Staying Safe Around Matter

Warm Up

- Examine each of the following pairs of equipment.
- Consider how the structure of each piece relates to its function.
- Circle the better piece of equipment for each task.

(a) Boiling a solution
(b) Holding a hot test tube
(c) Measuring a volume of liquid
(d) Evaporation over a hot flame

Chemistry Equipment and Its Uses

The equipment used for manipulating and measuring chemicals can be classified in a variety of ways.

One of the **most common methods of classification** is based on the ___________ it is made from.

This classification divides equipment into g__________ and h______________.

Most of the glassware found in the laboratory is made of a special type of glass with a ________*coefficient of expansion*.

This simply means the glass expands so __________ as it is heated that it is ___________ to break.

example: Two common brand names for this type of glassware are Pyrex® and Kimax®.

Other "glassware" is made of ____________ material. *(example ________________________________)*

It may be heated to red-hot temperatures without _________________ or ________________.

Hardware is made of various types of ______________ including wrought iron, stainless steel, aluminum, and brass.
<table>
<thead>
<tr>
<th>Glassware</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
</table>
| ![Image](image1.png) | Beaker | Liquid use:  
- May be graduated (sometimes in two directions)  
- Has a white spot for labeling  
- Various sizes including 50, 150, 250, 450, 650, and 1000 mL |
| ![Image](image2.png) | Erlenmeyer flask | Liquid use:  
- Shape avoids loss due to splashing  
- Used for titration  
- Common sizes include 125, 250, and 500 mL |
| ![Image](image3.png) | Test tube | Liquid or solid use:  
- Can be heated directly or in a water bath  
- May be used to mix small quantities of chemicals  
- Large variety of sizes |
| ![Image](image4.png) | Graduated cylinder | Liquid use:  
- Sizes vary  
- Commonly 10, 25, 50, 100, and 250 mL |
| ![Image](image5.png) | Funnel | Funneling liquids:  
- Useful for pouring liquids through small openings  
- Can contain filter paper for separating solids from suspensions by filtration |
| ![Image](image6.png) | Evaporating dish | Evaporating solvent:  
- Evaporation from a solution  
- Can be used to dry a damp product  
- Ceramic material allows direct heat to high temperatures |
| ![Image](image7.png) | Mantle | Heating covered or partially covered samples:  
- Useful for holding a sample of chemical  
- May cover a beaker or flask to prevent evaporation  
- Holds chemicals while drying  
- Ceramic material may be directly heated until red hot |
<table>
<thead>
<tr>
<th>Hardware</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
</table>
| ![Pipe stem triangle](image) | pipe stem triangle | Providing a base to hold a crucible  
- sits atop a wrought-iron ring  
- stems are made of ceramic material |
| ![Measuring volume](image) | Measuring volumes of liquids  
- liquid is drawn up with a pipette bulb or suction device  
- may be graduated or volumetric *(designed to deliver one specific volume)* |
| ![Measuring temperature](image) | Measuring temperatures  
- bulb should be submerged in the fluid being measured  
- temperature ranges vary  
- most contain dyed alcohol  
- more precise thermometers contain mercury  
- commonly measure temperature in degrees Celsius |

**Table 1.1.2** *Commonly Used Hardware in the Chemistry Lab*

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
</table>
| ![Hardware](image) | Providing a post to attach  
- ring clamps, burette clamps, extension clamps, etc.  
- also called a utility stand |
| ![Hardware](image) | Attaching to a ring stand  
- supports a ceramic pad, a pipe stem triangle, or an evaporating dish  
- may surround a beaker as a safety ring |
| ![Hardware](image) | Attaching to a ring stand  
- holds a burette  
- may hold a test tube in a stationary position  
- may support the neck of a flask |
| ![Hardware](image) | Lighting a Bunsen burner  
- provides a spark by moving a flint across a file |
| ![Hardware](image) | Providing heat  
- adjusts flame temperature by addition of air through the barrel  
- adjusts flame height by turning the regulator valve |
<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Image](image1.png) | Holding test tubes  
• used for heating test tubes over flame  
• used for removing test tubes from water baths |
| ![Image](image2.png) | Holding test tubes  
• during experiments (without heat)  
• while observing substances inside test tubes |
| ![Image](image3.png) | Lifting hot beakers  
• rubber cover allows tongs to firmly grasp and move beakers of all sizes |
| ![Image](image4.png) | Holding hot crucibles  
• may remove or adjust crucible lid  
• holds hot evaporating dishes  
• NOT designed for lifting beakers or test tubes |
| ![Image](image5.png) | Providing a base to hold glassware  
• sits atop a wrought-iron ring  
• provides a flat surface for beakers or flasks  
• sometimes called a wire gauze |
| ![Image](image6.png) | Moving samples of solids  
• sometimes called a spatula  
• should NOT be used as a stirring rod (stirring rods should be glass) |

**Labelling Chemicals**

The WHMIS (Canadian) system is the Canadian system for communicating information about the safety requirements for working with chemicals.

