

Safety in the Chemistry Laboratory

Chemicals are not toys.

Any chemical can be dangerous if it is misused. Always follow the instructions for the experiment. Pay close attention to the safety notes. Do not do anything differently unless told to do so by your teacher.

Chemicals, even water, can cause harm. The challenge is to know how to use chemicals correctly. To make sure you are using chemicals correctly, follow the rules stated below, pay attention to your teacher's directions, and obey the cautions on chemical labels and in an experiment's procedure.

These safety rules always apply in the lab.

First, read the rules very carefully and make sure you understand them very well. Next, create a lab safety contract by copying these rules by hand onto a sheet of notebook paper (front of the page only and you only have the copy the main rule that is in bold font). You will later add this document to your online lab portfolio.

1. I will read the entire experiment and complete all pre-lab reports before entering the lab.

Be familiar with the instructions for the experiment, paying special attention to the safety precautions. Only materials and equipment authorized by your teacher should be used. When you do the lab work, follow the instructions and the safety precautions described in the directions for the experiment.

2. I will wear the right clothing for lab work.

Necklaces, neckties, dangling jewelry, long hair, and loose clothing can cause you to knock things over or catch items on fire. Tuck in neckties or take them off. Pull back long hair, and tie it in place. Do not wear a necklace or other dangling jewelry, including hanging earrings. It isn't necessary, but it might be a good idea to remove your wristwatch so that it is not damaged by a chemical splash.

Nylon and polyester fabrics burn and melt more readily than cotton, so wear cotton clothing if you can. It's best to wear fitted garments, but if your clothing is loose or baggy, tuck it in or tie it back so that it does not get in the way or catch on fire.

Wear shoes that will protect your feet from chemical spills—no open-toed shoes or sandals and no shoes with woven leather straps. You will not be allowed to do lab with open shoes. Shoes made of solid leather or heavy polymer are much better than shoes made of cloth. Also, wear pants, not shorts or shorts skirts. If you happen to have shorts or a skirt, make sure you wear a long lab apron that covers all of your legs.

3. I will always wear a lab apron and safety goggles in the lab.

Even if you aren't working on an experiment, laboratories contain chemicals that can damage your clothing, so wear your apron and keep the strings of the apron tied. Because chemicals can cause eye damage, even blindness, you must wear safety goggles. If your safety goggles are uncomfortable or get clouded up, ask your teacher for help. Try lengthening the strap a bit, or washing the goggles with soap and warm water.

4. I understand that wearing contact lenses is not a safe practice in the lab.

Even while wearing safety goggles, chemicals could get between contact lenses and your eyes and cause irreparable eye damage. If your doctor requires that you wear contact lenses instead of glasses, then you should wear safety goggles designed for contact lenses in the lab. It will be imperative that you wear the goggles at all times.

5. I will never work alone in the laboratory.

Work in the lab only when supervised by your teacher. Do not leave assembled equipment unattended.

6. I will only have books and notebooks needed for the experiment in the lab.

Do not bring other textbooks, purses, book bags, backpacks, or other items into the lab; keep these things in your desk or locker.

7. I will walk carefully in the lab.

Sometimes you will carry chemicals from the supply station to your lab station. Avoid bumping other students and spilling the chemicals. Stay at your lab station at other times.

8. I will not take food, beverages, mints, chewing gum, or cosmetics to the lab.

9. I will read all chemical labels.

Read a chemical label at least three times to make sure you are obtaining the right chemical. Always heed safety symbols and cautions listed in activities, listed on handouts, posted in the room, provided on chemical labels, and given verbally by your teacher. Be aware of the potential hazards of the required materials and procedures, and follow all precautions indicated.

10. I will never taste chemicals or touch them with my bare hands.

You must also keep your hands away from your face and mouth while working.

11. I will not inhale fumes directly.

When instructed to smell a substance, use your hand to wave the fumes toward your nose, and inhale gently.

12. I will use a sparkler to light a Bunsen burner using proper lab techniques, and I will not leave a lit Bunsen burner unattended.

Do not use matches. Be sure that all gas valves are turned off if you leave your lab station.

13. I will be careful with hot equipment, Bunsen burners, and other heat sources.

Keep your body and clothing away from flames. Do not touch glassware, crucibles, ring stand, iron ring, etc., after you remove them from the flame of a Bunsen burner or a hot plate after it has just been turned off. They are probably hotter than you think and can cause serious burns!!

