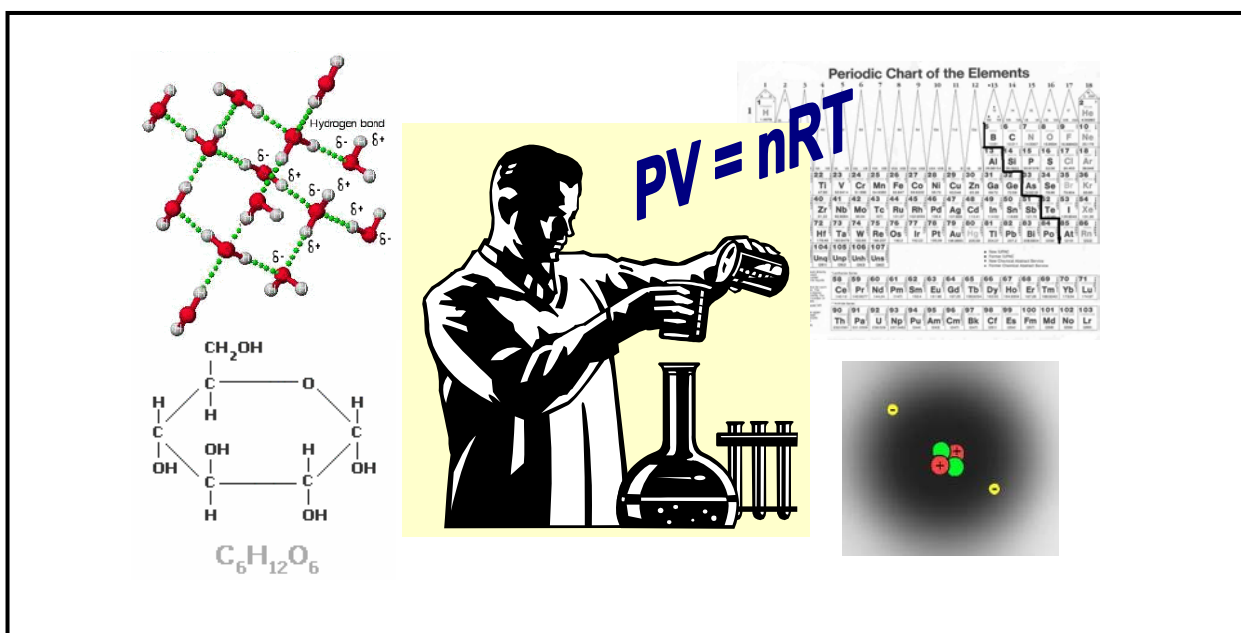


Project EASE

(Effective Alternative Secondary Education)

CHEMISTRY



MODULE 2

Laboratory Apparatus, Safety Rules and Symbols



BUREAU OF SECONDARY EDUC
Department of Education
DepEd Complex, Meralco Avenue
Pasig City



Module 2

Laboratory Apparatus, Safety Rules and Symbols



What this module is about

The first module let you go through sample activities of scientists to develop your science processes and skills. This time, you will experience how chemists work in a laboratory with different apparatus on hand and how to take laboratory precautions.

The activities in this module will teach you how to use different apparatus in the laboratory. It will also develop your skills in making accurate measurements using the common laboratory equipment, in using them safely, and in interpreting icons and symbols used in a laboratory.

This module contains the following lessons:

- **Lesson 1 – Identifying Laboratory Apparatus and Their Uses**
- **Lesson 2 – Laboratory Safety Precautions**
- **Lesson 3 – Laboratory Safety Symbols**

So let's start. Just read and follow the instructions in this module. Good luck and have fun!



What you are expected to learn

After going through this module you are expected to:

1. classify different laboratory apparatus based on their uses;
2. identify the laboratory icons and symbols used inside a laboratory; and
3. state different precautionary measures in the laboratory to be observed.



How to learn from this module


Here's a simple guide for you in going about the module:

1. Take your time in reading the instructions.
2. Follow the instructions very carefully.
3. Before working on the activities, answer the 20-item pretest honestly in order to determine how much you know about the topics discussed in this module.
4. Check your answers with the given answer key.
5. Perform all the activities diligently to help you understand the topics.
6. Take the self-tests after each lesson.
7. Answer the posttest.




What to do before (Pretest)

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper. Be honest in answering the questions.





1. Suppose your brother accidentally cut his finger with a broken glass. What will you do?
 - a. Continue with what you're doing.
 - b. Call your mother and tell her what happened.
 - c. As first aid, put a medicated plaster around his finger.
 - d. Call the attention of your neighborhood about what happened.
2. While reading the procedure of an activity, you happen to come across this icon. What does it mean?
 - a. It's a toy.
 - b. It's a trademark sign.
 - c. It's a sign of an electrician.
 - d. It's a sign that you will be using electricity in the activity.
3. Given the following laboratory apparatus: graduated cylinder, reagent bottle, test tube and watch glass. Which will you use to get the volume of water?

a. test tube	c. graduated cylinder
b. watch glass	d. reagent bottle
4. You are asked by your teacher to get the mass of a piece of stone that will be used in an experiment. What apparatus will you use?

a. florence flask	c. graduated cylinder
b. erlenmeyer flask	d. triple beam balance
5. You have come across this icon.  What does this mean?

a. It is poisonous.	c. It is a metal.
b. It is radioactive.	d. It is a nonmetal.

