Chemistry 11

# Unit 1: Safety in the Laboratory

1. Safety Equipment & Common Lab Rules
2. The Five Chemical Hazards
3. Hazard & WHMIS symbols
4. Accidents & Accident Prevention

## Safety in the Chemistry Lab

- Fire escape route
- Fire alarms
- Fire extinguishers
- Fire blanket
- Gas outlets
- Main gas shutoff
- Eyewash
- Fume Hood

- Safety shower
- Safety goggles
- Aprons
- Spill kits
- Buffer solution

## GENERAL SAFETY PRECAUTIONS

1. Unauthorized experiments are prohibited. Do only those experiments assigned by your teacher.
2. Never work alone in a science laboratory or storage area, and never work without the teacher's supervision.
3. Never eat, drink, smoke, or chew gum in a science laboratory or storage area. Do not store food or beverages in the laboratory environment.
4. Wear protective eye goggles and aprons at all times in the laboratory.
5. Restrain loose clothing (e.g., sleeves, full-cut shirts or blouses, neckties, etc.), long hair, and dangling jewelry.
6. Footwear should cover feet completely; no open-toe shoes.
7. Do not touch chemicals with your hands unless directed to do so. Wash your hands thoroughly before and after work in a science laboratory, and after spill cleanups.
8. Do not hold your face directly over an open container of chemicals. When observing the odor of a substance, fan a small amount of the vapor toward you by sweeping your hand over the top of the container.
9. Never reach over an exposed flame.
10. Use tongs, test-tube holders, or pot holders to handle hot laboratory equipment. Allow ample time for glassware to cool before handling. (Remember, hot glass looks like cool glass.)
11. When using electrical equipment, use only equipment that is in good working order. Never touch electrical equipment with wet hands or place equipment in areas that may be wet.
12. Never use broken or chipped glassware. Be sure all glassware is clean before you use it.
13. Never place flammable materials near an open flame.
14. When heating something in an open container such as a test tube, always point the open end of the container away from yourself and others.
15. Never pipette by mouth.
16. Keep chemicals, bottles, beaker, flasks, etc., away from the edges of the lab bench.
17. Become familiar with the safety precautions for each chemical to be used in an experiment.
18. Know the location of all safety equipment in the laboratory including fire extinguishers, fire blankets, sand, safety showers, an eyewash fountain, and a first-aid kit.

## ACCIDENTS

1. Report any accident or injury, no matter how minor, to your teacher.
2. If a chemical spills on your skin or clothing, wash it off immediately with plenty of cool water and notify your teacher.
3. If a chemical gets into your eyes or on your face, wash immediately in the eyewash fountain with plenty of water. Notify your teacher. Follow your teacher's instructions for washing your eyes.
4. Clean up all spills immediately. Do not pick up broken glassware with your bare hands. Use a dustpan and a brush.
5. If a thermometer breaks, do not touch the mercury. Call your teacher immediately.
6. Smother small fires with a towel. Use a blanket or the safety shower to extinguish clothing fires.

## SAFE CONDUCT AND PROCEDURES

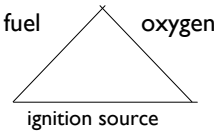
1. Approach laboratory work with maturity. Never run, push, or engage in horseplay or practical jokes of any kind in the laboratory.
2. Always prepare for an experiment by reading the directions in the manual before you come to the laboratory. Follow the directions carefully and intelligently, noting all precautions.
3. Never leave heat sources unattended (e.g., gas burners, hot plates, heating mantles, sand baths, etc.). Turn off equipment when not in use.
4. Always use heat-resistant (Pyrex®) glassware for heating.
5. Use materials only from containers that are properly labeled. Read labels carefully before using chemicals.
6. Never return unused chemicals to the stock bottles. Do not put any object into a reagent bottle, except the dropper with which it may be equipped.
7. Follow the directions from your teacher for the disposal of all chemicals.
8. When diluting acid with water, *always add the acid to the water.*
9. Store all equipment and chemicals in appropriate storage areas.
10. Do not use the sink to discard matches, filter paper, or other solid or slightly soluble materials.
11. Use a lubricant to insert glass tubing or thermometers into rubber stoppers. Do not force glassware into stoppers.
12. Keep your apparatus and desk area clean. Store items not in use such as books, purses, etc., out of the way in designated storage areas.

## 2. The Five Chemical Hazards

- 1. FLAMMABLES
- 2. CORROSIVES
- 3. REACTIVES
- 4. OXIDIZERS
- 5. POISONS

## 1. Flammables

- burn or explode
- Gases (e.g. $H_2$) and volatile liquids (e.g. alcohols) are flammable
- Three conditions are necessary for combustion:




- Remove any one of these to extinguish fire

- Fire extinguisher (5 lbs)
- - Type ABC (dry chemical)
- - A is common materials such as wood/paper
- - B is flammable liquids & C is electrical
- - Baking soda ($NaHCO_3$) pressurized with $CO_2$ gas
- - Duration 20 seconds (small ones 10 sec)
- - Use 4 m back from flames to start then approach slowly
- - Aim at base of flame
- - smothers fire (lack of oxygen)

