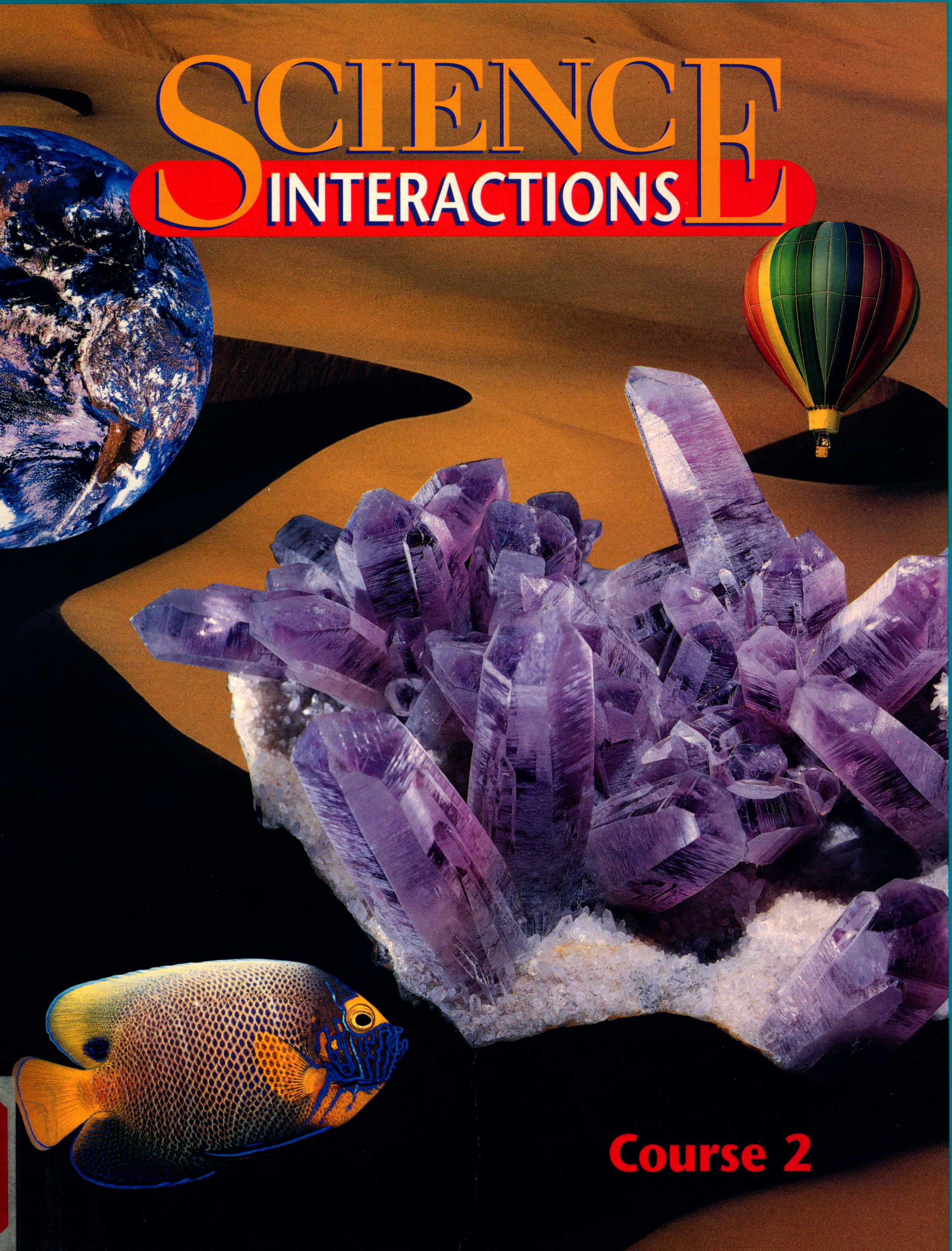
SCIENCE DISCOVERY ACTIVITIES

SCIENCE INTERACTIONS



Course 2

SCIENCE … VERY ACTIVITIES

SCIENCE INTERACTIONS

Course 2

GLENCOE
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A *GLENCOE* Program
Science Interactions

Student Edition
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Science Discovery Activities: SE
Science Discovery Activities: TE
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Laboratory Manual: TE
Study Guide: SE
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To the Student

Imagine that you are one member of a group that is trying to buy new tiles to resurface the floor of your office. Before you can make your selection, you need to consider a number of factors that might affect your decision. For example, you will have to secure samples of the different tiles you are considering, you will need to know the price of each type of tile, and the durability of the tiles given your office environment. For the last point, you may have to do some testing to determine if the tiles can withstand the amount of traffic in your office, the types of materials that you might spill on it, and how well the tiles clean up. Once you are armed with all of this information, you might narrow your choices down to two or three possibilities and look at these more carefully a second time.

