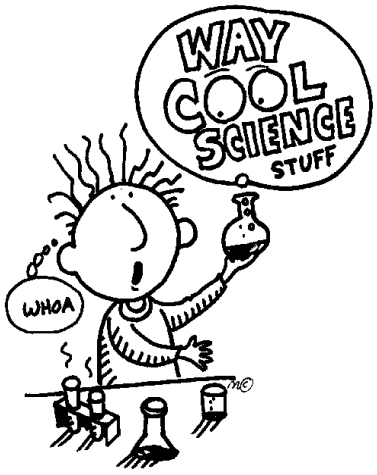
CHEMISTRY

-LABORATORY INTRODUCTION-



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LAB GENERAL RULES TO FOLLOW DURING AN EXPERIMENT[1]

1. **KNOW WHAT YOU ARE DOING!**
   - Read all directions before you start to work. Take notes.
   - When in doubt, ask the teacher to explain.
   - Use only the amounts and materials listed in the experiment.
   - Make substitutes only when told to do so by your teacher.

2. **OBSERVE LABORATORY SAFETY PROCEDURES!**
   - Always wear safety goggles and a laboratory apron while working in the laboratory.
   - Fasten long hair back.
   - Never taste, eat, or drink anything in the laboratory.
   - Immediately wash off any chemical spilled on your skin. Flood the area with copious amounts of running water for at least 2 minutes. Tell, or have someone tell, the teacher immediately.
   - If your skin itches or burns, flood the area of skin with water. Tell, or have someone tell, the teacher immediately.
   - Keep your face back away from containers being heated, and don't lean over your work area.
   - Avoid inhaling toxic fumes by using the ventilation hood.
   - Wash your hands before leaving the laboratory.
   - Report all accidents to your teacher at once.

3. **PREVENT ACCIDENTS FROM OCCURRING!**
   - Work in a quiet, businesslike manner.
   - Avoid moving about the laboratory.
   - Clean up spilled chemicals by first flooding them with water and then wiping them up with a sponge.
   - Keep the drawers and cupboard doors of your laboratory desk closed unless you are removing or putting something away.
   - Don't reach over a burner. (Sometimes you can't see a flame!)
   - Turn off a burner as soon as you are finished heating something, and remember the iron support ring stays hot for a while after the burner has been turned off.
   - Put burned matches, broken glassware, and used chemicals in the places designated by your teacher.
   - Know where the fire extinguisher, nearest fire alarm box, fire blanket, and eyewash device are located and how to use them.
   - Report all accidents to your teacher immediately.

[1] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York.

4. **AVOID CONTAMINATION OF CHEMICALS!**
   - Never return any excess chemical to its stock bottle (original container). Discard the extra chemical, as you would used chemicals.
   - Replace caps, stoppers and corks immediately after removing a chemical from its bottle. The chemical may be affected by the air or moisture.
   - Use only clean, dry spoons, spatulas, or scoopulas to remove solids from their containers. Rinse and dry stirring rods before using them to stir other liquids.
   - Be sure all glassware is clean before using. Drops of water will not cling to clean surfaces of glass.

5. **STUDY OBSERVATIONS BEFORE ANSWERING QUESTIONS!**
   - Look for differences and similarities. Hunt for "patterns" in the data.
   - Think what the question means before answering it. See if the textbook (or other references) gives you any help.
   - Look up the meaning of any term you do not understand.
   - Record any other questions or thoughts you may have that might lead to future experimentation or discussion.

"Always remember to write down your laboratory observations and data. You never know when you may need it."

LAB

SAFETY WORKSHEET[2]

INTRODUCTION

Because you use many chemicals in the chemistry laboratory, it is important to know something about them. Most chemicals are dangerous – e.g., poisonous when they enter the body, burn or irritate the skin, eyes and/or membranes of your digestive and respiratory tracts. Some chemicals destroy fabrics, especially synthetic or protein fibers. Chemicals can even make some things burn. Generally, most chemicals combine at a reasonable rate; however, under certain conditions they can get out of control. Knowing these things about chemicals helps you to prevent accidents and to work safely in the laboratory.