The main components of WHMIS are:  
• a labelling system consisting of eight specialized safety icons (see below)  
• training programs for people who work with chemicals  
• Material Safety Data Sheets (MSDS) providing information about chemicals

![Image](image7.png) poison and infectious material causing other toxic effects

![Image](image8.png) poison and infectious material causing immediate and serious toxic effects
Quick Check

An excerpt from an MSDS for hydrochloric acid solution follows the questions below. An actual MSDS may contain more than 15 sections, each of which may be quite detailed. Read this abbreviated excerpt carefully and answer these questions:

1. What **WHMIS labels** would you expect to find on hydrochloric acid?

2. Give a **synonym** (what else is it called?) for hydrochloric acid.

3. What are the **chemicals that make up** hydrochloric acid?

4. What are the **hazards** of spilling hydrochloric acid **on the skin**?

5. How should you **treat** a person who has **ingested** hydrochloric acid?

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**Material Safety Data Sheet**

1. **Product Identification**
   - Hydrochloric Acid
   - Synonym: Muriatic Acid

2. **Composition/Information on Ingredients**
   - Hydrogen Chloride 38% by weight
   - Water 62% by weight

3. **Hazards Identification**
   - Potential acute health effects
     - Skin Contact: Corrosive, irritant, permeation causing itching, reddening, scaling, or blistering
     - Eye Contact: Corrosive, irritant causing redness, watering, and itching
     - Inhalation: Irritation of respiratory tract, coughing, choking, or shortness of breath
   - Potential chronic health effects
     - May be toxic to: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, circulatory system, and teeth

4. **First Aid Measures**
   - Eye contact: Remove contact lenses, rinse with cold water for 15 minutes, get medical attention immediately.
   - Skin contact: Remove effected clothes, rinse with cold water for 15 minutes, get medical attention immediately.
   - Inhalation: Remove to fresh air, if breathing is difficult; give oxygen, if not breathing; give artificial respiration.
   - Ingestion: If swallowed, do not induce vomiting, loosen tight clothing, get medical attention immediately.

5. **Handling and Storage**
   - Storage: Keep container tightly closed in a cool, well-ventilated area.

6. **Stability and Reactivity Data**
   - Is highly reactive with metals.
   - Reactive with oxidizing agents, organic materials, alkalis and water
1. WHMIS is a:
   _____ Workplace transportation guide
   _____ Environmental system
   _____ Workplace hazardous materials information system
   _____ Workplace hazardous waste disposal system

2. WHMIS has 3 main communication components. They are:
   _____ Labels, MSDS, and training
   _____ Reading, writing and labeling
   _____ Heating, waste and storage
   _____ Stickers, shipping and storage

3. How often do MSDS sheets need to be replaced?
   _____ Every year
   _____ Every 3 years
   _____ Every 5 years
   _____ When needed

4. If you see this symbol it means that the product:
   _____ Is biohazardous
   _____ Is corrosive
   _____ Produces toxic effects immediately upon exposure
   _____ Produces toxic effects after prolonged exposure

5. Products displaying this symbol must be considered:
   _____ Corrosive
   _____ Flammable and combustible
   _____ Biohazardous
   _____ Oxidizing material

6. A Material Safety Data Sheet (MSDS) contains information on the following:
   _____ Hazardous ingredients
   _____ Toxicological Information
   _____ Physical Properties
   _____ All of the above

7. A chemical's characteristics (odor, appearance, etc) will be listed on the MSDS under:
   _____ Reactivity data
   _____ Physical data
   _____ Product identifier
   _____ Toxicological properties

8. Personal protective equipment (PPE) that is recommended on a MSDS:
   _____ Should be ignored
   _____ Does not have to be maintained
   _____ Must be available and used by employees when required
   _____ Does not have to be available on the unit
9. Which of the following is a concern when using respirators:
   ( ) It has to fit properly
   ( ) It has to be cleaned regularly
   ( ) The filter type must match the hazard
   ( ) All of the above

10. The WHMIS symbol for compressed gas is:
    ( ) “T” in a circle
    ( ) a cylinder in a circle
    ( ) a flame in a triangle
    ( ) “G” in a circle

11. The statement is FALSE regarding acute and chronic health effects:
    ( ) Acute refers to sudden or brief effects
    ( ) Chronic relates to long term or prolonged effects
    ( ) More information is known about acute effects than chronic effects
    ( ) MSDS’s include information on how to treat chronic health effects

12. Supplier labels must be written in:
    ( ) English
    ( ) French
    ( ) Both English and French
    ( ) None of the above

13. By law, how many items of information are required on a workplace label?
    ( ) 3
    ( ) 8
    ( ) 2
    ( ) none

**True of False:**

14. The ultimate goal of WHMIS is to reduce injuries and illnesses associated with chemical exposures in the workplace.  
    T/F

15. In the workplace, I don’t need to understand WHMIS.  
    T/F

16. Suppliers are not responsible for providing a MSDS.  
    T/F

17. This is the WHMIS symbol for flammable:  
    T/F

18. The following symbol indicates *immediate danger* to health & life:  
    T/F

19. ALL products & chemicals have a WHMIS label  
    T/F

20. WHMIS labels show the suppliers name and address  
    T/F
Household Hazardous Products Labels

The Consumer Chemicals and Containers Regulations (CCCR) require specific packaging and labeling of household products.

