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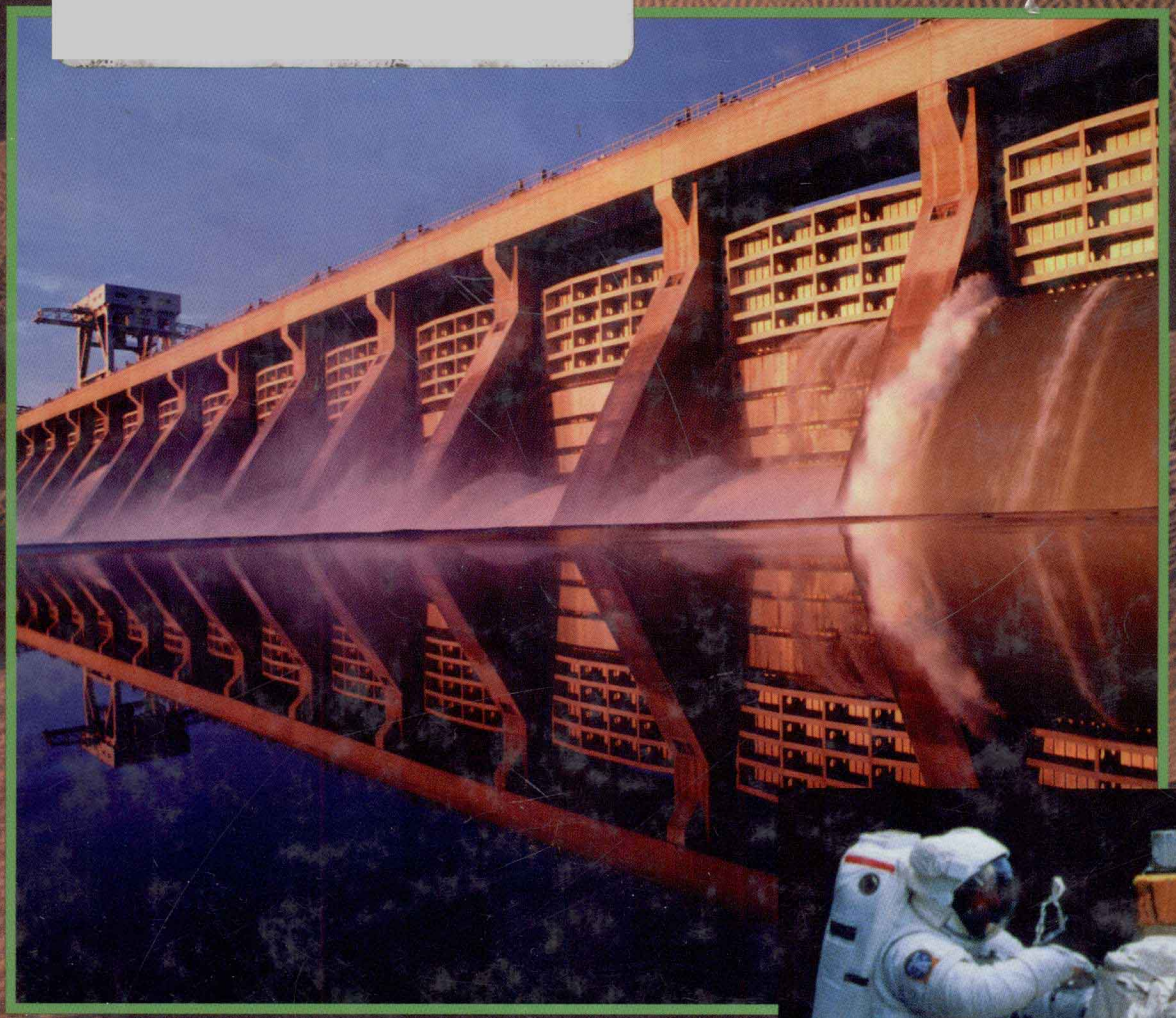
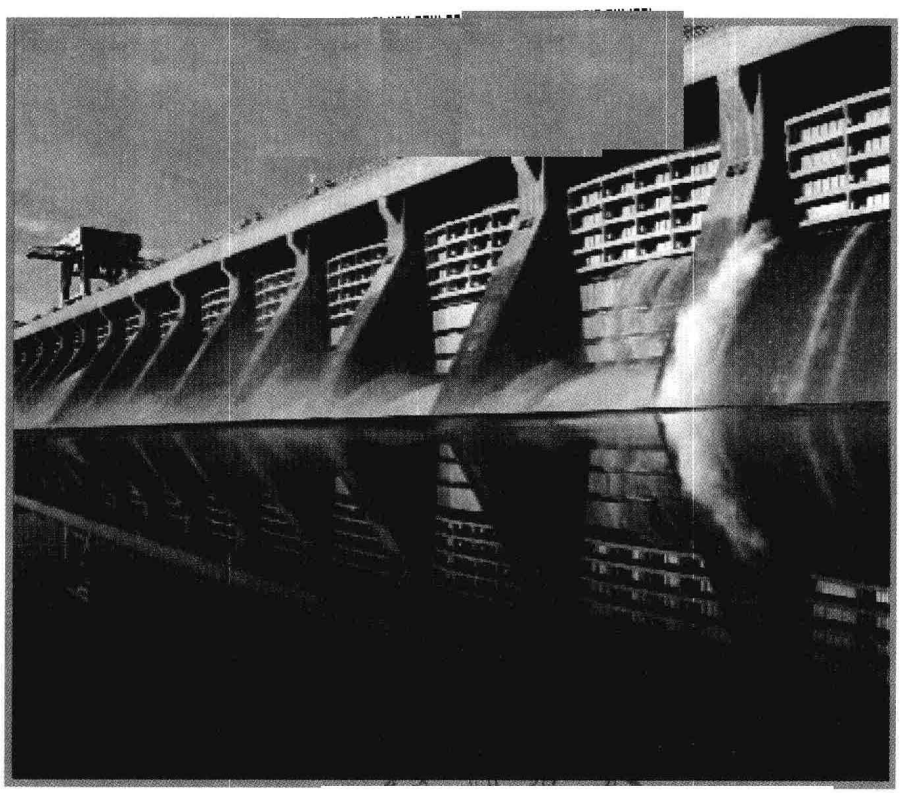


GLENCOE/McGRAW-HILL

SCIENCE PROBE I

Adapted by Gary E. Sokolis and Susan S. Thee



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FEATURES OF SCIENCE PROBE I

■ *Science Probe I* has an introductory chapter about the nature of science followed by six units, each representing a major area of science. These units can be studied in any sequence.