14. I will use caution when working with glassware.

Glass breaks easily and can cause serious cuts. Check the condition of any glassware before and after using it. Inform your teacher of any broken, chipped, or cracked glassware, because it should not be used. Handle all glassware with care. To protect your hands, wear heavy cloth gloves or wrap toweling around the glass and the tubing, stopper, or cork, and gently push in the glass. Do not pick up broken glass with your bare hands. Dispose of broken glass appropriately.

15. I will use caution when working with electrical equipment.

Working with electrical equipment for cords with frayed or twisted cords or wires can cause electrical shock. Also, be sure that your hands are dry before using electrical equipment as doing so can cause serious shock.

16. I know all fire drill procedures and the locations of exits.

17. I know the location and usage of all safety and emergency equipment used in the lab.

Be able to immediately locate where the nearest eyewash stations, safety blankets, safety shower, fire extinguisher, first-aid kit, and chemical spill kit are located. Be sure that you know how to operate the equipment safely.

18. If my clothes catch on fire, I will walk to the safety shower, stand under it, and turn it on.

If your clothing catches on fire, do not run; STOP— DROP—AND ROLL. If another student's clothes catch on fire, keep them from running and wrap them in the fire blanket provided in your lab to smother the flames. While doing so, call to your teacher. In case of fire, alert your teacher and leave the lab.

19. If I get a chemical in my eyes, I will walk immediately to the eyewash station, turn it on, and lower my head so that my eyes are in the running water.

Hold your eyelids open with your thumbs and fingers, and roll your eyeballs around. You have to flush your eyes continuously for at least 15 minutes. Call your teacher while you are doing this.

20. I will report all spills to my teacher immediately.

Call your teacher rather than trying to clean a spill yourself. Your teacher will tell you whether it is safe for you to clean up the spill; if it is not safe, your teacher will know how to clean up the spill.

21. If I spill a chemical on my skin, I will wash the chemical off in the sink and call my teacher.

If you spill a solid chemical on your clothing, brush it off carefully so that you do not scatter it, and call your teacher. If you get a liquid on your clothing, wash it off right away if you can get it under the sink faucet, and call your teacher. If the spill is on clothing that will not fit under the sink faucet, use the safety shower. Remove the affected clothing while under the shower, and call your teacher. (It may be temporarily embarrassing to remove your clothing in front of your class, but failing to flush that chemical off your skin could cause permanent damage.)

22. I will report any accident, incident, or hazard— no matter how trivial—to my teacher immediately.

Any incident involving bleeding, burns, fainting, nausea, dizziness, chemical exposure, or ingestion should also be reported immediately to the school nurse or to a physician. If you have a close call, tell your teacher so that you and your teacher can find a way to prevent it from happening again.

23. I will be careful to take only the chemicals that I need, and I will NEVER put unused chemicals back in the reagent bottle.

If somebody accidentally puts a chemical into the wrong bottle, the next person to use it will have a contaminated sample. Ask your teacher what to do with any leftover chemicals.

24. I will NEVER take any chemicals or equipment out of the lab unless I am given permission my teacher.

25. I will never fool around in the lab because I know this behavior is very dangerous.

Take your lab work seriously, and behave appropriately in the lab. Lab equipment and apparatus are not toys; never use lab time or equipment for anything other than the intended purpose. Be aware of the safety of your classmates as well as your safety at all times.

26. I will always ask the teacher before any unauthorized activity.

Student-designed procedures or inquiry activities must be approved by your teacher before you attempt the procedures or activities. Something as simple as burning a scrap of paper or mixing left over chemicals could result in a serious accident. Always ask the teacher first!

27. I will keep my work area clean and uncluttered.

Make sure your lab station is always free of clutter that could cause a fire or other accidents.

28. I will clean my lab station at the end of each lab.

After your work is done, clean the equipment you used with soap and water, and clean your work area. Broken glass, chemicals, and other waste products should be disposed of in separate, special containers. Dispose of waste materials as directed by your teacher. Put away all material and equipment according to your teacher's instructions. Be sure and report any damaged or missing equipment or materials to your teacher.

29. I will always wash my hands with soap and water before I leave the lab.

I agree to abide by all of these rules.