With *Science Discovery Activities* you will have the opportunity to apply the same organized methods to solve some very interesting problems. For example, using familiar materials and your own creativity, you will be asked to design some new sports equipment, make unusual substances, plan a course for a water race, and discover why musical instruments work as they do.

Each activity begins with a **Getting Started** section to review some ideas that may help you. The next section is either **Hypothesize** or **Think Critically** where you will consider possible explanations or ways to solve a problem you are given. In the **Try It** section, it will often be up to you to plan your own experiment or to make a model to test your ideas. **Summing Up/Sharing Ideas** gives you the opportunity to describe your methods and conclusions and compare your work with others. You may be surprised to discover that there was more than one approach that led to interesting and useful results. In **Going Further** you can extend or apply what you have learned to a related problem. Sometimes, there is a feature called **Be a Problem Solver** which presents an especially challenging question or idea for you to consider.

For most of the activities, you will work with a partner or in a small group. Just as in the real world, where problems may be very complex, sharing ideas and responsibilities with others is often the best way to be successful in achieving goals.

Now it's time to begin *Science Discovery Activities.*

Safety in the Laboratory

Following safety procedures in the laboratory is extremely important. Accidents are usually the result of carelessness, not following procedures correctly, or of ignoring warnings. Take lab work seriously. Pay attention to all safety procedures. Here are important safety guidelines to follow when you do laboratory experiments:

SAFETY EQUIPMENT

- Become familiar with the safety equipment available in your laboratory.
- Know where fire extinguishers, fire blankets, safety shower, and first-aid kits are and how to use them. Also, be sure you know where the fire alarm is and where the telephone is, should you need to call for help.

GUARDING YOUR EYES

- Wear goggles or other protective glasses when handling dangerous substances, such as chemicals, or when working with glass equipment. Otherwise, the chemicals or pieces of glass could enter the eyes.
- Should any such substances get into your eyes, wash them immediately with lots of water. Notify your teacher.
- Never use reflected sunlight to illuminate a microscope. Always use a lamp that provides the proper intensity of light needed.

PROTECTING YOUR BODY AND YOUR CLOTHING

- Wear gloves and an apron that covers the front of your clothing when working with chemicals in glassware or over an open flame.
- Tie your hair back so that loose hair cannot catch fire.
- Roll up your sleeves so that they cannot catch fire.
- Never pour water into a strong acid or base solution. The proper procedure is to pour the chemical slowly into the water.
- Never test the smell of a substance by putting your nose directly over the substance. Use your hand to wave the fumes toward you.

USING HEATING EQUIPMENT

- If possible, use a hot plate, not an open flame, to heat substances.
- If you do use an open flame to heat substances in glass containers, use a wire screen with a ceramic center.
- Never point the open end of a heated test tube containing a substance toward yourself or toward anyone else.

PREVENTING INJURIES FROM EQUIPMENT

- Use extreme care when using sharp instruments such as knives, scissors, or nails.
- Be sure that any glass equipment used for heating is heat-resistant. Never use glassware that is cracked or chipped.

CLEANLINESS

- Wash your hands with hot, soapy water after using any dangerous substances.
- Wash all work areas thoroughly. First, be sure to neutralize an acid spill with baking soda or a base spill with boric acid. Then wash the spill area with lots of water.
- Be sure all equipment is clean. Then store the equipment and left-over supplies in the proper place.
- Turn off all running water. Turn off all gas burners or electric plates.

Safety Symbols

The *Science Discovery Activities* Program uses safety symbols to alert you to possible laboratory dangers. These symbols are explained below. Be sure you understand each symbol before you begin an activity.

	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 student must be ensured.
	BIOLOGICAL HAZARD 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.