6. In an experiment you are asked to determine the volume of the stone. How are you going to do it given a 100 mL graduated cylinder alone?
- Fill the graduated cylinder with 50 mL water and place the stone in it. The rise in the level of the water is the volume of the stone.
 - Fill the graduated cylinder with water up to the brim and place the stone in it.
 - Put the stone inside the graduated cylinder.
 - All of the above
7. Which of the following is **NOT** in the group of apparatus that are used in storing liquids?
- beaker
 - florence flask
 - graduated cylinder
 - reagent bottle
8. Which of these apparatus will you use if you want to measure the density of a certain liquid?
- beaker and test tube
 - beaker and graduated cylinder
 - test tube and platform balance
 - graduated cylinder and triple beam balance
9. What will you use to transfer a liquid into a small-mouthed bottle without spilling?
- a funnel
 - a petri dish
 - a test tube
 - a graduated cylinder
10. If Bunsen burner is not available for an experiment, what can be used as replacement for the Bunsen burner?
- a candle
 - a gas stove
 - an alcohol burner
 - a long and thick thread
11. What will you use if you want to fill a narrow-mouthed bottle with liquid?
- burette
 - funnel
 - glass tubing
 - pipette
12. What can you use to avoid breakage when heating a glassware?
- clay triangle
 - iron ring
 - watch glass
 - wire gauze
13. When using a triple beam balance, what should you remember before weighing anything?
- Check if the pan is free from dust.
 - Always check the poises on the beam.
 - Always check if the pointer is set to zero.
 - Adjust the poise one at a time from zero to attain 100% accuracy.
14. One of the most important safety rules is to:
- avoid heating objects.
 - read the procedure of the activity.

- c. follow your classmates' directions.
d. read the instructions and follow them carefully.
15. In boiling 10 mL of water using a test tube, what is the proper way of holding the test tube when you're working with somebody in a laboratory?
a. Keep it away from anybody else inside the laboratory.
b. Let the test tube face someone as it is being heated.
c. Hold it directly above the flame.
d. All of the above
16. When doing an experiment like heating or anything that uses fire, what should you be ready with?
a. an apron
b. a damp cloth
c. a pail of water
d. a wet tissue paper
17. Which of the following symbols suggests that you are working with glassware in a laboratory?
a.  b.  c.  d. 
18. Which of the following statements about electrical safety is **NOT** correct?
a. Use proper extension cords to plug any electrical device.
b. Touch an electrical device with wet and clean hands.
c. Never plug too many electrical devices in only one outlet.
d. Always use extension cords with multiple sockets.
19. A safety symbol in the shape of a flask alerts you to
a. be careful with lab animals
b. be careful with glassware
c. wear heat resistant gloves
d. wear safety goggles
20. A triple beam balance measures
a. area
b. mass
c. pressure
d. volume



Key to answers on page 27.

Lesson 1. Identifying Laboratory Apparatus and Its Uses

When you think of chemists at work, you probably imagine them in a modern laboratory with test tubes, other delicate instruments, apparatus, and bottles of strange substances.

You're right! In the laboratory, you can find different laboratory apparatus. The Science laboratory is a place of adventure and discovery. Some of the most exciting events in scientific history have happened in the laboratory. The discovery of the atoms, the production of plastics for clothing, the analysis of chemicals of substances, and other discoveries were first made by chemists in a laboratory. But all these things could never have happened if there were no equipment and devices. Different laboratory apparatus served their purposes. Here are some of the laboratory equipment and their uses.

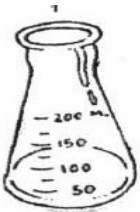
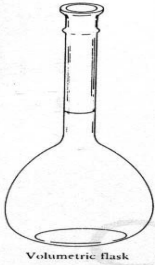
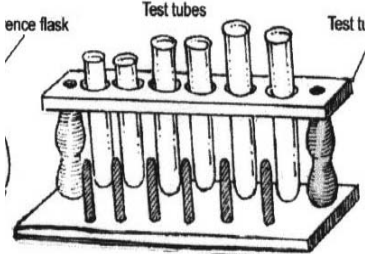

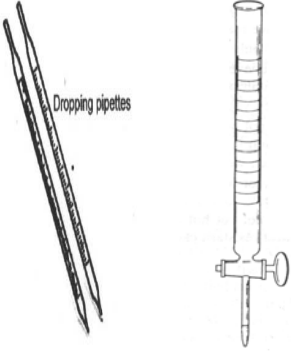



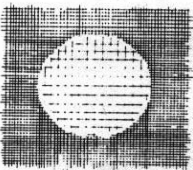


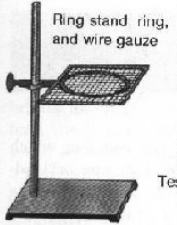
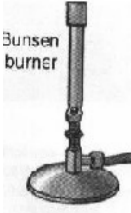
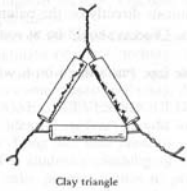
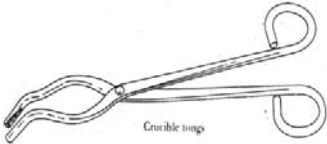


What you will do

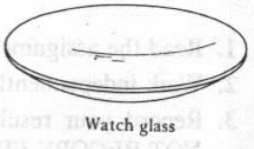





Activity 1.1

Study the different apparatus grouped in each box. They are grouped according to their uses.

Group I: Some apparatus used for STORING LIQUIDS		
<p>300 ml. beaker</p>	<p>Reagents</p>	<p>Florence</p>
<p>Beaker</p>	<p>Reagent bottles</p>	<p>Florence Flask</p>
<p>a deep wide mouthed, thin-walled, cylindrical vessel with a pouring lip used to measure large quantities of liquid; can also be used to store or contain liquid mixtures</p>	<p>a vessel used to contain chemicals that are mixed or added with other substances to bring about chemical reactions to form new substances or compounds.</p>	<p>a round, flat-bottomed, long necked vessel used to measure large quantities of liquid and to hold boiling liquids</p>

Group I: Some apparatus used for STORING LIQUIDS		
		
<p>Erlenmeyer Flask</p>	<p>Volumetric Flask</p>	<p>Test Tubes in a Rack</p>
<p>a cone-shaped vessel with a narrow flat bottom used to measure volume of liquid; also serves as receiver and stores liquid that is to be kept for further analysis</p>	<p>a flat-bottom vessel with long neck container used to store liquids or solutions for observation; can also be used to measure volume of volatile liquids</p>	<p>small, glass-tube shaped containers that are closed and round at the bottom with open end used to mix, heat and store small amounts of liquids and substances.</p>
Group II: Some apparatus used for MEASURING VOLUME		
		
