Timeframes](#)

Reference:

'Ammonium thiocyanate', Safety Data Sheet, Chem-Supply website,
<https://www.chemsupply.com.au/documents/AA0101CH17.pdf> (February 2014)

Source URL: <https://assist.asta.edu.au/question/4031/ammonium-thiocyanate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Banned chemicals/materials list NSW & ACT

Banned chemicals/materials list NSW & ACT

Posted by Anonymous on Thu, 2015-11-19 12:31

Banned chemicals/materials list NSW & ACT: Hi there, I have heard that schools in NSW & ACT have updated their list of banned chemicals and materials for use in Science. Is anyone able to please supply me with a copy of this list? Thanks.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Banned chemicals/materials list NSW & ACT

Submitted by sat on 27 November 2015

NSW: The NSW Department of Education has produced a Banned Chemicals list as part of their Chemical Safety in Schools Package (CSIS), which is available online (DoE intranet) to all staff in all government schools in NSW. The CSIS package is currently under review and

this revision is anticipated to be finalised by early 2016. The information available online is the most up to date. Access in the past was available to Catholic and Independent schools via a licence agreement. You are advised to contact the NSW Department of Education for further information regarding current access.

ACT: The ACT Education and Training Directorate are currently reviewing their Risk Management in ACT Secondary Science Programs. Schools currently have access to Chemwatch for information on hazardous substances, SDS etc.

Until now, there has been no nationally agreed list of recommended chemicals for use in science teaching and learning, with significant variations existing between the practices and local policies of the states, territories and educational jurisdictions. In order to remove the duplication and variation that exists, Science ASSIST has developed a List of recommended chemicals for use in science in Australian schools. The list addresses the years of schooling F-12, and covers safety and security information and assigns a User Group for each chemical. The list is not intended as a prescribed stock list, but rather as a reference list of chemicals which Science ASSIST has determined are suitable for use in schools and appropriate for modern school science teaching practices. The list is an evolving document and is updated in response to feedback, changes to safety data and changes to practices in school science. It is available for download as an Excel file. See [List of recommended chemicals for science in Australian schools](#).

Source URL: <https://assist.asta.edu.au/question/3365/banned-chemicalsmaterials-list-nsw-act>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Barium nitrate solutions

Barium nitrate solutions

Posted by Anonymous on Thu, 2019-02-21 11:35

Barium nitrate solutions: Is a 0.1M solution of barium nitrate permissible for years 7-10 in NSW Department of Education Schools? It is not clear in the CSIS chemical search. What percentage is a 1M solution of barium nitrate and is it a saturated solution? Can I make up a 0.5M solution of barium nitrate?

Voting:•



Average: 5 (1 vote)

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Barium nitrate solutions

Submitted by sat on 21 February 2019

As you are in a NSW Department of Education (DoE) school, you are required to follow the directives of your jurisdiction. • The Chemical Safety in Schools (CSIS) package in the NSW

DoE states that the user group for barium nitrate solid and solutions greater than 1% w/v is years 11–12. Years 7–10 are only permitted to use barium nitrate solutions of less than 1% w/v.¹

The CSIS package often refers to the concentration as a percentage and many schools refer to the concentration of solutions using molarity. Therefore, we need to consider what percentage a 0.1M solution is and if its concentration is <1% w/v. We could also consider what molar solution is equivalent to a 1% w/v solution:

In brief:

- a 0.1M solution of barium nitrate is greater than a 1% solution and is not permitted for years 7–10 in NSW DoE schools
- It is not possible to make up 1M and 0.5M solutions of barium nitrate as the amount required will not dissolve.
- A saturated solution of barium nitrate* at 25°C is approximately 10.1% or 0.38M

Some suggestions:

- Prepare a 0.1M solution and then dilute this to make 0.025M solution (<1%)
- Prepare a 0.9% solution of barium nitrate to provide a solution <1% (equivalent of 0.038M)
- If you are conducting a precipitation activity to identify cations and anions, you could substitute with a 0.1M solution of barium chloride, which is permitted for use by years 7–10 in NSW DoE schools
- Where possible use microscale techniques

Molarity, percentage and saturated solutions

Molarity indicates the number of moles of solute dissolved in a litre of the solution; has the symbol M, and the unit, moles per litre (mol/L).

Percentage concentration indicates the mass (or volume) of solute dissolved (or diluted) in 100g or mL, as appropriate, of the solution. It can be expressed as %w/v, %v/v or %w/w.

A saturated solution is one in which, at the temperature specified, no more solute can be dissolved in the solvent.

Science ASSIST has prepared some Laboratory Notes for the preparation of solutions, which contain more detail on calculating concentrations of solutions. See <https://assist.asta.edu.au/resource/4415/laboratory-notes-preparing-chem...>

Edit 24 July 2019: In response to feedback we provide the following links to online calculation tools, which may be helpful to check your calculations:

- ‘Mass Molarity Calculator’, Sigma-Aldrich website, <https://www.sigmaaldrich.com/US/en/support/calculators-and-apps/mass-molarity-calculator> (Accessed July 2019) (This also has a link to a solution dilution calculator)
- ‘Molarity Calculator’, Omni Calculator website,• <https://www.omnicalculator.com/chemistry/molarity>

(Link updated January 2021)

Barium nitrate solutions

Molecular formula: $\text{Ba}(\text{NO}_3)_2$

Molecular weight of barium nitrate is 261.3

Solubility: 10.1g per 100mL at 25°C

The following table compares the concentration expressed as molarity and by percentage and the required mass for different volumes.

Concentration (Molarity)	Concentration (% w/v)	..... Final volume of solution 100mL..... 250mL.....1000mL.....		
0.1M	2.613	.... 2.61g	.... 6.53g	.. 26.13g
0.5M (not soluble)	13.1 (not soluble)	.... NA	.... NA	.... NA
1.0M (not soluble)	26.13 (not soluble)	.... NA	.... NA	.... NA
0.038M	1.0	.... 1g	.... 2.5g	.. 10g
Saturated (25°C) Approx. 0.39M	Saturated (25°C) Approx. 10.1%	.... 10.1g	.... 25.3g	.. 101g
•				

What percentage solution is a 0.1M solution of barium nitrate?

0.1M solution requires 2.61g in 100mL, which is the equivalent of 2.61% w/v

Therefore a 0.1M solution is greater than a 1% solution and is not permitted for years 7-10 in NSW DoE schools

What molar solution is equivalent to a 1% w/v solution of barium nitrate?

A 1% w/v solution means that 1g is dissolved in 100mL water or 10g is dissolved in 1000mL

Number of moles of a chemical = mass chemical/molecular weight

Number of moles in 10g of barium nitrate = $10\text{g}/261.3\text{g} = 0.038$ moles

Molarity of 10g of barium nitrate in 1 litre = 0.038M

Therefore a 0.1M solution is greater than a 0.038M solution and is not permitted for years 7-10 in NSW DoE schools.

In summary: the concentration that is permitted for years 7-10 in NSW DoE schools needs to be below a 0.038M solution or less than 1g/100ml (we suggest that you prepare either a 0.025M solution; 0.9% w/v solution 0.9g/100mL or a 0.8% w/v solution 0.8g/100mL)

Saturated solution of barium nitrate

The solubility of barium nitrate is 10.1g/100mL water at 25°C.

Therefore, it is not possible to dissolve more than 10.1 g in 100mL water at 25°C, so it is not possible to make up 1M and 0.5M solutions of barium nitrate as the amount required will not dissolve.

Alternatives

If you are conducting a precipitation activity to identify cations and anions we suggest that you use a 0.1M solution of barium chloride. Barium chloride is more soluble in water than barium nitrate and a 0.1M solution of barium chloride is permitted for use by students in years 7-12 in NSW Department of Education schools.

In addition, we suggest that you consider doing it on a microscale, by using one drop of each solution on an acetate sheet (like an overhead projector sheet) or spotting tile, or a laminated white or black sheet of paper (that will show up the precipitate clearly). This reduces the amount of toxic/heavy metal waste produced and can be simply washed off or cleaned with a tissue or paper towel.

Barium chloride solutions

Molecular formula: $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$

Molecular weight of barium chloride is 244.26

Solubility: 37g per 100mL at 25°C

The following table compares the concentration expressed as molarity and by percentage and the required mass for different volumes.

Concentration	Concentration	..... Final volume of solution		
•(Molarity)	(% w/v)	..... 100mL.....	• • 250mL	1000mL
0.1M	2.44	..... 2.45g	.... 6.11g•	... 24.43g

0.5M	12.21	... 12.21g	... 30.53g	... 122.13g
1.0M	24.43	... 24.43g	... 61.07g	... 244.26g
0.041M	1	... 1g	... 2.5g	... 10g
Saturated (25°C)	Saturated (25°C)	... 37g	... 92.5g	... 370g
Approx. 1.5M	Approx. 37%			

.

Saturated solution of barium chloride

The solubility of barium chloride is 37g/100mL water at 25°C.

Therefore, it is not possible to dissolve more than 37g in 100mL water at 25°C, however it is possible to make up a 1M and 0.5M solution of barium chloride as the amount required will dissolve.

References and further reading:

¹ NSW Department of Education, 'Chemical Safety in Schools (CSIS)' resource package. NSW DoE website, <http://www.dec.nsw.gov.au/> • DoE Intranet, login required.

Science ASSIST. 2018. Laboratory notes: Preparing chemical solutions. Science ASSIST website. <https://assist.asta.edu.au/resource/4415/laboratory-notes-preparing-chem...>

Chem-Supply. 2015. Barium nitrate, Safety Data Sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/BA0341CH1B.pdf>

Chem-Supply. 2018. Barium chloride Safety Data Sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/BL0271CH19.pdf>

Science ASSIST. 2018. Chemical Management Handbook, Edition 3. Science ASSIST website. <https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au...>

*** Edit 22 July 2019 to make correction to state A saturated solution of barium nitrate (and not chloride)* at 25°C is approximately 10.1% or 0.38M**

Source URL: <https://assist.asta.edu.au/question/4288/barium-nitrate-solutions>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Calcium Carbide

Calcium Carbide

Posted by Anonymous on Mon, 2017-08-14 10:20

Calcium Carbide: My teachers are wondering whether there are any restrictions on us storing and using Calcium carbide for pracs here at school? They apparently used to do some wonderful pracs with it in the past, which they have not done for many years, however I am concerned about the safety of these pracs.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

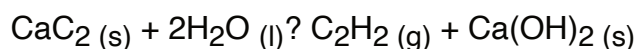
Calcium Carbide

Submitted by sat on 24 September 2017

Storage and properties

Calcium carbide can be safely stored with Dangerous Goods Class 4.3, segregated from incompatible chemicals, and MUST be kept dry.

When calcium carbide reacts with water it forms acetylene gas (ethyne) and calcium hydroxide, and generates heat.



Calcium carbide may contain impurities of phosphorus, nitrogen and sulfur compounds. While pure acetylene gas is odourless and non-toxic, these impurities in the calcium carbide, when reacted with water, produce trace amounts of phosphine, ammonia and hydrogen sulfide, which are toxic and can impart an unpleasant odour to the gas. Acetylene can form explosive mixtures with air.

Safe Handling

Calcium carbide is not banned from use; however, the following safe practices should be observed:

- Be familiar with the information contained in the Safety Data Sheet
- Conduct a risk assessment of the proposed activity
- Only use under controlled conditions
 - Wear suitable PPE Safety glasses, nitrile gloves, enclosed shoes, laboratory coat
 - Use in an operating fume cupboard, or a well-ventilated area
 - Control the scale of the activity by using only a very small lump (2-3g)
 - A small lump of calcium carbide reacts more slowly and is more controllable than fine powder, which reacts faster due to the larger surface area.
- Trial the proposed activity prior to classroom demonstrations
- Have dry sand available in the event of a fire

DO NOT:

- handle calcium carbide with bare hands
- inhale the gas produced
- use large quantities or fine powder of calcium carbide
- take the stock container of calcium carbide into the classroom
- perform any reactions in a closed vessel
- react acetylene with aqueous silver or copper(I) salts, because explosive acetylides are formed
- assume that reactions shown on YouTube are suitable for use in the classroom

A suitable activity:

- place about 50mL of water in a 250mL beaker
- place a small lump (2-3g) calcium carbide into the water
- bubbles of acetylene will form and these can be ignited using a long taper

Alternatively, the following suitable videos could be viewed:

1. 'Calcium Carbide & Acetylene - Periodic Table of Videos', YouTube (6:20 min), <https://youtu.be/KQSLpuVZK9Y> (7 May 2012)
2. 'Combustion of Acetylene', YouTube (11:14 min), <https://youtu.be/i-shpoG6jeM> (17 December 2012)
3. 'Carbide lamp.wmv', YouTube (3:37 min) <https://youtu.be/UqXnBXmPQ3U> (21 February 2010)
4. 'Acetylene Production from Calcium Carbide', YouTube (2:44 min) <https://youtu.be/5hExAXfql4w> (5 August 2012)

References:

'Calcium Carbide & Acetylene - Periodic Table of Videos', YouTube (6:20 min), <https://youtu.be/KQSLpuVZK9Y> (7 May 2012)

Chem-Supply. 2016. *Calcium carbide*, Safety Data Sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/CT1661CHA0.pdf> (January 2016)

NSW Department of Education and Training. 1999. *Chemical Safety in Schools Appendix D. Calcium carbide*, NSW Department of Education and Training; Sydney. p68

Queensland Department of Education, Training and Employment. 2014. *Unpredictable science experiments*. Health & Safety Alert, DET website, <https://education.qld.gov.au/initiativesstrategies/Documents/unpredictab...> (Link updated June 2019)

Source URL: <https://assist.asta.edu.au/question/4225/calcium-carbide>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Calcium Carbonate

Calcium Carbonate

Posted by Anonymous on Fri, 2016-05-13 13:17

Calcium Carbonate: Listed on ASSIST Chemical listing, Calcium Carbonate is listed as a Hazardous Substance. Is this correct? SDS's that I have looked at show it as not classified as hazardous.