Laboratory Techniques

Some of the activities in *Science Discovery Activities* require you to perform simple procedures, such as measuring temperature and volume. You need to know the best technique for performing these basic procedures. The accuracy of your activity work in the laboratory will depend on how well you do these techniques. Also, there are potentially dangerous substances and equipment in the laboratory. Your safety will depend on your correct handling of them. Remember, too, that the equipment in the laboratory is fragile and costly. Learn to handle it properly.

Before you begin the activities, be sure you understand and can do the following laboratory techniques correctly. Follow directions carefully. Refer to this section to review 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.

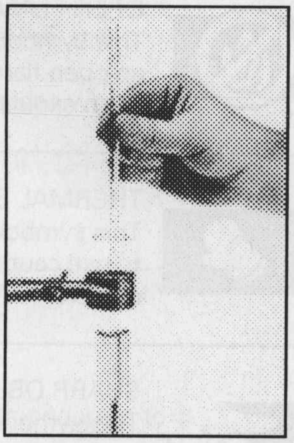


FIGURE A.

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 B. 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.

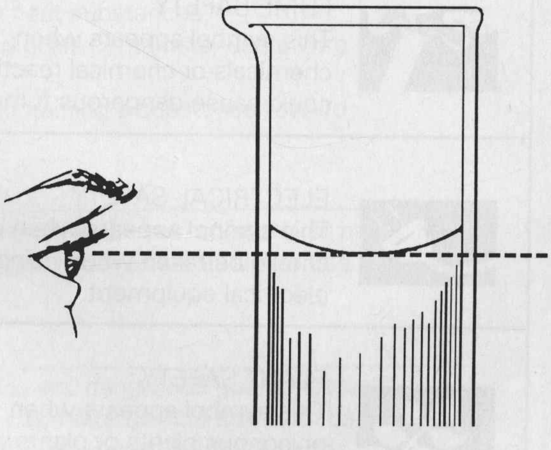


FIGURE B.

USING THE BALANCE

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

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

(1) Be sure all riders are back to the zero point.

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

(3) Place one hand under the balance and the other hand on the beams' support to carry the balance.

The following steps should be followed in using the balance.

(1) Before 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 pointer to stop at the zero point. The beam should swing an equal distance above and below the 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.

(2) *Never put a hot object directly on the balance pan.* Any dry chemical that is to be massed should be placed on waxed paper or in a glass container. *Never pour chemicals directly on the balance pan.*

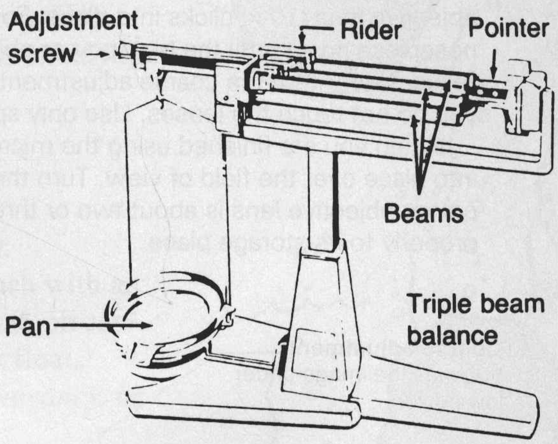
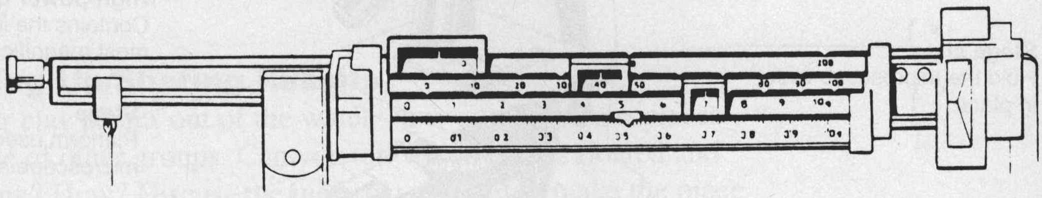


FIGURE C.