QUESTIONS

1. While you are working in the laboratory, why should you:
   a. wear safety goggles? _____
   b. fasten long hair back?_____
   c. wear a laboratory apron?_____
   d. use only the amounts and materials given in the directions?
      _____
   e. use only clean glassware? _____
2. Why are unused chemicals never returned to their original containers?
   _____
3. Rings and other jewelry should not be worn in the lab. Why?
   _____
4. Why are bottles of chemicals kept tightly closed except when a quantity of chemical is being removed?
   _____
5. Why should the teacher be informed if you are wearing contact lenses?
   _____
6. Why are most chemicals stored in glass or plastic containers rather than metallic ones?
   _____
7. How should you dispose of chemicals that you used in the experiment?
   _____

[2] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 6-8.

8. If your skin itches, burns, or appears red while you are using chemicals, what should you do? (a) _____

   (b) _____

9. What procedures should you follow to:
   a. report an accident resulting in injury to you or someone else? _____
   b. report spilling a chemical or breaking equipment? _____
   c. cope with a fire on your laboratory bench? _____
   d. dispose of cracked or broken glassware? _____

10. Where are the following items located in the classroom?
    a. fire extinguisher: _____
    b. fire blanket: _____
    c. shower: _____
    d. eye wash device: _____

11. Why are desk drawers and cupboard doors kept closed unless you are taking something out or putting it away?

    _____

12. Why is it important to work in a business-like manner, quietly, and with a minimum of distraction or migration around the classroom?

    _____

13. What is the meaning of the following words often found on the labels of chemicals?
    a. caustic: _____
    b. corrosive: _____
    c. hazardous: _____
    d. volatile: _____

14. Why are you not allowed to eat or drink anything in the chemistry classroom?

    _____

15. Why should you read the label on a bottle twice before using its contents?

    _____

16. You should hold a bottle of liquid with the label toward the palm of your hand when you pour out the liquid. Why?

    _____

17. A cap, cork, or stopper from a bottle of liquid is not put down on a desk while you are pouring out some of the liquid. Why?

    _____

18. Explain the statement: "*You are only as safe as the LEAST safe person in the laboratory.*"

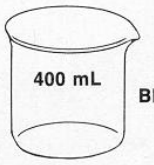
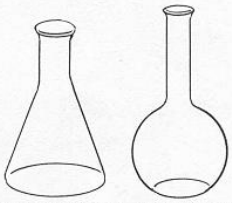
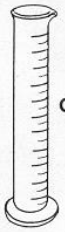
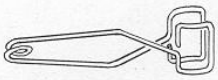
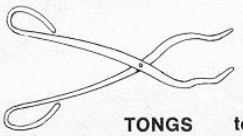
_____

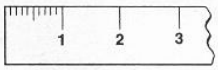
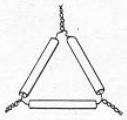
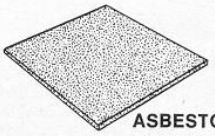
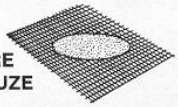
_____

_____

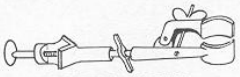
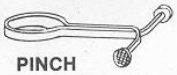
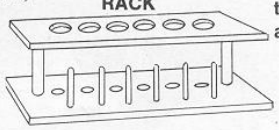
LAB LIST OF LABORATORY EQUIPMENT [3]

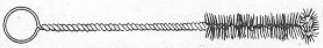
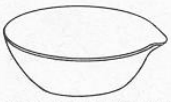
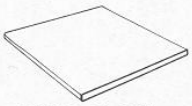
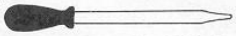
LIST OF APPARATUS FOR STUDENT USE

DESCRIPTION	APPARATUS	USE
glass common sizes 100 mL 250 mL 400 mL marked on the beaker	 BEAKER	as a container, like a cup may be heated
glass common sizes 125 mL 250 mL 500 mL marked on the flask	 ERLENMEYER FLASK FLORENCE FLASK	may be heated
glass marked with a milliliter (mL) scale size: 50 mL, 35 mL, 10 mL divisions: 1.0 mL, 0.2 or 0.5 mL, 0.1 mL	 GRADUATED CYLINDER	to measure volume
glass several sizes	 TEST TUBE	many uses can be heated
metal clamp with a spring handle	 TEST TUBE CLAMP	to hold a test tube
metal	 TONGS	to pick up and hold apparatus