Which is correct?

Thank you

Voting:



No votes yet

Laboratory Technicians:

Laboratory Technicians

Showing 1-2 of 2 Responses

Calcium Carbonate

Submitted by sat on 27 May 2016

Thank you for bringing this to our attention. We've checked the classification of calcium carbonate in SDSs from different manufacturers as well as other sources and agree that calcium carbonate is usually not classified as hazardous under the GHS and that this is consistent with the classification given by suppliers in Australia.

We have been advised that discrepancies between classifications in SDSs etc. can be due to the manufacturers or Chemwatch using a different versions of the GHS. We are in the

process of updating the classifications in the List of recommended chemicals for science in Australian schools to ensure that they reflect the Australian GHS classifications according to the Work Health and Safety legislation.

Calcium Carbonate

Submitted by NSW132 on 14 September 2018

Hi Just wanting to print a label for Marble chips. Chem supply for calcium carbonate(marble chips) provides a cas no of 471-34-1 which i put in chemwatch to look up the SDS. The SDS has a signal word Danger and Hazard Statements H315 H335 H318. But if you print out the SDS from Chem supply it has no hazard statements. The chemical search in CSIS says it is harmless. It is the same information when I search Calcium carbonate powder. Could you please advise me on which is correct. Catherine

Source URL: <https://assist.asta.edu.au/question/3818/calcium-carbonate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Calcium hydroxide

Calcium hydroxide

Posted by Anonymous on Thu, 2016-06-23 14:03

Calcium hydroxide: I have 2 bottles of Calcium Hydroxide that are moist. Can it be dried out? Or is it no good or Ok as is? Also how do I stop the chemicals from becoming moist?

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Calcium hydroxide

Submitted by sat on 21 July 2016

According to Armarego et al.,¹ pure calcium hydroxide should be prepared from calcium carbonate, by heating the carbonate at 1000°C to give calcium oxide, which is hydrated to give an aqueous suspension of calcium hydroxide, which is then collected by filtration and dried at 110°C. This procedure is more involved than required for school purposes, and is not

economical. We consider that it would be more economical and less hazardous to simply dispose of the moist calcium hydroxide and purchase a fresh supply.

If the calcium hydroxide has absorbed water, it is likely to have also absorbed carbon dioxide from the air,² and so, would have some calcium carbonate impurity. Heating a small quantity in an oven at 110°C would be a reasonable step for removing the absorbed water, although it would not remove the calcium carbonate impurity; as calcium hydroxide is corrosive, care should be taken to prevent exposure through inhalation or skin contact. When dry, or even in its current state, the impure calcium hydroxide could be used to make limewater, by using an excess, letting the precipitate settle, and then decanting the solution from the precipitated calcium carbonate.

As your current stocks may be quite old and are degraded, Science ASSIST recommends that they be disposed of, via a licenced chemical waste disposal contractor. They should not be disposed of to landfill as they pose a corrosive hazard. However, if you only have very small quantities, they can be treated by first adding to water, and neutralising the mixture to within pH 6-8 with dilute hydrochloric acid. The neutral mixture can then be disposed of down the sink with dilution.

Calcium hydroxide should be protected from air and water and stored in a cool dry place. We recommend that your school purchase a new bottle and that this be stored in a desiccator, ensuring that no incompatible chemicals are stored along with it in the desiccator. In general, it is good practice to purchase and store minimal quantities of chemicals.

References

¹Armarego, W.L.F., Chai, C.L.L. 2009. *Purification of Laboratory Chemicals*, 6th Edition, Butterworth-Heinemann

²'Calcium hydroxide' safety data sheet.

<https://www.chemsupply.com.au/documents/CL0111CH1M.pdf> (July 2013)

Source URL: <https://assist.asta.edu.au/question/3902/calcium-hydroxide>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Chemicals in schools (formaldehyde, melamine and cyanuric acid)

Chemicals in schools (formaldehyde, melamine and cyanuric acid)

Posted by Anonymous on Mon, 2016-02-15 09:21

Chemicals in schools (formaldehyde, melamine and cyanuric acid): Can someone please tell me if we can use formaldehyde (37%), melamine or cyanuric acid for IB individual design experiments in schools in Victoria? Thanks.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Chemicals in schools

Submitted by sat on 19 February 2016

Thank you for your question. In assessing chemicals for use in schools, we are guided in the

first instance by the Science ASSIST resource [List of recommended chemicals for science in Australian schools](#).

Summary Response

All three of your chemicals do not appear on the current Science ASSIST List of recommended chemicals for science in Australian schools, which may be the reason why you have raised the question. Taking the three chemicals in order:

- **Formaldehyde** (methanal). Science ASSIST strongly advises against this being used in a school science setting. It is a Category 1 (known) human carcinogen, has acute toxicity, and is a Category 2 drug precursor.
- **Melamine** (2,4,6-triamino-1,3,5-triazine). Science ASSIST considers that this chemical can be safely managed within a school setting, and will consider adding it to the recommended list.
- **Cyanuric acid** (iso-cyanuric acid). Science ASSIST considers that this chemical can be safely managed within a school setting, and will consider adding it to the recommended list.

In addition to looking at the individual chemicals, it is important to consider how they will be used and the products of any chemical reactions.

Always check the relevant Safety Data Sheet and conduct a risk assessment prior to purchasing any new chemical. In particular, the 'handling and storage' and the 'stability and reactivity' sections of the SDS should be consulted to help guide storage and handling, as well as to identify any incompatible materials and storage conditions to avoid.

It is also advisable to seek the SDSs for any chemicals produced to help inform decisions for proceeding with proposed activities. For example, the product of melamine and cyanuric acid is melamine cyanurate. Some sources of information on this compound are:

- https://www.who.int/foodsafety/fs_management/Melamine.pdf
- <https://www.sigmaaldrich.com/US/en/tech-docs/paper/22228804>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2984098/>

Additional Information

- **Formaldehyde (methanal, CH₂O) 37%.**

Formaldehyde was considered in the development of the Science ASSIST List of recommended chemicals and was deliberately not included because of its acute health hazards, and because it is not regarded as essential or important to the science curriculum. For further information regarding its classification as a carcinogen to humans, see <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100F-29.pdf> (Updated July 2018).

elamine (1,3,5-triazine-2,4,6-triamine, C₃H₆N₆)

This is currently not listed in the Science ASSIST List of recommended chemicals because at the time that the list was developed, there was no identified science curriculum use for it.

Melamine is classified as harmful, carries the Signal Word “Warning”, and phrase H303 “may be harmful if swallowed”. Research suggests that prolonged ingestion can lead to renal failure. A white crystalline solid, melamine is combined with formaldehyde to produce a commonly used thermosetting plastic.

Science ASSIST will further assess this chemical for appropriate inclusion in the recommended list.

- **Cyanuric acid (iso-cyanuric acid, 1,3,5-triazine-2,4,6-triol, C₃H₃N₃O₃)**

This is currently not listed in the Science ASSIST List of recommended chemicals because at the time that the list was developed, there was no identified science curriculum use for it. It is classified as non hazardous under GHS criteria. A crystalline solid, it is commonly sold as a swimming pool chemical, where it acts as a chlorine stabiliser slowing the loss of chlorine through the effects of ultraviolet radiation.

Science ASSIST will further assess this chemical for appropriate inclusion in the recommended list.

References

‘Cyanuric acid’, Safety Data Sheet, Sigma Chemicals website, <http://www.sigma-chem.com.au/download/aus-cyanuric-acid-tablets-sds10015...> (December, 2016)

‘Formaldehyde solution’, Safety Data Sheet, Chem-Supply website, <https://www.chemsupply.com.au/documents/FA0101CH2T.pdf> (January 2016)

‘IARC classifies formaldehyde as carcinogenic to humans’. Press release 153, IARC website. <https://web.archive.org/web/20180910164112/http://www.iarc.fr/en/media-c...> (December 2018. Original web page no longer exists, this copy is maintained by the Internet Archive).

Formaldehyde. 2012. IARC Monographs. <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100F-29.pdf> (Updated July 2018)

‘List of recommended chemicals for science in Australian schools, Science ASSIST website <http://assist.asta.edu.au/resource/3052/list-recommended-chemicals-science-australian-schools?search-id=1ebf159> (July 2015)

‘Melamine’, Safety Data Sheet. Please search the product information page of the Chem-Supply website for the latest version: <http://www.chemsupply.com.au>

‘Pharmacokinetics of melamine and cyanuric acid and their combinations in F344 rats’, Sigma-Aldrich website, <https://www.sigmaaldrich.com/US/en/tech-docs/paper/22228804> (Accessed February 2016)

‘Stabiliser (Cyanurate) Use in Outdoor Swimming Pools’, NSW Health website, <http://www.health.nsw.gov.au/environment/factsheets/Pages/stabiliser-cyanurate.aspx> (December 2012)

Suchy, P; Strakova, E; Herzig, I; Stana, J; Kalusova, R; Pospichalova, M. 2009. *Toxicological risk of melamine and cyanuric acid in food and feed*

, Interdiscip Toxicol. June 2.2: 55–59, US National Library of Medicine National Institutes of Health website. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2984098/>

World Health Organisation. 2008 *Melamine and Cyanuric acid: Toxicity, Preliminary Risk Assessment and Guidance on Levels in Food*, World Health Organization website https://www.who.int/foodsafety/fs_management/Melamine.pdf (October 2008)

Source URL: <https://assist.asta.edu.au/question/3563/chemicals-schools-formaldehyde-melamine-and-cyanuric-acid>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Demonstration of phosphorus

Demonstration of phosphorus

Posted by Anonymous on Mon, 2015-08-24 12:25

Demonstration of phosphorus: Are teachers still allowed to demonstrate the properties of white phosphorus? If so, where do we get some? Clearly we would need only a tiny amount.

Voting:•



No votes yet

Year Level:•

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Demo of phosphorus

Submitted by sat on 25 August 2015

White phosphorus is extremely hazardous. It is spontaneously flammable in air, which is why it must be stored under water. It emits very toxic fumes, and is also toxic when swallowed. It also can cause severe burns.

The risks are significant and therefore it is recommended that schools do not use white phosphorus. Instead, a suitable video should be shown to demonstrate the properties of white phosphorus. For example: <http://www.periodicvideos.com/videos/015.htm>

Science ASSIST does not recommend the use of white phosphorus in schools.

Therefore it is not in our [Recommended list of chemicals for science in Australian schools](#).

White phosphorus is banned or considered high risk in schools in several jurisdictions in Australia.

For schools that may currently have white phosphorus, we recommend that it is disposed of by a licenced waste disposal contractor. Until this is achieved, it is vital that the correct storage is managed by a technician or teacher with tertiary-level chemistry training and/or experience such that they understand the chemistry and hazards involved with storing and handling the chemical.

References

'Phosphorus Safety Data Sheet' 2015. Sigma-Aldrich website.

<http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang...>
(Accessed August 2015)

'Phosphorus-Periodic Table of Videos' Periodic Videos, University of Nottingham website.
<http://www.periodicvideos.com/videos/015.htm> (Accessed August 2015)

Source URL: <https://assist.asta.edu.au/question/3121/demonstration-phosphorus>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Electrophoresis Dyes

Electrophoresis Dyes

Posted by Anonymous on Fri, 2015-12-04 17:06

Electrophoresis Dyes: Hi, We have recently purchased our own equipment for doing electrophoresis and would like to know what the best dyes to use are and their preparation please?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Electrophoresis Dyes

Submitted by sat on 11 December 2015

In Brief

The electrophoresis of food dyes and scientific stains in school science laboratories demonstrates the basic principles and procedures of gel electrophoresis in a simple way. The dyes and stains used are affordable, safe, and the procedure simpler than using DNA. •A big advantage is that they behave in a similar way to DNA molecules during electrophoresis, and any bands produced can be visualized directly in the gel, without any further staining.

Different scientific stains produce distinct bands of colour during electrophoresis, whilst food dyes can be separated into their different pigments.

Samples of stains or food dyes are required to be mixed with a 20% v/v glycerol/distilled water solution prior to electrophoresing. The glycerol will make the sample denser than the electrophoresis buffer and allow the sample to sink and remain in the well rather than float into the buffer. This is an important step, so that no dye floats into the buffer and cross contaminates other samples.

Samples can be loaded into the gel using micropipettes, transfer or Pasteur pipettes. Care needs to be taken not to puncture the bottom of the well or overfill the wells. • Loading every second well is also a good idea to minimise the chance of contamination between adjacent wells. A 10-20 uL (1drop) sample size is generally used and the samples are electrophoresed at 90-100 volts for 30-35 min.

Preparation of samples

Food dyes can be purchased at the supermarket. They are negatively charged molecules like DNA molecules and will migrate to the anode (+ve terminal).

Preparation of food dyes for electrophoresis

1. Prepare 2 mL of a 20% v/v glycerol/distilled water solution.
2. Using a transfer or automatic pipette, add 0.1-0.2 mL of food dye to the glycerol solution and mix thoroughly until the dye is evenly distributed.
3. Repeat steps 1 and 2 for each colour.
4. Store the prepared dye solutions at 4°C for a longer shelf life.

Electrophoresis of food dyes will result in the following pigment separations.

- Green = blue and yellow bands
- Red = pink and red/orange bands
- Yellow = pink, orange and yellow bands
- Blue = light blue, dark blue and dark red bands
- Black = orange/red, yellow, orange, pink, light blue and dark blue

Scientific stains such as Bromophenol Blue, Methyl Green, Orange G, Indigo Carmine, Rose Bengal, Tartrazine and Xylene Cyanol are commonly used. These can be purchased from various scientific suppliers as ready-to-use reagents, or can be made up from individual powdered stains at a concentration of 0.2% w/v in 20% glycerol/distilled water. Stains can be used as a mixture, often referred to as a 'ladder'. They produce distinct bands of colour when electrophoresed.