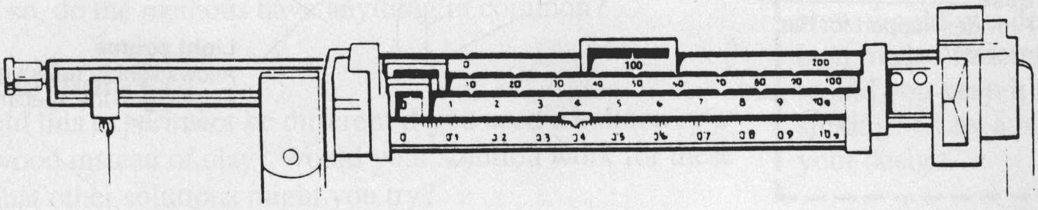
(3) After you have placed the object to be massed on the pan, move the riders along the beams beginning with the largest mass first. If the beams are notched, make sure all riders are in a notch before you take a reading. Remember, the pointer does not have to stop swinging, but the swing should be an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

(4) 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

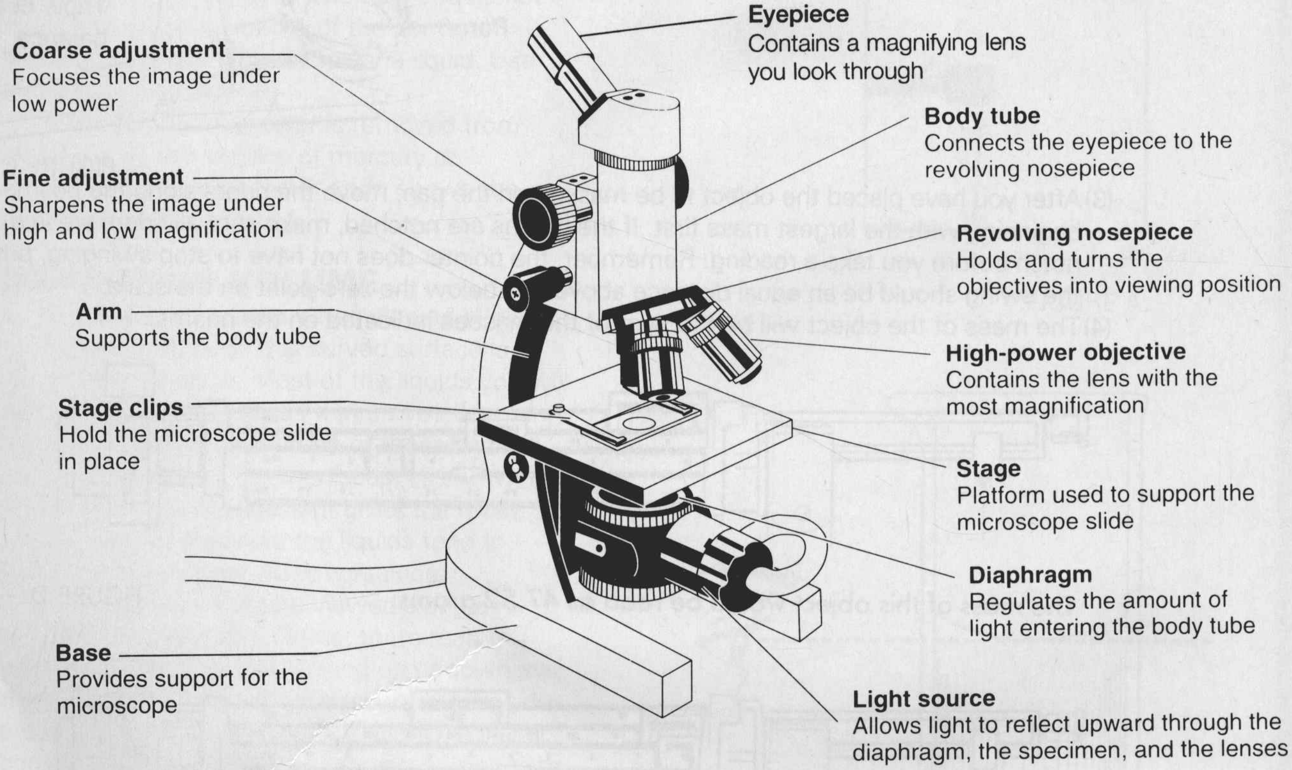
The microscope is an important tool of scientists. To use the microscope properly, you should study the diagram below and learn the name of each part. Whenever you use the microscope, carefully follow these instructions.

Always carry the microscope with both hands. Hold the arm with one hand. Put your other hand under the base. Place the microscope on a table gently, with the 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 a lamp as a light source. Never use direct sunlight as a light source. It can damage your eyes. Look through the eyepiece and adjust the mirror so that light from the lamp is reflected up through the opening in the stage.) Make sure that electric cords from microscopes or lamps do not block aisles. Be careful not to upset a microscope or lamp by running into a cord. Always unplug electric cords by gripping the plug and not the cord itself.

