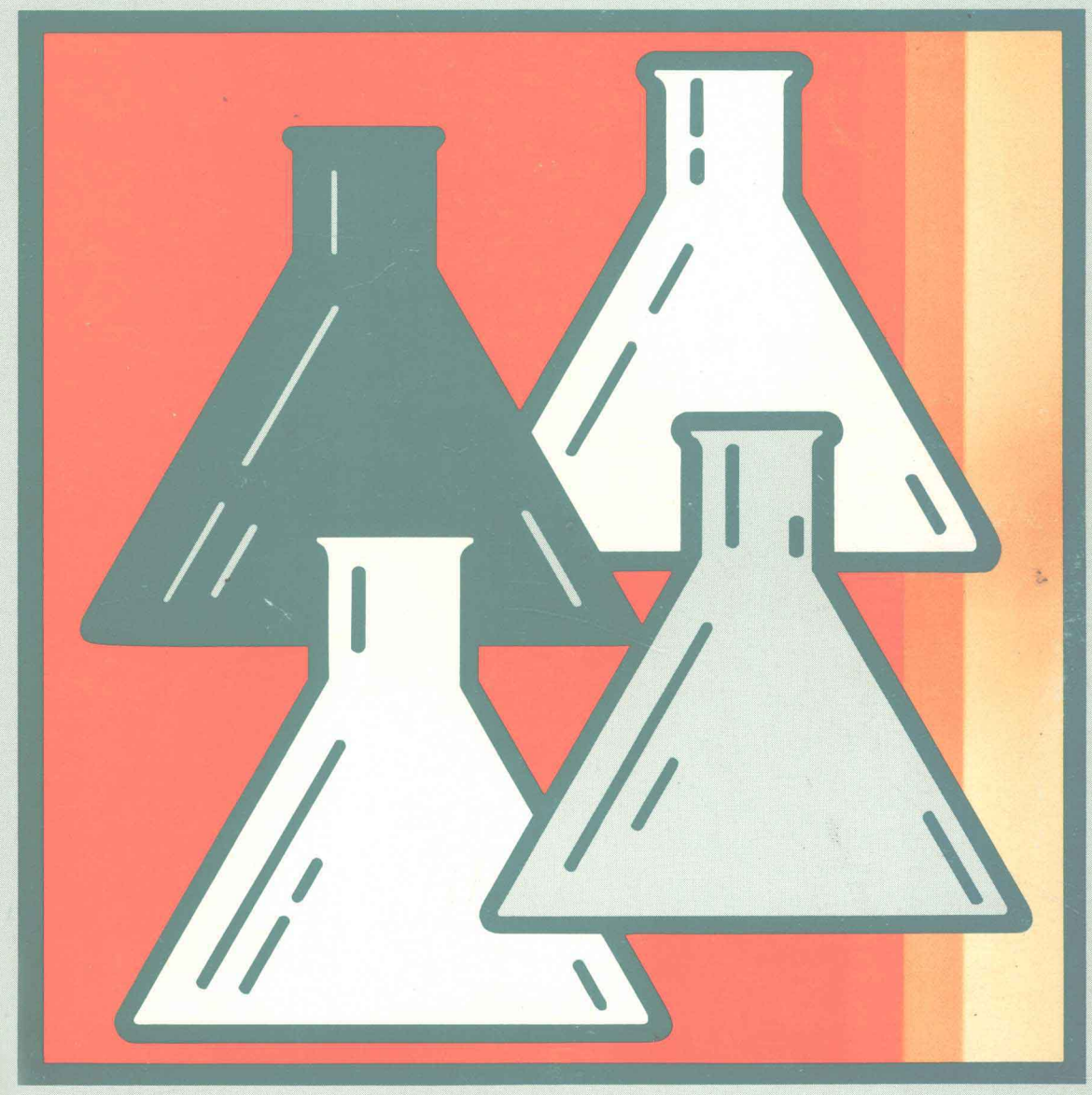
LABORATORY MANUAL

MERRILL

Focus On

Life Science



Daniel · Kaskel

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Focus On Life Science

LABORATORY MANUAL

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To the Student

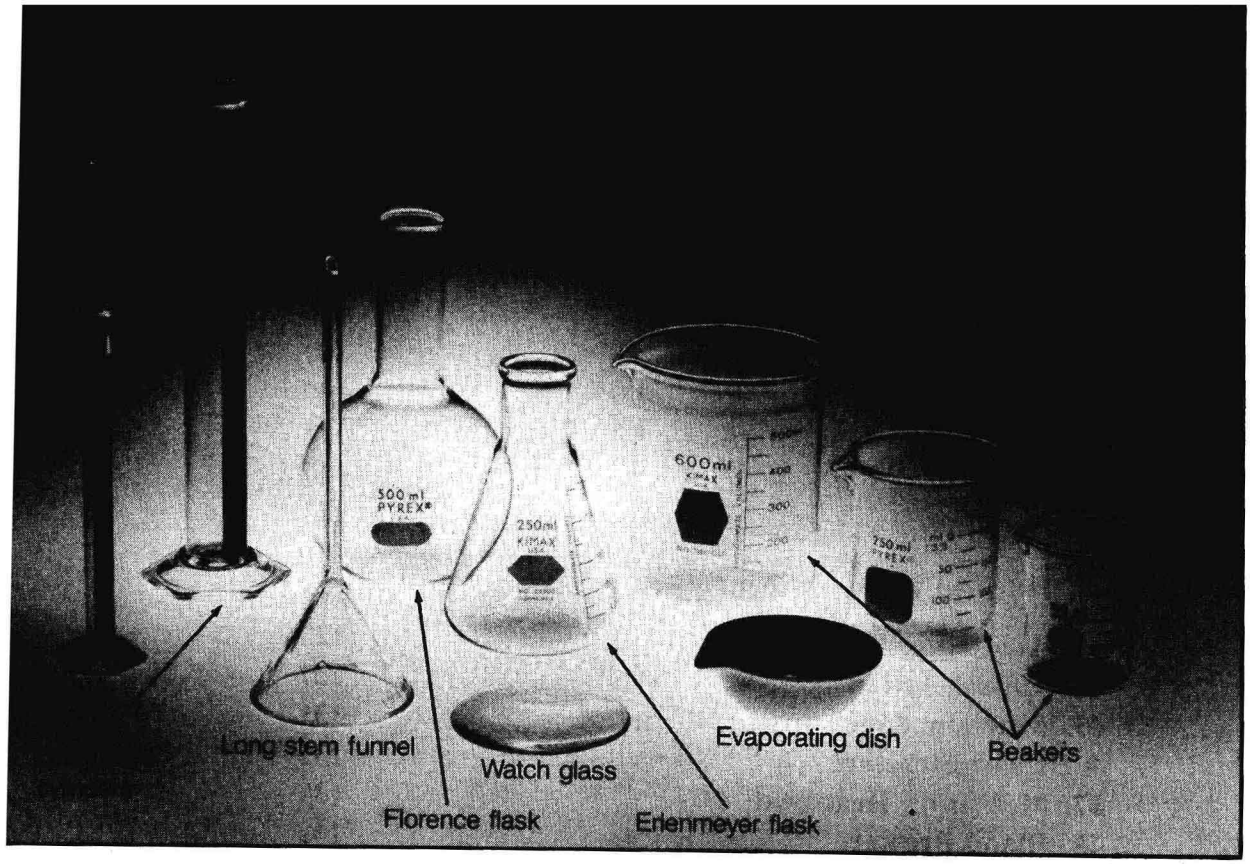
Science is the body of information including all the hypotheses and experiments that tell us abc our environment. All people involved in scientific work use similar methods for gaining informatic One important scientific skill is the ability to obtain data directly from the environment. Observatic must be based on what actually happens in the environment. Equally important is the ability to or nize this data into a form from which valid conclusions can be drawn. The conclusions must be su that other scientists can achieve the same results.