Most scientific stains are negatively charged and will migrate towards the anode (+ve terminal). Methyl Green is positively charged and will migrate towards the cathode (-ve terminal). The smaller the molecule the further it will migrate. •

Preparation of stain solutions for electrophoresis

1. Prepare 10 mL of a 20% v/v glycerol/distilled water solution.
2. Add 20 mg of the required stain to the glycerol solution and mix thoroughly until the powder has completely dissolved. This may take a while.
3. Store the prepared stain solution in a brown bottle at room temperature to increase shelf life (slowing decomposition).
4. If requiring a mixture, then combine prepared stains in a 1:1 ratio for use.

Some safety and other considerations

- The power supply and the gel apparatus use high voltage and should be handled with caution. Ensure electrodes are in place before turning on. Make sure the power supply is turned off before disconnecting any leads and when not in use.
- Do not operate the power supply in damp or humid conditions. Keep water away from the power source.
- Gloves and eye protection should be worn at all times during the procedure.
- Observe the position of the bands during the electrophoresis procedure, so that it can be stopped when sufficient separation has occurred and to make sure that the bands do not run off the end of the gel.
- Measurements and photographs should be taken soon after stopping the electrophoresis as the molecules will continue to diffuse into the gel.
- If using samples that will migrate to both the anode and cathode, the wells should be prepared in the centre of the gel to allow good visualisation of the stains as they move to the different electrodes.
- At the end of the experiment, place all used gels in a plastic bag and dispose in the general waste bin. Used buffer solutions can be disposed of down the sink.
- Safety Data Sheets (SDSs) should be consulted as a first step in assessing the risks associated with a chemical: most of the stains used during electrophoresis are irritants.

Additional information

Gel electrophoresis

Gel electrophoresis is the separation of molecules through their migration in an electric field. The molecules are separated based on their size, electrical charge and shape when applied to a gel medium. Electrophoresis is a commonly used technique in laboratories to analyse

DNA, RNA and protein samples, plus other compounds in mixed samples. The principle of electrophoresis is that molecules are placed into a gel that is subjected to an electric current. Any negatively charged molecules will move towards the anode (+ve terminal) , whilst positively charged molecules will move towards the cathode (-ve terminal). The smaller the molecule, the further it will migrate. The density of the gel and the type of buffer used will affect how a molecule migrates. Most biological molecules are electrically charged, causing them to move when subjected to an electric field.

Types of gels for electrophoresis

There are several different types of agar that can be used to separate food dyes and scientific stains. Mobility of molecules is affected by gel concentration. Higher percentage gels, as well as thicker gels, are sturdier and easier to handle but the migration of molecules will take longer. Gels can be prepared, poured and stored at 4°C for several days before use.

Type of gel	Concentration	Use
Agarose: •a polysaccharide derivative of agar. •	1% w/v in buffer solution	<ul style="list-style-type: none"> • Most widely used to separate DNA. • Molecular biology grade gives the best results • Can be used for stains and food dyes. • Gives the best resolution.
Agar for microbiological media	1% w/v in buffer solution	<ul style="list-style-type: none"> • Can be used for stains and food dyes. • Does not produce gels with uniform pore sizes which will influence the electrophoretic process. • Bands will be more diffuse.

Agar from health food stores

1% w/v in buffer solution

- Can be used for stains and food dyes.
- Does not produce gels with uniform pore sizes which will influence the electrophoretic process.
- Bands will be more diffuse.

Edited 19 February 2020: Correction: The gel should not be made up with water. The gels should be made up in the same buffer used to run the gel in the electrophoresis chamber. This results in all the ions equilibrating in both the gel and the running buffer resulting in nice sharp bands. If using two different buffer types you run the risk that you end up with blurred and warped bands.

Buffers

The buffer solution is used to conduct the electric current and maintain the pH during the process. A buffer is poured into the electrophoresis chamber, filling the wells until it just covers the top of the casting tray. There are several different types of buffers that can be used to separate dyes and stains. The most commonly used buffer solutions are TAE (Tris-acetate-EDTA) and TBE (Tris-borate-EDTA) and are quite expensive. However, a safer and cheaper option for schools is to use a 10 mM sodium bicarbonate buffer.^{1, 2}

References

Edited 19 February 2020 to remove/update links that are no longer valid.

¹ 'Dyes for Electrophoresis', Southern Biological website, <https://www.southernbiological.com/dyes-for-electrophoresis/> (Updated February 2020)

² 'Getting started with Gel Electrophoresis', Southern Biological website, <https://www.southernbiological.com/getting-started-with-gel-electrophore...> (Updated February 2020)

'Activity 2: Gel Electrophoresis of Dyes', The American Phytopathological Society (APS) website, (Accessed December 2015)•<https://www.apsnet.org/Pages/default.aspx> and search for 'gel electrophoresis' (Updated February 2020)

'Basic Biotechnology Kit Gel electrophoresis of dyes', University of California Davis website, <https://pbge.faculty.ucdavis.edu/wp-content/uploads/sites/408/2016/10/Ge...> (Updated February 2020)

Bio-Tek Services Pty Ltd. n.d. *Agarose Gel Electrophoresis using dyes –Instruction manual*, Biotechnology Education website, <https://web.archive.org/web/20120321125959/http://www.biotechnologyeduca...> (Internet Archived Version, April 2018)

Carolina Biological Supply Company, 2005. *Introductory Gel Electrophoresis –Teacher's Manual with Student Guide*, Centre for Precollegiate Education and Training, University of Florida website <https://web.archive.org/web/20150513210641/http://www.cpet.ufl.edu/wp-content/uploads/2013/10/Intro-Gel-Electrophoresis-manual.pdf> (Original resource no longer available. This version provided by the Internet Archive October 2019)

Flinn Scientific Inc. 2008. *Dyeing for Electrophoresis*, Flinn Scientific Inc. website, <https://www.flinnsci.com/media/452802/bf10901.pdf> Further resources can be found at Flinn Scientific, visit <https://www.flinnsci.com/>, search for electrophoresis and then select the resources tab, see also 'Introduction to Electrophoresis' and 'Basic Electrophoresis'. (Updated February 2020)

'Forensic Science: Building Your Own Tool for Identifying DNA' Science Buddies website, • https://www.sciencebuddies.org/science-fair-projects/project-ideas/BioChem_p028/biotechnology-techniques/forensic-science-building-your-own-tool-for-identifying-dna (Updated February 2020)

Queensland Museum. 2006. *Food dye electrophoresis –Student task sheet*, Queensland Museum website, https://www.qm.qld.gov.au/microsites/qx/pdf/dd002_food_dye_electrophoresis.pdf

Southern Biological, n.d. • *Gel Electrophoresis of Dyes*, Southern Biological website, • <https://www.southernbiological.com/biotechnology/biotech-consumables/g42-90-dyes-for-electrophoresis/> (Updated October 2019).

Safety data sheets:

Chem-Supply. 2014. *Bromophenol Blue* Safety Data Sheet. • Search <https://www.chemsupply.com.au/> to source the latest Safety Data Sheet via the product information page.

Chem-Supply. 2013. • *Tartrazine Yellow (C.I. 19140)* • Safety Data Sheet. • Search <https://www.chemsupply.com.au/> to source the latest Safety Data Sheet via the product information page.

Chem-Supply. 2011. *Indigo Carmine*, Safety Data Sheet. Search <https://www.chemsupply.com.au/> to source the latest Safety Data Sheet via the product information page.

Sigma-Aldrich. 2013. • *Rose Bengal*, • Safety Data Sheet, • Search <https://www.sigmaaldrich.com/australia.html> to source the latest Safety Data Sheet via the product information page.

Sigma-Aldrich. 2013. ••*Xylene Cyanol FF*, •Safety Data Sheet. •Search <https://www.sigmaaldrich.com/australia.html> to source the latest Safety Data Sheet via the product information page.

Electrophoresis Dyes

Submitted by on 08 December 2015

We found it easier to buy the dyes from Southern Biological.

Source URL: <https://assist.asta.edu.au/question/3419/electrophoresis-dyes>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Ferrothiocyanate $\text{Fe}(\text{SCN})_2$

Ferrothiocyanate $\text{Fe}(\text{SCN})_2$

Posted by Anonymous on Tue, 2016-08-02 12:00

Ferrothiocyanate $\text{Fe}(\text{SCN})_2$: We are currently doing a prac called the *Effect of concentration changes on equilibrium yields*. I need to make up 0.0005M of $\text{Fe}(\text{SCN})_2$ solution, but I have no protocol to make it up. Can anyone help me?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Ferrothiocyanate $\text{Fe}(\text{SCN})_2$

Submitted by sat on 03 August 2016

Iron(III) thiocyanate, $\text{Fe}(\text{SCN})_2^{2+}$ is a complex ion formed in situ and the concentration is dependent upon the state of equilibrium, which is mostly shown qualitatively rather than quantitatively.

We provide the following links with useful information:

- 'Stressing an Equilibrium System by Changing the Concentration of Ions in Solution',

University of Illinois at Urbana-Champaign website,
<http://www.chem.uiuc.edu/chem103/equilibrium/iron.htm> (Accessed August 2016). This activity uses 0.0020M KSCN which is diluted to produce 0.0010M KSCN, to which 5 drops of 0.02 M $\text{Fe}(\text{NO}_3)_3$ is added.

- 'Experiment 1 Chemical Equilibria and Le Châtelier's Principle', Colby College, Chemistry website, <https://www.colby.edu/chemistry/CH142L/Expt1.pdf> (2012) This is a more quantitative activity using KSCN and $\text{Fe}(\text{NO}_3)_3$
- 'The effect of concentration changes on equilibria', Creative Chemistry website, • <https://www.creative-chemistry.org.uk/documents/N-ch2-12.pdf> (Accessed August 2016). This uses more concentrated solutions of KSCN and FeCl_3

Source URL: <https://assist.asta.edu.au/question/3991/ferrothiocyanate-fescn2>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Gallium Metal

Gallium Metal

Posted by Anonymous on Tue, 2015-01-13 15:23

Gallium Metal: Hi, I was wondering what your thoughts were on the use of gallium in schools (Years 7-12) for the purpose of demonstrating the melting point of metals and possibly other experiments. Is it considered safe for students to handle assuming they're wearing gloves?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Metal

Submitted by sat on 02 February 2015

Thank you for your excellent question.• Yes, from the available information, metallic gallium can be safely stored, managed and used within a school science context. From a curriculum perspective, it provides an excellent example of metal properties, low melting point (29.8 °C),

metallic lustre, and high density (5.9).• In this context, it offers a much safer alternative to mercury as an example of a low melting point metal.

Gallium is regarded as comparatively non-toxic. However, as gallium is not a commonly used element, the body of knowledge of its properties is not as extensive as for more common metals. •Therefore, Science ASSIST recommends that a site-specific risk assessment should be conducted before use, and that gallium is used as a teacher demonstration due to the high cost of this element.

Gallium is insoluble in water and unlikely to be absorbed by the skin during handling. There are some reports of skin sensitivity leading to dermatitis. Wearing of thin disposable gloves is recommended. •

Eye protection should also be worn.

At room temperature, there is no inhalation hazard and the metal is non-corrosive to plastics. • It is considered corrosive to metals, so contact with metals, especially aluminium and aluminium alloys, should be avoided. Some gallium compounds are known to be toxic and contact of the metal with strong acids, strong bases, oxidising materials and halogens should be avoided.

Spills can be cleaned up by pouring ice water over the spill to freeze the gallium, which can then be scooped up with a spatula. Gallium is electrically conductive, so any spills into or onto powered equipment need to be treated with caution. If gallium is spilt on electrical equipment, the power must be switched off before attempting to clean it up.

Storage

Gallium is best stored in its original container. However, as it expands and contracts with temperature change, storage in a glass or metal container is not recommended. If repackaged, it can be safely stored in a polyethylene container. •• Storage in the fridge (2-8 °C), is also recommended, as the metal will remain solid, which minimises its absorption of oxygen from the air and therefore slows its rate of oxidation. •

Activities

As one likely activity would be to demonstrate that gallium melts in the hand, wearing thin disposable gloves should allow this to happen. • Used gloves can be disposed of in general waste.

Gallium is the metal used in the classic “disappearing teaspoon” demonstration. • The references below include video clips of this activity, and overseas sites offering gallium and silicone rubber moulds for recasting spoons from the molten metal. • Clearly a risk assessment of this activity would include steps to ensure that the stirred liquid is not ingested, and that the gallium spoons do not come into contact with foods.

Some additional information regarding gallium and its uses can be found here:•
<https://pubs.usgs.gov/fs/2013/3006/pdf/fs2013-3006.pdf>

Availability and price

Unfortunately gallium is a very expensive substance, and its cost is likely to be prohibitive to schools. It could perhaps be considered for demonstration purposes. There are several reasons for this high cost.

- Gallium is a very uncommon low-use element.
- Because of its use in electronics, gallium is available only in very high purity, with the lowest available grade being 99.99%. This increases the cost.
- Gallium is a Class 8 Dangerous Goods (UN 2803), and is thus very expensive to transport and import. Our advice from importers of chemicals is that, even for the online purchase of gallium from overseas suppliers, such as those given in the references below, there would be added transport and import costs.

Science chemicals wholesale company Chem-Supply does not currently hold stocks of gallium, but gives the following indicative school retail prices for 99.99% pure gallium:

- 50 grams \$492
- 10 grams \$123

It is available for purchase from some Australian sources such as Sigma-Aldrich. For current prices and availability see:

<http://www.sigmaaldrich.com/catalog/product/aldrich/263265?lang=en®ion=US>

These prices would not include GST or the extra costs of delivery to school sites.