DESCRIPTION	APPARATUS	USE
10 centimeter (cm) ruler, plastic divided into centimeter and millimeter (mm) divisions	 10 CM RULER	to measure length
triangular wire frame with clay material coverings	 PIPESTEM TRIANGLE	to support the crucible
small porcelain dish with cover	 CRUCIBLE AND COVER	to heat small amounts of solid material at high temperature
hardened asbestos	 ASBESTOS SQUARE	to place under hot apparatus
wire screen asbestos center	 WIRE GAUZE	to spread the heat of a flame
metal heating device connected to gas outlet with rubber tubing	 LABORATORY BURNER	to heat chemicals in beakers or test tubes
metal rod upright heavy base	RING STAND	a support with many uses

[3] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 4-5.

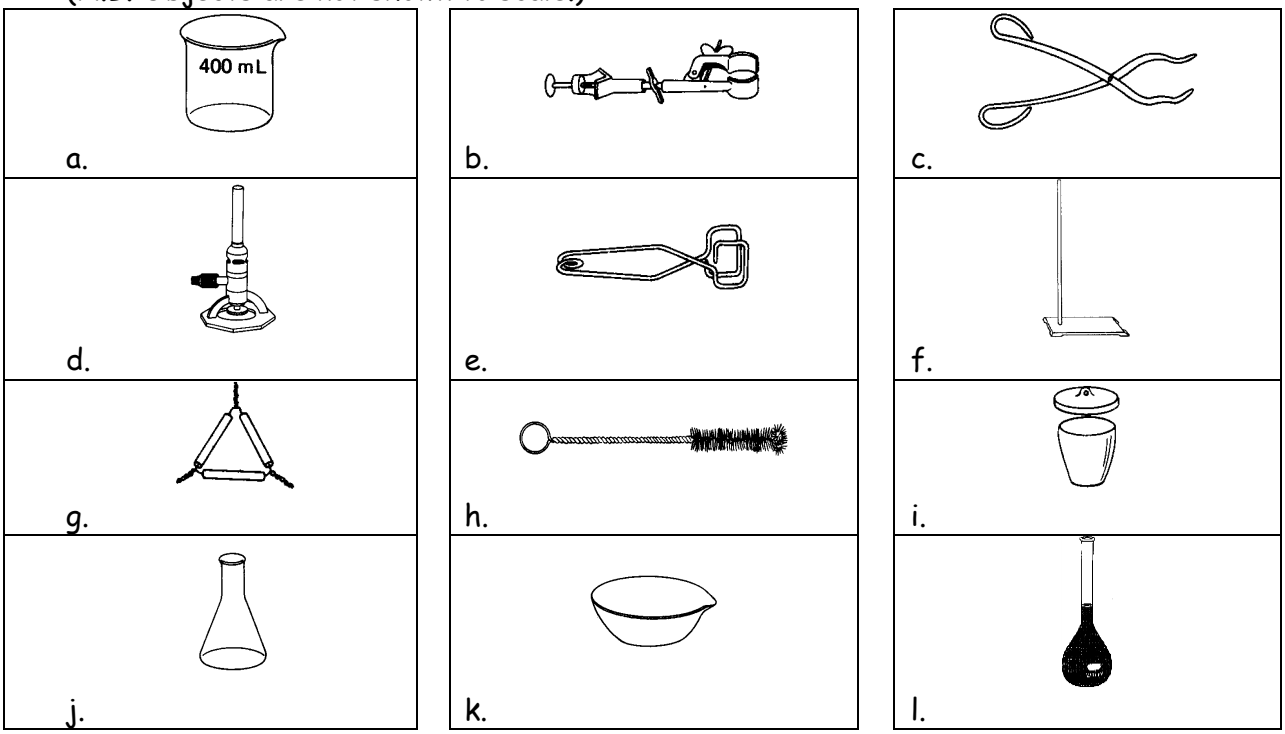
DESCRIPTION	APPARATUS	USE
iron ring with screw fastener several sizes	 IRON RING	to fasten to the ring stand as a support for apparatus
metal clamp with 1. screw fastener 2. swivel and lock nut 3. adjusting screw 4. curved clamp	 BURET CLAMP	to hold apparatus may be fastened to the ring stand
heavy porcelain dish with grinder	 MORTAR AND PESTLE	to grind chemicals to a powder
may be of metal or porcelain	 SPATULA	to transfer solid chemicals in weighing
metal file with three cutting edges	 TRIANGULAR FILE	to scratch glass to file
short length of rubber tubing	 RUBBER CONNECTOR	to connect parts of apparatus
metal clamp with finger grips	 PINCH CLAMP	to clamp a rubber connector
rack; may be wood, metal or plastic	TEST TUBE RACK 	to hold test tubes in an upright position