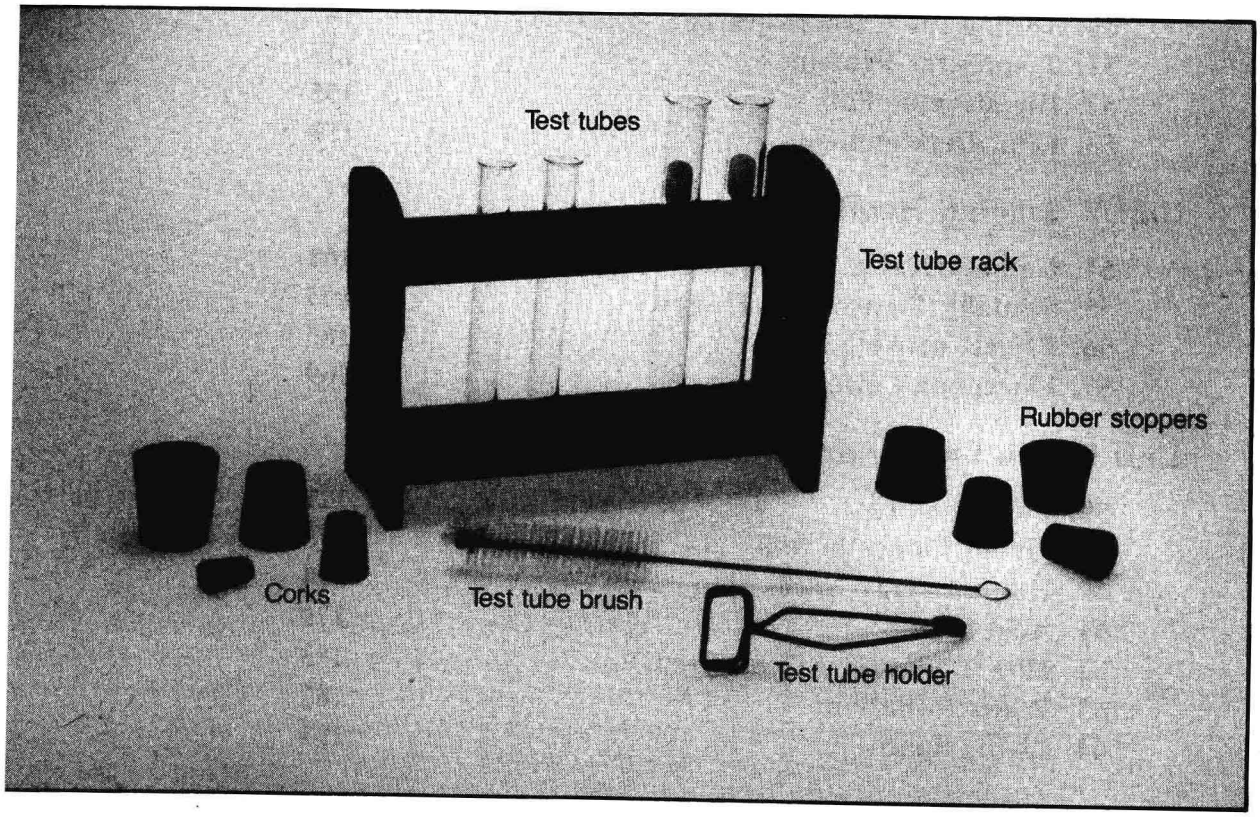
Focus on Life Science: Laboratory Manual is designed for your active participation. The activit in this manual require testing hypotheses, applying known data, discovering new information, a drawing conclusions from observed results. You will be performing activities using the same proces that professional scientists use. Work slowly and record as many observations and as much numeri data as possible. You will often be instructed to make tables and graphs to organize your data. Usi these tools, you will be able to explain ideas more clearly and accurately.

