

Chemicals: What's in? What's out?



Mention the word *chemistry* in a middle level classroom and the first thing students want to know is, “Will we be blowing anything up?” Chemistry should be fun and exciting, but much preparation and skill are needed by the teacher and students in working with chemicals. Unfortunately, accidents do happen and things can blow up, but you can help prevent these incidents by knowing and following proper safety procedures. Knowing which chemicals are appropriate for the middle level classroom is a good place to start.

Some chemicals, though still found in middle school inventories, are considered too hazardous to store and use. Unfortunately, some school science curricula require experiences

in labs or demonstrations that have made our “what is out” list. Should this be the case, extreme caution, preparation, planning, personal protection equipment (PPE), appropriate facilities, and proper disposal are all required.

The Occupational Safety and Health Administration’s (OSHA) Laboratory Standards requires the employer in most states to develop a Chemical Hygiene Plan (CHP). The CHP needs to address chemical use or non-use policy with input from science employees. This is a good starting point for professional dialogue on the appropriate selection of chemicals for use in the middle school.

What's in?

The following chemicals can be considered for use in hands-on middle school science programs. However, the teacher should review the character of each chemical or compound by consulting the appropriate Material Safety Data Sheet. Appropriate precautions, such as PPE and ventilation, are an absolute must for safe use of any and all chemicals. Please note that this brief list represents the most common types. There are other chemicals that can be considered safe. MSDSs need to be reviewed prior to use. Note also that all acids and bases listed are in a dilute, not concentrated form.

- Activated charcoal (carbon)
- Alka-Seltzer tablets
- Alum (several compounds containing aluminum and sulfate)
- Aluminum foil (aluminum metal)
- Ammonia water (aluminum hydroxide)
- Baking powder (sodium aluminum sulfate)
- Baking soda (sodium bicarbonate)
- Beet or cane sugar (sucrose)
- Borax (sodium borate)
- Boric acid
- Calcium chloride salt (calcium chloride)
- Chalk (calcium chloride)
- Club soda (carbonic acid)
- Copper wire (copper metal)
- Corn starch
- Cottonseed oil
- Cream of tartar (potassium bitartrate)
- Denatured alcohol (ethanol)
- Epsom salts (magnesium sulfate)
- Flowers of sulfur (sulfur)
- Fruit sugar (fructose)

Glycerin (glycerol)
Grape or corn sugar (glucose)
Graphite (carbon)
Hydrogen peroxide solution (hydrogen peroxide)
Iron filings (iron metal)
Olive oil
Plaster of Paris (calcium sulfate)
Rubbing alcohol (propanol 2)
Salt (sodium chloride)
Table salt (sodium chloride)
Table sugar (sucrose)
Vinegar (acetic acid)
Vitamin C (ascorbic acid)

What's out?

The following list represents common chemicals that may be found in middle school science labs or storerooms and should be removed due to their hazardous nature. Remember that any chemical can be considered hazardous if not used appropriately. Again, consult the MSDS for additional information.

Ammonium dichromate— $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (toxic byproducts)
Benzene (carcinogen)
Calcium carbide— CaC_2 (explosion hazard)
Carbon tetrachloride— CCl_4 (carcinogen)
Chloroform— CHCl_3 (carcinogen)
Concentrated inorganic/mineral acids such as hydrochloric acid— HCl , nitric acid— HNO_3 , sulfuric acid— H_2SO_4 (corrosive, serious burn and eye hazard)
Copper sulfate (toxic)
Diethyl ether (forms explosive peroxides)
Dry ice—carbon dioxide (frostbite and blisters)
Elemental mercury— Hg (highly toxic)
Elemental potassium— K (forms explosive oxides)
Elemental sodium— Na (dangerous reactions with water)
Formaldehyde— HCHO (carcinogen)
Hydrogen sulfide— H_2S (toxic vapors)
Iodine— I_2 (respiratory irritant)
Lead compounds such as lead chloride— PbCl_2 , lead nitrate— $\text{Pb}(\text{NO}_3)_2$ (one or more are potential carcinogens, toxic)
Magnesium strips— Mg (burn hazard)
Mercury salts such as mercuric sulfate— HgSO_4 (toxic)
Methanol or methyl alcohol— CH_3OH (toxic)
Mineral talc— $\text{Mg}_3\text{Si}_4\text{O}_{10}$ (can cause asbestosis)
Picric acid—2,4,6-trinitrophenol (explosive crystals)
Potassium chlorate— KClO_3 (can cause violent reactions)
Silver cyanide— AgCN (toxic)

Sodium hydroxide— NaOH (caustic)
Vinyl chloride— $\text{CH}_2=\text{CHCl}$ (carcinogen)
White phosphorous— P (fire hazard)

Chemical watch!

The study of chemistry concepts and hands-on chemistry activities belong in the middle school science curriculum. Teachers need to make sure they understand and respect chemicals by being informed. Often, simple substitutes can work just as well as a chemical that presents a safety concern. Be on your guard by using the first line of defense—the Material Safety Data Sheet.

Resource

The following print resource has useful information relative to chemical use:

Kwan, T., and J. Texley. 2002. *Inquiring safely: A guide for middle school teachers*. Arlington, Va.: NSTA Press.

Question of the month

I have inherited a very old chemistry closet with chemicals that are missing labels and are eating through bottles—what a mess! There are no MSDSs and I need to know where to get them. We had a number of very dangerous problems this past school year. I am having all unlabeled or deteriorating bottles removed by a licensed company. Any advice?

Answer

Any chemicals missing labels or in compromised containers need to be professionally removed and appropriately disposed of by a licensed and bonded chemical disposal company. Make sure they are reputable by checking with your state's Better Business Bureau for the company's history relative to complaints and credibility.

Relative to the MSD sheets, if there is a label, try contacting the chemical company noted and ask for the specific MSDS. If that is not available, there are a number of free and subscription websites having MSD sheets. Two useful sites are:

MSDS Search at www.msdssearch.com. This is a national repository.

MSDS on the Internet at www.ilpi.com/msds. This excellent site lists specific free and subscription MSDS websites on the Net for use.

Do you have a question?

Submit questions relative to safety in the middle school science laboratory to Ken Roy at Royk@glastonburyus.org.