Name

Date

SAFETY SYMBOLS WITH PRECAUTIONS



Caustic Substances

- Alert your teacher to any chemical spills.
- Do not let acids and bases touch your skin or clothing. If a substance gets on your skin, rinse immediately with cool water and alert your teacher.
- Wear your laboratory apron to protect your clothing.
- Never add water to acids; always add acids to water.
- When shaking or heating a test tube containing chemicals, always point the test tube away from yourself and other students.



Electrical Safety

- Never handle electrical equipment with wet hands. Work areas, including floors and tables, should be dry.
- Never overload an electric circuit.
- Make sure all electrical equipment is properly grounded.
- Keep electrical cords away from areas where someone may trip on the cords, or where the cords can tip over laboratory equipment.



Chemical Safety

- Never taste any substance in the laboratory. Do not eat or drink from laboratory glassware.
- Do not eat or drink in the laboratory.
- Properly label all bottles and test tubes containing chemicals.
- Never transfer substances with a mouth pipette; use a suction bulb.
- Never return unused chemicals to the original container.



Gas Precaution

- Do not inhale fumes directly. When instructed to smell a substance, wave fumes toward your nose and inhale gently.
- Use flammable liquids only in small amounts and in a well-ventilated room or under a fume hood.
- Always use a fume hood when working with toxic or flammable fumes.
- Do not breathe pure gases such as hydrogen, argon, helium, nitrogen, or high concentrations of carbon dioxide.



Explosion Danger

- Use safety shields or screens if there is a potential danger of an explosion or implosion of apparatus.
- Never use an open flame when working with flammable liquids such as ether or alcohol.
- Follow a water bath procedure to heat solids. Never risk an explosion by heating materials directly.



Eye Safety

- Wear approved safety goggles in the laboratory.
- Make sure an emergency eye wash station is available in the laboratory.
- Never look directly at the sun, even for short periods of time. Laboratory goggles will not protect your eyes from the sun's rays.



Fire Safety

- Make sure that fire extinguishers and fire blankets are available in the laboratory.
- Tie back long hair and confine loose clothing.
- Wear safety goggles when working with flames.
- Never reach across an open flame.



Heating Safety

- Use proper procedures when lighting Bunsen burners.
- Turn off hot plates, Bunsen burners, and other open flames when not in use.
- Heat flasks or beakers on a ringstand with a wire gauze between the glass and the flame.
- Store hot liquids only in heat-resistant glassware.
- Turn off gas valves when not in use.



Proper Waste Disposal

- Clean up the laboratory after you are finished; dispose of paper toweling, etc.
- Follow your teacher's directions regarding proper procedures for waste disposal, especially for hazardous waste disposal.
- Place broken glass in a specially designated container.
- Dispose of hazardous wastes only in proper containers, never in an ordinary trash can.



Glassware Safety

- Check the condition of glassware before and after using it. Inform your teacher about any broken, chipped, or cracked glassware; it should not be used.
- Air-dry glassware; do not dry by toweling. Do not use glassware that is not completely dry.
- Do not pick up broken glass with your bare hands.
- Never force glass tubing into rubber stoppers.
- Never place glassware near edges of your work surface.



Hand Safety

- Always wear gloves when cutting, fire polishing, or bending glass tubing.
- Use tongs when heating test tubes. Never hold test tubes in your hand while heating them.
- Always allow heated materials, including glassware, to cool before handling them.



Radiation Precaution

- Always wear gloves when handling a radioactive source.
- Always wear safety goggles when performing experiments with radioactive materials.
- Always wash hands and arms after working with radioactive materials.



Hygienic Care

- Always wash your hands after the laboratory.
- Keep your hands away from your face and mouth.



Clothing Protection

- Wear laboratory aprons in the classroom.
- Confine loose clothing.

Safety Control Equipment

Instruments and tools play an important part in the safety program of your chemistry course. Throughout this course, references are made to equipment and devices used to prevent accidents from occurring in the science classroom and laboratory. Before experimenting in the laboratory, you should become familiar with the safety equipment listed below, know the location of each item, and know how to use it. All equipment should be easily accessible to everyone and should be checked periodically to assure proper operation and cleanliness.

Eye and Face Wash Fountains

Eye and face wash fountains prevent or reduce injuries from chemicals splashing in or near the eyes. The fountain is designed to provide a gentle flow of aerated water to cleanse the eye and surrounding areas of foreign substances. Affected areas should be flushed immediately for a period of at least 15 minutes. Fountains should be checked daily for proper operation.