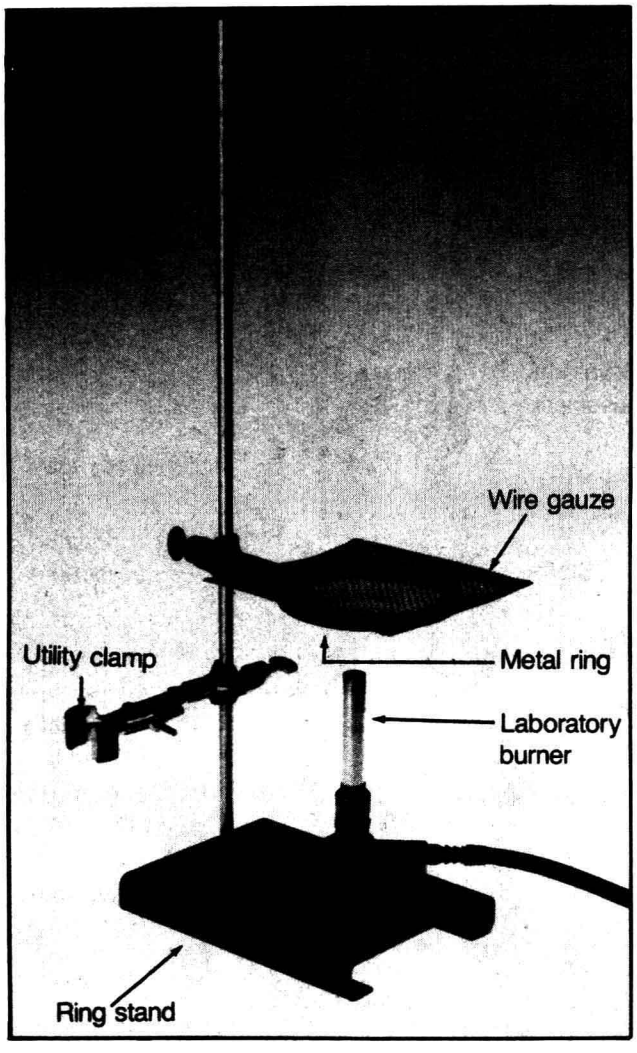
Each activity in ***Focus on Life Science: Laboratory Manual*** is designed to guide you in the proces scientists use to solve a problem. The **Introduction** provides information about the problem under stuc **Strategy** tells you what you are expected to learn from the activity. These statements emphasize t most important concept(s) in the activity. **Materials** tells you the equipment and supplies needed conduct the activity. **Procedure** is the list of steps you follow in doing the activity. **Data and Obser tions** is the section in which you record your findings. Record all observations, no matter how min they may seem. Many times you will be asked to organize your data into tables or graphs. Organizi data helps you recognize relationships among the data. In **Questions and Conclusions,** you must gi written answers to questions and problems. The questions are designed to test your understanding the purpose and results of the activity. The last section is the **Strategy Check.** If you can answer "ye to each question, you understand the concepts involved in the activity. If not, reread or repeat t activity to see if you can identify the concept you do not understand.

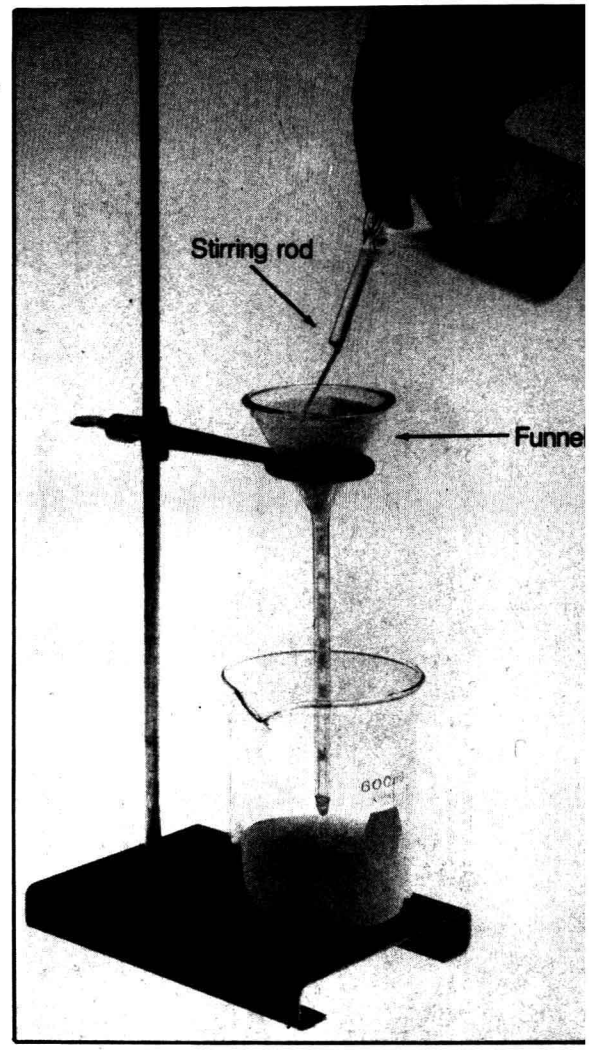
Remember that the way you approach a problem—collecting data and making observations—is important as the "right" answer. Good luck in your laboratory experiences!