Adjust the diaphragm so that the greatest amount of light comes through the opening. The circle of light that you see is called the field of view. Turn the nosepiece so that the low power objective lens (10 ×) clicks into place. Focus by turning the coarse adjustment. Turn the nosepiece again until the high power objective lens clicks into place. Turn the fine adjustment to focus. Never turn the coarse adjustment when the high power objective lens is in place. Be sure you 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 back into place over the field of view. Turn the coarse adjustment to raise the body tube until the low power objective lens is about two or three centimeters above the stage. Carry the microscope properly to its storage place.



Contents

ACTIVITY

SCIENCE SKILLS ACTIVITY 1

Sink and Swim

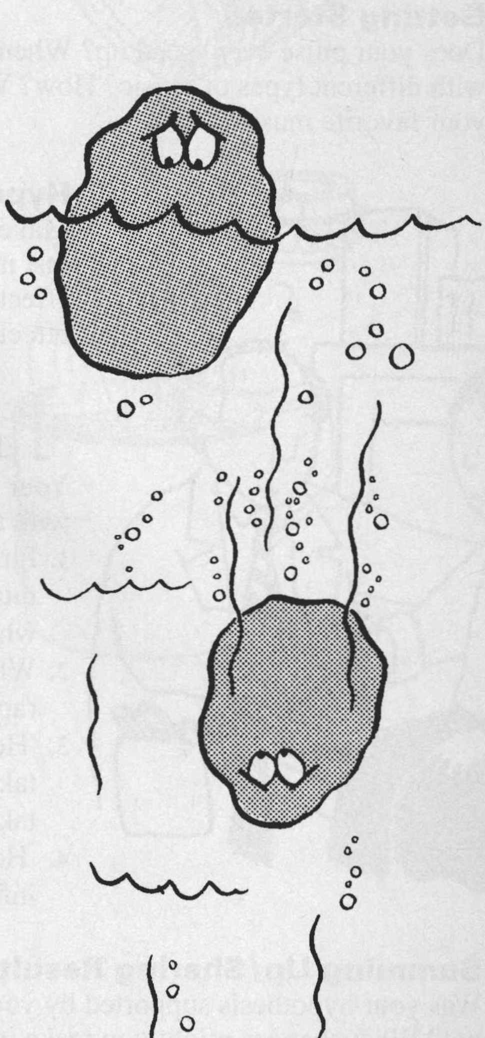
When you put something in water, it floats or it sinks, right? Maybe not. Could something float sometimes and sink other times? How can you find out?

Getting Started

Can you tell by looking at something whether it will sink or float? Are your observations always right? Can you change something that sinks to make it float? How?

Thinking Critically

You will conduct an experiment with two pieces of clay. What characteristics of the clay are variables? If you cannot change the mass of the clay, which variable can you change? Do you think changing this variable will affect the ability of the piece of clay to float? Why?



Try It!

Each group will use clay and a large container of water.

1. Use a balance to divide your clay into two pieces, each with an equal mass. Why should the mass be the same for both pieces?
2. Place the pieces in the water. Observe if they sink or float. Think about what you can do to change the clay's *buoyancy,* or ability to float.
3. Now experiment with the pieces. Can you get both pieces to float? Can you get both pieces to sink? What changes will you make? What variable are you working with?
4. Finally, arrange it so that one of your pieces of clay floats and the other sinks. You will use these pieces in the next part of the activity.

Summing Up/Sharing Results

Take your clay pieces out of the water. Now compare your pieces with those of other groups. Can you tell which pieces floated and which sank? How? Discuss the method you used to make the piece that floats. Give reasons why you think your method worked. Did other groups use the same method? Is there more than one way that works? If so, do the methods have anything in common?

Going Further

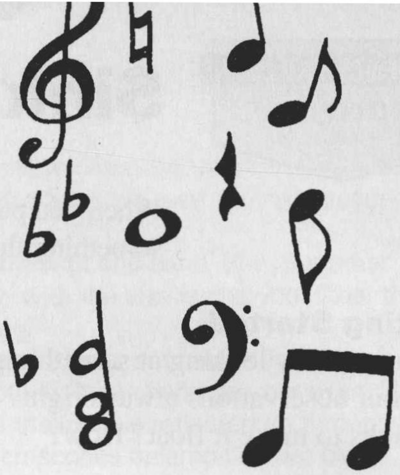
How would this experiment be different if you used a balloon or a piece of wood instead of clay? Would your solution work for these items? What other solutions might you try?