Safety Showers

Safety showers prevent or reduce injuries from caustic chemicals or acid burns, from contact with toxic chemical reagents, or from clothing fires. A good water supply is essential for a safety shower. The shower heads must be nonclogging, deluge-type fixtures capable of covering a contaminated area of skin with a flood of water that is sufficient to dilute material to a safe level in 15 seconds. They should be checked monthly for proper operation.

Fire Blankets

Fire blankets are used to smother flaming hair or clothes. **If the clothing is polyester,** the best way of putting out the fire is to use the safety shower.

Fire Extinguishers

Fire extinguishers are labeled to indicate which of the four recognized classes of fires they can be used to extinguish. The teacher and students should be familiar with the operating instructions for all fire extinguishers. Your local fire department can give instructions in extinguishing each type of fire.

First Aid Kits

First aid kits are used to give emergency treatment for burns, cuts, or other minor injuries, and such treatment should be administered only by your teacher. It is recommended that a chart showing proper treatment for specific injuries be posted prominently next to the kit.

Lab Aprons

Lab aprons are used to protect body and clothing from chemical hazards. The front side of the apron should be coded so that you always know which side may have caustic chemicals on it. Remember to clean the apron frequently.

Lab Gloves

Lab gloves protect your hands from laboratory hazards. Everyone should have a pair to wear when handling caustic chemicals, glass tubing, or heated materials.

Safety Goggles

Safety Goggles protect your eyes from chemical and particle injuries. Each student should have his/her own pair, and the goggles must meet the ANSI standard. The type most commonly used in the school laboratory is a flexible soft-sided plastic model with a single large plastic lens. The goggles are available with baffled vents on the sides, so that air can flow through but liquids will not enter. Goggles can be worn over prescription eyeglasses. The goggles should be washed frequently and stored in a protected place. See the special note on prohibiting the wearing of contact lenses in the lab, page 1, *Safety Regulations*.

Sand Buckets

Sand is used to smother small fires such as ones contained in beakers. A scoop or hand shovel should be used to apply the sand.

Tongs

Tongs protect the hands from burns and chemical injuries. Always remember to use them when handling heated materials, especially in glass or porcelain containers.

Waste Containers

Waste containers reduce the chance of fires, explosions, and pollution. Separate waste containers should be provided for each of the following: chemicals, matches, broken glass. **NEVER** use the wastepaper basket for disposal of materials.

Ventilation Hoods

Ventilation hoods prevent the spreading of poisonous or noxious gases in an experiment. Ventilation-hood-escape outlets and fans should be checked frequently to assure proper operation.

Heat-Resistant Mat

A heat-resistant mat should be placed under hot apparatus that needs to cool. This prevents the breakage of glass and porcelain containers that might otherwise shatter when they come in contact with the cool surface of the lab bench.

Spill Control Packages

Spill control packages are designed to minimize the harmful effects of a chemical spill by absorbing the chemical and restricting its movement across the laboratory bench or floor. Chemical manufacturers produce spill control kits that can be ordered. Some spill control packages consist of a pail containing a mixture of sand and soda ash. Sodium carbonate or sodium bicarbonate is useful in neutralizing acid spills. Other useful commercial products are spill control pads, pillows, and sponges that contain amalgamating powder.

Labeling

In any science laboratory the *labeling* of chemical containers, reagent bottles, and equipment is essential for safe operations. Proper labeling can lower the potential for accidents that occur as a result of misuse. Labels and equipment instructions should be read several times before using. Be sure that you are using the correct items and that you know how to use them.

All chemical containers and reagent bottles should be labeled prominently and accurately with labeling materials that are not affected by the chemical. Chemical labels should contain the following information.