■ The text includes a variety of activities designed to foster the development of thinking skills and the processes and skills of investigation. The diverse formats include step-by-step experiments, reading activities, informal discussion, and student-designed investigations. All activities are designated by the same type of heading. The first activity in each chapter is designed to help students consider what they already know about the topic of the chapter and what they may want to find out.

■ Activities that are strong examples of the use of collaborative learning are marked with a Group Activity icon. (In addition to the activities that specifically require collaboration, many of the other activites, which are not marked with icons, can be conducted in pairs or in larger groups, as the teacher chooses.) Similarly, activities that require students to integrate other subject areas with science learning are marked with a Cross-Curricular icon.

■ Within an activity, the word CAUTION! followed by a few words or sentences indicates that the activity contains potentially dangerous procedures or materials. More information on safety can be found in *Safety Rules* on page ix.

■ Enrichment activities in the margin under the heading *Extension* are intended to challenge students or to reinforce new concepts. Under the heading *Did You Know?* are interesting facts and scientific discoveries.

■ Special features, *Profile*, *Career*, *Computer Application*, and *Science in Our World*, examine topics related to the chapter.

■ Terms considered essential for understanding new concepts are printed in **boldface**, defined in the text, included in the *Vocabulary* at the end of the chapter, and listed in the *Glossary*.

■ At the end of each numbered section, questions are listed under the heading *Review*. These questions allow students to check their understanding of content as they progress through the chapter.

■ Each chapter concludes with a five-part chapter review. *Key Ideas* lists the main ideas of the chapter. *Vocabulary* lists the boldface words and suggests two activities using these key terms. *Connections* require skills such as comparison, evaluation, prediction, and problem solving. *Explorations* suggest projects, research, and group activities. *Reflections* allow students to consider how the chapter has changed their ideas and to reflect on what they have learned.

■ The *Glossary* includes definitions of all boldface terms, along with other important scientific terms.

■ The *Appendices* provide information of general use and an activity, Fish Anatomy and Dissection.

■ The *Index* helps students to locate important topics and to find connections between units.

■ The *Science Probe I Teacher's Guide* provides teaching strategies, lesson plans, practical tips, answers to questions, additional questions and activities, sample tests, blackline masters (some for overhead projection, some for student use), and other useful information for planning and teaching each unit.

SAFETY RULES

Your school laboratory, like your kitchen, need not be dangerous. In both places, understanding how to use materials and equipment and following proper procedures will help you avoid accidents.

The activities in this textbook have been tested and are safe, as long as they are done with proper care. Take special note of the instructions accompanying the word CAUTION! whenever it appears in an activity. These instructions will help you understand how to use electricity, laboratory equipment, and chemicals safely.

Follow the safety rules listed below. Your teacher will give you specific information about other safety rules for your classroom. You will also be told about the location and proper use of all safety equipment.

1. Give your teacher your complete attention when listening to instructions.
2. Learn the location and proper use of the safety equipment available to you, such as safety goggles, protective aprons, heat-resistant gloves, fire extinguishers, fire blankets, eyewash fountains, and showers. Find out the location of the nearest fire alarm.
3. Inform your teacher of any allergies, medical conditions, or other physical problems you may have. Tell your teacher if you wear contact lenses.
4. Read through the entire activity before you start. Before beginning any step, make sure you understand what to do. If there is anything you do not understand, ask your teacher to explain.
5. Do not begin an activity until you are instructed to do so.
6. If you are designing your own experiment, obtain your teacher's approval before carrying out the experiment.
7. Clear the laboratory bench of all materials except those you are using in the activity.
8. Follow your teacher's instructions regarding the No Crowding Zone.
9. Wear protective clothing (a lab apron or a lab coat) and closed shoes during activities involving heating substances or using chemicals. Long hair should be tied back.
10. Wear safety goggles when using hazardous or unidentified materials and when heating materials.
11. Do not taste or touch any material unless you are asked to do so by your teacher.
12. Do not chew gum, eat, or drink in the laboratory.
13. Do not rock or lean on lab stools.
14. Do not run or play games in the laboratory.
15. Do not throw any objects, including paper, chalk, pens, and liquids.
16. Carry lab equipment, containers of chemicals, and glassware carefully.
17. Read and make sure you understand all safety labels.
18. Label all containers.
19. When taking something from a bottle or other container, double-check the label to be sure you are taking exactly what you need.
20. If any part of your body comes in contact with a chemical or specimen, wash the area immediately and thoroughly with water. If your eyes are affected, do not touch them but wash them immediately and continuously for at least 15 minutes and inform your teacher.

21. Handle all chemicals carefully. When you are instructed to smell a chemical in the laboratory, follow the procedure shown here. Only this technique should be used to smell chemicals in the laboratory. Never put your nose close to a chemical.

22. Hold the container(s) away from your face when pouring liquids.

23. Place test tubes in a rack before pouring liquids into them. If you must hold the test tube, tilt it away from you before pouring liquids in.

24. Clean up any spilled water, chemicals, or other materials immediately, following instructions given by your teacher.

25. Do not return unused chemicals to original containers. Do not pour them down the drain. Dispose of chemicals as instructed by your teacher.