BE A PROBLEM SOLVER

How would you design a boat made of metal? How would you keep it from sinking? Draw a picture of your design.

SCIENCE SKILLS
ACTIVITY
2

On the Beat



People say that music soothes the savage beast. What about the savage *beat*? Do you think that music can affect your heartbeat? How can you find out?

Getting Started

Does your pulse ever speed up? When? Does your pulse change with different types of music? How? When? When you listen to your favorite music?

Hypothesize

Make a hypothesis about how music affects a listener's pulse. Will fast music cause the pulse to speed up, slow down, or have no effect? What about slow music? Will one kind of music be more effective than another?

Try It!

Your group will use a music source and a stopwatch (or a watch with a second hand).

1. First you should test each person's pulse when not listening to music. Why? Then, have each person listen to music to determine whether or not their pulse changes.
2. What types of music will you use? You might try rock, classical, rap, new age, or marching band songs.
3. How will you take each person's pulse? For how long should you take the pulse in order to get an accurate measure? Is it easier to take a pulse if you can't hear the music?
4. How will you set up a table to record your data? What information do you need to keep track of?

Summing Up/Sharing Results

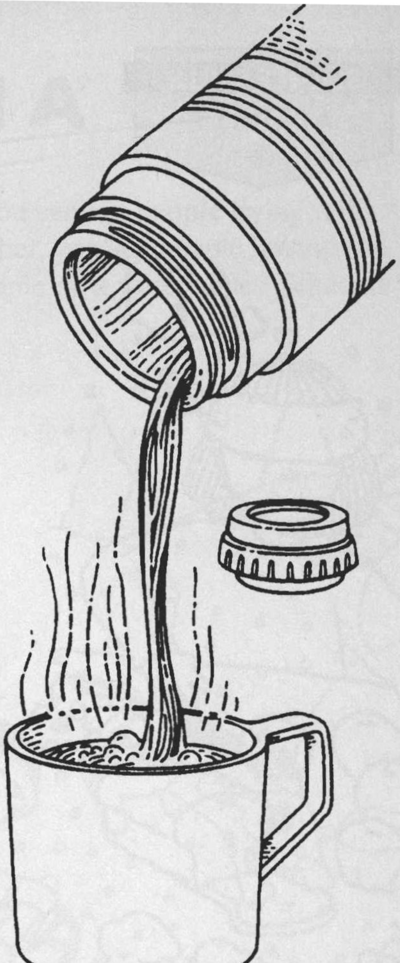
Was your hypothesis supported by your experiment? Why or why not? What changes might you make in your hypothesis now? Compare your results with your class. Did everyone's results agree? Can you form a class generalization about the effect of music on the pulse?

Going Further

Music therapy is used to help many patients. Why do you think music is considered a useful tool for health? Does your experiment suggest any ways in which music could be used to help people?

SCIENCE SKILLS
ACTIVITY
3

Keep Warm



What's the best way to keep things from cooling down? Have you ever used a container designed to keep soup or a beverage warm? How well did it work?

Getting Started

How does something hot cool down? What kinds of clothing do you wear in winter? How do they keep you warm?

Hypothesize

What can you do to keep liquid in a jar warm? Make a hypothesis to explain under what conditions the warmth will be retained. What types of materials prevent heat loss? Make a list of materials that you might try. Think about using:

- aluminum foil
- plastic foam
- plastic wrap
- newspaper
- cotton fabric
- thermometers
- wool
- rubber sheet

Try It!

The goal of this experiment is to keep water warm. You will use four identical glass jars of water at the same temperature. All jars will have lids. You can use a thermometer to measure the temperature. Design an experiment to test the amount of heat lost by water after 30 minutes, using different insulating materials.

First, decide what water temperature you will use to begin. Do you want to use hot tap water or do you want to heat the water? How will you design a control? Which materials will you test? How much of each material will you use?

Make a table to record your data. What headings will you use?

Summing Up/Sharing Results

Did your results support your hypothesis? Compare your results with those of other groups. Which groups used the same materials? Did you find similar results? What factors could have caused results to vary? Which materials kept the water warmest? Which materials had very little effect?