1. *Name of chemical* and the *chemical composition* (formula).
2. *Statement of possible hazards*. This is indicated by the use of an appropriate signal word, such as **DANGER**, **WARNING**, or **CAUTION**. This signal word usually is accompanied by a word that indicates the type of hazard present such as **POISON**, **CAUSES BURNS**, **EXPLOSIVE** or **FLAMMABLE**.
3. *Precautionary measures*. Precautionary measures describe how users can avoid injury from the hazards listed on the label. Examples include: "Use only with adequate ventilation," and "Do not get in eyes or on skin or clothing."
4. *Instructions in case of contact or exposure*. If accidental contact or exposure does occur, immediate treatment is often necessary to minimize injury. Such treatment usually consists of proper first-aid measures that can be used before a physician administers treatment. An example is: "In case of contact, flush with large amounts of water; for eyes, rinse freely with water for 15 minutes and get medical attention immediately."
5. The *date of preparation* and the *name of the person who prepared the chemical* are important for inventory. The *location of preparation*, such as the manufacturer's address or the name of the school, should also appear on the label.

Working Name of Contents	
Chemical Composition	
Hydrochloric Acid 6 M HCl	
WARNING! CAUSTIC and CORROSIVE—CAUSES BURNS CAUTION! Avoid contact with skin and eyes. Avoid breathing vapors.	
IN CASE OF CONTACT: Immediately flush skin or eyes with large amounts of water for at least 15 minutes; for eyes, get medical attention immediately!	
May 8, 1989	
Prepared by Betsy Byron Faribault High School, Faribault, Minnesota	
Statements of Possible Hazards and Precautionary Measures	
Date Prepared or Obtained	
Manufacturer (Commercially obtained) or preparer (Locally made)	
Instructions in Case of Contact or Exposure	

Techniques and Safety Sketches

Decanting and Transferring Liquids

1. The safest way of transferring a liquid from one test tube to another is shown in Figure S-1. The liquid is transferred at arm's length with the elbows slightly bent. This position enables you to see what you are doing and still maintain steady control.
2. Sometimes liquids contain particles of insoluble solids that sink to the bottom of a test tube or beaker. Use one of the methods shown below to separate a supernatant (the clear fluid) from insoluble solids.
 - (a) Figure S-2 shows the proper method of decanting a supernatant liquid in a test tube.
 - (b) Figure S-3 shows the proper method of decanting a supernatant liquid in a beaker by using a stirring rod. The rod should touch the wall of the receiving vessel.

Hold the stirring rod against the lip of the beaker containing the supernatant liquid. As you pour, the liquid will run down the rod and drop off into the beaker resting below. In this way the liquid will not run down the side of the beaker from which you are pouring.

Heating Substances and Evaporating Solutions

1. Use care in selecting glassware for high-temperature heating. The glassware should be Pyrex or a similar heat-resistant type.
2. When heating substances in glassware by means of a gas flame, use a ceramic-centered wire gauze to protect glassware from direct contact with the flame. These wire gauzes can withstand extremely high temperatures and will help prevent glassware from breaking.
3. Figure S-4 shows the proper setup for evaporating a solution over a water bath.
4. In some experiments you are required to heat a substance to high temperatures in a porcelain crucible. Figure S-5 shows the proper apparatus setup used to accomplish this task.
5. Figure S-6 shows the proper setup for evaporating a solution in a porcelain evaporating dish with a watch glass cover that prevents spattering.
6. Heated glassware, porcelain, and iron rings look cool several seconds after they are removed from a heat source, but can still burn your skin for several minutes. Use heat-safety items such as safety tongs, heat-resistant mittens and pads, aprons, rubber gloves, and safety goggles whenever you handle this apparatus.
7. You can test the temperature of questionable beakers, ring stands, wire gauzes, or other pieces of apparatus that have been heated by holding the back of your hand close to their surfaces before grasping them. Any heat generated from the hot surfaces will be felt—**DO NOT TOUCH**. Allow plenty of time for the apparatus to cool before handling.