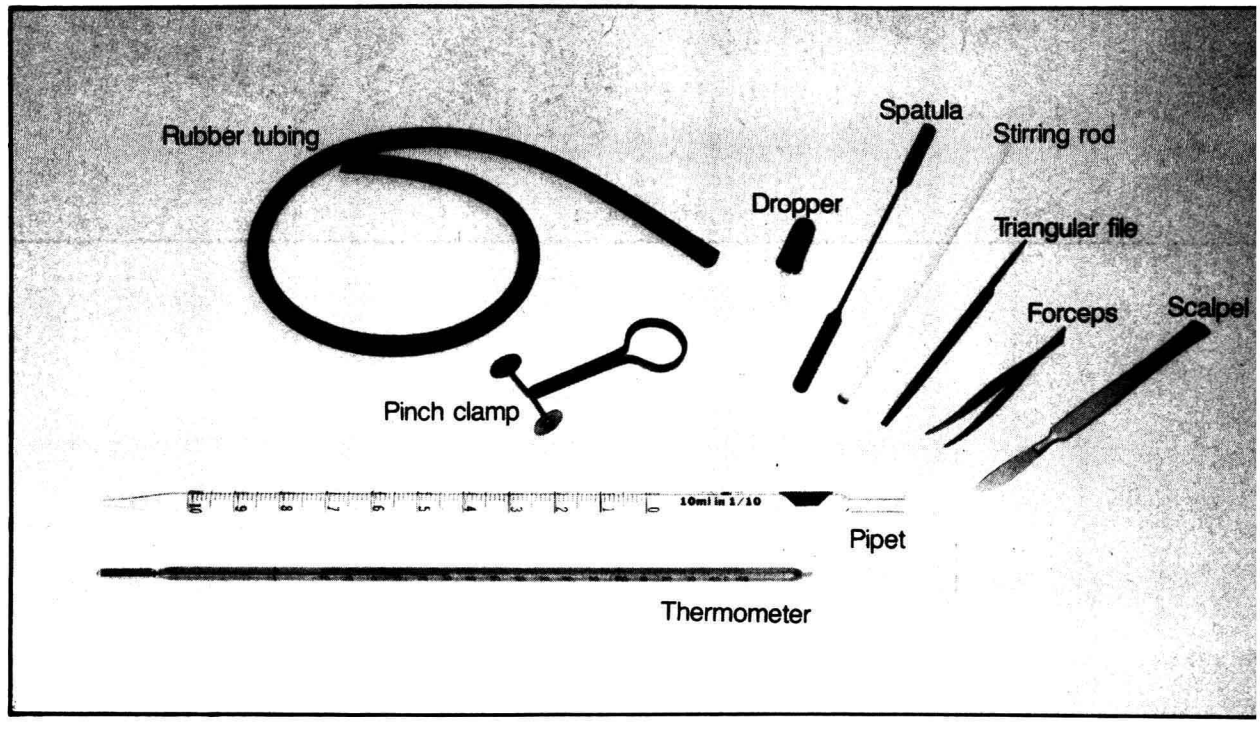
Laboratory Equipment

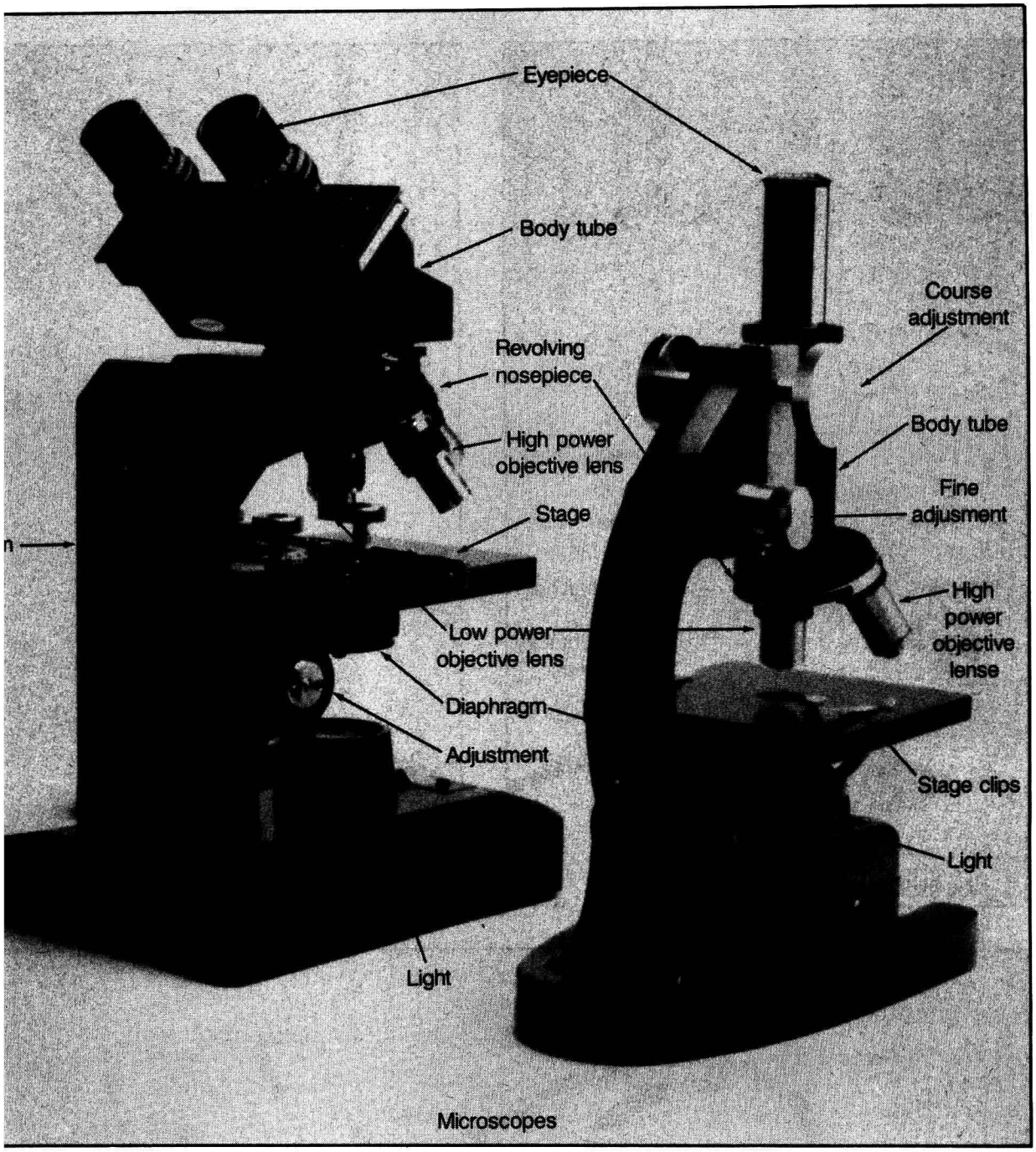





Wire gauze
Utility clamp
Metal ring
Laboratory burner
Ring stand


Stirring rod
Funnel


Rubber tubing
Spatula
Stirring rod
Dropper
Triangular file
Forceps
Scalpel
Pinch clamp
Pipet
Thermometer



Microscopes

Laboratory Techniques

Many of the activities in *Focus on Life Science: Laboratory Manual* require you to perfor simple procedures, such as measuring temperature and volume. You need to know the best tec nique for performing these basic procedures. The accuracy of your activity work in the laborato will depend on how well you do these techniques. Also, there are potentially dangerous substanc and equipment in the laboratory. Your safety will depend on your correct handling of the Remember, too, that the equipment in the laboratory is fragile and costly. Learn to handle properly.