<p>Graduated Cylinder</p>	<p>Pipette & Burette</p>	<p>Medicine Dropper</p>
<p>a narrow cylindrical vessel used to measure the volume of liquids and the volume of irregular solids by water displacement</p>	<p>Pipette - used to transfer small amount of liquid of known volume to another container Burette - a glass tube with measurements marked on the side and a stopcock at the bottom, used to accurately measure the volume of liquid before releasing it in another container.</p>	<p>a small glass or plastic tube with rubber bulb at one end that is used to suck up liquid and release it one drop at a time</p>

Group III: Apparatus used when HEATING SUBSTANCES		
	 Iron ring	 Iron clamp
Wire Gauze	Iron Ring	Iron Clamp
used to protect the glassware during the heating process.	used as base to hold the wire gauze and any other container to be heated	used to hold the test tube, distilling flask, and other apparatus to be heated
 Ring stand ring, and wire gauze Te	 Bunsen burner	 Clay triangle
Iron Stand	Bunsen Burner	Clay Triangle
supports the iron ring and iron clamp during heating, distillation and other extraction purposes	A burner that produces hot flame by mixing flammable gas under pressure through controlled quantities of air.	Supports the crucible on an iron ring when heating
 Crucible tong	 Crucible and cover	
Crucible Tong	Crucible and cover	Evaporating Dish
a tool used to hold hot materials or apparatus	a heat resistant container with cover in which ores or materials are melted	a shallow heat resistant porcelain dish in which a solution is heated and allowed to evaporate leaving a residue on its plate

Group IV: OTHER LABORATORY APPARATUS		
		
Watch Glass	Test Tube Brush	Test Tube Holder
A rounded-bottom circular plate where chemical reactions are being observed	Used to clean small-mouthed containers like test-tubes	Holds the test tube while heating or during an experiment
		
Spatula	Funnel	Mortar and Pestle
a shallow round crystal or glass dish used to hold small amounts of substances to be tested for a reaction	a cone-shaped tool with large opening at the top and a small opening or tube at the bottom used to guide liquids and other substances through a small opening; used to hold filter paper during filtration	Used to grind, pound and mash solid substances into powder form



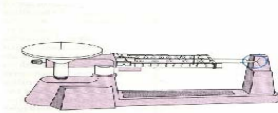


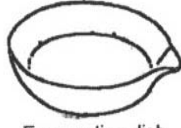


What you will do

Self-Test 1.1






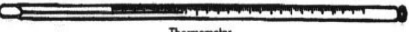


Matching Type: Shown in Column A are the drawings of some common laboratory apparatus listed. In Column B you will find the uses of these apparatus. Draw a line that connects the apparatus to its use.

COLUMN A APPARATUS	COLUMN B USES
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1.	A. used to hold small amount of liquid solution for testing
2. 	B. used to clean test tubes or glassware with narrow opening
3. 	C. used to measure the volume of liquid
4. 	D. used to allow a heated liquid solution to evaporate leaving a residue on its place
5. 	E. used to measure the mass of an object
6. 	F. used to hold liquid / solution to be tested
7. 	G. used to hold hot materials

COLUMN A	COLUMN B
APPARATUS	USES

8.		H. used as container of substances for testing if there is a chemical reaction
9.		I. used to measure the hotness and coldness of an object
10.		J. used to guide liquids when pouring or transferring into a small tube container
11.		K. used to pulverize solid materials to powder form
12.		L. used as container of liquids or reagent ready for testing or experiment
13.		M. used to contain liquids or solution in large amount
14.		N. a tool where ore or materials are melted
15.		O. used to heat substances



Key to answers on page 27.

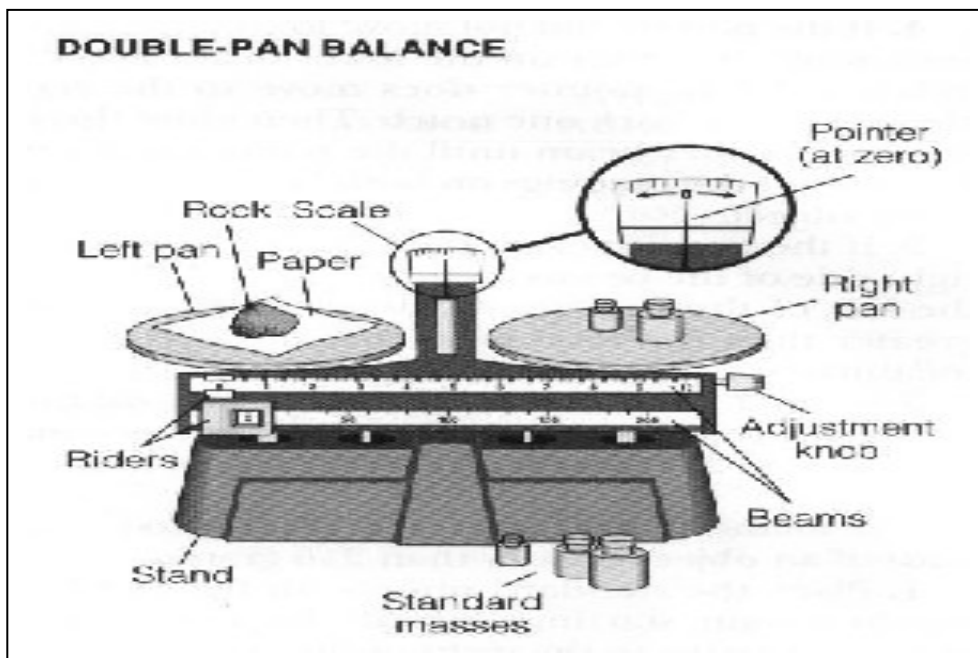


What you will do

Activity 1.2 Double-Pan and Triple Beam Balances: Measurement of Mass

The laboratory balance is an important tool in scientific investigations. You can use the balance to determine the mass of materials. Different kinds of balances are used in the laboratory. One kind of balance is the double-pan balance. Another kind is the triple-beam balance. To use the balance properly, you should learn the parts, function and location of each part of the balance you want to use.