26. Special care must be taken when dissecting an organism. A dissection must be performed cautiously and patiently. Be sure to follow the instructions in the text and also those that your teacher gives you. Each time you dissect, you should do the following:

- Make sure that the area you are working in is well ventilated.
- Wear safety goggles and an apron at all times.
- Wear disposable gloves when performing a dissection to prevent any chemicals from coming in contact with your skin.
- Gently rinse your specimen under running water to wash away excess preservatives.
- Wash all splashes of the preservative solution off your skin and clothing immediately. If you get any chemical in your eyes, rinse thoroughly for at least 15 minutes and inform your teacher.
- Position your specimen so that it is not directly beneath your face and nose.
- Familiarize yourself with the safe and proper use of all dissecting instruments.
- Report dull or damaged equipment immediately. Dull blades will slip and may cause injury.
- Use the dissection tools carefully. Be sure to follow your teacher's instructions when using a knife or razor blade. In most cases, you will be asked to cut away from yourself and away from others.
- Always cut gradually through layers of tissue.
- Always thoroughly wash your hands and lower arms with soap and warm water after completing your dissection work.
- Dispose of any waste material in the container provided by your teacher.

27. Whenever possible, use electric hot plates for heating materials. Use flames only when instructed to do so. Read the special Bunsen burner safety procedures listed under safety rule number 47.

28. When heating materials, always wear safety goggles and use hand protection if required.

29. When heating glass containers, make sure you use clean Pyrex or Kimax. Do not use broken or cracked glassware. Always keep the open end pointed away from yourself and others. Never allow a container to boil dry.

30. When heating a test tube over a flame, use a test tube holder. Holding the test tube at an angle and facing away from anyone, move it gently through the flame so that the heat is distributed evenly.

31. Handle hot objects carefully. Hot plates can take up to 60 minutes to cool off completely. Hot and cold hot plate burners can look the same. If you burn yourself, immediately apply cold water or ice.

32. Keep water and wet hands away from electrical cords, plugs, and sockets.

33. Always unplug electrical cords by pulling on the plug, not the cord. Report any frayed cords or damaged outlets to your teacher.

34. Make sure electrical cords are not placed where anyone can trip over them.

35. When cutting with a knife or razor blade, follow your teacher's instructions. In most cases, you will be asked to cut away from yourself and away from others.

36. When walking with a pair of scissors or any pointed object, keep the pointed surface facing the floor away from yourself and away from others.

37. Watch for sharp or jagged edges on all equipment.

38. Place broken or waste glass only in specially marked containers.

39. Follow your teacher's instruction when disposing of waste materials.

40. Report to your teacher all accidents (no matter how minor), broken equipment, damaged or defective facilities, and suspicious-looking chemicals.

41. Be sure all equipment is shut off when not in use. Be ready to shut off equipment quickly if it breaks down or if an accident occurs.

42. Clean all equipment before putting it away.

43. Put away all equipment and chemicals after use.

44. Wash your hands thoroughly using soap and warm water after working in the science laboratory. This practice is especially important when you handle chemicals, biological specimens, or microorganisms.

45. Do not take any equipment, materials, or chemicals out of the laboratory.

46. Do not practice laboratory experiments at home unless directed to do so.

47. If a Bunsen burner is used in your science classroom, make sure you follow the procedures listed below. (NOTE: Hot plates should be used in preference to Bunsen burners whenever possible.)

- Do not wear scarves or ties, long necklaces, or earphones suspended around your neck. Tie back long hair and roll back or secure loose sleeves before you light a Bunsen burner.
- Obtain instructions from your teacher on the proper method of lighting and using the Bunsen burner.
- Do not heat a flammable material (for example, alcohol) over a Bunsen burner.
- Be sure there are no flammable materials nearby before you light a Bunsen burner.
- Do not leave a lighted Bunsen burner unattended.
- Always turn off the gas at the valve, not at the base of the Bunsen burner.

48. If a fire occurs, make sure you follow the procedures listed below.

- Do not panic. Remain calm.
- Notify your teacher immediately. Act quickly to provide help in an emergency.
- Shut off all gas supplies at the desk valves if it is safe to do so.
- Pull the fire alarm.
- Follow your teacher's instructions if your assistance is required.
- If your clothing is on fire, roll on the floor to smother the flames. If another student's

clothing is on fire, use a fire blanket to smother the flames.
- Avoid breathing fumes.
- Do not throw water on a chemical fire.
- If the fire is not quickly and easily put out, leave the building in a calm manner.

49. Labelling and placarding assists shippers, carriers, fire departments, police, emergency response personnel, and others in complying with and enforcing the regulations governing the safe transport of hazardous materials by highway, rail, water, and air. The labelling of hazardous material is specific to the hazard class of the material. The placards represent the hazard class(es) of the material(s) contained within the freight container, motor vehicle, or rail car.

Become familiar with the warning labels that are placed on containers of potentially dangerous materials. You should be able to identify and understand each of the labels shown here.

Hazardous Material Warning Placards

The warnings on labels of household products were developed to indicate exactly why and to what degree a product is dangerous. Pay careful attention to any warning labels on the products or materials that you handle.

TO THE STUDENT

This book is about science in your world. You will find information here on how to dispose of hazardous household chemicals, how your body uses the food you eat, what makes volcanoes erupt, why Venus is the brightest planet we can see, what a machine is, how human activities can harm fish, and much, much more. In addition, this book contains activities and other suggestions to help you learn and understand science. A few of the many things you might do during science classes are described below.