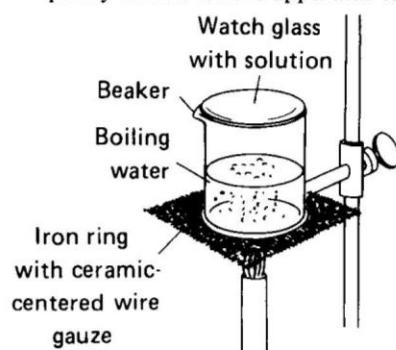


Figure S-4

Boiling a Liquid Over
a Water Bath

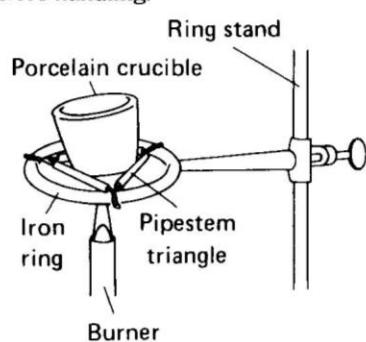


Figure S-5

Heating a Substance
Intensely

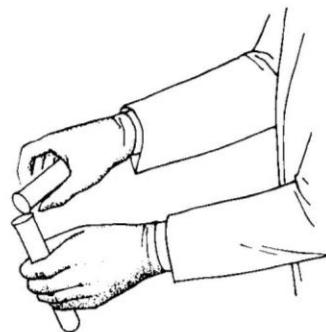


Figure S-1



Figure S-2



Figure S-3

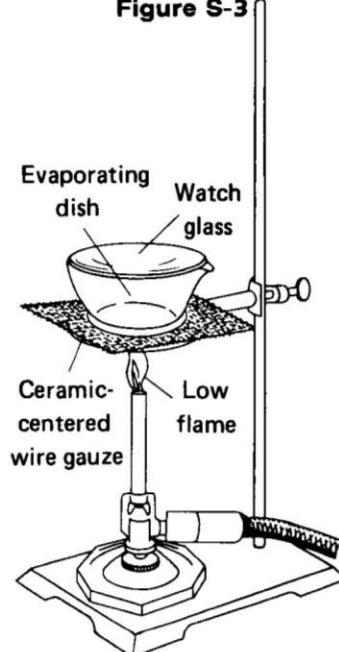


Figure S-6

Evaporating a Liquid



Figure S-7



Figure S-8

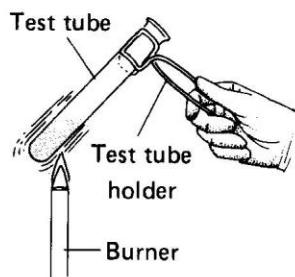


Figure S-11

How to Pour Liquid from a Reagent Bottle

1. Read the label at least three times before using the contents of a reagent bottle.
2. Never lay the stopper of a reagent bottle on the lab table. Remove the stopper by grasping the stopper between two fingers, as shown in Figure S-7.
3. Pick up the reagent bottle making sure the label is toward the palm of your hand. Note that the stopper is still between the fingers. See Figure S-8.
4. When pouring a caustic or corrosive liquid into a beaker, use a stirring rod to avoid drips and spills. Hold the stirring rod against the lip of the reagent bottle. Estimate the amount of liquid you need and pour this along the rod into the beaker. See Figure S-9.
5. Extra precaution should be taken when handling a bottle of acid. Remember these two important rules: (a) Never add water to any concentrated acid, particularly sulfuric acid, because of splashing and heat generation. (b) To dilute any acid, add the acid to water in small quantities, stirring slowly and constantly. Remember the "triple A's"—**Always Add Acid to water**.
6. Replace the stopper on the reagent bottle after you are finished pouring. See Figure S-10.
7. Examine the outside of the reagent bottle for any liquid that has dripped down the bottle or spilled on the counter top. Your teacher will show you the proper procedures for cleaning up a chemical spill.
8. Never pour reagents back into stock bottles. At the end of the experiment, any excess chemicals should be properly discarded under the direction of your teacher.

How to Heat Material in a Test Tube

1. Check to see that the test tube is Pyrex or a similar heat-resistant type.
2. Always use a test tube holder or clamp when heating the test tube.
3. Never point a heated test tube at anyone, because the liquid may splash out of the test tube.
4. Never look down into the test tube while heating it.
5. Do not heat any one spot on the test tube. Heat the test tube from the upper portions of the tube downward and continuously move the test tube as shown in Figure S-11. Otherwise pressure from a vapor meeting a layer of liquid above it may cause the bottom of the tube to blow out.

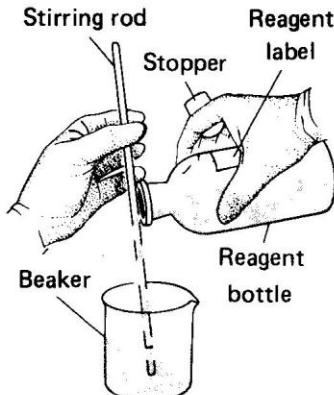


Figure S-9



Figure S-10

How to Use a Mortar and Pestle

1. A mortar and pestle should be used for grinding only **one** substance at a time. See Figures S-12 to S-14.
2. Never use a mortar and pestle for simultaneously mixing different substances.
3. Place the substance to be broken up into the mortar.
4. Pound the substance with the pestle and grind to pulverize.
5. Remove the powdered substance with a porcelain spoon.