Before you begin the activities, be sure you understand and can do the following laborato techniques correctly. Follow directions carefully. Refer to this section of your book to revi any technique that you are directed to perform as part of an activity.

Measuring Temperature

When measuring the temperature of hot liquids, be sure you use a thermometer that is calibrated for high temperatures. When the temperature of a material is measured with a thermometer, the bulb of the thermometer should be in the material. The bulb should not touch the sides or bottom of the container. Never use a thermometer to stir a liquid. Use a stirring rod for stirring.

When the thermometer is removed from the material, the column of mercury or alcohol in the thermometer soon shows the temperature of the air.

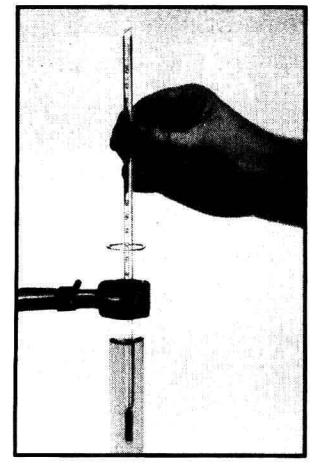


FIGURE A.

Measuring Volume

The surface of liquids when viewed in glass containers is curved. This curved surface is called the meniscus. Most of the liquids you will be using form a meniscus that curves down in the middle. Read the volume of these liquids from the bottom of the meniscus, as shown in Figure G. This measurement gives the most precise volume because the liquids tend to creep up the sides of glass containers.

The meniscus must be viewed along a horizontal line of sight. Do not try to read the volume of a liquid while looking up or down at the meniscus. Hold the cylinder so that its sides are at a right angle to your eye. Liquid in plastic containers does not form a meniscus. If you are using plastic graduated cylinders and no meniscus is noticeable, read the volume from the level of the liquid.

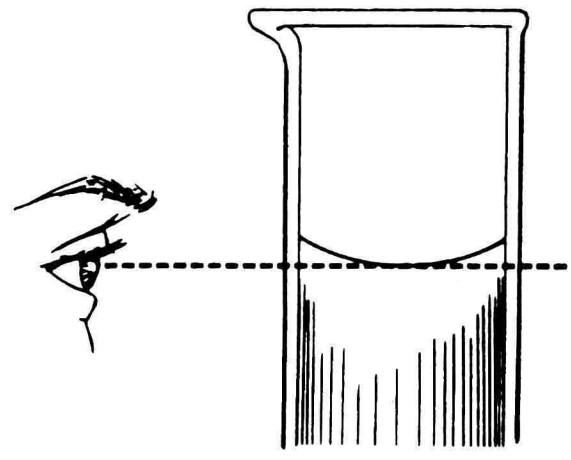


FIGURE B.

ing the Balance

ıere are various types of laboratory balances in common use today. The balance you use look somewhat different from the one in Figure C; however, all beam balances have some mon features.

ıe following technique should be used to transport a balance from place to place.

3e sure all riders are back to the zero point.

f the balance has a lock mechanism to lock the pan(s), be sure it is on.

Place one hand under the balance and the other hand on the beams' support to carry the ɔalance.

ıe following steps should be followed in using the balance.

3efore determining the mass of any substance, slide all of the riders back to the zero point. Check to see that the pointer swings freely along the scale. You do not have to wait for the ɔointer to stop at the zero point. The beam should swing an equal distance above and below ;he zero point. Use the adjustment screw to obtain an equal swing of the beams, if necessary. You must repeat this procedure to "zero" the balance every time you use it.

Never put a hot object directly on the balance ɔan. Any dry chemical that is to be massed ;hould be placed on waxed paper or in a glass ;ontainer. *Never pour chemicals directly on the ɔalance pan.*

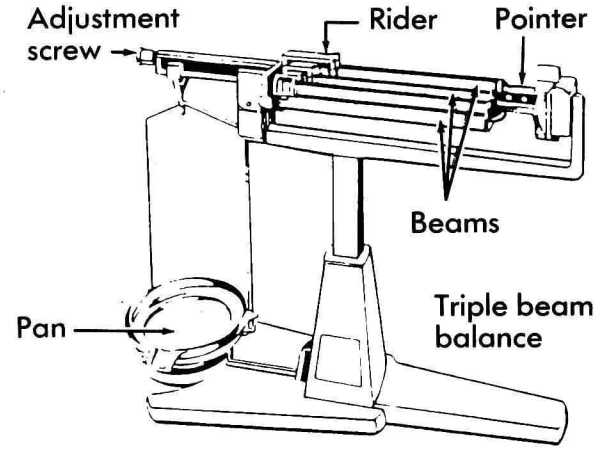
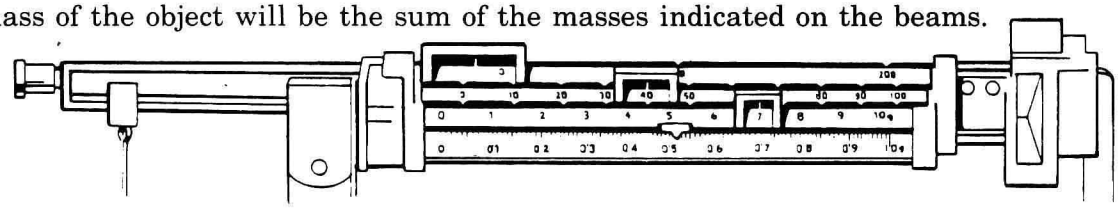


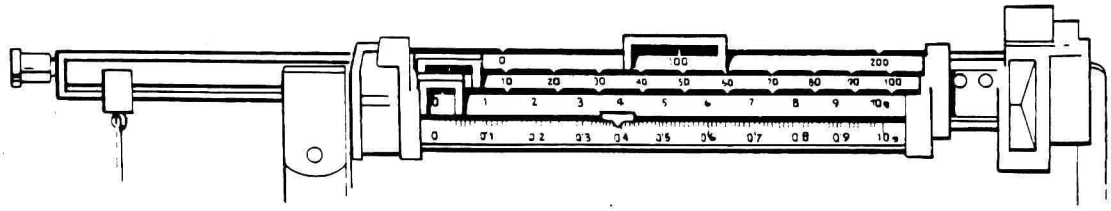
FIGURE C.