Consider What You Already Know

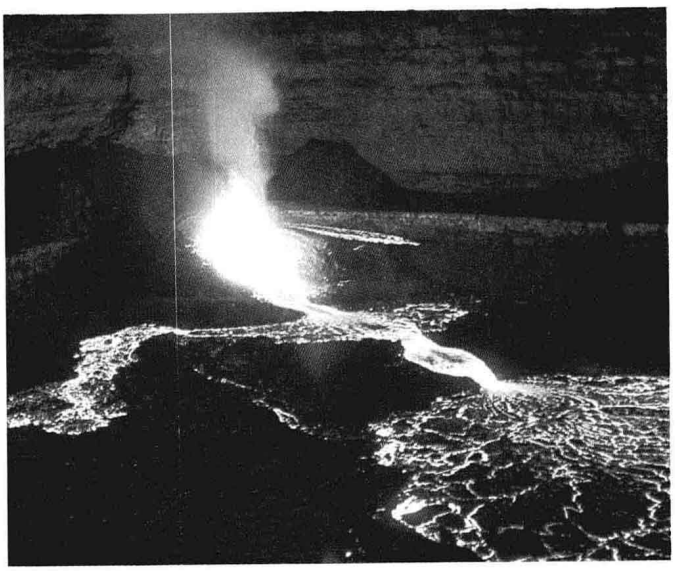
At the beginning of each chapter in this book, you will find an activity that helps you consider what you already know about a particular topic. For instance, Activity 10A in Chapter 10 asks you to consider what you already know about physical fitness. As you read Chapter 10, you may find that you want to change or add to some of your original ideas. You may also find that you know a lot more about the subject than you thought you did.

Write in Your Learning Journal

Throughout this book, you will find references to "your learning journal." A learning journal is a notebook where you write your ideas and comments about your learning as you read and investigate. Writing down your ideas will help make them clear to you and to others, should you choose to share your writing. As well as helping you think, your learning journal will be a record of your learning in science.

Read Actively

Some of the activities in this book ask you to do something as you read. For instance, in Activity 18F in Chapter 18, you are asked to write down information as you read about energy resources.



What makes volcanoes erupt? See Chapter 11.

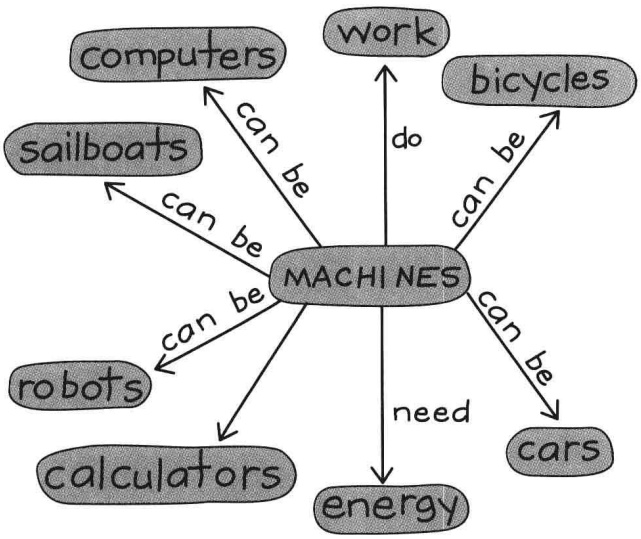
There are also reading activities that ask you to complete a task while you read. For example, you might be asked to fill in a table, make a flowchart, or draw diagrams. These reading activities will help you learn by allowing you to organize the ideas in a useful way.

Make a Mind Map

In school, at home, and in the workplace, you use your ability to think. There are many ways you can record your thinking, including learning journals, illustrations, flowcharts, poems, and stories. Another way to record your thinking is by using a mind map.

A mind map is drawn like a spider's web. You start a mind map by printing an idea in the center of a page. Next, you think of other ideas that have something to do with the main idea in the center. You print these ideas around the main idea and connect them to the main idea with lines. On the lines, you then print a few words that describe why or how these ideas are connected to the main idea.

Here is the beginning of a mind map that a student drew about machines.