Going Further

Try to create a container that will keep water warm for a long period—two or more hours. What kind of container will you start with? What materials will it be made of? Will you add any additional materials to the container? How will you attach them?

SCIENCE SKILLS
ACTIVITY
4

A Matter of Taste

What foods do you like to eat cold? What foods wouldn't you enjoy eating if they were cold? Can you think of some foods that taste good to you at any temperature? Why do you think this is so?

Getting Started

Is temperature related to taste? Do foods have more or less flavor when they are cold? Do you think an apple has more taste frozen or at room temperature?

Hypothesize

Make a hypothesis about the relationship between taste and temperature. Do you think that food has more flavor or less flavor when it is cold? Do you think taste is unaffected by temperature? Write down your hypothesis before you begin the experiment.

Try It!

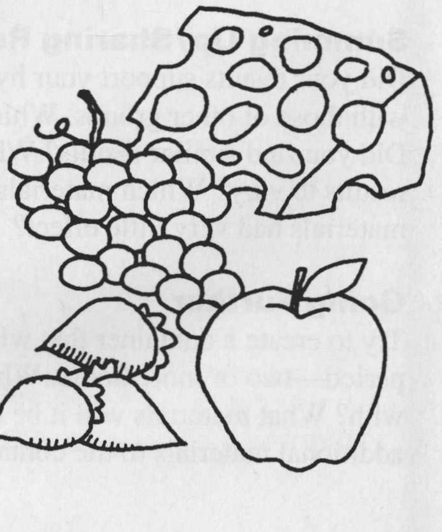
Test a variety of foods at three different temperatures: room temperature, cold, and frozen. What foods will you try? Think of foods with a range of tastes from mild to strong or sweet to salty. Here are some ideas:

- apples
- bread
- grapes
- chocolate
- cheese
- radishes

How will you decide how much flavor each item has at each temperature? You could have each taster assign a number from 1 to 10 for each trial. Or you could blindfold each person and see how much time it takes to identify each food. What other methods might you use? How will you record your data?

Summing Up/Sharing Results

Was your hypothesis supported by the experiment? Did the results of the experiment surprise you? What might explain the relationship between taste and temperature that you discovered? Share your results with the class. What generalizations can you draw about ideal eating temperatures for the foods you explored? Can you make any generalizations about other foods, too?



Going Further

Testing taste can be a scientific challenge. People have personal reactions to taste. How would you design an experiment to test the sensitivity and accuracy of someone's sense of taste? How would you design an experiment to find the tastiest brand of ice cream?

ACTIVITY 1-1

Slip Sliding Away

Everyone seems to like sliding down hills. You can see people trying it in cold weather with skis and sleds. In hot weather, you see people having fun on slick water slides. Did you ever watch people on a water slide? What are some factors that affect sliding?

Getting Started

It's difficult to slip on a level surface unless it's very smooth or icy. You slide faster and farther if the surface is sloped. That's why ski runs and sliding boards are sloped. Think what will happen if you put some boxes on a ramp and then begin to raise one end of the ramp. Will all the boxes start to slip at the same time? Will a lightweight box slip before a heavier one? Will a rough box slip less than a smooth one?

Hypothesize

An object's weight and surface texture seem to be important factors in determining if it slips on a raised ramp. Write a hypothesis about how you think the steepness of a ramp at which a box just begins to slip down the ramp is related to the box's weight. Then write one relating the ramp's steepness to the box's surface texture.

Try It!

You may want to use the following materials:

- ramp
- books
- sand
- glue
- metric ruler
- small cardboard box with cover
- sandpaper

1. What variable is the independent variable in your first hypothesis? What is the independent variable in the second? How are you going to measure them? How will you change them?

2. What is the dependent variable in each hypothesis? How will you measure them? What variables must you control? After thinking about the answers to these questions, write a procedure to test your two hypotheses. Also, design a table for the data you will collect.

Summing Up/Sharing Results

Did the results of your experiments support your hypotheses? Were there any surprises? Explain. Did you and your classmates have the same hypotheses? Did you and your classmates get the same results? What is the important factor in predicting how easily an object will begin sliding down a ramp?

Going Further

Without changing the box, its contents, or the ramp, how can you make the box begin to slide at a lower ramp height?

BE A PROBLEM SOLVER

Why does spraying oil or graphite into a keyhole make turning a key in it easier?