References:

Wilkinson, S. Personal communication. ChemCentre. Western Australia.

Safety Data Sheets:

<http://www.espimetals.com/index.php/msds/135-Gallium>

<http://www.sigmaaldrich.com/MSDS/MSDS/PleaseWaitMSDSPage.do?language=&co...>

Melting spoon activity:

<https://boingboing.net/2011/02/27/howto-make-a-disappe.html>

<https://www.rotometals.com:443/gallium-disappearing-spoon-mold-make-it-yourself/>

Source URL: <https://assist.asta.edu.au/question/2576/gallium-metal>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Genetics

Genetics

Posted by Anonymous on Wed, 2014-09-03 12:33

Genetics: Looking at ordering some PTC papers and a MSDS is not supplied with the papers. Are we still allowed to purchase them and do the experiment? Many thanks.

Voting:•



No votes yet

Australian Curriculum:•

People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities

Biological Sciences

Year Level:•

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Answer by labsupport on question Answer by labsupport on question Genetics

Submitted by sat on 05 September 2014

An SDS is available for PTC papers:<https://www.southernbiological.com/ptc-papers-sds/>•
[Edit 18/12/2020•If you purchase PTC papers you should request a Safety Data Sheet with the name, Australian address and business telephone number of either the manufacturer or the importer.]

It is very important, as you are doing, to ensure the suitability of products prior to purchase by consulting the Safety Data Sheet in order to do a risk assessment. You will see that Phenylthiocarbamide (PTC), also known as Phenylthiourea is highly toxic and swallowing the pure chemical can be fatal.• However PTC papers contain a very low dose of PTC. This product is used in genetics studies to see if students can taste the PTC.• A difficulty with this is that non-tasters may seek to try additional pieces of the PTC impregnated paper to see if they can taste the chemical.

Science ASSIST strongly advises against the making of PTC papers due the extreme risks associated with the pure chemical. Science ASSIST will be seeking further expert advice regarding the suitability of the PTC papers for use in schools and will publish this advice as soon as it becomes available to us.

Schools that are considering using PTC papers should conduct their own risk assessment for each class to determine whether or not to use PTC papers. They should check with their own jurisdiction to see if they are permitted to use them, as some jurisdictions have banned them from use or have limited the quantity per student. Teachers choosing to conduct this activity should closely supervise and restrict the distribution of 1 test paper/student.

Pending further advice, Science ASSIST recommends that schools consider the use of genetics test papers that use much safer chemicals such as sodium benzoate.• As with PTC, this also demonstrates the link between genetic makeup and taste capacity.• We would also refer you to the availability of other simply observed genetic traits such as ear lobe attachment, widow's peak hairline, and tongue rolling, pigmented iris of the eye, naturally curly or straight hair, hand clasping and dimples. See•
<http://learn.genetics.utah.edu/content/basics/observable/>

[18/12/2020 Edit:Updated links and removed broken links]

See a subsequent Q&A with further information at•
<http://assist.asta.edu.au/question/3037/phenylthiocarbamide-paper>

Source URL: <https://assist.asta.edu.au/question/2480/genetics>

GHS Hazard category ratings:

[Australian school science information support for teachers and technicians](#)

GHS Hazard category ratings: Can some one please explain the rating on the chemicals in the SDS please? For example the Hydrochloric Acid 25 - 36% Hazard Identification : skin corrosion/irritation: category 1B, for Specific Target Organ Toxicity Single Exposure: category 3 and Corrosive to Metals: category 1.

Is the lower number less of a hazard or more of a hazard?

Voting:

0

No votes yet

Publication Date: 26 September 2017

Asked By: Anonymous

Tags

- [Safety Data Sheet](#)
- [SDS](#)
- [hazard](#)
- [Hazard category](#)

[Sign in to respond to this question](#)

Showing 1-1 of 1 Responses

Sort by

Order

Submitted by [Science ASSIST Team](#) on Fri, 2017-10-06 17:57

Expert Answer

In brief:

Under the Globally Harmonised System (GHS) of classification and labelling of chemicals, the classification of chemicals is by hazard class and category. These will be found in Section 2 Hazard Identification of the chemical's Safety Data Sheet (SDS).

The GHS hazard class provides details on the physical, health and environmental hazards of the chemical.

The GHS hazard category refers to the severity of the hazard within the hazard class.

Each chemical will have a hazard class and at least one hazard category within that class. Some hazard classes may have 2 or more categories. A number is usually assigned to identify the hazard category. Sometimes a sub-category is also identified and this will be indicated with a letter e.g. 1A and 1B. A few hazard classes have other descriptors for the categories.

The lower the number, the higher the hazard and risk. Category 1 is the most hazardous within a class. If the category is further divided then 1A will have a greater hazard than 1B.

A useful resource:

Safe Work Australia has produced a poster with different hazard classes and their subdivision into hazard categories entitled 'Work Health & Safety Regulations: Classification and labelling for workplace hazardous chemicals'. We recommend it is printed out for your reference see:

<https://www.safeworkaustralia.gov.au/doc/classification-and-labelling-wo...>

Under the (GHS), whilst there are only 9 pictograms, there are many more hazard categories. This poster sets out:

- **Classification:** itemising each hazard class and the categories within that class
- **Labelling:** noting the labelling that is required for each hazard class and category, i.e. relevant pictograms, signal words, hazard codes and statements under the GHS.

Comparing categories (in flammable liquids):

If you consider the hazard class of flammable liquids, you can clearly see the progression of reducing hazard through the 4 categories, which is reflected in the labelling components:

- Pictogram: Categories 1-3 require the pictogram whereas category 4 does not.
- Signal Word: Categories 1-2 require the signal word "Danger", which indicates a more severe hazard, whereas categories 3-4 only require the signal word "Warning"
- Hazard Code and Statements: The category 1 statement is the most hazardous with category 4 being the least hazardous

Here is that portion of the poster (with the relevant headings copied here)¹:

Classification		Labelling			
Hazard		Pictogram,	Signal	Hazard Statement	
Class	Category	code*	word	Code*	Text
Flammable Liquids	Category 1		Danger	H224	Extremely flammable liquid and vapour
	Category 2			H225	Highly flammable liquid and vapour
	Category 3	GHS02	Warning	H226	Flammable liquid and vapour
	Category 4	No Pictogram	Warning	H227	Combustible liquid

Considering hazard identification for hydrochloric acid:

The Chem-Supply SDS for hydrochloric acid 25 - 36%², provides the following hazard information:



- Skin Corrosion/Irritation: Category 1B
- Specific Target Organ Toxicity Single Exposure Category 3 (respiratory tract irritation)
- Corrosive to Metals: Category 1

Therefore, when we look at the poster and look for the hazard categories identified we can see them in context and where they sit within the hazard class:


Skin corrosion/irritation: category 1B¹: in between 1A and 1C and more hazardous than category 2

Skin corrosion / Irritation	Category 1A		Danger	H314	Causes severe skin burns and eye damage
	Category 1B				
	Category 1C				
	Category 2		Warning	H315	Causes skin irritation

Specific Target Organ Toxicity Single Exposure: category 3¹: less hazardous than categories 1 and 2

Specific target organ toxicity (single exposure)	Category 1		Danger	H370	Causes damage to organs ⁽⁶⁾
	Category 2		Warning	H371	May cause damage to organs ⁽⁶⁾
	Category 3		Warning	H335	May cause respiratory irritation
				H336	May cause drowsiness or dizziness

Corrosive to Metals: category 1¹: This only has 1 category

Corrosive to metals	Category 1		Warning	H290	May be corrosive to metals
---------------------	------------	---	---------	------	----------------------------

References and further reading:

¹ 'Classification and labelling for workplace hazardous chemicals poster'. 2012. Safe Work Australia Website. <https://www.safeworkaustralia.gov.au/doc/classification-and-labelling-wo...> (Accessed April 2018) © Commonwealth of Australia 2014. This work is licensed under a [Creative Commons Attribution 3.0 Australia Licence](#)

² 'Hydrochloric acid 25–36%, Safety Data Sheet'. 2017. Chem-Supply website. <https://www.chemsupply.com.au/documents/HL0201CH34.pdf>

'GHS Hazard Class and Hazard Category'. ChemSafetyPro website. http://www.chemsafetypro.com/Topics/GHS/GHS_hazard_class.html (Accessed October 2017)

'Globally Harmonised System of Classification and Labelling of Chemicals (GHS) information sheet' 20.16. Safe Work Australia Website. <https://www.safeworkaustralia.gov.au/doc/globally-harmonised-system-clas...>

'Hazard communication under the GHS'. Safe Work Australia Website. <https://www.safeworkaustralia.gov.au/classifying-chemicals#hazard-commun...> (Accessed October 2017)

University of New South Wales. 2013. Fact_Sheet_on_the_GHS.<https://safety.unsw.edu.au/hs681-fact-sheet-ghs> (Link update May 2019)

-



- [Home](#)
- [Tutorial](#)
- [Terms of Use](#)
- [Privacy Policy](#)
- [Contact Us](#)
- [Sitemap](#)
- [Subscribe](#)

Public material available under a CC Attribution by 4.0 International licence



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Glutaric Acid

Glutaric Acid

Posted by Anonymous on Fri, 2016-09-02 10:39

Glutaric acid: I have found some old glutaric acid in my chemical store and would like to know if it is an approved chemical for use in schools.

It has an orange dot on the container, but I have no information in the old CSIS or on the ASSIST List of recommended chemicals for science list. Thanks.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Glutaric Acid

Submitted by sat on 09 September 2016

When considering the suitability of a chemical for use in schools, it should be determined if there is a particular use in supporting the curriculum. If it is deemed useful, then it should be assessed for safety in the school setting. In particular, how it will be used, as well as the nature of the products of any chemical reactions.

We are unaware of any particular use for glutaric acid in the Australian curriculum and therefore it is not currently on our list. However, if you have a specific reason for its use, then let us know, so that we can consider adding it to the List of recommended chemicals for science in Australian schools.

In keeping with good housekeeping practice, it is important to keep chemicals to a minimum. Therefore, as you have indicated that it is an old chemical, and in the absence of any confirmed requirement for the curriculum, we suggest that you dispose of it. The SDS indicates a hazard statement H319 Causes serious eye irritation and that disposal should be by a licenced chemical waste disposal contractor.

Reference

'Glutaric acid', Please visit the Sigma-Aldrich website for the most recent version of this Safety Data Sheet: <https://www.sigmaaldrich.com/AU/en>

Source URL: <https://assist.asta.edu.au/question/4045/glutaric-acid>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Health monitoring requirements

Health monitoring requirements

Posted by Anonymous on Wed, 2019-08-28 12:00

Health monitoring requirements: Is health monitoring for exposure to hazardous chemicals required for chemicals in the List of Recommended Chemicals/ Chemical Management Handbook? Do you have any advice?

Voting:•



No votes yet

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Health monitoring requirements

Submitted by sat on 28 August 2019

The hazardous chemicals used in school science and included in our resources are generally used infrequently in small quantities and for a short exposure time. Control measures determined by a risk management approach in consultation with the information found in the chemical's Safety Data Sheet, should be in place such as engineering controls (e.g. fume cupboard) and relevant Personal Protective Equipment (PPE) to further limit the exposure.

By following Science ASSIST recommendations and jurisdictional policies for working with hazardous chemicals, there should be no situations that warrant health monitoring in school science.¹

The model WHS Regulations:

The model WHS Regulations set out instructions regarding the requirement for health monitoring in regulations 368, 405 and 435. Health monitoring, such as testing body fluids or function, is required 'if the worker is carrying out ongoing work using, handling, generating or storing hazardous chemicals and there is a significant risk to the worker's health because of exposure to a hazardous chemical referred to in Schedule 14, table 14.1, column 2(Reg 368)', and there are valid tests available; and for lead risk work (Reg 405) and asbestos (Reg 435).²

There are only two chemicals from schedule 14, chromium and mercury, that are included in the list of recommended chemicals:

- Chromium: metal and chloride/nitrate salts, are used rarely in the science curriculum
- Mercury: it is recommended that only a small quantity be kept for demonstration purposes and that it be stored in a tightly sealed container.

Schedule 10 in the Regulations sets out prohibited carcinogens in table 10.1, and restricted carcinogens in table 10.2. There are no chemicals from either of these lists in the list of recommended chemicals.

Schedule 10 in the Regulations also sets out restricted hazardous chemicals with restricted use in Table 10.3. They are not permitted to be used in certain concentrations for abrasive blasting or spray painting processes. Chemicals from this list which are included in the list of recommended chemicals include chromium and its compounds; cobalt and its compounds; lead and compounds, methanol, nickel and its compounds, nitrates, nitrites, and tin and its compounds. By implementing relevant controls these chemicals should not be used in ways to create dust, fumes or aerosols that would contribute to exposure to the hazardous chemicals.

While chemicals other than those listed in Schedules 10 and 14 can also be the focus for health monitoring², chemicals used in schools should not be used in a manner that would pose a significant risk to staff or students.

It is the responsibility of a person conducting a business or undertaking (PCBU) to determine if health monitoring is required. The guide, *Health Monitoring for Exposure to Hazardous Chemicals*³ sets out the factors to consider in making such a determination.

A note about sensitisers:

It is important to be aware that amongst hazardous chemicals, there are a number of chemicals used in schools which may be classified as sensitisers.^{4,5} These may be respiratory⁶ and/or skin⁷ sensitisers and the GHS classification, would carry the exclamation or health hazard pictogram and relevant hazard statement.

These chemicals are used infrequently, in small quantities and for short exposure times. By

implementing relevant control measures, the likelihood of an adverse reaction, is very low.

However, in the case where a staff member or student has existing chemical sensitivities, e.g. latex allergies,⁸ additional precautions should be taken to avoid further contact, just as a school would in other cases where allergies are noted and appropriate safety measures are taken.