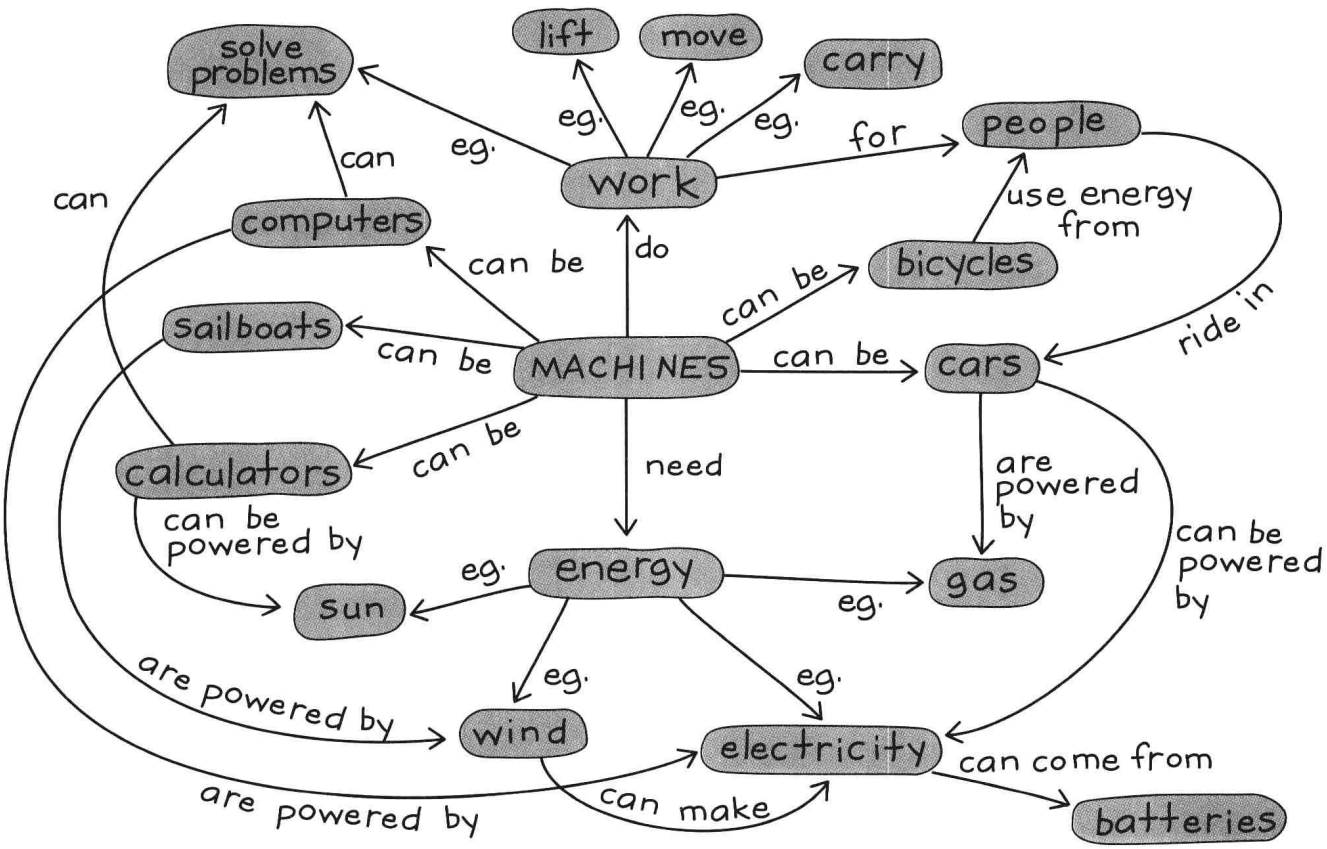


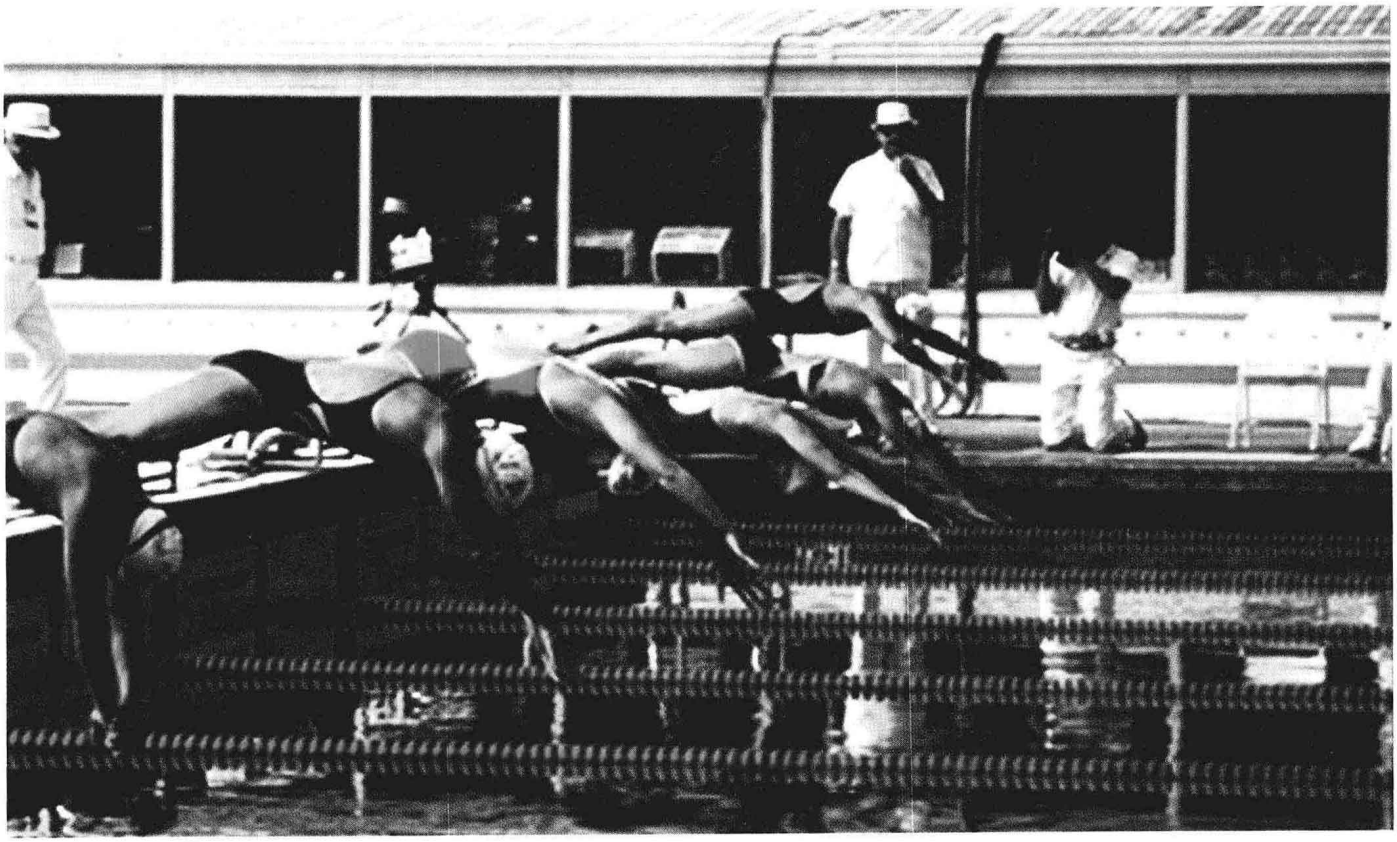
Here is the same mind map about machines with more details added.

You can see that the student has provided more description for each of the new ideas by printing other ideas around them and connecting the ideas with lines and a few describing words.

Mind mapping is a good way to "brainstorm." You can quickly transfer many ideas from your brain to your paper. When you find an idea that appears in more than one location on your mind map, you can connect it with a line. By the time you have finished mapping, you usually have a giant spider web of ideas and lines. You might use colors and different styles of printing for the different levels of a mind map. You might also add your own drawings and designs to make your mind map attractive.

In this book, you will have many opportunities to practice mind mapping. In fact, at the end of every chapter, you will be asked to draw a mind map of your new ideas. Making a mind map will help you sort information into categories and see





Create a mind map of ideas about sports.

relationships between ideas. The ideas that you include in your mind maps may come from your classroom learning, from reading books, magazines, or newspapers, and from experiences you have had.

