

LABORATORY SAFETY INFORMATION

Safety in the Chemistry Lab

Working in the chemistry laboratory is an interesting and rewarding experience. During your labs, you will be actively involved from beginning to end—from setting some change in motion to drawing some conclusion. In the laboratory, you will be working with equipment and materials that can cause injury if they are not handled properly. However, the laboratory is a safe place to work if you are careful. Accidents do not just happen, they are caused—by carelessness, haste, and disregard of safety rules and practices. Safety rules to be followed in the laboratory are listed below. Before beginning any lab work, read these rules, learn them, and follow them carefully.

General

1. Be prepared to work when you arrive at the laboratory. Familiarize yourself with the lab procedures before beginning the lab.
2. Perform only those lab activities assigned by your teacher. *Never* do anything in the laboratory that is *not* called for in the laboratory procedure or *by* your teacher. Never work alone in the lab. Do not engage in any horseplay.
3. Work areas should be kept clean and tidy at all times. Only lab manuals and notebooks should be brought to the work area. Other books, purses, brief cases, etc. should be left at your desk or placed in a designated storage area.
4. Clothing should be appropriate for working in the lab. Jackets, ties, and other loose garments should be removed. Open shoes should not be worn.
5. Long hair should be tied back or covered, especially in the vicinity of open flame.
6. Jewelry that might present a safety hazard, such as dangling necklaces, chains, medallions, or bracelets should not be worn in the lab.
7. Follow all instructions, both written and oral, carefully.
8. Safety goggles and lab aprons should be worn at all times.
9. Set up apparatus as described in the lab manual or by your teacher. Never use makeshift arrangements.
10. Always use the prescribed instrument (tongs, test tube holder, forceps, etc.) for handling apparatus or equipment.
11. Keep all combustible materials away from open flames.

12. Never touch any substance in the lab unless specifically instructed to do so by your teacher.

13. Never put your face near the mouth of a container that is holding chemicals.

14. Never smell any chemicals unless instructed to do so by your teacher. When testing for odors, use a wafting motion to direct the odors to your nose.

15. Any activity involving poisonous vapors should be conducted in the fume hood.

16. Dispose of waste materials as instructed by your teacher.

17. Clean up all spills immediately.

18. Clean and wipe dry all work surfaces at the end of class. Wash your hands thoroughly.

19. Know the location of emergency equipment (first aid kit, fire extinguisher, fire shower, fire blanket, etc.) and how to use them.

20. Report all accidents to the teacher immediately.

Handling Chemicals

21. Read and double check labels on reagent bottles before removing any reagent. Take only as much reagent as you need.

22. Do not return unused reagent to stock bottles.

23. When transferring chemical reagents from one container to another, hold the containers out away from your body.

24. When mixing an acid and water, *always add the acid to the water.*

25. Avoid touching chemicals with your hands. If chemicals do come in contact with your hands, wash them immediately.

26. Notify your teacher if you have any medical problems that might relate to lab work, such as allergies or asthma.

27. If you will be working with chemicals in the lab, avoid wearing contact lenses. Change to glasses, if possible, or notify the teacher.

Handling Glassware

28. Glass tubing, especially long pieces, should be carried in a vertical position to minimize the likelihood of breakage and to avoid stabbing anyone.

Safety in the Chemistry Laboratory (continued)

29. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Dispose of the glass as directed by your teacher.

30. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) with water or glycerine before attempting to insert it into a rubber stopper.

31. Never apply force when inserting or removing glassware from a stopper. Use a twisting motion. If a piece of glassware becomes "frozen" in a stopper, take it to your teacher.

32. Do not place hot glassware directly on the lab table. Always use an insulating pad of some sort.

33. Allow plenty of time for hot glass to cool before touching it. Hot glass can cause painful burns. (Remember: Hot glass *looks* cool.)

Heating Substances

34. Exercise extreme caution when using a gas burner. Keep your head and clothing away from the flame.

35. Always turn the burner off when it is not in use.

36. Do not bring any substance into contact with a flame unless instructed to do so.

37. Never heat anything without being instructed to do so.

38. Never look into a container that is being heated.

39. When heating a substance in a test tube, make sure that the mouth of the tube is not pointed at yourself or anyone else.

40. Never leave unattended anything that is being heated or is visibly reacting.

LABORATORY SAFETY INFORMATION

First Aid in the Chemistry Laboratory

Accidents do not often happen in well-equipped chemistry laboratories if students understand safe laboratory procedures and are careful in following them. When an occasional accident does occur, it is likely to be a minor one.

The school nurse is responsible for treating injuries. However, for some types of injuries, you must take action immediately, before the nurse takes over. The following information will be helpful to you if an accident occurs.