After you have placed the object to be massed on the pan, move the riders along the beams beginning with the largest mass first. If the beams are notched, make sure all riders are in a notch before you take a reading. Remember, the pointer does not have to stop swinging, but the swing should be an equal distance above and below the zero point on the scale.

The mass of the object will be the sum of the masses indicated on the beams.



The mass of this object would be read as 47.52 grams. FIGURE D.



The mass of this object would be read as 100.39 grams. FIGURE E.

Using the Microscope

The microscope is an important tool of life scientists. To use the microscope properly, you shou study page viii and learn the name of each part. Whenever you use the microscope, carefu follow these instructions.

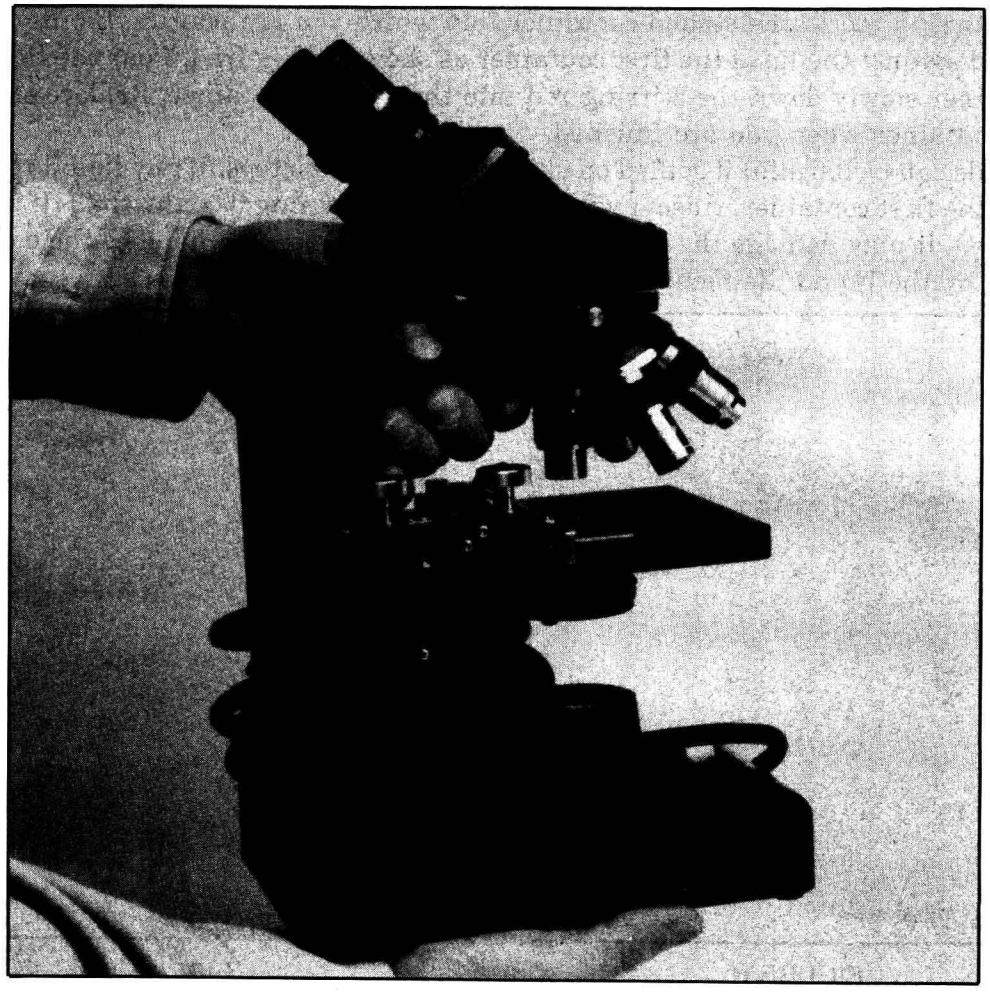
Always carry the microscope with both hands. Hold the arm with one hand. Put your oth hand under the base as shown in Figure F. Place the microscope on a table gently, with t arm facing you. Clear the table of other objects not needed for the activity you are doing.

Turn on the light if the microscope has one. (If the microscope does not have a light, use lamp as a light source. Never use direct sunlight as a light source. It can damage your ey Look through the eyepiece and adjust the mirror so that light from the lamp is reflected up throu the opening in the stage.) Make sure that electric cords from microscopes or lamps do not blo aisles. Be careful not to upset a microscope or lamp by running into a cord. Always unplug el tric cords by gripping the plug and not the cord itself.

Adjust the diaphragm so that the greatest amount of light comes through the opening. T circle of light that you see is called the field of view. Turn the nosepiece so that the low pow objective lens (10×) clicks into place. Focus by turning the coarse adjustment. Turn the nosepie again until the high power objective lens clicks into place. Turn the fine adjustment to foc Never turn the coarse adjustment when the high power objective lens is in place. Be sure y do not touch the lenses. Use only special lens paper to clean the lenses.

When you are finished using the microscope, always click the low power objective lens ba into place over the field of view. Turn the coarse adjustment to raise the body tube until t low power objective lens is about two or three centimeters above the stage. Carry the microsco properly to its storage place.

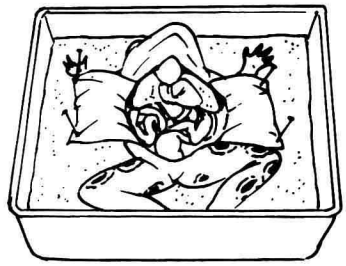
FIGURE F.



Disposal of Biological Materials

In certain laboratory investigations, living and preserved plant and animal tissues will be handled. Once the investigation is completed, these materials should be disposed of immediately. Give all preparations to your teacher for proper disposal unless otherwise instructed by your teacher. Familiarize yourself with the safety symbol for biologicals. Always wash your hands after handling these materials.