Try making a mind map now. In your notebook, print the word "sports" as the main idea for a mind map. Follow the suggestions in this section and your teacher's directions to create a spiderweb of your ideas about sports. Share your ideas with your classmates. Were the same ideas about sports recorded by several students in your class?

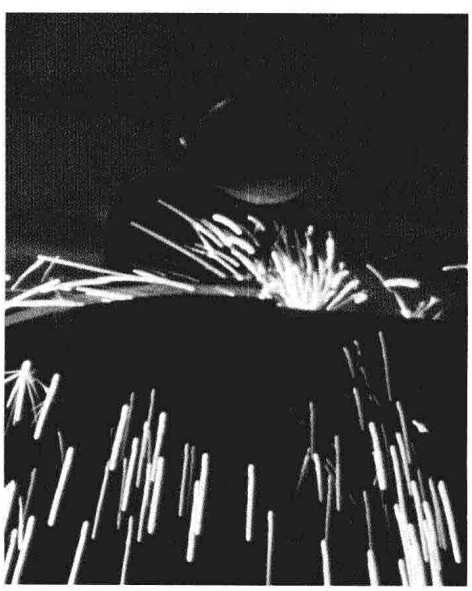
Look Back at Your Learning

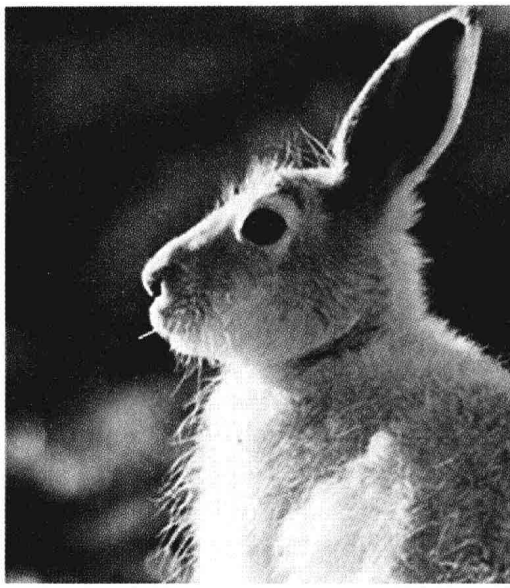
This book provides many opportunities to review and reconsider your learning and your thinking. The Reflections section at the end of each chapter contains questions that ask you to think about what you have learned or to add to your own ideas. For example, in Chapter 16, you are asked: "Now that you have finished this chapter, have your ideas about the formation of the solar system and the universe changed? If so, describe how they have changed."

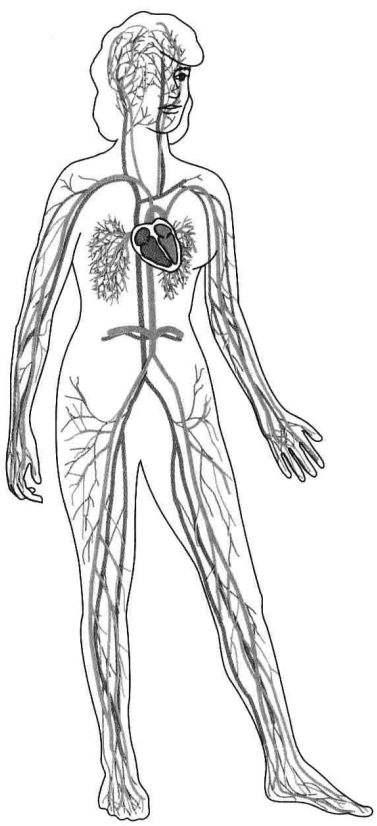
Share Your Ideas

In many of the activities in this book you are asked to share your ideas with others, to express what you think you know, and to hear other ideas in return. For example, Activity 23A in Chapter 23 asks you to work with other students to study the water cycle in your area. You are then asked to share what you found out with the rest of the class. If you are afraid to do this because you might be "wrong," then you will miss the opportunity to see whether or not you can explain your thinking to others. So share your ideas. Then listen to the responses and the ideas of others and compare them with your own. You will not only learn more about science, you will also learn how to learn. You will develop skills that will help you long after you have finished this science course.