Here are the two kinds of balances. Study their parts and functions:



Parts of a Double-Pan Balance and Their Functions

1. Pointer – used to determine when the mass being measured is balanced by the riders or masses of the balance
2. Scale – series of marks along which the pointer moves.
3. Zero point – center line of the scale to which the pointer moves when the mass being measured is balanced by the riders or masses of the balance
4. Adjustment knob – knob used to set the balance at the zero point when the riders are all on zero and no masses are on either pan
5. Left pan – platform on which an object whose mass is to be determined is placed
6. Right pan – platform on which standard masses are placed.
7. Beams – horizontal strips of metals on which marks or graduations appear that indicate grams or parts of grams
8. Riders – devices that are moved along the beams and used to balance the object being measured to determine its mass
9. Stand – support for the balance.

How to Use the Double-Pan or the Platform Balance

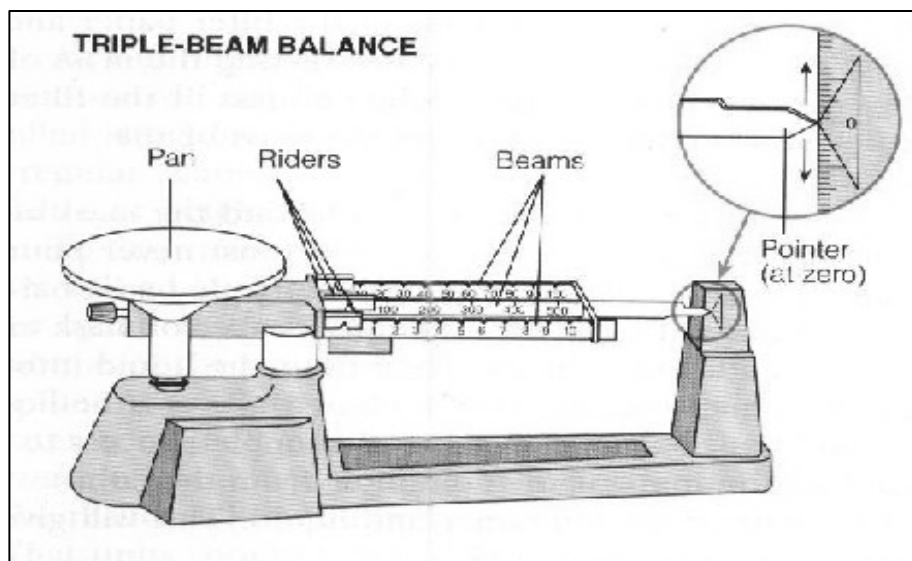
As the name implies, the double beam or platform balance has two beams. The

beams are calibrated or marked in grams. The upper beam is divided into ten major units of 1 gram each. Each of these units is further divided into units of 1/10 of a gram. The lower beam is equal to 10 grams. The lower beam can be used to find the masses of the objects up to 200 grams. Each beam has a rider that is moved to the right along the beam. The rider indicates the number of grams needed to balance the object in the left pan.

Before using the balance, be sure that the pans are empty and both riders are set to zero. If your pointer does not read zero, slowly turn the adjustment knob so that the pointer does read zero.

The following procedure can be used to find the mass of an object using the double-pan balance:

1. Place the object whose mass is to be determined on the left pan.
2. Place the standard masses on the right pan.
3. Be sure that the pointer indicator should be at zero, meaning, the left pan and the right pans are balanced.
4. Count the number of standard masses. Its equivalent is equal to the mass of the objects weighed.



The triple beam balance is a single-pan balance with three beams calibrated in grams. The front beam or 100-gram beam is divided into ten units of ten grams each. The middle or 500-gram beam is divided into five units of 100 grams each. The back beam or 10-gram beam is divided into 10 major units of 1 gram each.

The following steps can be used to find the mass of an object using a triple beam balance:

1. Place the object to be weighed on the pan.
2. Move the rider on the middle beam notch by notch until the horizontal pointer drops below zero. Move the rider back to one notch.

3. Move the rider on the front beam notch by notch until the pointer again drops below zero. Move the rider back to one notch.
4. Slowly slide the rider along the back beam until the pointer stops at the zero point.
5. The mass of the object is equal to the sum of the readings on the three beams.



What you will do

Self-Test 1.2

Fill in the blank with a word or phrase that best completes the statement.

1. In using a double-pan balance, the object to be weighed is placed on _____.
2. In using the triple beam balance, the mass of the object is _____.
3. _____ is the knob used to set the balance at the zero point when the riders are all on zero and no masses are on either pan.
4. The horizontal strips of metals on which marks or graduations appear that indicate grams or parts of grams is called the _____.
5. In using a double-pan balance, the equivalent mass of the object is placed on _____.



Key to answers on page 27.

Lesson 2. Laboratory Safety/Precautions

Science is a hands-on laboratory class. You will be doing many laboratory activities that require the use of different apparatus and hazardous chemicals. Safety in the science classroom is the number one priority for students and teachers. To ensure a safe science classroom, a list of rules has been developed. These rules must be followed at all times. The science laboratory is a safe place to work in if you are careful.



What you will do

Activity 2.1

Following are some safety precautions to help you protect yourself from injury in the laboratory while doing the experiment. Read and understand them to insure your safety before, during, and after doing an experiment.

A. Inside the Laboratory

1. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.
2. Safety goggles and aprons must be worn whenever you work in the lab. Gloves should be worn whenever you use chemicals that cause skin irritations or when you need to handle hot equipment.
3. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times.
4. Know the locations and operating procedures of all safety equipment including the first aid kit, eyewash station, safety shower, spill kit, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located.
5. Be alert and proceed with caution at all times in the laboratory. Notify the instructor immediately of any unsafe conditions you observe.
6. Dispose all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water and those solutions designated by the instructor. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in the proper waste containers.
7. Labels and equipment instructions must be read carefully before use.
8. Keep hands away from your face, eyes, mouth, and body while using chemicals. Wash your hands with soap and water after performing all experiments. Clean (with detergent powder), rinse, and dry all work surfaces and equipment at the end of the experiment.
9. If you spill acid or any other corrosive chemical on you skin or clothes, immediately wash the area with large amounts of water (remember that small amounts of water may be worse than no water at all). After this, get the teacher's attention. The spill kit will be used for spills on floor or counter-top.
10. After doing an experiment check if: a) the main gas outlet valve is shut off b) the water is turned off c) the desk top, floor area, and sink are clean d) all equipment are cool, clean, and arranged properly.

