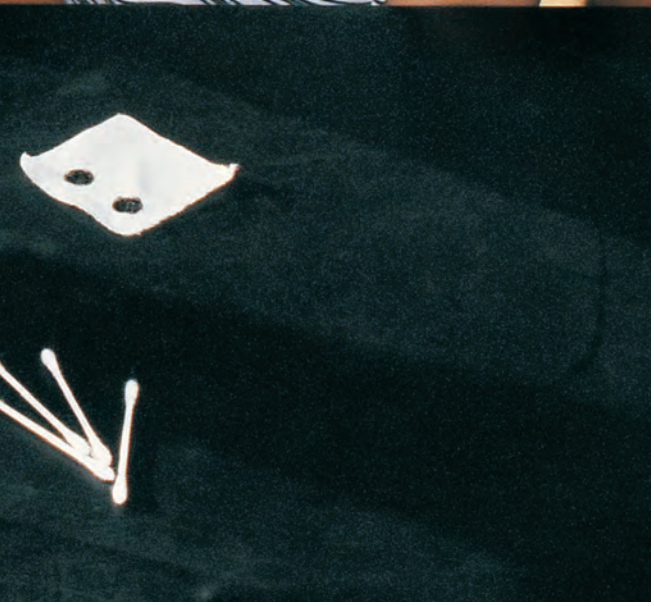

PART 2 Mixtures and Solutions

LESSON 10

Starting the Anchor Activity

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What materials are chosen to make these sneakers? How are these choices made?

INTRODUCTION

In this lesson, you will begin the Anchor Activity, which you will work on over the next several weeks. What is an Anchor Activity? It is a project that gives you the opportunity to apply what you have learned in the module to the world around you. In this Anchor Activity, you and a partner will select a simple manufactured object. You will investigate the chemistry, technology, and history of the object by doing research at the library and on the Internet. You will then compile the information you have collected to create an exhibit. You will also give an oral presentation on one of the materials that makes up the object you choose. The work you do for this Anchor Activity will be an important part of your grade for this module.

OBJECTIVES FOR THIS LESSON

Select a simple manufactured object to research.

Conduct library and Internet research on the major materials that make up the object you have chosen.

Create an exhibit based on your research.

Give an oral presentation on one of the materials that makes up the object you have chosen.

Getting Started

1. Contribute to a class discussion on the reader from Lesson 9, "Choosing Materials for Pedal-Powered Flight," and the accompanying questions.

2. Read "The Right Material" on page 88.

3. Your teacher may have brought a bicycle to class. It is an example of a manufactured object. Discuss the choice of materials that make up the bicycle. After the class discussion, work with the rest of your group to complete Table 1 on Student Sheet 10a. List the function, the type of material, and the properties of the material for each bicycle part.

Introducing the Anchor Activity

PROCEDURE

1. After your teacher gives you Student Sheet 10b: Anchor Activity Schedule, tape it to the inside front cover of your science notebook. You will need to refer to it as you work on the Anchor Activity. Follow it carefully, or you may lose points.

2. Follow along as your teacher reviews the Anchor Activity Guidelines.

MATERIALS FOR LESSON 10

For you

1 copy of Student Sheet 10a: What Are Bikes Made From and Why?
1 copy of Student Sheet 10b: Anchor Activity Schedule
Clear tape or glue
Scissors
Card stock, poster board, or lightweight cardboard

THE RIGHT MATERIAL

Matter is used to make things. The term "technology" refers to the way people alter and shape matter so that it can be used to make things. For example, gold can be found as metal nuggets. But through technology (for example, the lost wax method), it can be fashioned into jewelry. Through different technology, it can be used to plate electronic components inside a computer.

CORBIS/KEVIN R. MORRIS

What properties made aluminum and transparent plastic ideal materials for the manufacture of this disk?

Part of making any useful object is choosing the right kind of material for it. Materials can be any type of matter, from the metal in a bicycle frame to the compressed air in a bicycle tire. Some materials are used directly from nature (for example, wood and stone). These are called raw materials. Other materials are made from raw materials that are refined or processed in some way. For example, one of the raw materials used to make glass is sand.

Think about some everyday manufactured objects. Some are very complex. For example, a car contains thousands of different parts and is made from hundreds of different types of matter. Each material used to build the car is chosen for the job it must do. That job is its function. How is this choice made? It is based on several factors, including cost, availability, and, most important, the properties of the material.

Scientists and engineers are often on the lookout for better, cheaper, or more readily available materials to replace the traditional materials used in objects. They try to find or design materials that have the right properties. For example, most shoes were once made entirely from pieces of leather that were sewn or nailed together. Nowadays, many shoes are made from a variety of materials, each suited or designed to fit the function of that part of the shoe. Soles may consist of a combination of durable, shock-absorbing rubbers or plastics. Uppers are often made of waterproof, breathable synthetic fabrics or stain-resistant plastics with soft linings that cushion the foot and protect from abrasion.