References and further reading

¹ Queensland Department of Education. 2019. Appendix 2a –effects of chemical exposure in *Guideline for managing risks with chemicals in DoE workplaces*, Queensland Department of Education website, <https://education.qld.gov.au/curriculums/Documents/itd-guidelines-part-3...> (Link Updated May 2021)

² Safe Work Australia. 2019. Safe Work Australia website. *Model Work Health and Safety Regulations*, <https://www.safeworkaustralia.gov.au/doc/model-work-health-and-safety-regulations>

³ Safe Work Australia. 2013. • Safe Work Australia website. *Health Monitoring for Exposure to Hazardous Chemicals*, <https://www.safeworkaustralia.gov.au/book/health-monitoring-when-you-work-hazardous-chemicals-guide>

⁴ ‘Sensitizer’, Interactive Learning Paradigms Incorporated website, <http://www.ilpi.com/msds/ref/sensitizer.html> (Accessed August 2019)

⁵ ‘Experiencing an Adverse Immune Response’, The Extension TOXicology NETwork housed on the Oregon State University website, <http://extoxnet.orst.edu/faqs/senspop/immune.htm> (August 1997)

⁶ ‘Factsheet 39 –Respiratory sensitisers’, The European Agency for Safety and Health at Work website, • <https://osha.europa.eu/en/publications/factsheet-39-respiratory-sensitisers> (2003)

⁷ ‘Factsheet 40 –Skin sensitisers’, The European Agency for Safety and Health at Work website, • <https://osha.europa.eu/en/publications/factsheet-40-skin-sensitisers> (2003)

⁸ Science ASSIST. 2017. *AIS: Latex allergies in schools*, Science ASSIST website, <https://assist.asta.edu.au/resource/4243/ais-latex-allergies-schools>

•

Safe Work Australia. 2018. Safe Work Australia website. ‘*Model code of practice: Managing risks of hazardous chemicals in the workplace*’ <https://www.safeworkaustralia.gov.au/doc/model-code-practice-managing-risks-hazardous-chemicals-workplace>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Lead and lead salts

Lead and lead salts

Posted by Anonymous on Fri, 2015-10-23 12:39

Lead and lead salts. On your List of Recommended Chemicals for Science in Australian Schools, you say that lead nitrate can be used in Years 7–12. They are classed as 'high risk' substances with uncertain or unpredictable risk levels in Education QLD's guidelines. I don't, therefore, understand why lead and lead salts are included on your list?

Voting:•



Average: 5 (1 vote)

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by ginny.r.ward on question Lead and lead salts

Submitted by sat on 23 October 2015

Thank you for highlighting the hazards associated with the use of lead and lead salts.

Lead poses a significant risk of harm to humans, and especially to children, as it accumulates in the body and can have long-term effects.^[1,2] • The use of lead and its salts in schools are banned in some Australian jurisdictions, and approved or restricted in others.

On the List of Recommended Chemicals, we have included only three lead-containing substances: lead metal, lead nitrate (in solution for students) and lead (II) oxide. • These are included because we consider that they allow for some worthwhile demonstrations and activities and that their associated hazards can be reduced to an acceptable level with safe practices.

We have included lead metal on the List of Recommended Chemicals, so that it may be used to demonstrate the difference in its malleability compared with that of other metals. • Elemental lead also has applications in physics activities, which employ its high density compared with that of other metals, also lead shot is used in determinations of specific heat.^[3]

Lead is not readily absorbed through the skin,^[2] however, there is the risk of lead ingestion from eating or touching the mouth after handling lead. • To minimise exposure, pieces of lead metal can be wrapped in plastic clingwrap or provided in a zip-lock plastic bag prior to handling. • Students should be instructed to wash their hands well after handling lead.

Lead nitrate in solution is included on the List of Recommended Chemicals in order that the reaction of lead nitrate and potassium iodide to give a yellow precipitate of lead iodide may be conducted. • This reaction gives a dramatic colour change and is effective on a microscopic scale; using one drop each of the reactants on a white tile, spotting tile or flat acrylic sheet. • Making a precipitate in a test tube is not recommended because of the difficulty in cleaning up the only very slightly soluble lead iodide. • A teacher demonstration of this reaction is also a good alternative.

Lead nitrate in solution may also feature in senior chemistry activities such as the demonstration of displacement reactions and qualitative inorganic analysis, although the use of lead salts is not strictly necessary in any of these activities. • The amount of heavy metal waste produced from displacement reactions can be minimised by using spotting tiles.^[4] • Lead salts are not necessarily required as unknowns in inorganic analysis activities. • Lead salts are also not necessary as reagents in these activities; barium chloride can be used to indicate the presence of sulfate ions and silver nitrate can be used to indicate the presence of iodide ions.

Lead monoxide, PbO, is included for the purpose of demonstrating its facile reduction to lead metal when heated in the presence of carbon.^[5] • This reaction is best conducted in a fume cupboard and as a teacher demonstration. • Students could then perform the less hazardous extraction of iron from iron oxide on a match head.^[6,7]

As lead is not biodegradable and persists in the environment, waste lead and lead compounds should not be disposed of in the general waste and should be stored for collection by a licenced waste disposal contractor.

It is recommended that any reactions using lead or its compounds be conducted on a conservative scale and that other materials be substituted for lead where possible (e.g. using

lead-free solder in electronics).•• Science ASSIST will be developing further guidance regarding the use of lead and its compounds in the coming months.

References

[1] Flora, G., Gupta, D., & Tiwari, A. (2012). Toxicity of lead: A review with recent updates. *Interdisciplinary Toxicology*, 5(2), 47-58.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3485653/>

[2] Abadin H, Ashizawa A, Stevens YW, et al., Toxicological Profile for Lead. Atlanta (GA): Agency for Toxic Substances and Disease Registry (US); 2007 Aug.

<https://www.ncbi.nlm.nih.gov/books/NBK158766/>

[3] Nuffield Foundation, Institute of Physics, The specific thermal capacity of lead, 2015,

<https://spark.iop.org/practical-physics/specific-thermal-capacity-lead.html>

[4] Royal Society of Chemistry, Learn Chemistry: TeacherExpt:Displacement reactions between metals and their salts, 2013, <http://www.rsc.org/learn-chemistry/wiki/index.php%3Ftitle%3DTeacherExpt:...>

[5] Royal Society of Chemistry, Learn Chemistry: Extracting metals with charcoal, 2015,

<http://www.rsc.org/learn-chemistry/resource/res00000417/extracting-metal...>

[6] Royal Society of Chemistry, Classic Chemistry Experiments: The Reduction of Iron oxide by Carbon, 2015, <https://edu.rsc.org/lcredir/learn-chemistry/resource/res00000419/the-reduction-of-iron-oxide-by-carbon?cmpid=CMPO0000489>

[7] Bianchi, Zoe, Extracting Metal on a Match Head, 2013,

<http://asd54.blogspot.com.au/2013/04/extracting-metal-on-match-head.html>

Source URL: <https://assist.asta.edu.au/question/3288/lead-and-lead-salts>

Published on *ASSIST* (<https://assist.asta.edu.au>)

[Home](#) > Litmus Paper

Litmus Paper

Posted by Anonymous on Thu, 2016-03-10 10:03

Litmus Paper: The Litmus paper in our lab is many years old, but has been kept dry in a dark drawer. We have a significant prac in June to prepare for and I was wondering if Litmus paper has a 'best before date' and whether it can be used or not. There is no use-by date on the packaging. I would appreciate your comment.

Voting:•



No votes yet

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Litmus Paper

Submitted by sat on 14 March 2016

In brief

Litmus paper affords a cheap, simple and reliable method of determining whether a solution is acidic, basic or neutral. Litmus papers are based on acidobasic indicators, which are very

stable compounds. They can stay chemically stable for a long time provided they are stored properly. This is why some litmus papers do not indicate an expiration date.

The samples at your school, which have been stored dry and in the dark, are likely to still be suitable. An inspection of the paper would indicate signs of deterioration, such as variations in colour or texture. A simple and easy way to determine whether the litmus paper is still usable is to immerse one end of it in some acid or basic solution and note if it changes colour as expected. As you are preparing for a significant practical activity, it would also be worthwhile testing the paper under the conditions of the practical activity to ensure that it performs well.

Science ASSIST recommends keeping litmus papers in a dry and tightly closed container in a cool and well-ventilated area, and also to keep the container away from light, oxidising agents, heat and sources of ignition.

Additional Information

Litmus paper is made of up wood cellulose paper infused with litmus—a mixture of weakly acidic blue organic dyes obtained from certain lichens.

There are three different types of litmus paper.

- Blue litmus paper turns red in acid
- Red litmus paper turns blue in bases
- Neutral litmus paper (purple) turns red in acids and blue in bases

To determine if a solution is neutral, you would test with blue paper (does not become red) and then with red paper (does not become blue). Neutral paper would remain purple.

References

Fisherbrand™ 'Acid/Alkali Test Papers', Safety Data Sheet, Fisher Scientific, IMS Company website, <https://imscompany.com/static/msds/121711%20Fisherbrand-AcidAlkali-Test-Papers%20SDS%2005122014.pdf> (May 2014)•

'Litmus paper', How Products are Made website, <http://www.madehow.com/Volume-6/Litmus-Paper.html> (Accessed March 2016)

'Water and Food Analysis –Test kits, instruments and accessories', NetSuite website https://system.netsuite.com/core/media/media.nl?id=5594&c=3339985&h=4afe9d791d06be7bcf15&_xt= (Accessed March 2016)

Source URL: <https://assist.asta.edu.au/question/3660/litmus-paper>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Mercury (II) Thiocyanate

Mercury (II) Thiocyanate

Posted by Anonymous on Wed, 2015-05-06 08:18

Mercury II Thiocyanate: Hi all. Does anyone know if we can use this in high schools? it is used to make Pharoah's serpent?

Voting:•



No votes yet

Year Level:•

9

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Mercury 11 Thiocyanate

Submitted by sat on 18 May 2015

Summary Answer:

The Pharaoh/Black Snake reaction is a highly dangerous chemical reaction that involves the decomposition of mercury (II) thiocyanate, which is a toxic substance, and is considered too hazardous to be used in schools. In addition, the decomposition yields many extremely hazardous substances. THIS REACTION SHOULD NEVER BE CARRIED OUT IN A SCHOOL.

Safety Data Sheets (SDSs) are the best general source of information available for any chemical and they should be consulted as a first step in assessing the risk associated with a chemical's use and disposal. Science ASSIST has developed a Risk Assessment Template for schools to use see [Risk Assessment Template](#).

Science ASSIST has developed a [Recommended List of Chemicals](#) for all schools in Australia. Mercury salts, which include mercury thiocyanate, are considered too hazardous for use in schools and will not be on this list. Science ASSIST **strongly** advises not to purchase any mercury salts and, if you have some in the chemical store, then they should be disposed of by a licensed waste disposal contractor.

Background information:

Mercury (II) thiocyanate is a highly toxic chemical and dangerous to the environment. Using mercury (II) thiocyanate, equates to danger-# it is fatal if inhaled, swallowed or absorbed through the skin, causes digestive and respiratory tract irritation, may impair fertility and can also cause kidney damage. Mercury (II) thiocyanate is classified as an Acute Toxicity Category 3 on the Safe Work Australia GHS Hazardous Chemical Information List.

The decomposition of mercury (II) thiocyanate yields: carbon nitride, mercury vapours, carbon dioxide and sulfur dioxide. Carbon nitride further decomposes into dicyan gas. Mercury vapours, sulfur dioxide and dicyan gases are all highly toxic and classified as hazardous.

All aspects of this reaction are **HAZARDOUS**:

- Handling the reagent
- Breathing the smoke
- Touching the ash column
- Contact with the remains of the reaction during clean-up

Suggested alternative activities:

1. Dehydration of sucrose using concentrated sulfuric acid. This reaction should be carried out as a demonstration in the fume cupboard and relevant PPE should be worn when handling the acid. See www.rsc.org/education/eic/issues/2007March/ExhibitionChemistry.asp.
2. Black Snake Fireworks involving powdered sugar and sodium bicarbonate in the presence of lighter fluid or alcohol. This reaction should be carried out on a small scale on a bed of sand in a metal tray as a demonstration in the fume cupboard. See <https://www.thoughtco.com/ultimate-colored-smoke-bomb-605967> and <https://www.youtube.com/watch?v=HtAgxVT2x5s> [Note: Science ASSIST recommends that ONLY the sugar and sodium bicarbonate version is used for this activity].
3. View the activity on YouTube <https://youtu.be/yN9pioJWtk0>

References

'Sulfur dioxide (SO₂) Air quality fact sheet', Australian Government, Department of Environment website www.environment.gov.au/protection/publications/factsheet-sulfur-dioxide-so2

(2005)

'Mercury (II) thiocyanate' Merck Millipore website, Material Safety Data Sheet.
http://www.merckmillipore.com/INTERSHOP/web/WFS/Merck-AU-Site/en_US/-/US... (Link updated, October 2018).

'Mercury and health', Fact sheet No361' World Health Organisation website
www.who.int/mediacentre/factsheets/fs361/en/ (September 2013)

'Material Safety Data Sheet: Mercuric Chloride', Chem-Supply website
<https://www.chemsupply.com.au/documents/ML0591CH4B.pdf> (July 2011)

'Hazardous Chemical Information System (HSIS)', Safe Work Australia website.
http://hsis.safeworkaustralia.gov.au/GHSInformation/GHS_Hazardous_Chemical_Information_List
(September 2014)

'How to make black snake fireworks with and without fire', *Instructables* website
<https://www.instructables.com/id/How-to-Make-Black-Snake-Fireworks-With-Without-F/>
(Accessed May 2015)

'How To Make Black Snakes or Glow Worms', *About education* website
<https://www.thoughtco.com/ultimate-colored-smoke-bomb-605967> (Accessed May 2015)

'Pharoah's snakes', *Chem-Toddler* website www.chem-toddler.com/redox-reactions/pharaohs-snakes.html (Accessed May 2015)

'The dehydration of sucrose', Royal Society of Chemistry website
www.rsc.org/education/eic/issues/2007March/ExhibitionChemistry.asp (March 2007)

Source URL: <https://assist.asta.edu.au/question/2811/mercury-ii-thiocyanate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > organic chemicals

organic chemicals

Posted by Anonymous on Thu, 2016-08-18 17:25

Organic chemicals: I have been asked to purchase examples of esters, amides, amines, alkanes and alkenes.