B. Clothing

1. Wear goggles or eye protector if necessary.
2. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory. Wear an apron. Shoes must completely cover the foot.

C. Accidents and Injuries

1. Report any accident or any untoward incident to your teacher.
2. If a chemical should splash in your eye(s), immediately flush with running water from the eyewash station for at least 20 minutes. Notify your teacher immediately.

D. Handling Chemicals

1. All chemicals in the laboratory are to be considered dangerous. Do not touch, taste, or smell any chemical unless specifically instructed to do so. The proper technique for smelling chemical fumes is to gently fan the air above the chemical toward your face.
2. Check the label on reagent bottles twice before removing any of the contents. Take only as much chemical as you need. Smaller amounts often work better than larger amounts. Label all containers and massing papers holding dry chemicals.
3. Never return unused chemicals to their original containers.
4. Acids must be handled with extreme care. ALWAYS ADD ACID SLOWLY TO WATER, with slow stirring and swirling, being careful of the heat produced, particularly with sulfuric acid.
5. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.

E. Handling Glassware and Equipment

1. Inserting and removing glass tubing from rubber stoppers can be dangerous. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) before attempting to insert it in a stopper. Always protect your hands with towels or cotton gloves when inserting glass tubing into, or removing it from, a rubber stopper. If a piece of glassware becomes "frozen" in a stopper, take it to your instructor for removal.
2. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Hands must be completely dry before touching an electrical switch, plug, or outlet.
3. Examine glassware before each use. Never use chipped or cracked glassware. Never use dirty glassware. **Do not immerse hot glassware in cold water; it may shatter.**
4. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires, and loose connections. Do not use damaged electrical equipment.

F. Heating Substances

1. **SHOULD THE FLAME OF THE BUNSEN BURNER GO OUT, IMMEDIATELY TURN**

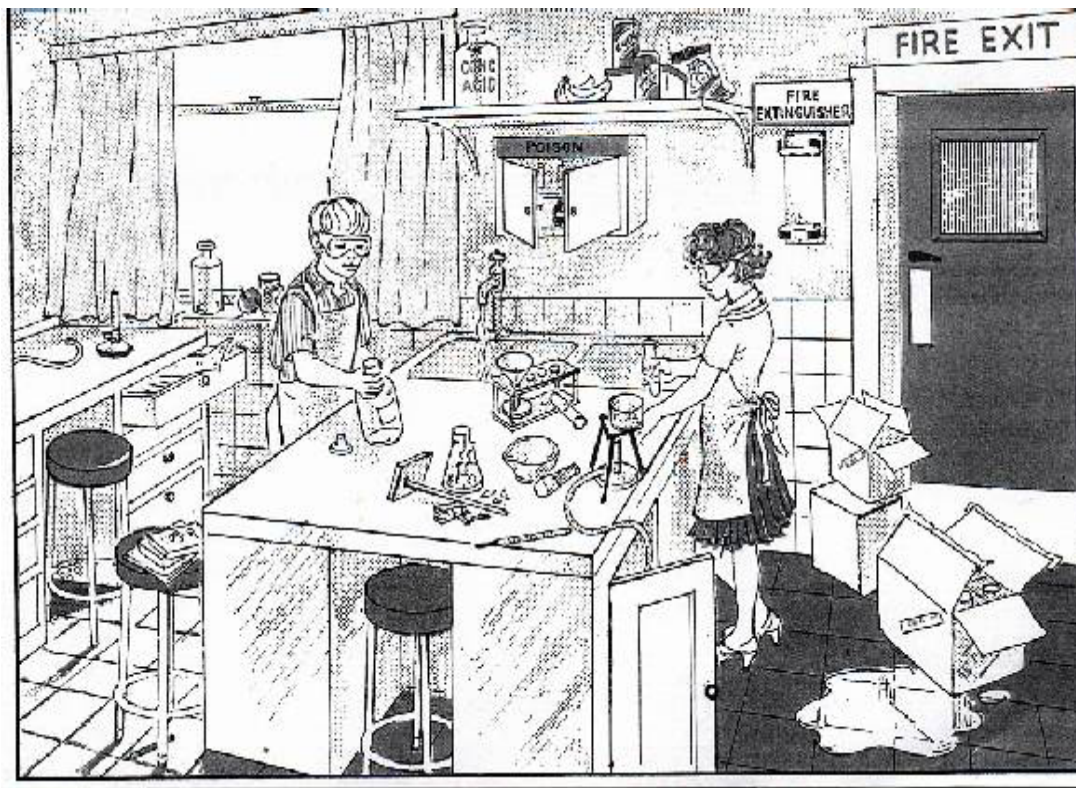
OFF THE GAS AT THE GAS OUTLET VALVE. If you wish to turn off the burner, do so by turning off the gas at the gas outlet valve first, then close the needle valve and barrel. Never reach over an exposed flame. Light gas burners only as instructed by the teacher.

2. Never leave a lit burner unattended. Never leave anything that is being heated or is visibly reacting unattended. Always turn the burner or hot plate off when not in use.
3. Do not point the open end of a test tube being heated at yourself or anyone else.
4. Heated metals, glass, and ceramics remain very hot for a long time. **They should be set aside to cool** and then picked up with caution. Use crucible tongs or heat-protective gloves if necessary. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.



What you will do
Activity 2.2

Look at the picture below. From the safety precautions listed above, what are some of the rules that are followed strictly and what are those that are violated in the picture. Write your answers on the space provided below: (List at least 5 each)



Rules that are strictly followed:

Rules that are violated:



What you will do Self-Test 2.1

Write **YES** if the statement is a good safety rule in the laboratory and **NO**, if it is not.