- DANGERS:
- - can freeze flesh
- - powder can get into eyes and lungs

http://www.youtube.com/watch?v=jQetHlv4y-8

- Fire Blanket
- - made from fibreglass
- - used mainly on people, but may be used on small fires to smother
- - wrap, drop, and roll

http://www.youtube.com/watch?v=Ko9iUJ9Hz50

- Burning metals
- - some metals burn when in powder form
- - used for colour in fireworks
- - iron, magnesium, copper

http://www.youtube.com/watch?v=vltFchuGi0Y

## Assignment / Homework:

- Read Heath Lab Manual, p. vi – vii
- Read Hebden pages 1-8

## 2. Corrosives

- Includes acids and bases
- Destroy living tissue by "burning"
- e.g. $2\ H_2SO_4 + 2\ C_6H_{12}O_6$ -->
- $12\ C + 2\ SO_3 + 14\ H_2O$ + heat energy
- Dilution procedure:
- - always add acid to water so that any splashing is just water

- Caps for concentrated acids are colour coded
- - hydrochloric (HCl) - blue
- - sulphuric ($H_2SO_4$) - yellow
- - nitric ($HNO_3$) - red

- Eyewash fountain
- - use for at least 5 minutes
- - contact lenses must be removed if glass or chemicals in the eye

- Safety Glasses
- - MUST be worn during labs

- Neutralizing Solutions
- - use Spill-X on counter spills
- - use running water and then possibly pH 7 buffer solution on skin
- You'll learn about buffers in Chemistry 12

## 3. Reactives

- React readily together releasing large amounts of heat energy
- E.g. Potassium + water
  (potassium is pyrophoric – it reacts with water, therefore it must be stored in mineral oil)
- $2\ K + 2\ H_2O \rightarrow 2\ KOH + H_2 + energy$

http://www.youtube.com/watch?v=vJslbQiYrYY

## 4. Oxidizers

- Release large quantities of $O_2$, especially if heated
- E.g. Nitrates ($KNO_3$)
- Chlorates ($NaClO_3$)

## 5. Poisons

- Classified into three major groups
- A) neurotoxins - e.g. nicotine, caffeine
- B) metabolic poisons -e.g. carbon monoxide
- C) heavy metals - e.g. Pb, Hg, As

- Wash hands after lab and before eating

### 3. Hazard & WHMIS Symbols

## Safety Symbols

- Combination of:
- - outer shape (and sometimes colour) giving level of hazard
  - inner symbol describing type of hazard

## Level of Hazard

Caution - lowest level of hazard
- often colour coded yellow

Warning - intermediate level of hazard
- often colour coded orange

Danger - highest level of hazard
- often colour coded red

## Types of Hazards

Flammable

Poison/Toxic

Corrosive

Explosive

## Combined Symbols (examples)

Caution
Explosive

Warning
Flammable

Danger
Corrosive

## Other Combinations

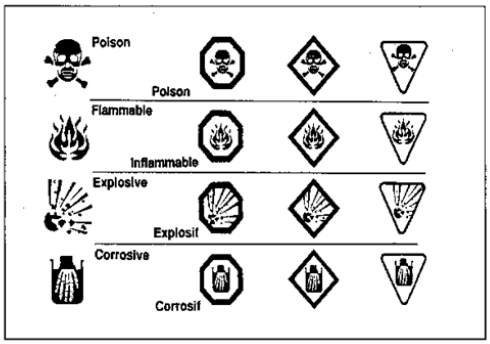


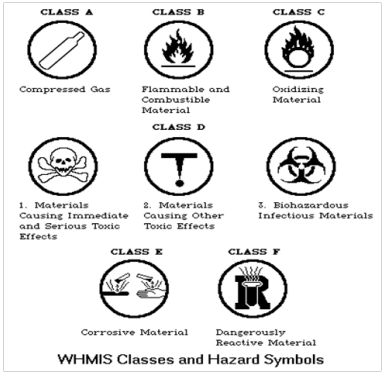

Figure 3-2 Labels for Consumer Products
Figure 3-2 Étiquettes des produits de consommation

## WHMIS Labels

- Workplace Hazardous Materials Information System
- Applies to industrial, commercial and school sites

http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php

WHMIS SYMBOLS




WHMIS Classes and Hazard Symbols

### 4. Accidents & Accident Prevention

## Before Starting Your Experiment

- Read labels on all chemicals so you know what you're dealing with
- Label all glassware
- If unsure about anything, ASK!

## Accident Priorities

- Accidents should be dealt with in this order
- 1) person on fire
- 2) person with chemical or glass in eye
- 3) person with chemical on other parts of body

## Dealing with Accidents

- Remain calm, but act quickly
- Alert teacher
- First Aid Room & First Aid Kit in main office
- First Aid Attendant - call office, they will page
- (Mr. Spigg and Mr. Newell)

## In Case of Fire

- 1) Alert teacher
- Assess situation: can a fire extinguisher or fire blanket deal with the problem?
- 2) If not, pull fire alarm
- 3) Shut off main gas valve
- 4) Exit building in calm manner

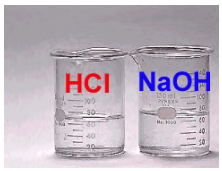
## Disposal of Chemicals

- UNUSED chemicals:
- **NEVER** return to stock bottle because of possible contamination
- Dispose of as instructed

- USED chemicals:
- Dispose of as instructed
- May be harmful to the environment

## Reminder

- To ensure safety, clearly label all beakers and other containers used in lab experiments
- Many chemicals **LOOK** the same!




## Assignment / Homework:

- Read Hebden p. 1 - 8
- prepare for safety symbol quiz on:
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- prepare for safety test on:
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