FIGURE G.



Transferring Liquids

Follow these general rules to safely transfer a liquid from one container to another. If the first container has a stopper, remove the stopper and hold it in your fingers as shown in Figure H. Put a stirring rod in the second container into which you are pouring the liquid. Hold the stirring rod against the lip of the first container as shown in Figure I. Pour the liquid from the first container slowly down the stirring rod into the second container. Replace the stopper in the first container when you are finished.

Chemicals can be harmful if spilled on skin, clothes, or tabletops. If any liquid runs down the outside of the first container, rinse it with water before retuning it to the shelf. If the container is not rinsed, it may damage the shelf. Also, the next student who handles the container may be burned by the liquid. Remember: *You* might be that student!

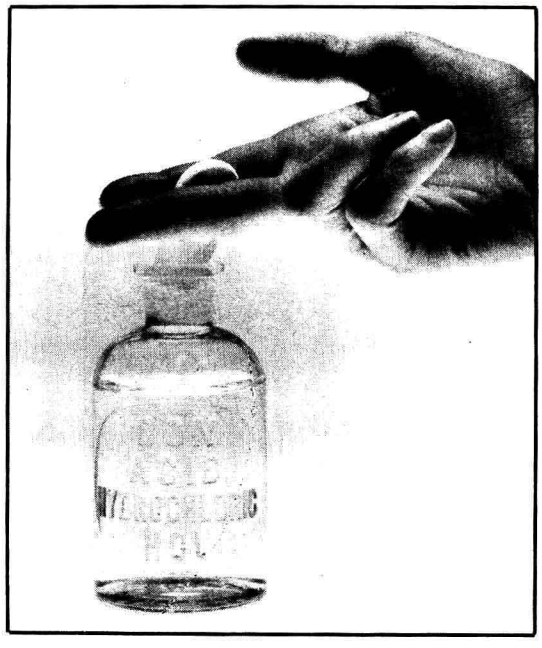


FIGURE H.

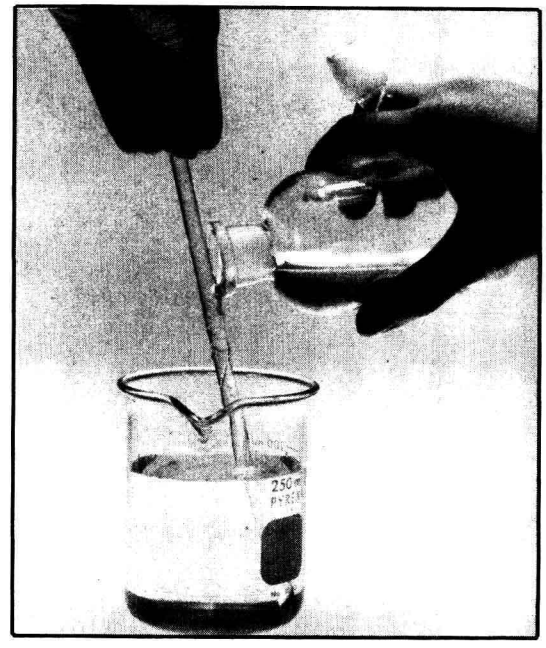
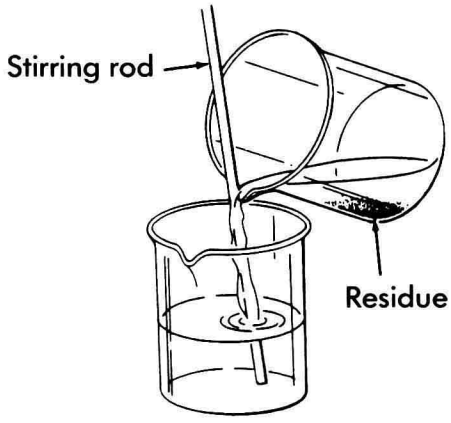


FIGURE I.

Decanting and Filtering

It is often necessary to separate a solid from a liquid. Filtration is a common process of separati used in most laboratories. The liquid is decanted, that is, the liquid is separated from the so by carefully pouring off the liquid leaving only the solid material. To avoid splashing and maintain control, the liquid is poured down a stirring rod. See Figure J. The solution is usua filtered through filter paper to catch any solid that has not settled to the bottom of the beak See Figure K.



Decanting liquid from a precipitate

FIGURE J.

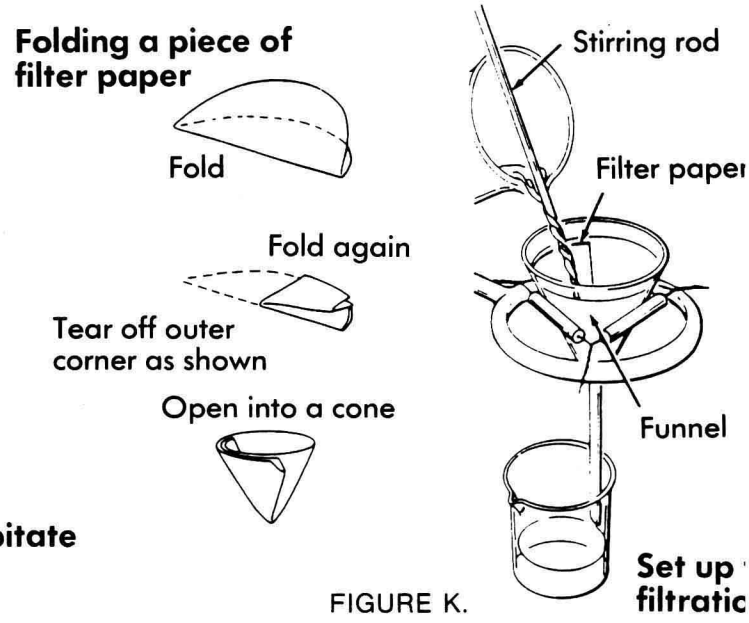


FIGURE K.

Lighting a Laboratory Burner and Adjusting the Flame

Connect the hose of the burner to a gas supply. Partly open the valve on the gas supply, a hold a lighted match to the edge of the top of the burner. See Figure L.