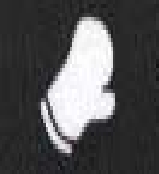



1. Avoid using protective equipment such as gloves, goggles and aprons. _____
2. Use heat resistant containers for hot materials. _____
3. When heating liquid substances in a test tube, hold it in an upright position, away from your body and everyone else in the laboratory room. _____
4. TASTE substances in the laboratory room even if you are NOT told to do so. _____
5. Play with open flames inside the laboratory. _____
6. Report any untoward incident to the teacher, no matter how small. _____
7. When removing an electrical plug from its socket, grasp the electrical cord. _____
8. In diluting an acid ALWAYS POUR WATER SLOWLY TO ACID. _____
9. Never bring your food and drinks in the laboratory. _____
10. When inside the laboratory, NEVER start an experiment unless you are told to do so. _____



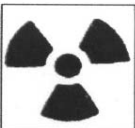




Key to answers on page 27.

Lesson 3. Laboratory Safety Symbols

The idea of using symbols is to transmit information regarding your safety inside the laboratory clearly and easily. The safety symbols that will be presented in this module are the most familiar ones. These symbols are accompanied by explanations.

SAFETY	SYMBOLS	HAZARD	EXAMPLES	PRECAUTION
DISPOSAL		Special disposal considerations required	Chemicals, broken glass, living organisms such as bacterial cultures, protists, etc.	Dispose of wastes as directed by your teacher
BIOLOGICAL		Organisms or organic materials that can harm humans	Bacteria, fungus, blood, raw organs, plant material	Avoid skin contact with organisms or material. Wear dust mask or gloves. Wash hands thoroughly
EXTREME HEAT		Objects that can burn skin by being too cold or too hot	Boiling liquids, hot plates, liquid nitrogen, dry ice, all burners	Use proper protection when handling. Remove flammables from the area around open flames or spark sources
SHARP OBJECT		Use of tools or glassware that can easily puncture or slice skin	Razor blade, scalpel, nails, push pins, etc.	Practice common sense behavior and follow guidelines for use of the tool
FUME		Potential danger to olfactory tract from fumes	Ammonia, heating sulfur, moth balls, nail polish remover, acetone, any volatile substances	Make sure there is good ventilation and never smell fumes directly
ELECTRICAL		Possible danger from electrical shock or burn	Improper grounding, liquid spills, short circuits	Double-check setup with instructor. Check condition of wires and apparatus

SAFETY	SYMBOLS	HAZARD	EXAMPLES	PRECAUTION
CORROSIVE		Substances (acids and bases) that can react with and destroy tissue and other materials	Acid such as vinegar, hydrochloric acid, hydrogen peroxide, sodium hydroxide, soap	Wear goggles and an apron
TOXIC		Poisonous substances that can be acquired through skin absorption, inhalation, or ingestion	Mercury, many metal compounds, iodine, poinsettia leaves	Follow your teacher instructions. Always wash hands thoroughly after use
RADIOACTIVE		Radioactive substances such as uranium and plutonium	Uranium, thorium, plutonium and other elements that emit radiation	Be careful in handling. Notify your teacher of spills or excess substances
FLAMMABLE		Combustible materials that may ignite if exposed to an open flame or spark	Alcohol, powders, kerosene, potassium permanganate	Avoid heat and flame sources. Be aware of locations of fire safety equipment
HYGIENE				Always wash your hands after completing an experiment.



What you will do
Self-Test 3.1

Write the meaning of the following symbols.



1. _____



2. _____



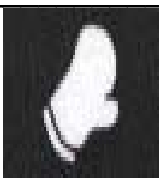
3. _____



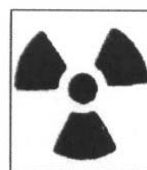
5. _____



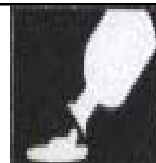
7. _____



9. _____



4. _____



6. _____



8. _____



10. _____



Key to answers on page 28.



Let's Summarize

A. LABORATORY APPARATUS AND EQUIPMENT

1. **Beaker** – a deep, wide-mouthed, thin-walled cylindrical vessel with a pouring lip used to measure large quantities of liquid; can also be used to store or contain liquid mixtures
2. **Volumetric Flask** – a vessel used to contain large amounts of liquid; can also be used to measure volume of volatile liquids
3. **Florence Flask** – a round, flat-bottomed, long necked vessel used to measure large quantities of liquid and to hold boiling liquids
4. **Erlenmeyer Flask** – a cone-shaped vessel with a narrow flat bottom used to measure large amounts of liquid; also serves as receiver or stores liquid that has undergone titration that is to be kept for further analysis
5. **Reagent Bottles** – a vessel used to contain chemicals that are mixed or added with other substances to bring about chemical reactions to form new substances or compounds.

6. **Test Tubes** – small glass-tube shaped containers that are closed and round at the bottom with open end used to mix, heat and store small amount of liquids and substances.
7. **Graduated Cylinder** – a narrow cylindrical vessel used to measure volume of liquids and volume of irregular solids by water displacement
8. **Volumetric Flask** – can be used to measure the volume of volatile liquids
9. **Erlenmeyer Flask** – a cone-shaped vessel with a narrow flat bottom used to measure large amounts of liquid
10. **Pipette** – used to transfer small amounts of liquid of known volume to another container
11. **Burette** – a glass tube with measurements marked on the side and a stopcock at the bottom, used to accurately measure the volume of liquid before releasing it in another container.
12. **Medicine Dropper** – a small glass or plastic tube with rubber bulb at one end that is used to suck up liquid and release it to another container one drop at a time
13. **Iron Stand** – supports the iron ring and iron clamp during heating, distillation and other extraction purposes
14. **Iron Ring** – used as base to hold the wire gauze and any other container to be heated
15. **Iron Clamp** – used to hold the test tube, distilling flask, and other apparatus to be heated
16. **Crucible Tong** – a tool used to hold hot materials or apparatus
17. **Crucible and cover** – a heat resistant container with cover in which ores or materials are melted
18. **Evaporating Dish** – a shallow heat resistant porcelain dish in which a solution is heated and allowed to evaporate leaving a residue on its plate
19. **Watch Glass** – a shallow, round crystal or glass dish used to hold small amounts of substances to be tested for a reaction
20. **Mortar and Pestle** – a pair consisting of a strong vessel and a club-shaped implement used to pound or grind solid substances into powder or granule forms
21. **Triple Beam Balance** – used to measure the mass of an object
22. **Test Tube Brush** – a slender and long brush with long handle used to clean test tubes
23. **Thermometer** – used to measure the hotness and coldness of an object
24. **Funnel** – a cone-shaped tool with large opening at the top and a small opening or tube at the bottom used to guide liquids and other substances through a small opening; used to hold filter paper during filtration

B. LABORATORY PRECAUTIONS

1. Inside the Laboratory:
 - a. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.
 - b. Wear safety goggles and aprons
 - c. Always keep the working area clean and orderly.
 - d. Know the locations and operating procedures of all safety equipment.
 - e. Notify the instructor immediately of any unsafe conditions you observe.