DESCRIPTION	APPARATUS	USE
brush with wire handle	 TEST TUBE BRUSH	to scrub glass apparatus
glass rod	 STIRRING ROD	to stir combinations of materials to use in pouring liquids
porcelain dish	 EVAPORATING DISH	as a container for small amounts of liquid being evaporated
thick glass	 GLASS PLATE	many uses (should not be heated)
curved glass	 WATCH GLASS	may be used as a beaker cover may be used in evaporating very small amounts of liquid
glass or plastic	 FUNNEL	to hold a filter paper may be used in pouring
glass tip with rubber bulb	 MEDICINE DROPPER	to transfer small amounts of liquid
metal	 FORCEPS	to pick up or hold small objects

LAB GENERAL LABORATORY PROCEDURES WORKSHEET[4]

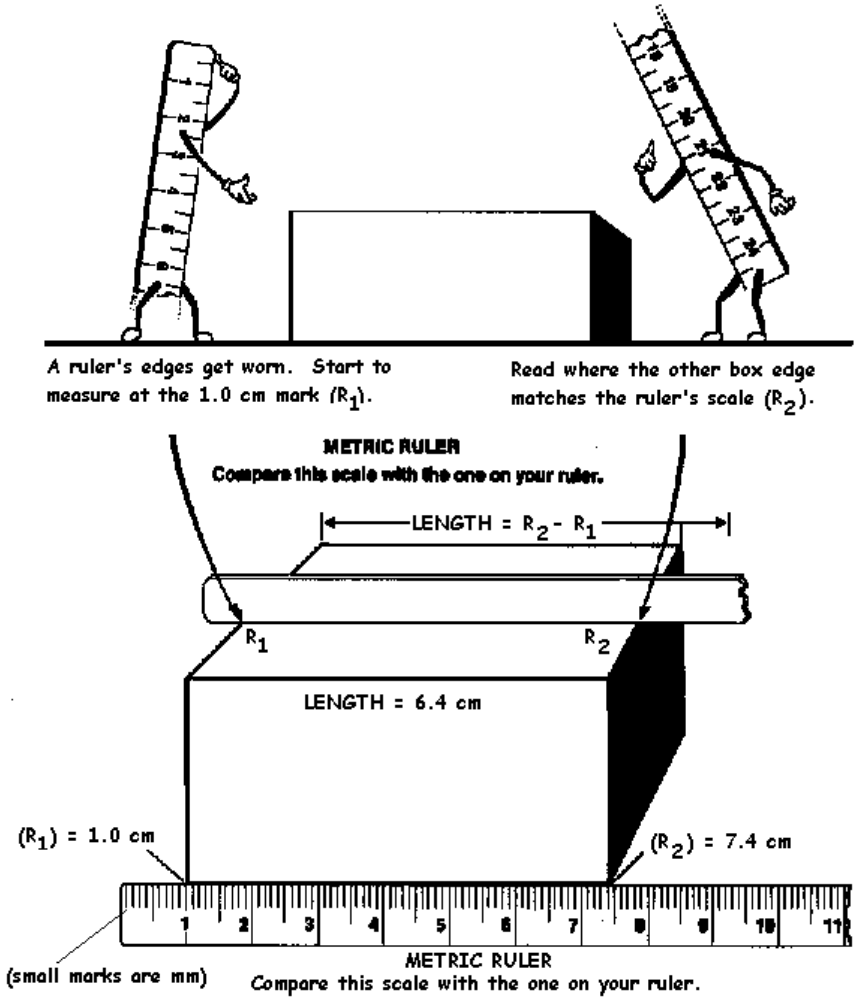
QUESTIONS

1. Name the apparatus or glassware is used?
   a. to pick up and hold apparatus? _____
   b. to clean glassware? _____
   c. as a cover for a beaker? _____
   d. to transfer solid chemicals in massing? _____
   e. as a container for small amounts of liquid being evaporated? _____ or _____
   f. to grind chemicals to a powder? _____
   g. to measure a volume of a liquid? _____
   h. to measure length? _____
   i. to measure mass? _____
2. What is the name for each of the following pieces of laboratory equipment? (N.B. Objects are not shown to scale.)