Can someone recommend which of these chemicals are best for school use please?

I have looked on the ASSIST Page of Recommended Chemicals, but I'm still confused as to which would be the best ones to purchase for use by Year 12 students.

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

organic chemicals

Submitted by sat on 02 September 2016

It is important that a full risk assessment is conducted considering the proposed use of all chemicals prior to their purchase.

All of the types of chemicals that you have mentioned are considered different **functional** groups of organic chemicals.^{1,2}

In the absence of any knowledge of the particular curriculum purpose or activity for these chemicals, we make the following comments considering the chemicals that we have included in our List of recommended chemicals for science in Australian schools.

- **Esters:** These are often manufactured in the school laboratory³, however, we have sixteen esters included in our list. A common ester is ethyl acetate.
- **Amides:** We have one amide included in our list, which is acetanilide
- **Amines:** tris(hydroxymethyl)aminomethane (Tris) is a primary amine and is used for preparing buffers. Hexane-1,6-diamine has two amine groups and is often used in making nylon in school activities. See Making Nylon. You may consider using an amino acid such as histidine or lysine, depending upon what you are planning on using it for. If you would like to suggest adding an amino acid to the list, please let us know.
- **Alkanes and alkenes:** These are both in the family of non-halogenated hydrocarbons⁴. We have nine chemicals in this group. The names of alkanes typically end in 'ane' and alkenes end in 'ene'. A common alkane used in schools is cyclohexane and a common alkene used in schools is cyclohexene.

Alternative activity: using molecular models is a safe way to show the structure of different functional groups of organic chemicals.⁴

References:

¹'Organic functional groups'. Chemistry drills website, <http://www.chemistry-drills.com/functional-groups.php?q=simple> (Accessed August 2016)

²'Ball, David, W; Hill, John, W and Scott, Rhonda, J. 2011. 'Section 4.6 Introduction to Organic Chemistry' in *Introduction to Chemistry: General, Organic and Biological*, Lard Bucket website, <http://2012books.lardbucket.org/books/introduction-to-chemistry-general-organic-and-biological/s07-06-introduction-to-organic-chemis.html>

³'Carboxylic acids and esters, making an ester' BBC website, <https://www.bbc.co.uk/bitesize/guides/z33j6sg/revision/2> (Accessed August 2016)

⁴'Alkanes and alkenes', BBC website, <https://www.bbc.co.uk/bitesize/guides/zvwxnb/revision/1> (Accessed August 2016)

Source URL: <https://assist.asta.edu.au/question/4027/organic-chemicals>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Phenanthroline

Phenanthroline

Posted by Anonymous on Sat, 2018-08-18 10:47

Phenanthroline: My Chemistry teacher would like to use Phenanthroline for senior chemistry EEI's. The MSDS lists this chemical as Acute hazard category 1, and Acute toxicity oral category 3. Could you tell me if this chemical is ok to use in schools?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Phenanthroline

Submitted by sat on 18 August 2018

It is important to understand that there are variations between the policies of the different educational jurisdictions regarding chemicals that can be used in school science. You are advised in the first instance to consult with your school jurisdiction policies and procedures for specific chemical use. Phenanthroline (1. 10 phenanthroline) is not on any banned or restricted list in any of the Australian jurisdictions.

Before purchasing any chemical, a site-specific risk assessment should be conducted taking

into consideration the hazards of the chemical, how it will be used and the products of any chemical reactions.

Although, the solid chemical is toxic if swallowed and very toxic to aquatic life^{1,2}, the solution is considered not hazardous³. Schools may consider purchasing the chemical in solution form (0.1%) rather than prepare the solution on-site, although this can be done using safe handling procedures.

Phenanthroline is generally used by students as a dilute solution and not in solid form, which reduces the risks. It is used as an indicator in redox systems. It is commonly used to detect small amounts of iron in water with the formation of an intense orange red complex. Iron exists in water predominantly as Fe^{3+} and this first has to be reduced to Fe^{2+} with the addition of a reducing agent. It is the iron (II) ions that complex with the phenanthroline. The concentration of the iron present in the water sample can then be measured using a spectrophotometer and a calibration curve. Redox indicators are normally used in very small amounts, typically a few drops of a dilute solution

Therefore, with safe handling procedures, phenanthroline is suitable for use in school science.

Hazards of phenanthroline in solid form:

‘Hazardous to the aquatic environment - Acute hazard category 1’ Under the GHS, in Australia it is not mandatory to classify according to environmental hazards. However, this does alert the user to risks to the environment and as such the SDS also includes the statements ‘Avoid release to the environment’ and ‘Do not allow to enter waters, waste water or soil’. Therefore, this hazard is important when considering the disposal of this chemical and should be disposed of by a chemical waste disposal contractor.

‘Acute toxicity oral category 3’ Under the GHS, the category 3 is less hazardous than categories 1 and 2. This chemical carries the hazard statement ‘Toxic if swallowed’ and the precautionary statement ‘wash thoroughly after handling’. Good laboratory hygiene is essential to minimising the risk of ingesting this chemical.

The use of the following safe handling procedures will control and reduce the risks when handling this chemical in solid form.

Safe handling procedures

- Consult the information contained in the Safety Data Sheet.
- Do not breathe dust, vapour or mists and avoid eye and skin exposure.
- Wear suitable PPE such as safety glasses, gloves, enclosed shoes and laboratory coat.
- Conduct good laboratory hygiene such as cleaning up spills, no eating or drinking in the lab and washing hands at the end of all laboratory activities.
- Avoid contact with strong oxidising agents and nitric acid.
- The solid chemical is hygroscopic. Store in a cool, dark place.
- Avoid release to the environment.

Science ASSIST will include this chemical in a future update of our List of recommended chemicals for science in Australian schools

References and further reading

¹ Chem-supply. 2013. *1,10-PHENANTHROLINE Monohydrate*, Safety Data Sheet, ChemSupply website, <https://www.chemsupply.com.au/documents/PA1801CHJF.pdf>

² Sigma-Aldrich. 2013. *1,10-Phenanthroline*.•Please see the Sigma Aldrich website for the latest version of the Safety Data Sheet:•<https://www.sigmaaldrich.com/AU/en>

³ Sigma-Aldrich. 2019. *Ferroun indicator solution*, Please see the Sigma Aldrich website for the latest version of the Safety Data Sheet:•<https://www.sigmaaldrich.com/AU/en>

Flinn Scientific. 2017. *Determination of Iron in Water*, Flinn Scientific website, <https://www.flinnsci.com/determination-of-iron-in-water/dc0585/>

Source URL: <https://assist.asta.edu.au/question/4362/phenanthroline>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Phenylthiocarbamide paper

Phenylthiocarbamide paper

Posted by Anonymous on Tue, 2015-07-28 09:25

Phenylthiocarbamide paper: Hi, Are you still allowed to use phenylthiocarbamide paper?

Voting:•



No votes yet

Australian Curriculum:•

Transmission of heritable characteristics from one generation to the next involves DNA and genes

People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities

Year Level:•

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

phenylthiocarbamide paper

Submitted by sat on 31 July 2015

There are conflicting views as to whether PTC papers are safe to use in school genetics

classes.^{1,2,3} The use of this test is not permitted in W.A. Department of Education schools⁴, but we are not aware of bans in any other Australian jurisdiction. PTC is toxic, however, the amount of PTC on one commercially produced PTC paper is very small; students who can taste the bitterness would be able to detect it immediately from one test paper. However, for non-tasters, there may be a temptation to repeat the test with one or more papers. See our previous answer on this topic: [Genetics](#).

Rather than use PTC papers to test for bitterness-tasting ability, we suggest that schools consider substituting non-hazardous substances such as the juice of broccoli or kale, or the use of genetics test papers that use much less toxic chemicals such as sodium benzoate. Other genetic traits could also be observed such as: ear lobe attachment, widow's peak hairline; tongue rolling; pigmented iris of the eye; naturally curly or straight hair; hand clasping; dimples; see <http://learn.genetics.utah.edu/content/basics/observable/>

References:

1. 'Safety Questions –PTC Paper' Science Teachers' Association of Ontario blog. <https://stao.ca/safety-questions-ptc-paper/> (Accessed July 2015) [Link updated 18/12/2020]
2. Texley J., T. Kwan and J Summers 2004. *Investigating safely*. National Science Teachers Association Press. Virginia, U.S.A. p.80 <https://my.nsta.org/resource/99999>• [Link replaced 18/12/2020]
3. Merrit, Robert B., L.A. Bierwert, B. Slatko, M.P. Weiner, J. Ingram, K. Sciarra and E. Weiner 2008. 'Tasting Phenylthiocarbamide (PTC): A New Integrative Genetics Lab with an Old Flavor'. *The American Biology Teacher*, 70(5):e23-e28:27 <https://bioone.org/journals/the-american-biology-teacher/volume-70/issue...> (2008)70[23:TPPANI]2.0.CO;2/Tasting-Phenylthiocarbamide-PTC--A-New-Integrative-Genetics-Lab-with/10.1662/0002-7685(2008)70[23:TPPANI]2.0.CO;2.full (Link replaced: January 2019)
4. WA Department of Education. 2014 'Banned and restricted hazardous substance and experiments in schools August 2014'

Further information:

Drewnowski, Adam and Carmen Gomez-Carneros. 2000. 'Bitter taste, phytonutrients, and the consumer: a review 1, 2, 3' *American Journal of Clinical Nutrition* 72:1424-35 <https://academic.oup.com/ajcn/article/72/6/1424/4729430>

'Learning Genetics with Paper Pets' 2006. NSTA website. • <https://www.nsta.org/resources/learning-genetics-paper-pets>•(Link updated June 2020) [Edit 18/12/2020 Login required]

'Observable Human Characteristics'. University of Utah website. <http://learn.genetics.utah.edu/content/basics/observable/> (Accessed August 2016)

'PTC: Genes and Bitter Taste'. University of Utah website. <http://learn.genetics.utah.edu/content/basics/ptc/> (Accessed August 2016)

Source URL: <https://assist.asta.edu.au/question/3037/phenylthiocarbamide-paper>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > potassium bromate

potassium bromate

Posted by Anonymous on Mon, 2015-03-30 10:08

potassium bromate: I am wondering if it is safe/acceptable to order potassium bromate in solid form for a visually impressive science reaction for open day purposes. Are there any special considerations associated with this chemical, as I believe it can be quite hazardous? The teacher hopes to use the whole amount of potassium bromate ordered within a few days of ordering, so it would not be stored indefinitely in our chem room.

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

potassium bromate

Submitted by sat on 16 April 2015

Thank you for taking the time to check on the appropriateness of the use of this chemical.•

The response to your question is not a simple one. •

Summary Response:

Science ASSIST recommends that, in general, potassium bromate is not stored or used in schools. • **Potassium bromate $KBrO_3$ is an extremely hazardous chemical. It is a very strong oxidising agent with the capacity to form explosive mixtures with combustible materials. It is also extremely toxic and is classified as a carcinogen.** • Its main application seems to be as a reagent in the Belousov-Zhabotinsky (B-Z) “oscillating clock” chemical reaction. As potassium bromate is not an important chemical in the context of the school science curriculum, and as there are alternative “oscillating clock” reactions that use safer reagents, our current position, pending a final decision on our Recommended List of Chemicals, is that the limited applications for potassium bromate in school science do not justify the risks associated with its use.

If its use is contemplated, we strongly advise that this be subject to meeting the requirements of a **strict, local risk assessment process**, and then **only as a demonstration activity undertaken by qualified staff**. • Elements for consideration in a risk assessment would be the **avoidance of any risk of human exposure to the chemical**, the availability of similar demonstrations that use safer reagents, the disposal of unused potassium bromate and any wastes generated in the activity, purchase in minimum quantities, short-term storage of the chemical, and the levels of qualification and experience of staff proposing to undertake the activity. •

The proposed use for potassium bromate:

When the question was first raised, the Science ASSIST team was particularly concerned because at that stage there was no indication of the planned purchase quantity, management, or use, and no information as to the qualifications of the person(s) conducting the activity. • With just the information provided, we would strongly advise against the use of potassium bromate in a school.

Through further correspondence, we now understand that the proposed activity is the Belousov-Zhabotinsky (B-Z) chemical oscillating (“clock”) reaction that uses relatively small quantities, and will be conducted by a trained staff member at low temperatures and with minimal generation of vapours and using relevant Personal Protective Equipment (PPE). • These factors provide some reassurance that the activity can be safely managed, however, the use of safer alternative reactions is recommended.