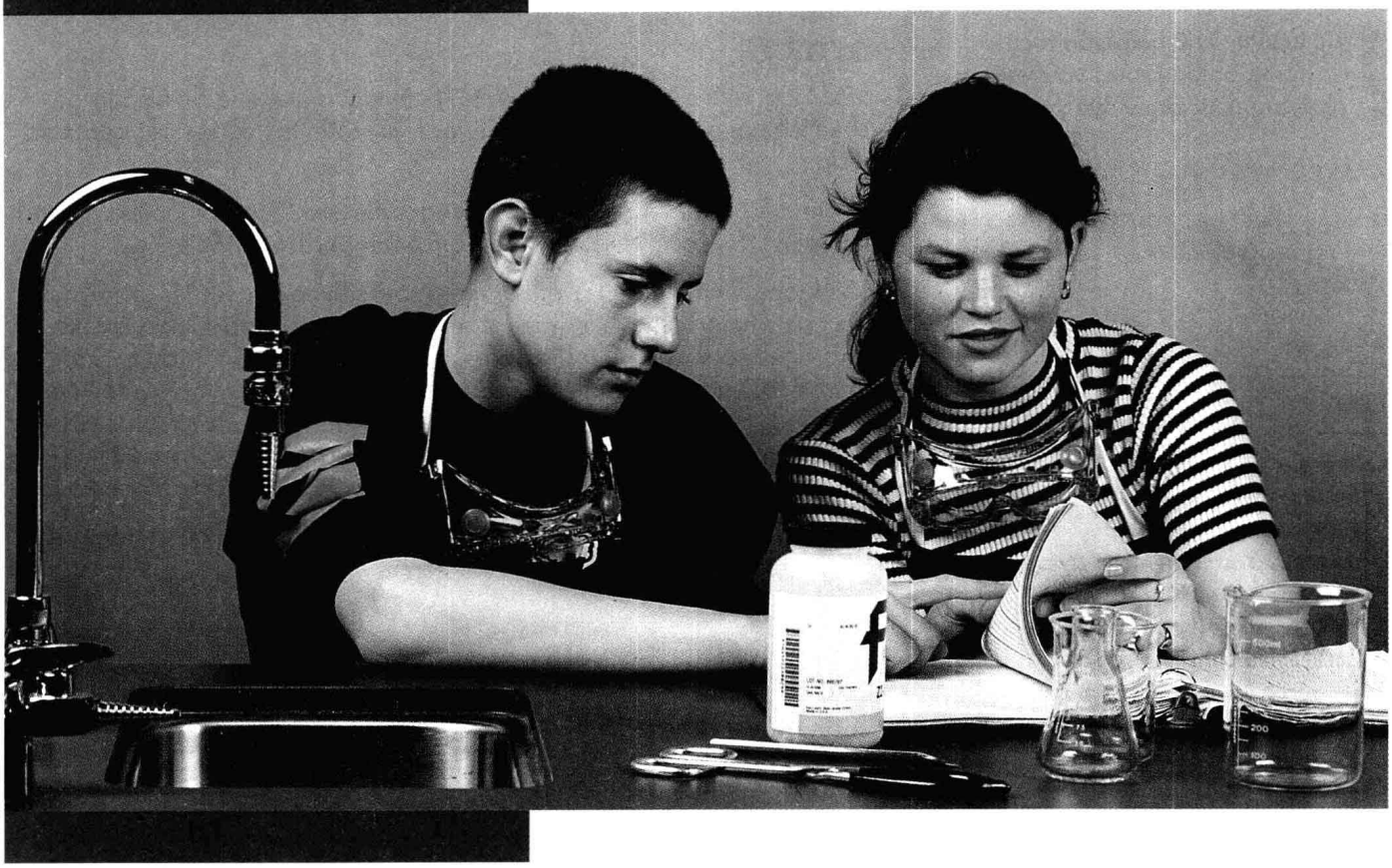
TABLE OF CONTENTS







CHAPTER 1



SCIENCE, TECHNOLOGY, SOCIETY, AND YOU

The boy and the girl in the photograph are ready to do a scientific experiment. They have collected the safety equipment and the materials they will need for the experiment. But before they begin, they have some questions about what they will be doing. Asking questions is an important part of science.

Suppose you decide to use some money you have received for your birthday to buy a new headset for your tape deck. You already know a lot about headsets. But before making a purchase, you plan to ask questions about the price, quality, and design of the headsets that are available. The answers to these questions will help you decide which headset to buy.

Science is about asking questions and then looking for answers in an organized way. Scientists look for the answers to questions by using various process skills. In this chapter, you will review the process skills that you have already learned about. You will also find out about some other process skills. Finally, you will explore how science is part of your everyday life.

ACTIVITY 1A / LOOKING FORWARD

This activity will help you focus on some of the topics you will be studying in science this year.

MATERIALS

a large sheet of paper
writing instruments

SELECTED SCIENCE TOPICS

Changes in Matter
The Sun and the Planets
Chemicals in the Home
The Stars You See in the Sky
Your Body Needs Food
Why Is Energy Important?
Factors Affecting Fitness
Temperature, Thermal Energy, and Heat
When the Earth Shakes
The Soil Ecosystem
The Origin of Continents
The Ocean

PROCEDURE

1. Working with a small group, write "Science" in the middle of a large sheet of paper (Figure 1.1). This word will form the center of your mind map.
2. Write the phrases from the list entitled "Selected Science Topics" around the word "Science." Draw a line from each phrase to "Science."
3. Think about what you have learned about science in earlier grades, as well as what you have learned from newspapers, magazines, books, and other sources of information. Use this information to add two or three subtopics around each topic. For example, you might write "cleaners" and "pesticides" around "Chemicals in the Home." Draw a line from each subtopic to the appropriate topic. Write one or two connecting words on each line to describe how each subtopic is related to the topic.
4. When all the members of your class have finished their mind maps, display them around the classroom.

DISCUSSION

1. How was your group's mind map similar to those of other groups in your class? How was it different?
2. Are there any topics you do not know much about? If so, list those topics in your learning journal.
3. Look at what some of your classmates said about the topics in your list. Write down any information your classmates included on their mind maps that might help you understand the topics more easily. ❖

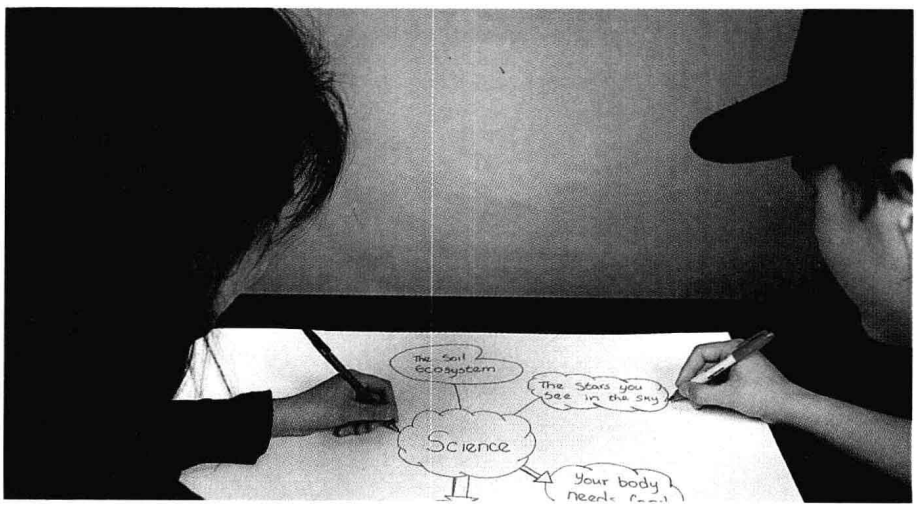


FIGURE 1.1 ▶
You can use a mind map to focus on what you already know about the science topics you are going to study this year.