[4] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 8-10.

LAB HOW TO MEASURE LENGTH[5]



FINAL READING (R_2) MINUS INITIAL READING (R_1) = LENGTH

R_1 = 1.0 cm R_2 = 7.4 cm

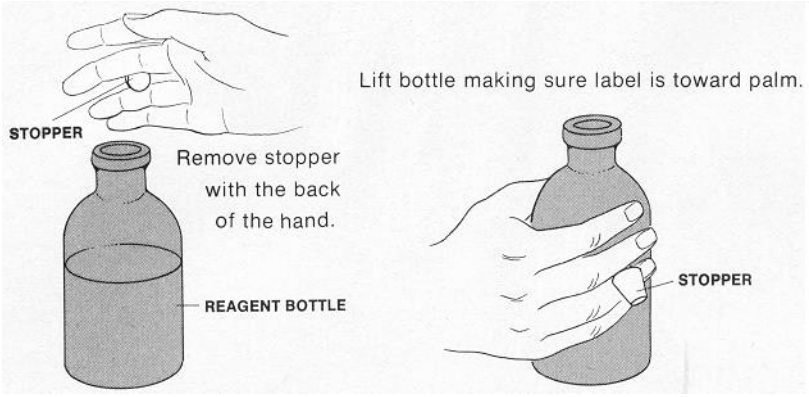
7.4 cm – 1.0 cm = 6.4 cm LONG

[5] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 23

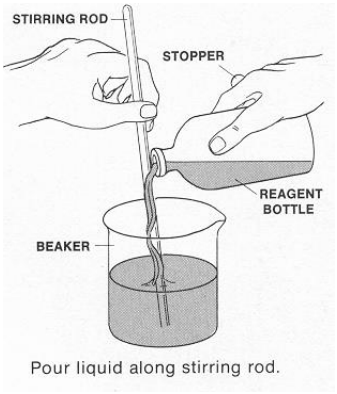
LAB HOW TO POUR A LIQUID[6]

Remove the cap to the bottle. Do not put cap on the counter in a way that would allow liquid on the counter top – when you do this, you have essentially spilled chemical onto the countertop. Moreover, when you replace the cap on the bottle, you can contaminate the liquid if there was anything on the countertop.

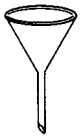
Shown below is the correct way to remove the stopper to a bottle containing a liquid. A similar procedure should be used if the cap is a screw-cap, parafilm® wrapping, etc.



Generally, liquids can be poured carefully directly into the desired container. However, one common technique, used especially for pouring liquids that also contain suspended solids, is DECANTING, which is shown below.



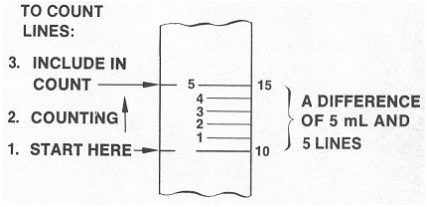
Also, don't hesitate to use a funnel when pouring into a small-mouth container.



[6] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 17

LAB HOW TO MEASURE VOLUME[7]

1. Decide what each unmarked line represents:

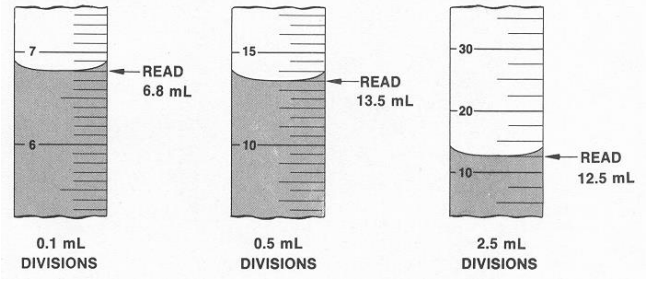


A. On the above scale (Figure 1):

1) $$\text{Divide}: \frac{\text{difference}}{\text{number of lines}} = \frac{\text{amount}}{1\,\text{line}}$$