2. Handling Chemicals

- a. All chemicals in the laboratory are to be considered dangerous. Do not touch, taste, or smell any chemical unless specifically instructed to do so.
- b. Check the label on chemical bottles twice before removing any of the contents.
- c. Never return unused chemicals to their original containers.
- d. Acids must be handled with extreme care. **ALWAYS ADD ACID SLOWLY TO WATER.**
- e. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.




3. Handling Glassware and Equipment



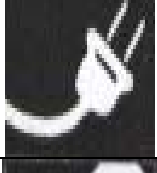
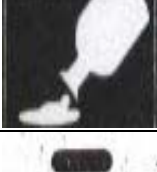


- a. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) before attempting to insert it in a stopper.
- b. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Keep your hands dry when working with electricity.
- c. Do not immerse hot glassware in cold water; it may shatter.
- d. Report damaged electrical equipment immediately.

4. Heating Substances

- a. **TURN OFF THE GAS AT THE GAS OUTLET VALVE** after using.
- b. Never leave a lit burner unattended. Never leave anything that is being heated or is visibly reacting unattended.
- c. Use tongs or heat-protective gloves when holding or touching heated apparatus.

C. WARNING SIGNS

SAFETY	SYMBOLS	HAZARD
DISPOSAL		Special disposal considerations required
BIOLOGICAL		Organisms or organic materials that can harm humans
EXTREME HEAT		Objects that can burn skin by being too cold or too hot

SAFETY	SYMBOLS	HAZARD
SHARP OBJECT		Use of tools or glassware that can easily puncture or slice skin
FUME		Potential danger to olfactory tract from fumes
ELECTRICAL		Possible danger from electrical shock or burn
CORROSIVE		Substances (acids and bases) that can react with and destroy tissue and other materials
TOXIC		Poisonous substances that can be acquired through skin absorption, inhalation, or ingestion
RADIOACTIVE		Radioactive substances such as uranium and plutonium



Posttest


Multiple Choice: Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.


- When doing an experiment like heating or anything that uses fire, what should you be ready with?
 - an apron
 - a damp cloth
 - a pail of water
 - a wet tissue paper
- Acids must be handled with extreme care. In diluting an acid, what should you do?
 - Do it in any way you want.
 - Always add acid slowly to water
 - Always add the water to the acid.
 - Mix the acid to the water by stirring

3. Given three laboratory apparatus: spring balance, graduated cylinder and test tube. Which will you use to get the mass of water?
- a. the spring balance
 - b. the graduated cylinder
 - c. the test tube
 - d. all of the above

4. Which does **NOT** belong to the group?
- a. graduated cylinder
 - b. beaker
 - c. wire gauze
 - d. Florence flask


5. You have come across this icon  pasted on a bottle. What does this mean?
- a. It is a metal
 - b. It is radioactive
 - c. It is a nonmetal
 - d. It is poisonous/toxic

6. While inside the hospital's laboratory area, you saw this icon in one of the rooms. What does this mean? 
- a. The room is strictly for nurses.
 - b. The room is only for technician.
 - c. The room is used for X-ray purposes.
 - d. The room is used for storage of hazardous chemicals.

7. While reading the procedure of an activity, you happen to come across this icon. What does it mean? 
- a. Always wash your hands after an experiment.
 - b. "CLOSE THE FAUCET AFTER USE."
 - c. Always use water in all experiments.
 - d. Water is a universal solvent.

8. Given three laboratory apparatus: beaker, test tube and test tube brush. Which will you use to perform titration?
- a. beaker
 - b. burette
 - c. evaporating disk
 - d. pipette

9. In an experiment you are asked to get the mass of a piece of stone. What apparatus will you use?
- a. erlenmeyer flask
 - b. florence flask
 - c. graduated cylinder
 - d. triple beam balance

10. You have come across this icon.  What does this mean?
- a. It is poisonous/hazardous.
 - b. It is radioactive.
 - c. It is a nonmetal.
 - d. It is a metal.

11. Which of the following is **NOT** in the group of apparatus that are used for heating?
- a. alcohol burner
 - b. beaker
 - c. crucible
 - d. watch glass

12. Which of these apparatus will you use if you want to measure the density of a certain liquid?

- a. beaker and test tube
- b. test tube and platform balance
- c. beaker and graduated cylinder
- d. graduated cylinder and triple beam balance

13. What will you use to transfer a liquid into a small-mouthed bottle without spilling?

- a. a funnel
- b. a petri dish
- c. a test tube
- d. a graduated cylinder

14. When doing an experiment like heating, and a Bunsen burner is not available, what will you use as replacement for the Bunsen burner?

- a. a candle
- b. a gas stove
- c. an alcohol lamp
- d. a long and thick thread

15. Which of the following apparatus does **NOT** belong to the group?

a.



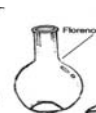
b.



c.



d.



16. One of the most important safety rules is to:

- a. avoid heating objects.
- b. read the procedure of the activity.
- c. follow your classmates' directions.
- d. follow the instructions carefully as advised

17. Why is wire gauze necessary when heating?

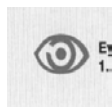
- a. Avoid breakage.
- b. Avoid direct contact.
- c. To make heating faster
- d. To make the set-up look attractive.