The size of the flame can be changed by opening and closing the valve on the gas supply. T color of the flame indicates the amount of air in the gas. The air supply is controlled by mov the tube of the burner. A yellow flame indicates more air is needed, and the burner tube be turned to increase the amount of air. If the flame goes out, the air supply should be redu by turning the burner tube in the opposite direction. The gas supply is controlled by the va on the bottom of the burner. The hottest part of the flame is just above the tip of the inner c of the flame.

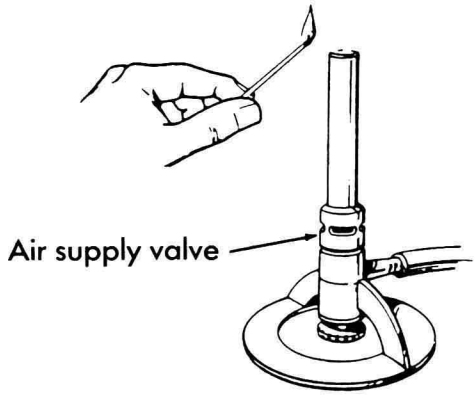


FIGURE L.

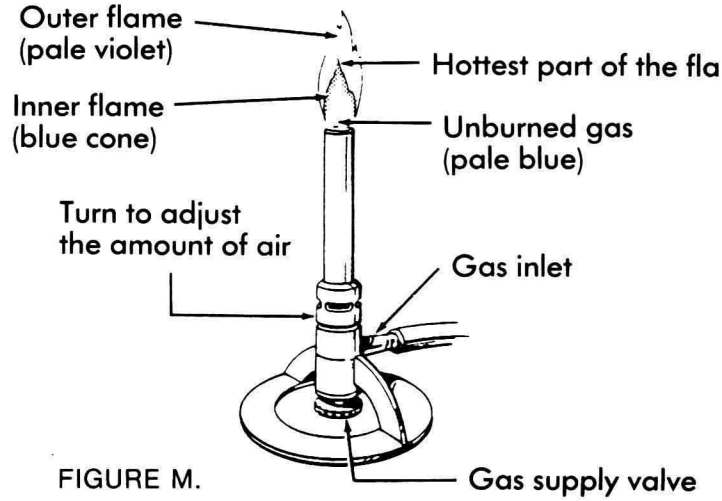


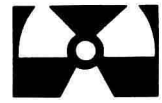
FIGURE M.

Safety Symbols

DISPOSAL ALERT
This symbol appears when care must be taken to dispose of materials properly.

ANIMAL SAFETY
This symbol appears whenever live animals are studied and the safety of the animals and the students must be ensured.

BIOLOGICAL SAFETY
This symbol appears when there is danger involving bacteria, fungi, or protists.



RADIOACTIVE SAFETY
This symbol appears when radioactive materials are used.

OPEN FLAME ALERT
This symbol appears when use of an open flame could cause a fire or an explosion.

CLOTHING PROTECTION SAFETY
This symbol appears when substances used could stain or burn clothing.

THERMAL SAFETY
This symbol appears as a reminder to use caution when handling hot objects.

FIRE SAFETY
This symbol appears when care should be taken around open flames.

SHARP OBJECT SAFETY
This symbol appears when a danger of cuts or punctures caused by the use of sharp objects exists.

EXPLOSION SAFETY
This symbol appears when the misuse of chemicals could cause an explosion.

FUME SAFETY
This symbol appears when chemicals or chemical reactions could cause dangerous fumes.

EYE SAFETY
This symbol appears when a danger to the eyes exists. Safety goggles should be worn when this symbol appears.

ELECTRICAL SAFETY
This symbol appears when care should be taken when using electrical equipment.

POISON SAFETY
This symbol appears when poisonous substances are used.

PLANT SAFETY
This symbol appears when poisonous plants or plants with thorns are handled.

CHEMICAL SAFETY
This symbol appears when chemicals used can cause burns or are poisonous if absorbed through the skin.

Table of Contents

NAME _____ DATE _____ CLASS _____

THE SCIENTIFIC METHOD 1

When scientists are asked questions, they may not know the answers. They think of possible answers, called hypotheses, and experiment to find the correct answer. Using the results of the experiment, they may need to form another hypothesis and test it. This way of solving a problem is called the scientific method.

Strategy

You will predict whether or not red cabbage juice will remain red when chemicals are added to it.
You will test you prediction with an experiment.
You will observe what happens and record your observations.
You will draw conclusions based on your observations.

Materials 

3 droppers
graduated cylinder (25 mL)
labels
40 mL red cabbage juice
test tube rack
4 test tubes (18 × 150 mm)
chemical X (vinegar) Keep containers closed when not in use.
chemical Y (ammonia)
chemical Z (baking soda solution)
apron
goggles

Procedure

1. In the space below, predict what will happen to the red cabbage juice when chemicals X, Y, and Z are added to it. _____

2. Label four test tubes, 1, 2, 3, and 4.
3. Add 10 mL of red cabbage juice to each test tube.
   CAUTION: *Do not spill chemicals X, Y, or Z on clothes or skin.* Rinse with water if spilled.
4. Add 10 drops of chemical X to test tube 1.
5. Add 10 drops of chemical Y to test tube 2.
6. Add 10 drops of chemical Z to test tube 3.
7. Do not add anything to test tube 4. This is the control. The control is part of an experiment that is not tested.

Data and Observations

1. Record your observations in Data Table 1

Data Table 1

Test tube	Substance added	Color
1		
2		
3		
4		

Questions and Conclusions

1. *(a)* Was your prediction correct? _____

(b) What part of the scientific method is predicting? _____

2. Do all chemicals have the same effect on red cabbage juice? _____

3. Why did you record the color changes? _____

_____

4. What steps in the scientific method did you use? _____

_____

5. What is the purpose of the control in an experiment? _____

_____

6. Why is a hypothesis called an educated guess? _____

_____

7. Was your experimenting a way of proving your hypothesis? Explain. _____

_____

8. How did your hypothesis change after experimenting? _____

_____

Strategy Check

_____ Did you make a prediction?

_____ Did you test your prediction and record what happened?

_____ Can you draw conclusions based on your observations?