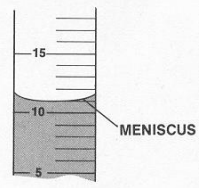
2) $$\frac{5\,\text{mL}}{5\,\text{lines}} = 1\,\text{mL per line}$$

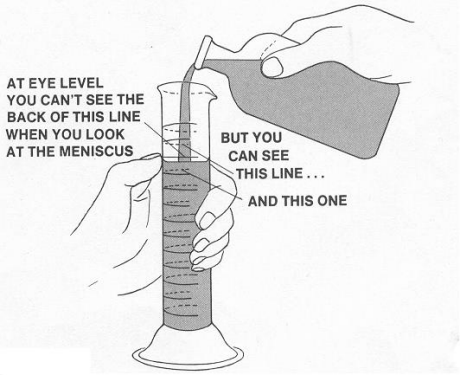
B. Look carefully at the scale. Some graduated cylinders are marked differently.



C. Read at the bottom of the meniscus (the curved surface of the liquid).

Hold the graduated cylinder at eye level so that it is high enough that you can't see the back of the nearest number.





[7] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 22

LAB HOW TO LIGHT A BURNER[8]

OVERVIEW:
Fire requires three parts: (1) heat, (2) fuel, and (3) oxygen. Remove any one of these and the fire will be extinguished. There are several styles of burners available but all share the combining of heat, fuel, and oxygen. Gas intake can be adjusted at the main gas valve or by a valve at the base of the burner. Oxygen intake can be adjusted at the air intake. The style of the burner and the source of heat will determine the steps you follow. Listed below are the two most common burners and two ways for lighting either type.

The hottest part of any flame is the tip of the inner blue cone.

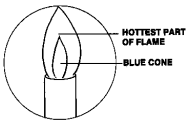


Figure 1.

Fischer Burner

1. Use rubber tubing to connect the burner to the gas valve. Make sure that the chimney is lowered and just snug (no he-man tightening: it will strip the threads), or that the collar is closed. This will make it easier to light the gas.
2. Turn on the main gas valve.
3. Strike the striker and ignite the gas. (If you smell gas, turn off the main gas valve and wait a couple of minutes for the odor to dissipate.)
4. Adjust the height of the flame with the burner gas valve (Figure 2) – again, just so it is snug or you will damage the valve.
5. Adjust the air intake to obtain a blue cone (Figure 1).

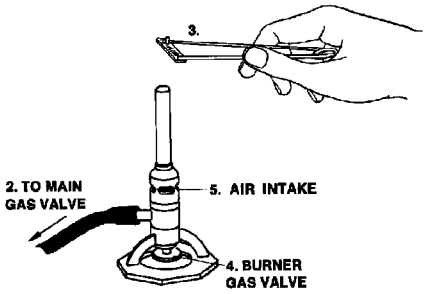


Figure 2.

Bunsen Burner

1. Use rubber tubing to connect the burner to the gas valve. Make sure that the chimney is lowered and snugly tight (no he-man tightening: it will strip the threads), or that the collar is closed. This will make it easier to light the gas.
2. Strike match.
3. Turn on the main gas valve.
4. Bring lighted match up to the chimney to ignite the gas. (If you smell gas, turn off the main gas valve and wait a couple of minutes for the odor to dissipate.)
5. Adjust the height of the flame with the main gas valve. Adjust the air intake (by raising/lowering chimney or by adjusting the air intake) to obtain a blue cone (Figure 1).

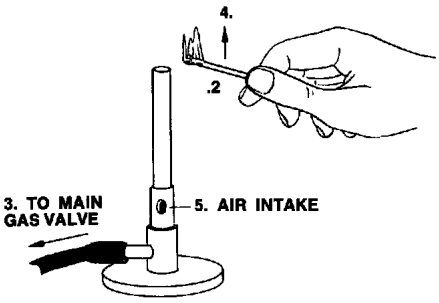


Figure 3.

NOTES:

1. **Remember: hot labware looks the same as cold labware!**

[8] Bolton, Ruth P., Lamphere, Elizabeth V., and Menesini, Mario. (1979). *Laboratory Experiments in ACTION CHEMISTRY*. Holt, Rinehart and Winston, Publishers, New York. p. 22