CAUTION Do not blow into the mortar to remove any remaining powder, since dust may get into eyes and nasal passages.

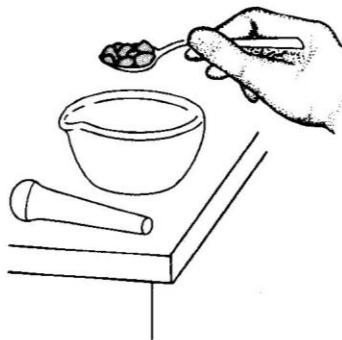


Figure S-12

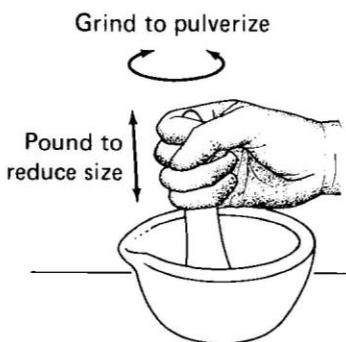


Figure S-13

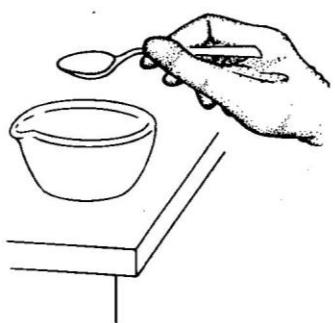


Figure S-14

Testing an Odor Safely

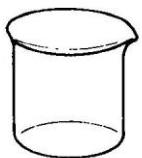
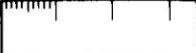
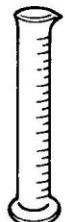
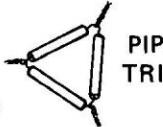
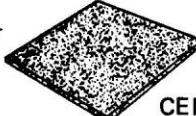
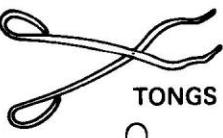
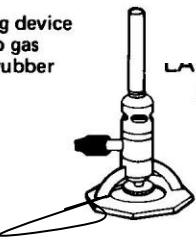
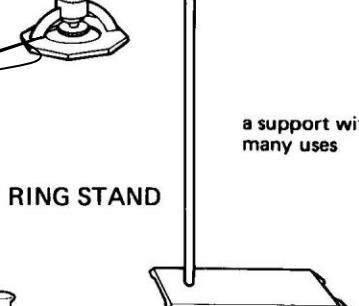
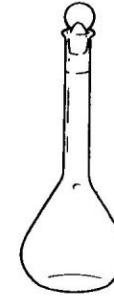
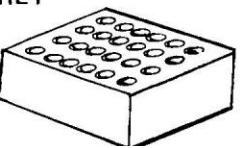
1. Test for the odor of gases by wafting your hand over the test tube and cautiously sniffing the fumes as shown in Figure S-15.
2. Do not inhale any fumes directly.
3. Use a fume hood whenever poisonous or irritating fumes are evolved. **DO NOT waft and sniff poisonous or irritating fumes.**

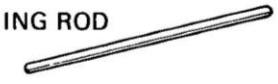
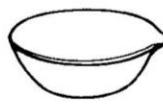
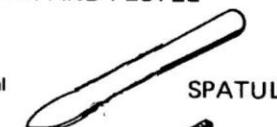
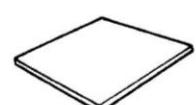
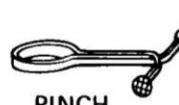
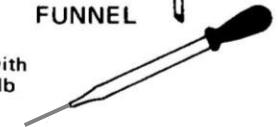
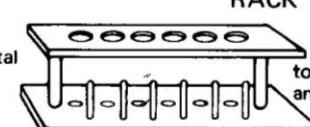
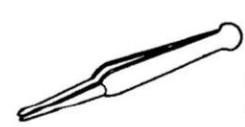
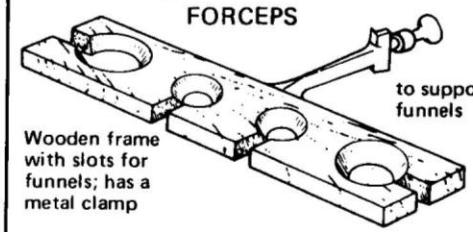
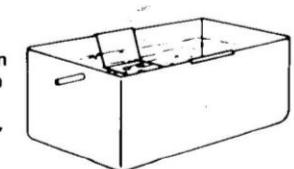
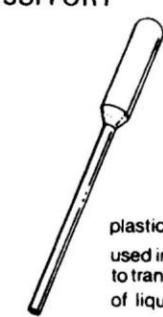