First Aid

1. Shock. People who are suffering from any severe injury (for example, a bad burn or major loss of blood) may be in a state of shock. A person in shock is usually pale and faint. The person may be sweating, with cold, moist skin and a weak, rapid pulse.

Shock is a serious medical condition. Do not allow a person in shock to walk anywhere—even to the nurse's office. While emergency help is being summoned, place the victim face up in a horizontal position, with the feet raised about 30 centimeters. Loosen any tightly fitting clothing and keep him or her warm.

2. Chemicals in the Eyes. Getting any kind of a chemical into the eyes is undesirable, but certain chemicals are especially harmful. They can destroy eyesight in a matter of seconds. Because you will be wearing safety goggles at all times in the lab, the likelihood of this kind of accident is remote. However, if it does happen, flush your eyes with water immediately. Do NOT attempt to go to the nurse's office before flushing your eyes. It is important that flushing with water be continued for a prolonged time—about 15 minutes. While flushing is continuing, the school nurse should be informed.

3. Clothing or Hair on Fire. A person whose clothing or hair catches on fire will often run around hysterically in an unsuccessful effort to get away from the fire. This only provides the

fire with more oxygen and makes it burn faster. For clothing fires, throw yourself to the ground and roll around to extinguish the flames. For hair fires, use a fire blanket to smother the flames. Notify the nurse immediately.

4. Bleeding from a Cut. Most cuts that occur in the chemistry laboratory are minor. For minor cuts, apply pressure to the wound with a sterile gauze, and take the victim to the school nurse.

If the victim is bleeding badly, raise the bleeding part, if possible, and apply pressure to the wound with a piece of sterile gauze. While first aid is being given, someone else should notify the school nurse.

5. Chemicals in the Mouth. Many chemicals are poisonous to varying degrees. Any chemical taken into the mouth should be spat out and the mouth rinsed thoroughly with water. Note the name of the chemical and notify the nurse immediately.

If the victim swallows a chemical, note the name of the chemical and notify the nurse immediately.

If necessary, the nurse will contact the Poison Control Center, a hospital emergency room, or a physician for instructions.

6. Acid or Base Spilled on the Skin. Flush the skin with water for about 15 minutes. Take the victim to the school nurse.

7. Breathing Smoke or Chemical Fumes. All experiments that give off smoke or noxious gases should be conducted in a well-ventilated fume hood. This will make an accident of this kind unlikely.

If smoke or chemical fumes are present in the laboratory, *all* persons—even those who do not feel ill—should leave the laboratory immediately. Make certain that all doors to the laboratory are closed after the last person has left. Since smoke rises, stay low while evacuating a smoke-filled room. Notify the nurse immediately. Thoroughly ventilate the room before going back to work.

Identifying Caution Alert Symbols

The symbols shown below are used throughout this lab manual at points where extra caution should be exercised. Whenever you see one of these symbols, stop, read the material carefully, and proceed with extra care. If you have any questions, ask your teacher before going on.



SAFETY CLOTHING/SAFETY GOGGLES

These two symbols appear at the beginning of each experiment. They are to remind you that safety goggles and a lab apron (or coat) are to be worn *at all times* when working in the lab. For some activities, your teacher may also instruct you to wear protective gloves.



FIRE

This symbol indicates the presence of an open flame. Loose hair should be tied back or covered, and bulky or loose clothing should be secured in some manner.



CORROSIVE SUBSTANCE

This symbol indicates a caustic or corrosive substance—most frequently an acid. Avoid contact with skin, eyes, and clothing. Do not inhale vapors.



BREAKAGE

This symbol indicates an activity in which the likelihood of breakage is greater than usual, such as working with glass tubing, funnels, etc.



DANGEROUS VAPORS

This symbol indicates the presence of or production of poisonous or noxious vapors. *Use the fume hood* when directed to do so. Care should be taken not to inhale vapors directly. When testing an odor, use a wafting motion to direct the vapor toward your nose.



EXPLOSION

This symbol indicates that the potential for an explosive situation is present. When you see this symbol, read the instructions carefully and *follow them exactly*.



POISON

This symbol indicates the presence of a poisonous substance. Do not let such a substance come in contact with your skin and do not breathe its vapors.



ELECTRICAL SHOCK

This symbol indicates that the potential for an electrical shock exists. Read all instructions carefully. Disconnect all apparatus when not in use.



RADIATION

This symbol indicates a radioactive substance. Follow your teacher's instructions as to the proper handling of such substances.



DISPOSAL

This symbol indicates that a chemical should be disposed of in a special way. Dispose of these chemicals as directed by your teacher.

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.