There are only _______ different household labels.

These labels may be bordered in _______ different ways.

The border indicates whether the label refers to the ___________ or the ___________ within the container.

The ___________ border refers to the contents of the labelled container while the ___________ border refers to the container itself.

Quick Check

What household labels would you expect to find on a container of muriatic acid?

Hazard Classification

- The National Fire Protection Association (NFPA) developed a hazard identification system for emergency responders that is still in use today.
- In the past some chemical manufacturers used NFPA diamonds on their products, but now labels are required to use Global Hazard System (GHS) labeling.
- The NFPA system was designed to convey safety information to emergency first responders, such as fire fighters. It was not designed to notify the user of the hazards of chemicals in the laboratory setting.
Prepare For Lab
- Always use ____________ in the lab.
- Handle chemicals ____________.
- No ____________ in the lab!
- ____________ and ____________ all directions.
- Learn ____________ procedures.
- Know where emergency ____________ is stored.
- Push lab stools in out of the way—Keep ____________ clear!

Dress For Lab
- No shorts, skirts, or ____________.
- Roll up ____________.
- Long hair MUST be ____________.
- No ____________ jewelry.
- Wear ____________ goggles, lab coat, or ____________.
- No books, ____________, or purses in the lab area.

The Lab Burner
- Never leave a lit ____________ unattended.
- Use caution when handling heated ____________.
- Do not place hot glassware ____________ on the lab desk or in cold ____________.
- Never heat a closed ____________.
- Keep ____________ away from open ____________.
- Point the end of a ____________ being heated away from yourself and ____________.

In Case of Accident
- Always notify ____________ immediately.
- Dispose of broken glass as directed ____________.
- Clean up any spills ____________.
- Report any spills, ____________ immediately!
- For a chemical spill on you skin, ____________.
- For a chemical splash in you eyes ____________.
- In case of a large area of spill ____________.
- In case of fire: List 4 items that can be used depending on the size of the fire.

End of Lab
- Clean and put away all ____________ at the end of the lab period.
- Dispose of ____________ according to instruction.
- Always wash ____________ after each lab!

Handling Chemicals
- Don’t use chemicals that aren’t ____________.
- Don’t taste anything in the lab unless ____________.
- Smell by ____________.
- No ____________ experiments!
- Always add ____________ to water—never add water to ____________.
- Never return spilled or unused ____________ to the ____________ bottle!
- Don’t touch your face, eyes, or mouth while ____________.
- No food, ____________ allowed in the lab.

Lab Safety

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Safely Using Glassware

Read the following passage to answer the questions below...

Background: Tools made of glass, called glassware, are very useful in the science lab. Glassware can be heated or cooled, and will not melt. However, glassware is also very fragile. In fact, breaking glassware is one of the most common laboratory accidents. You can take several important precautions when using glassware, to make the lab experience safer for everyone. First, be sure to always place glassware far from the edge of the table. This way it cannot easily be knocked off. Be sure to have dry hands when moving cool glassware; wet glass can be very slippery! Glassware does not change color or shape with temperature, therefore it can be hard to tell whether it is hot or cold. It is important to always assume that glassware is hot unless you are absolutely sure that it is cool. Always use beaker tongs or test tube tongs to touch hot glassware. When measuring the temperature of a liquid with a glass thermometer, do not use the thermometer to stir the liquid. Thermometers are made of glass and are not meant to be used as stirring rods. If you notice a chip or a crack in a piece of glassware, you should stop using it and tell your teacher. Broken glassware will only break more if used. And, if you should happen to accidentally break a piece of glassware, tell your teacher immediately. Do not attempt to clean up the broken glass until you have instructions for safe cleanup from your teacher. If you follow these few safety precautions, your science lab experience will be safer and more fun for everyone.

Directions: Below and on the next page are seven pictures of common pieces of glassware. Read the scenarios beside each picture and write down the safety precautions you should use in each situation.

1. You have poured a chemical into your beaker and now need to carry it across the room to your lab station.

2. Using a traditional thermometer, you are measuring the temperature of a beaker of ice water. You need to stir some salt into the water to observe its affect on the temperature.
3. You are pouring a chemical into a graduated cylinder to measure it. Your lab partner is watching at eye level while you do this.

4. You have mixed two chemicals in a glass beaker. You now need to stir them vigorously with a stirring rod to begin the chemical reaction.

5. In a test tube you have mixed several chemicals. The test tube is placed in a hot water bath to accelerate a chemical reaction.

6. Your lab partner has stored a flask and placed it at the end of your lab table.

7. You made a wet mount. You need to use a microscope to look at it using both the low and high power objectives.