Alternative “oscillating clock” demonstrations:

Two examples of alternative oscillating reactions:

- The “Blue bottle”
<https://projects.ncsu.edu/project/chemistrydemos/Kinetics/Blue%20Bottle.pdf>
- The Briggs-Rauscher reaction <https://www.thoughtco.com/briggs-rauscher-oscillating-color-change-reaction-602057>

Potassium bromate safety information:

Regarding the use of potassium bromate, it is the carcinogenic classification that raises the most serious concern for use in school science. • It is listed in the World Health Organisation's International Agency for Research on Cancer (IARC) Monographs on the evaluation of carcinogenic risks to humans as Group 2B (Possibly carcinogenic to humans). It is classified as Carcinogen Category 2 on the Safe Work Australia Hazardous Substances Information System (HSIS) with the new classification of Category 1B (presumed human carcinogen based on demonstrated animal carcinogenicity) under the GHS classification system. • It is very clear that any human exposure to this chemical is to be avoided. •

Potassium bromate carries the following GHS information:

- Pictograms:
 - GHS 03 Flame over circle
 - GHS 06 Skull and crossbones
 - GHS 08 Health hazard
- Signal Word "Danger"
- Hazard Statements
 - May cause fire or explosion, strong oxidiser
 - May cause cancer
 - Toxic if swallowed
- Precautionary Statements
 - Take any precautions to avoid mixing with combustibles
 - Wear fire/flame resistant/retardant clothing
 - Keep away from heat/sparks/open flames/hot surfaces. No smoking
 - If swallowed: immediately call a POISON CENTRE or doctor/ physician
 - Store locked up
 - Dispose of contents/container in accordance with local/regional/national/international regulations

Due to its carcinogenic category, its toxicity and its strong oxidising properties, if a school decides to use potassium bromate, it is essential that engineering controls, such as a fume cupboard is used and relevant PPE, such as safety glasses, gloves, lab coat and closed in shoes are worn when handling this chemical. Storage should be kept to minimum quantities in an appropriately labelled and sealed container, segregated from incompatible substances, as well as protected from sunlight and moisture in a secure chemical store. • If potassium bromate is purchased, then we recommend that schools minimise the management issues by purchasing a small pack size such as 100g rather than the more common 500g chemical pack size. •

Chemicals Approved for Use in Schools:

Science ASSIST has developed a list of recommended chemicals for use in schools. • Potassium bromate has been included on that list as it is acknowledged that there are currently a small number of carcinogenic chemicals that are commonly managed and used in senior school chemistry, with this use based on their specific relevance to the science curriculum, and on the lack of available safer substitutes. Potassium dichromate is an

example. •

Hazardous Chemicals for Demonstration Purpose Use Only:

The Science ASSIST team recognises that there are some requirements for the special use of hazardous chemicals for demonstration purposes that lie outside usual student use and curriculum requirements. • It is not our intent to unnecessarily restrict such activities, but to support their safe conduct. •

In developing and maintaining the recommended list for schools, consideration is given to setting guidelines for such a category of chemicals. These guidelines include the following:

- The school undertakes a detailed (written) Risk Assessment on the management, storage and use of the chemical prior to purchase. •
- The teacher who is conducting the activity must be trained in its use.
- Purchase can proceed only if the Risk Assessment indicates that there are adequate control measures for the storage, use and disposal of the chemical.
- Purchase quantity is limited to the minimum available required for the planned activity.
- After the activity, unused quantities of the chemical must be disposed of in an appropriate way, either immediately, when the teacher leaves employment at the school, or in any case within twelve months.

References

Chem-Supply Pty Ltd Safety Data Sheet: Potassium bromate. Please search the product information page of the Chem Supply website for the latest version:

<https://www.chemsupply.com.au/>

Chemwatch, Material Safety Data Sheet: Potassium bromate, issue date 25/1/2013
www.chemwatch.net • (subscription required)

IARC Monographs. *Agents classified by the IARC Monographs.*

<https://monographs.iarc.fr/agents-classified-by-the-iarc/> (Updated July 2018)

Safe Work Australia. 2015. *GHS Hazardous Chemical Information List*

http://hsis.safeworkaustralia.gov.au/GHSInformation/GHS_Hazardous_Chemic...

Safe Work Australia. 2012. *Guidance on the Classification of Hazardous Chemicals under the WHS Regulations* <http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/g...>

Safe Work Australia. 2014. *Hazardous Substances Information System (HSIS) Consolidated Listing.* <http://hsis.safeworkaustralia.gov.au/ConsolidatedLists>

Sigma Aldrich Safety Data Sheet: Potassium bromate, issue date 15/04/2013

<http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang...>

United Nations Institute for Training and Research (UNITAR). 2010. *Understanding the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) A Companion Guide to the GHS Purple Book*

http://cwm.unitar.org/publications/publications/cw/ghs/GHS_Companion_Gui...

.....

Source URL: <https://assist.asta.edu.au/question/2749/potassium-bromate>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Potassium iodide status and EUDs

Potassium iodide status and EUDs

Posted by Anonymous on Fri, 2019-02-15 10:09

Potassium iodide status and EUDs: Can you confirm whether potassium iodide is allowed in WA schools and can you explain what an EUD is?

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Potassium iodide status and EUDs

Submitted by sat on 15 February 2019

Potassium iodide is permitted in WA schools. However, it is important to be aware that iodine and all iodide salts have been identified as precursor chemicals that could be used in the illicit

manufacture of drugs.¹ This has implications for both the supply and storage.

Supply of chemicals and End User Declarations: Iodine and iodide salts are listed as Category II illicit drug precursor chemicals, which means that they require an End User Declaration (EUD) prior to their supply, when sold to non-account customers.¹ Different states and territories may currently have different conditions concerning requirements for EUDs, but this is in the process of being harmonized across Australia.²

In general, the following information is required on an EUD:

- the name and address of the purchaser,
- proof of identity of the purchaser such as passport number or driver's licence number,
- name and quantity of the chemical to be supplied plus its intended use.

Some companies require an EUD for every order request.

The person responsible for the chemical's end use should complete and sign the End User Declaration. This should be a senior member of staff such as the Head of the Science Department.

Note: It is not the responsibility of the science laboratory technician to complete this form.

Storage: Iodine and iodide salts should be stored locked up³ to prevent unauthorised access. It is best practice to store minimal quantities of all chemicals to enable easier management of chemical segregation and chemical stocktaking.

Regular checks of stock levels are recommended to fully account for all chemicals, including their location.

References and further reading:

¹ 'Code of Practice for Supply Diversion into Illicit Drug Manufacture', Chemistry Australia website, <https://chemistryaustralia.org.au/Content/drugs.aspx> (Accessed February 2019)

² 'Precursor Chemicals and Equipment [Decision]', Regulation impact statement updates, Department of the Prime Minister and Cabinet website, <https://ris.pmc.gov.au/2017/01/06/precursor-chemicals-and-equipment-deci...> (6 January 2017)

³ Chem-Supply. 2017. Potassium iodide, Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/PL0011CH5J.pdf>

•

'Restricted products', Chem Supply website, <https://www.chemsupply.com.au/restricted-products> (Accessed 4 February 2019)

Science ASSIST. 2018. Science ASSIST Chemical Management Handbook –Edition 3, Science ASSIST website, <https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au...>

Science ASSIST. 2015. AIS: School science area security, Science ASSIST website, <https://assist.asta.edu.au/sites/assist.asta.edu.au/files/AIS%20-%20Scho...>

Source URL: <https://assist.asta.edu.au/question/4429/potassium-iodide-status-and-euds>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Recommended Chemicals for secondary Schools

Recommended Chemicals for secondary Schools

Posted by Anonymous on Thu, 2017-08-24 10:54

Recommended Chemicals for secondary Schools: I have to order new chemicals for our school in QLD, but the following chemicals are not in the list

"List_of_recommended_chemicals-18March-2016.

Iron (III) chloride Anhydrous, Iron (III) chloride hexahydrate, Iron (III) nitrate, Iron Sulfate powder, Lead (II) chloride, Lithium carbonate.

Does this mean that these chemicals are prohibited?

Also, Potassium Chlorate is listed as prohibited in your Science Assist Chemical Management handbook 2017 but it is in the list mention above.

Could you please clarify this for me?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Recommended Chemicals for secondary Schools

Submitted by sat on 14 September 2017

In brief:

The inclusion of a chemical in the List of recommended chemicals¹ or in the Chemical Management Handbook² indicates that the chemical is suitable for use in schools. We have not published a list of prohibited chemicals.

The absence of a chemical from the List of recommended chemicals or from the Chemical Management Handbook, does not mean that the chemical is prohibited from use in schools. However, some jurisdictions have banned the use of certain chemicals and we have taken this into consideration in the development of the List. Schools are required to follow the policies and directives of their educational jurisdiction.

The List of recommended chemicals is an evolving document and will be updated in response to feedback, changes to safety data and changes to practices in school science.

Regarding the specific chemicals that you mention:

- **Iron (III) chloride Anhydrous and Iron (III) chloride hexahydrate:** You are correct that these have not been included. We will include Iron (III) chloride hexahydrate as this form is not classified as a Dangerous Good.
- **Iron (III) nitrate:** is already included in the List of recommended chemicals
- **Iron Sulfate powder:** Iron (II) sulfate heptahydrate is included in the List of recommended chemicals.
- **Lead (II) chloride:** We are not aware of a specific curriculum requirement for this chemical. • It is important to limit the amount and concentration of lead substances stored and used due to their toxicity. We have included three lead-containing substances in the List: lead metal, lead (II) nitrate and lead (II) oxide. • These are included because we consider that they allow for some worthwhile demonstrations and activities and that their associated hazards can be reduced to an acceptable level with safe practices. Lead (II) nitrate is included because it is a soluble lead salt; we recommend that it is only used by students as a solution of concentration 0.5M or less. • See an earlier Q&A for more detailed information <https://assist.asta.edu.au/question/3288/lead-and-lead-salts>
- **Lithium carbonate:** We are not aware of a specific curriculum requirement for this chemical and have not included this because it is not very soluble. The more soluble salts have greater application and therefore, we have included lithium chloride, due to its solubility in water.
- **Potassium chlorate:** is not included in the List of recommended chemicals and we note that it is banned in Queensland Department of Education schools.³

Regarding ordering chemicals for your school:

Prior to purchasing chemicals for your school, it is important to conduct a risk assessment and

research whether the chemical is suitable for use in your school. Aspects to consider include:

- If the chemical is prohibited or restricted in your jurisdiction
- the hazards of the chemical
- if a less hazardous chemical can be used
- safe handling procedures, how it will be used and if any hazardous by-products will be produced
- requirements for safe and secure storage especially if it is a toxic chemical, a chemical of a security concern or a chemical that may be used in the illicit drug manufacture
- licensing/purchasing requirements or restrictions
- disposal considerations and costs

The Queensland Department of Education and Training have a good checklist in Appendix 4A of their publication 'Guideline for managing risks with chemicals in DETE workplaces'³, see <http://education.qld.gov.au/health/pdfs/healthsafety/guideline-managing-...>

References:

¹ Science ASSIST. 2016. List of Recommended Chemicals for Science in Australian Schools. <https://assist.asta.edu.au/question/4230/recommended-chemicals-secondary...>

² Science ASSIST. 2017. Chemical management Handbook. Edition 1. <https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au...>

³ Department of Education, Training and Employment. 2013. 'Guideline for managing risks with chemicals in DETE workplaces' DETE Website. <http://education.qld.gov.au/health/pdfs/healthsafety/guideline-managing-...>

•"Iron (III) chloride anhydrous" Safety Data Sheet. 2014. Merckmillipore website. http://www.merckmillipore.com/INTERSHOP/web/WFS/Merck-AU-Site/en_US/-/US... (Fixed broken link, October 2018).

"Iron (III) chloride hexahydrate" Safety Data Sheet. 2015. Chem-Supply website. <https://www.chemsupply.com.au/documents/FL0231CH3C.pdf>

Source URL: <https://assist.asta.edu.au/question/4230/recommended-chemicals-secondary-schools>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Sulfuric acid - going brown

Sulfuric acid - going brown

Posted by Anonymous on Fri, 2017-09-01 11:29

Sulfuric acid - going brown: Would you please tell me why concentrated sulfuric acid goes brown?

Also, if you use a diluted solution (2M) of the brown acid as part of the standardisation of potassium permanganate, will it work and are results reliable?

Voting:•



No votes yet

Year Level:•

7

8

9

10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Sulfuric acid - going brown

Submitted by sat on 23 September 2017

Physical appearance of sulfuric acid

Concentrated sulfuric acid when pure is generally a clear, viscous, colourless to slightly yellow corrosive oily liquid¹. Occasionally during manufacture it is dyed a brown colour to highlight its hazards¹.

Part 9 of the manufacturer's SDS (Physical and Chemical Properties) for sulfuric acid should be consulted for information on the form and appearance if there is any uncertainty about what it should look like².

Contamination of sulfuric acid

If your concentrated sulfuric acid has changed colour since purchase then it is likely to be an indication of an impurity or contaminant. Sulfuric acid can appear as a yellow to brown colour when contaminated with certain metals mainly iron and organic material^{3,4}. Sulfuric acid is a very strong dehydrating chemical and is hygroscopic.

Issues using contaminated sulfuric acid in experiments

If you are unable to identify the type of contamination in your sulfuric acid you would not be able to determine if it would be safe to use as you could not assess for any unwanted reactions. It is important to know what you are working with to be able to identify and assess any hazards and implement controls.

You also need to consider whether the sulfuric acid will be suitable for the purpose. The activity you describe requires conducting a titration. In a titration you are required to read an end point due to a sensitive colour change. This colour change may be masked and difficult to read due to the presence of any colour in the reagents being used.

Recommendations

Science ASSIST recommends that you dispose of the contaminated sulfuric acid and prepare a fresh solution from a pure uncontaminated acid.

Science ASSIST also recommends that schools assess their chemical stocks periodically. Chemicals should be purchased in minimal quantities and should be inspected for any change in the colour and form, absorption of any water and any cloudiness or crystals which may develop in a liquid.