1.1 WHAT IS SCIENCE?

You may recall that **science** is both a body of knowledge and a process for gaining more knowledge about the world in which we live. Since science represents a vast body of knowledge, it is impossible for any individual to know everything about science. For this reason, scientists usually specialize in a particular area, or branch, of science.

Just like the branches of a tree, a branch of science is made up of many smaller branches. For instance, one of the main branches of science is biology, the study of living things. A biologist has a good general knowledge of biology but will probably specialize in a particular area of biology, like ecology—the study of the environment. In other words, an ecologist is a biological scientist whose area of expertise is the study of the environment.

■ Until the middle part of the 20th century, almost every new invention was developed by an individual working alone. Today this is no longer so. Most recent inventions are the result of teams of specialists working together in university, government, or corporate research laboratories. Can you think of a reason for this change?

ACTIVITY 1B / SOME BRANCHES OF SCIENCE

In this activity you will define some branches of science and put them into categories.

MATERIALS

a copy of the sheet entitled "Some Branches of Science"
a dictionary

PROCEDURE

1. On the sheet entitled "Some Branches of Science," use a pencil to lightly number all the terms in the column "Branch of Science" from 1 to 20.
2. Beside each term in the column "Is the Study of," lightly write a letter from A to T. Use your knowledge of science to match as many lettered items in the second column as you can to the numbered terms in the first column so that true statements are formed. For example, the first statement would read, "Biology is the study of life." Use a dictionary to help you match any branch of science that is unfamiliar to you.
3. Compare your completed matched set with those of other students.
4. Using the completed matched set, group the statements into three or more categories. Write the categories in your notebook. The first statement in each category should also act as the title for the entire group. Be prepared to defend your grouping during a class discussion.
5. Refer to the Table of Contents on page vi. Beside each branch of science, write the numbers of the unit and chapter where you might find more information about that branch of science.

DISCUSSION

1. (a) List the branches of science that were most familiar to you.
   (b) How many branches of science were unfamiliar to you?
2. Share your categories with your classmates. Why did you group the branches of science the way you did?
3. Check the Table of Contents on page vi. Which branches of science will you discover more about in this textbook?
4. Write the names of the following careers in your notebook. List the branches of science that people preparing for these careers would study during their training. You may need to list more than one branch of science for some of the careers. ➥

pharmacist | fish and wildlife officer | seismic observer
dietitian | photographer | heart surgeon

5. Suggest the name of a career for each of the descriptions below. Description (a) has been done for you. ❖

Description	Career
(a) a scientist who studies living things	a biologist
(b) a scientist who studies how elements and compounds combine and behave	
(c) a scientist who specializes in the study of animals	
(d) a heart specialist	
(e) an earthquake specialist	
(f) a person who is trained to make weather forecasts	

EXTENSION

■ Choose one of the branches of science that interests you. Use illustrations and labels to prepare a display that will explain the branch of science to someone who knows nothing about it. Include names of any careers connected to this branch of science. Check encyclopedias under the headings "Biology," "Chemistry," "Physics," and so on to learn more about branches of science.

PROCESS SKILLS

Most of us are curious about what goes on around us. We are constantly looking for knowledge that will explain events that we do not understand or that we wish to know more about. Like scientists, we gain knowledge by asking questions, predicting possible answers, performing experiments, examining results to look for causes and effects, and sharing our ideas with others.

Even after scientists have answered a question, they keep on investigating, thinking, and sharing ideas. Often the result is a change in an old explanation, or the formation of a new one. What scientists believe to be true today may turn out in the future to be incomplete or incorrect (Figure 1.2).

Scientists explain unknown events, or revise current explanations, by following a **process**, a set of actions done in a specific order. In the process of doing science, many skills are used. These skills are sometimes known as thinking skills, or **process skills**. A process skill is a procedure, such as observing or measuring, that is used in scientific research (Figure 1.3). You can use process skills to find answers in other subjects as well.

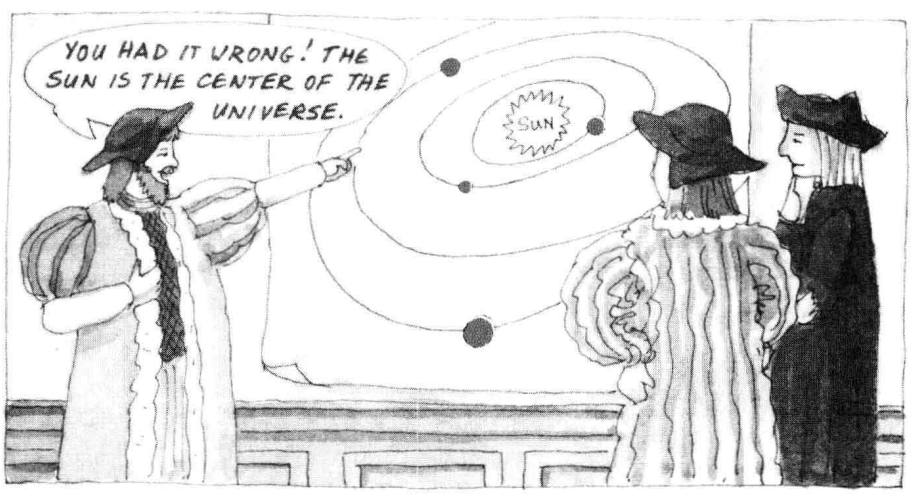


FIGURE 1.2 ▶
The ideas, measurements, and calculations of Copernicus and the investigators who followed him convinced later scientists to revise their view of the solar system to our current sun-centered (heliocentric) view.