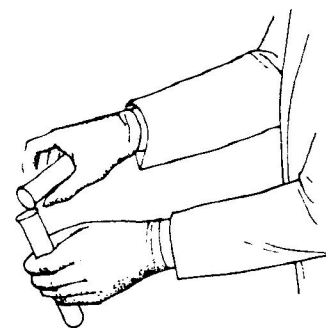


Figure S-1

Settled precipitate



Figure S-2

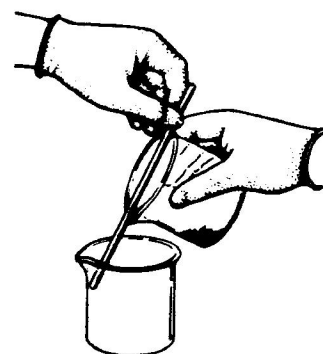


Figure S-3

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.

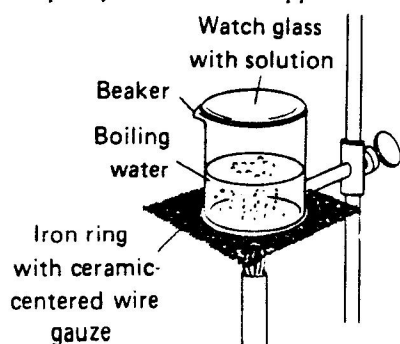


Figure S-4

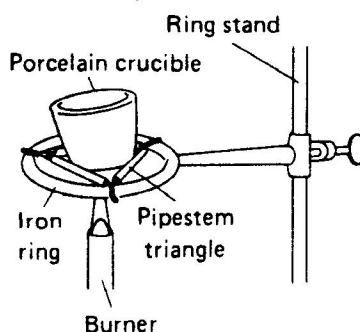


Figure S-5

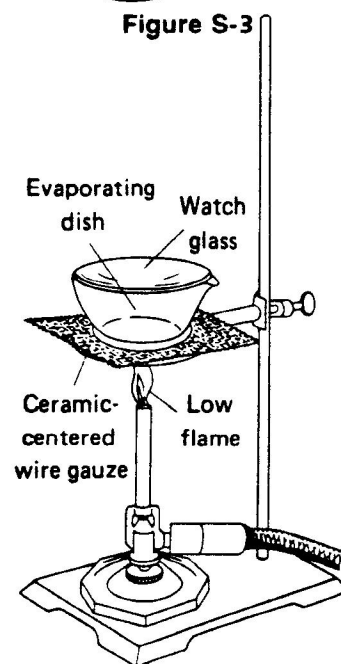


Figure S-6



Figure S-7



Figure S-8

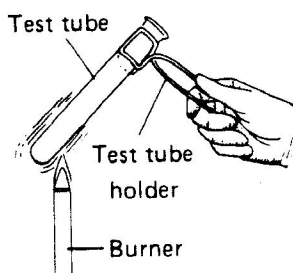


Figure S-11

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.

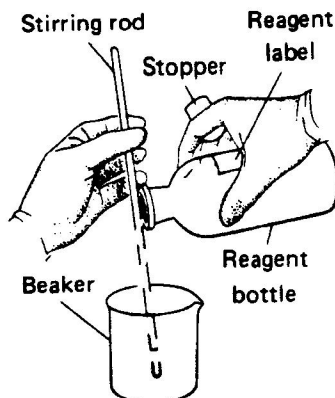


Figure S-9



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.

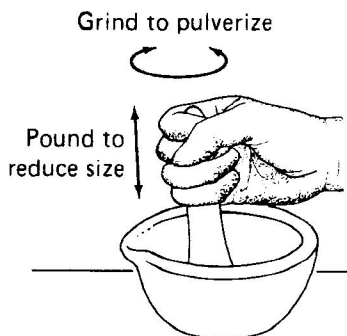


Figure S-13

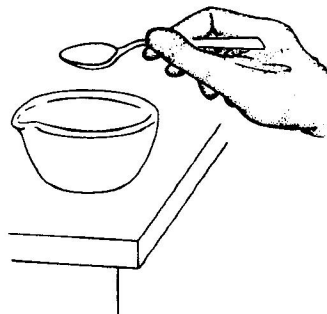


Figure S-14

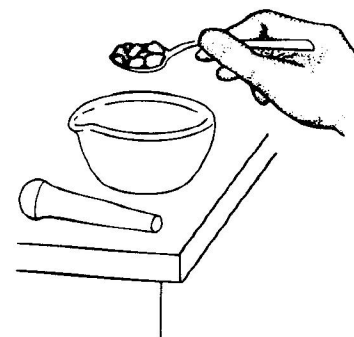


Figure S-12

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.**

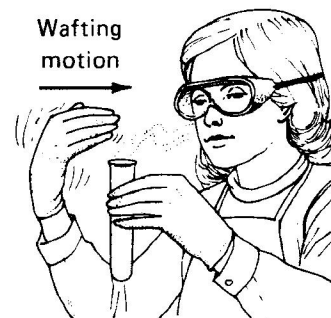


Figure S-15