Further information on sulfuric acid can be obtained from our Chemical Management Handbook [Chemical Management Handbook for Australian schools](#)

References:

¹ 'Sulfuric Acid', Chemwatch website, <https://www.chemwatch.net/news> (Accessed September 2017)

²Chem-supply. 2013. *Sulfuric Acid 52-98%* , Safety Data Sheet, Chem-supply website, <https://www.chemsupply.com.au/documents/SA0081CH72.pdf> (April 2013)

³Flinn Scientific. 2016. *Acid Safety – Safety Tips for Using Acids in School Laboratories*, <https://www.flinnsci.com/api/library/Download/1f8f76d330554992ae36ef25b1...> (Link updated May 2020)

⁴ ‘Sulfuric acid’, Sciencemadness Wiki website, http://www.sciencemadness.org/smwiki/index.php/Sulfuric_acid (Accessed September 2017)

International Labour Office. nd. *Chapter 104 - Guide to Chemicals, Encyclopaedia of Occupational Health and Safety*, 4th Edition. International Labour Office website, <http://www.ilocis.org/documents/chpt104e.htm> (Accessed September 2017)

‘Sulfuric acid’, ChemSpider website, <http://www.chemspider.com/Chemical-Structure.1086.html>

‘Sulfuric acid’, National Pollutant Inventory website (Australian Government Department of Environment and Energy, <http://www.npi.gov.au/resource/sulfuric-acid> (Accessed September 2017)

Source URL: <https://assist.asta.edu.au/question/4235/sulfuric-acid-going-brown>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Sulfur Hexafluoride

Sulfur Hexafluoride

Posted by Anonymous on Fri, 2015-02-13 15:17

Sulfur hexafluoride: I require information on availability, safety, cost and suppliers of sulfur hexafluoride. I would also appreciate advice from anyone with experience in using and disposal of the gas. Thank you.

Voting:•



No votes yet

Year Level:•

7
8
9
10

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Sulfur Hexafluoride

Submitted by sat on 26 February 2015

Sulfur hexafluoride (SF₆) is a colourless, odourless gas which is produced from the reaction of sulfur with fluorine gas. It is a very unreactive gas which has a density about five times greater than that of air. •

Sulfur hexafluoride has a very low toxicity but, as with other gases, it poses an asphyxiation hazard as it can displace air. Its high density means that it will accumulate in low-lying areas and therefore, good ventilation must be ensured in an area where the gas has been released.

When inhaled, sulfur hexafluoride has the effect of lowering the timbre of the voice, the opposite effect of a gas of low density, such as helium. Inhaling sulfur hexafluoride is very dangerous as the high density of the gas makes it difficult to expel from the lungs. Therefore, there is a significant risk of death by asphyxiation in carrying out this activity. Inhaling any inert gas can have serious health consequences and can potentially lead to asphyxiation; please see the references below for more information about the dangers of inhaling industrial gases.

Sulfur hexafluoride is a potent greenhouse gas, which does not break down in the atmosphere, and has a very high global warming potential 23,900 times that of carbon dioxide. Due to its low reactivity, the only way to dispose of sulfur hexafluoride is to release it to the atmosphere. As it is a greenhouse gas, the importation of sulfur hexafluoride is subject to licensing and handling requirements and its cost is quite high – probably prohibitive for most schools. •

Taking into consideration the asphyxiation hazard of using sulfur hexafluoride, as well as the environmental concerns, Science ASSIST does not endorse the use of sulfur hexafluoride in schools and recommends that schools do not carry out any activities, experiments or demonstrations using sulfur hexafluoride.

•

Substitution of a safer alternative

To demonstrate a gas with a greater density than air, the less hazardous and cheaper alternative to sulfur hexafluoride is carbon dioxide, which has a density 1.6 times that of air. This property of carbon dioxide can be demonstrated by floating bubbles on a bed of the gas or by ‘pouring’ the gas from a jug or bucket into a vessel which contains lighted candles of different heights. ••

Dry ice also has associated cryogenic and asphyxiation hazards; please see the Science ASSIST Standard Operating Procedure '[SOP: Handling dry ice](#)' for more information.

Another alternative is to show a *YouTube* video that demonstrates the properties of sulfur hexafluoride. •For example, <https://youtu.be/DzLX96VWTkc> demonstrates the buoyancy of the gas. (Note: We advise against promoting videos that encourage the extremely hazardous practice of inhaling this gas.)

References

Australian Government Department of Sustainability, Environment, Water, Population and

Communities, 2012, Sulfur hexafluoride (SF₆) and the equivalent carbon price, <https://web.archive.org/web/20130509133305/http://environment.gov.au/atm...> • (Link updated to Internet Archive copy, July 2019)

Bennett H., 2019. *Magnificent molecules: Sulfur hexafluoride*. Royal Society of Chemistry website. <https://edu.rsc.org/magnificent-molecules/sulfur-hexafluoride/4010538.ar...> [Reference added February 2020]

Scottish Environment Protection Agency, Scottish Pollutant Release Inventory, Sulfur hexafluoride, <http://apps.sepa.org.uk/spria/Pages/SubstanceInformation.aspx?pid=10> • Accessed February, 2015.

Wilkinson, Steven. Science Business Manager, Investigative Chemistry Division, ChemCentre, Curtin University, Bentley W.A. (Personal communication, February, 2015)

Further information on the dangers of inhaling helium, sulfur hexafluoride and other industrial gases

Australia New Zealand Industrial Gas Association, Safety Advice No. 22, The Dangers of Industrial Gas Abuse, October 2012, http://www.anziga.org/public/editor_images/Publication/142_-022_Safety_A...

ELGAS LPG, Be Gas Wise - Community Service Announcement, November 16 2014, <https://youtu.be/0ln9O0CXAFs>

Hahn, Eric, ELGAS LPG Gas Blog, Helium Balloon Gas Safety, <http://www.elgas.com.au/blog/1030-helium-balloon-gas-safety-don-t-be-a-d...> • Accessed February 2015

News Limited, Inhaling gas from helium balloons no laughing matter, it can kill, November 15, 2014, <http://www.news.com.au/lifestyle/health/inhaling-gas-from-helium-balloon...>

Source URL: <https://assist.asta.edu.au/question/2654/sulfur-hexafluoride>



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Use of iron III nitrate and zinc nitrate

Use of iron III nitrate and zinc nitrate

Posted by Anonymous on Thu, 2015-09-24 10:14

Use of iron III nitrate and zinc nitrate: Is it still okay to use iron III nitrate and zinc nitrate, as they are not listed on the Recommended List of Chemicals for Schools. We currently make up 0.5 M solutions of each to use in Year 11 & 12 Chemistry to look at half cells and the electrochemical series. Should we continue to use them and/or are there recommended alternatives?

Voting:•



No votes yet

Year Level:•

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-2 of 2 Responses

Use of Iron III Nitrate and Zinc Nitrate

Submitted by sat on 23 October 2015

Thank you for your question regarding the use of iron (III) nitrate and zinc nitrate. They are both suitable for use in schools.

Iron (III) nitrate is on the list and the zinc nitrate should be included in the list of recommended chemicals. Thank you for bringing this to our attention.

Both these chemicals are now on the List of recommended chemicals for science in Australian schools.

Use of Iron III Nitrate and Zinc Nitrate

Submitted by sat on 14 January 2016

In response to the part of your question regarding half-cells:

Yes, you can continue to use these solutions, although we suggest using iron (II) sulfate, rather than iron (III) nitrate, in an Fe/Fe^{2+} half-cell (or using a mixture of iron (II) sulfate and iron (III) sulfate, if you are preparing an $\text{Fe}^{2+}/\text{Fe}^{3+}$ half-cell).

Concentrations of 0.5 M achieve a better voltmeter reading than 0.1 M solutions. Aqueous solutions of nitrates are usually used in half-cells as the nitrates ions will not interfere with the electrochemical reaction by being oxidised or reduced and will not form any precipitates.

A half-cell consists of an electrode partially immersed in an aqueous solution. A potential difference is developed between the positively charged solution and the negatively charged electrode when connected to a standard hydrogen electrode. A number of different half-cells can be used.

Typical half-cells

- Copper metal in an aqueous solution of copper (II) nitrate
- Zinc metal in an aqueous solution of zinc (II) nitrate
- Magnesium metal in an aqueous solution of magnesium nitrate
- Aluminium metal in an aqueous solution of aluminium nitrate

Note: Aqueous solutions of the metal sulfates can also be used for the copper, zinc, magnesium and aluminium half-cell.

- Iron metal in an aqueous solution of iron (II) sulfate
- Lead metal in an aqueous solution of lead (II) nitrate

Note: Before using lead or its compounds, a risk assessment should be prepared taking into consideration its toxicity, level of student compliance, quantities used and clean up procedures.

Science ASSIST recommendations

- Consult SDSs before using any chemicals.
- Safety glasses and lab coats should be worn throughout the laboratory activity.
- General laboratory hygiene, such as washing hands before leaving the laboratory,

should be observed.

- All used solutions should be collected and disposed of in a heavy metal wastes container.
- Metal strips can be cleaned and reused.

Additional information

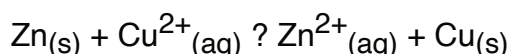
An electrochemical cell comprises of two half-cells joined by a salt bridge. In one half-cell, oxidation of a metal electrode occurs, while in the other half-cell there is the reduction of metal ions in solution. The half-cell with the most negative electrode potential forms the negative terminal (anode). Oxidation occurs at the anode. Reduction occurs at the positive terminal (cathode). The salt bridge usually contains a saturated solution of sodium or potassium nitrate or chloride. The salt bridge allows the flow of ions from one half-cell to another without the mixing of the two solutions. The salt bridge also maintains electrical neutrality of the solutions in the two half-cells and completes the electrical circuit.

Consider the electrochemical cell consisting of the 2 half-cells expressed in the following half equations:



Copper (II) ions have a higher standard electrode potential value and are a stronger oxidant than zinc ions. At the zinc anode, Zn^{2+} ions are released into the solution of the half-cell while at the copper cathode, Cu^{2+} ions are reduced to metallic copper.

The overall equation is:



References.

C Lewis and P Lewis, *Chemistry for WA2 Stage 3: Units 3A and 3B* (Pearson, 2013) ch9.



ASSIST

AUSTRALIAN SCHOOL SCIENCE
INFORMATION SUPPORT FOR
TEACHERS AND TECHNICIANS

Published on ASSIST (<https://assist.asta.edu.au>)

[Home](#) > Use of lead in ACT schools

Use of lead in ACT schools

Posted by Anonymous on Thu, 2016-09-08 11:14

Use of lead in ACT schools: From reading answers to another question, it's my understanding that lead is banned in some Australian jurisdictions, and approved or restricted in others.

Can anyone tell me if lead (solid, lead shot, salts) is allowed to be used in Years 7 to 10 in ACT class rooms? Or where exactly I go to find this out?

Voting:•



No votes yet

Year Level:•

7
8
9
10

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Use of lead in ACT schools

Submitted by sat on 16 September 2016

Variation in school policies: You are correct that there are significant variations between the practices and local policies of the states and territories and educational jurisdictions with

regard to chemicals used in school science. We understand that there are no formal lists of chemicals to be used or banned in ACT schools and that schools are directed to consider information from a chemical's Safety Data Sheet (SDS) or other advisory information to make judgements and decisions on the suitability of staff/students handling particular chemicals.

Chemicals in science: In order to remove the duplication and variation that exists, Science ASSIST has developed a List of recommended chemicals for science in Australian schools. The list is not intended to supersede the advice of the educational jurisdictions; schools are subject to the policies and directives of their educational jurisdiction with regard to the use of chemicals in science. It is therefore important that schools consult their school governing body to determine the policies and procedures that they are required to follow with regard to chemical use. Some school jurisdictions have set policies and some sectors allow this to be a school based decision. In the absence of any specific formal directives, schools should conduct their own site specific risk assessment and could consider adopting the List of recommended chemicals for science in Australian schools.

Use of lead: When Science ASSIST did a comparison between different jurisdictions, lead metal was permitted in all jurisdictions although it was noted as being a high risk substance in Queensland¹. There was much variation between jurisdictions regarding the use of lead salts, from being approved, restricted to year 11 and 12 through to being banned. Science ASSIST considers that although there are health hazards associated with lead, by implementing appropriate controls such as restricting the number of lead-containing substances used in science and ensuring safe handling procedures, the risks can be safely managed within the school setting.

Lead-containing substances: We have included only three lead-containing substances: lead metal, lead nitrate (in solution for students) and lead (II) oxide. •These are included because we consider that they allow for some worthwhile demonstrations and activities and that their associated hazards can be reduced to an acceptable level with safe practices. It is recommended that any reactions using lead or its compounds be conducted on a conservative scale and that other materials be substituted for lead where possible (e.g. using lead-free solder in electronics).•

Safe procedures: for handling solutions would include using small quantities for short amounts of time, wearing appropriate PPE such as gloves and safety glasses as well as good laboratory hygiene such as cleaning up any spills, no eating or drinking in laboratories and washing hands at the end of all laboratory sessions. When making up solutions from the solid chemicals the additional control of conducting this in an operating fume cupboard should be used. Schools may prefer to purchase some chemicals in solution form, rather than prepare the solution on site.

Here are some links to previous questions that we have answered:

Lead and lead salts contains an explanation regarding the suitability and reasoning for the applications of lead and selection of lead salts in school science activities

Use of chemicals contains safe handling considerations for lead nitrate and phenolphthalein

Links to School sectors in the ACT:

ACT Government Education Directorate home page. ACT Government Education Directorate website, <https://www.education.act.gov.au/> (Accessed September 2016)

Catholic Education Archdiocese of Canberra and Goulburn home page, Catholic Education Office Archdiocese of Canberra and Goulburn website, <https://cg.catholic.edu.au/>• (Accessed September 2016)

The Association of Independent Schools of the ACT homepage, AISACT website, <https://ais.act.edu.au/> (Accessed September 2016)

Reference

¹Queensland Department of Education. 2020, *Guideline for Managing Risks with Chemicals in DoE Workplaces*. Queensland DoE website. <https://mpe.education.qld.gov.au/initiativesstrategies/Documents/guideli...>•(Link updated May 2021)

Source URL: <https://assist.asta.edu.au/question/4070/use-lead-act-schools>