18. Which of the following apparatus does not measure mass?

- a. balance beam
- b. double beam balance
- c. Newton scale balance
- d. triple beam balance

19. Which of the following symbols suggests that you are working with flammable substances in a laboratory?

a.



b.



c.



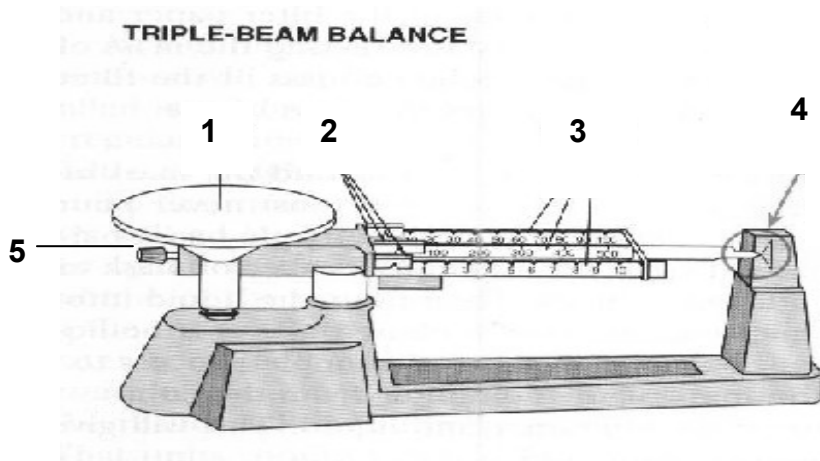
d.



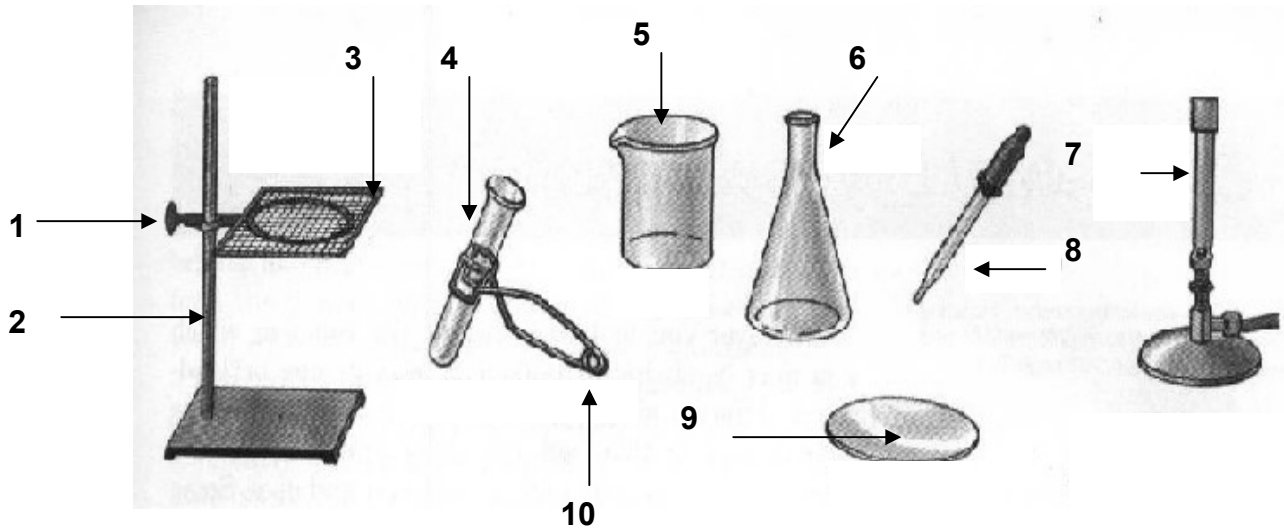
20. All of the following laboratory instructions are correct **EXCEPT**:


- a. Always add acid slowly to water.
- b. Always wear your lab gown or apron.
- c. Start the experiment without being told.
- d. Taste substances in the laboratory room when you are not told to do so.

II. Label the parts of the triple beam balance:



III. Name the apparatus below:



 Key to answers on page 28.



Key to Answers

Pretest

I.

- | | | | |
|------|-------|-------|-------|
| 1. c | 6. a | 11. b | 16. b |
| 2. d | 7. c | 12. d | 17. d |
| 3. c | 8. b | 13. c | 18. b |
| 4. d | 9. a | 14. d | 19. b |
| 5. a | 10. c | 15. a | 20. b |

Lesson 1

Self-Test 1.1

- | | | |
|------|-------|-------|
| 1. F | 6. G | 11. H |
| 2. E | 7. A | 12. L |
| 3. O | 8. B | 13. I |
| 4. C | 9. K | 14. N |
| 5. D | 10. J | 15. M |

Self-Test 1.2

1. left pan
2. the sum of the readings on the three beams
3. adjustment knob
4. beams
5. right pan

Lesson 2

Self-Test 2.1

- | | |
|--------|---------|
| 1. NO | 6. YES |
| 2. YES | 7. NO |
| 3. YES | 8. NO |
| 4. NO | 9. YES |
| 5. NO | 10. YES |

Lesson 3

Self-Test 3.1

- | | |
|----------------|-----------------|
| 1. ELECTRICAL | 6. CORROSIVE |
| 2. DISPOSAL | 7. HYGIENE |
| 3. TOXIC | 8. SHARP OBJECT |
| 4. RADIOACTIVE | 9. EXTREME HEAT |
| 5. FLAMMABLE | 10. FUME |

Posttest

I.

- | | | | |
|------|-------|-------|-------|
| 1. b | 6. c | 11. d | 16. d |
| 2. b | 7. a | 12. d | 17. b |
| 3. d | 8. c | 13. a | 18. a |
| 4. c | 9. d | 14. c | 19. b |
| 5. d | 10. a | 15. b | 20. c |

II.

1. pan
2. poise(s)
3. beam(s)
4. pointer
5. adjustment knob

III.

1. iron ring
2. iron stand
3. wire gauze
4. test tube
5. beaker
6. Erlenmeyer flask
7. burner
8. medicine dropper
9. watch glass
10. test tube holder

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