Figure S-15

Sample Lab Apparatus

(The complete list of lab apparatus you will draw for your portfolio is on the website, not here. However, you may use many of these images to help with the drawings and to learn the uses of the equipment.)

DESCRIPTION	APPARATUS	USE	DESCRIPTION	APPARATUS	USE
glass common sizes 100 mL 250 mL 400 mL marked on the beaker		as a container, like a cup may be heated	10 centimeter (cm) ruler, plastic divided into centimeter and millimeter (mm) divisions		to measure length
glass marked with a milliliter (mL) scale size divisions 50 mL 1.0 mL 35 mL 0.2 or 0.5 mL 10 mL 0.1 mL		to measure volume	triangular wire frame with clay material coverings		PIPESTEM TRIANGLE to support the crucible
glass common sizes 125 mL 250 mL 500 mL marked on the flask	 ERLENMEYER FLASK FLORENCE FLASK	may be heated	small porcelain dish with cover		CRUCIBLE AND COVER to heat small amounts of solid material at high temperature
glass several sizes		many uses can be heated	hardened ceramic-fibered material		CERAMIC-FIBERED SQUARE to place under hot apparatus
metal clamp with a spring handle		to hold a test tube	wire screen with ceramic-fibered center		WIRE GAUZE to spread the heat of a flame
metal		to pick up and hold apparatus	metal heating device connected to gas outlet with rubber tubing		BUNSEN LABORATORY BURNER to heat chemicals in beakers or test tubes
glass marked with a milliliter (mL) scale		used to collect and measure the volumes of gases	metal rod upright heavy base		RING STAND a support with many uses
metal clamp with flexible clips		to hold burets when titrating	glass marked with a milliliter (mL) scale and fitted with a stopcock, pinch clamp, or glass bead		BURET used to withdraw and measure volumes of solutions in titrations
			glass marked off to liter capacity, with a glass stopper		VOLUMETRIC FLASK used in the preparation of solutions
			plastic		REACTION PLATE used to hold liquids in micro experiment

DESCRIPTION	APPARATUS	USE	DESCRIPTION	APPARATUS	USE
iron ring with screw fastener several sizes		to fasten to the ring stand as a support for apparatus	brush with wire handle		to scrub glass apparatus
metal clamp with 1. screw fastener 2. swivel and lock nut 3. adjusting screw 4. curved clamp		to hold apparatus may be fastened to the ring stand	STIRRING ROD		to stir combinations of materials to use in pouring liquids
heavy porcelain dish with grinder		to grind chemicals to a powder	porcelain dish		as a container for small amounts of liquid being evaporated
MORTAR AND PESTLE			EVAPORATING DISH		
may be of metal or porcelain		to transfer solid chemicals in weighing	thick glass		many uses (should not be heated)
metal file with three cutting edges		to scratch glass to file	curved glass		may be used as a beaker cover may be used in evaporating very small amounts of liquid
RUBBER CONNECTOR		to connect parts of apparatus	glass or plastic		to hold a filter paper may be used in pouring
PINCH CLAMP		to clamp a rubber connector	glass tip with rubber bulb		to transfer small amounts of liquid
TEST TUBE RACK		to hold test tubes in an upright position	metal		to pick up or hold small objects
PLASTIC WASH BOTTLE		to dispense distilled water	Wooden frame with slots for funnels; has a metal clamp		to support funnels
squeezable plastic bottle with angular tip			FUNNEL SUPPORT		
GALVANIZED IRON CONTAINER		to hold water, gas collecting bottles, and delivery tube from gas generator	glass		many uses as a container
PNEUMATIC TROUGH			WIDE-MOUTH BOTTLE		
			plastic		used in micro experiment to transfer small amounts of liquid