During the Anchor Activity, you will learn more about the materials that make up an object. You will study the relationship between object function, the choice of materials to make the object, and the properties and origins of the materials.

Anchor Activity Guidelines

PROCEDURE

Part 1: Choosing the Object

1. To make your work easier, you and your partner should choose a relatively simple manufactured object. Discuss with your partner which object you are going to research. You do not need to make a final decision immediately. Some examples are given in the list entitled "Anchor Activity Objects." You can choose one of these or think of another that you use every day. But remember, keep the object simple. An object made from two or three materials will be much easier to research and present than one made from many materials.

Anchor Activity Objects

Aerosol can	Ballpoint pen
Battery	Bottle
Cassette tape	CD/DVD
Clothing	Cooking pot
Diaper	Felt-tip pen
Floppy disk	Football
Furniture	Golf ball
In-line skates	Joystick
Knife	Lightbulb
Magnifier	Matches
Notebook	Pencil
Pencil sharpener	Scissors
Sneakers	Soda can
Tape dispenser	Thermometer
Tools	Toothbrush
Toy	Videotape

2. During the next week, meet with your partner and write a short paragraph identifying the object you have chosen. Give the reasons for your choice (Figure 10.1 shows a sample paragraph). Hand it in by the due date on your schedule. Your teacher must approve your object. If too many pairs choose the same object, you may be asked to select another.

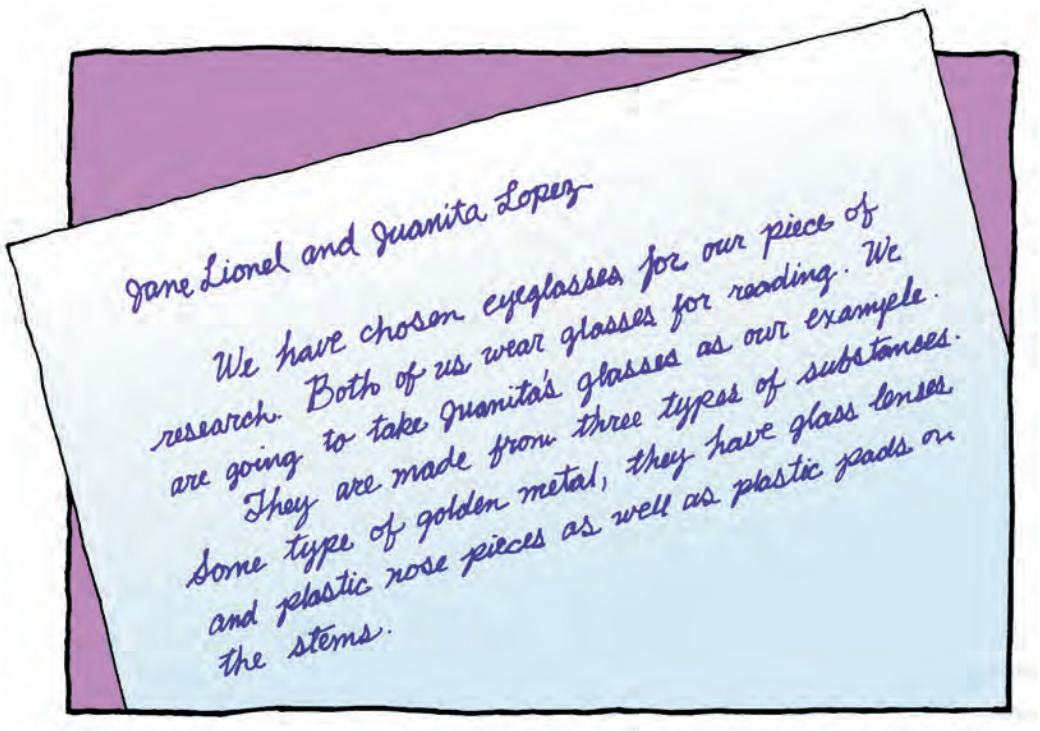


Figure 10.1 *Sample paragraph identifying an object and outlining the reason for its choice*

Part 2: Starting the Research

1. Start gathering information about your object. Your information will be divided into five sections. As you gather information, write your notes under these headings:

   - **Function** (Explain what the object does or what its use is.)
   - **Major Materials** (Give the main materials from which the object is made.)
   - **Why These Materials Were Chosen** (Tell what properties of the materials make them good choices for use in the object.)
   - **Origin of One of the Materials** (Select one major material in the object and investigate its raw materials, where they are found, and the processes they undergo to make them usable in the object.)
   - **History of the Object** (Answer these questions: Was it invented? If so, by whom? When and where did it first appear? How do the original designs and choice of materials differ from those in use today?)

2. The section "Origin of One of the Materials" is similar to (but not as detailed as) the topic of your oral presentation. See Part 4: Giving the Oral Presentation (on page 95) to find out what you should research for your presentation.

3. Use your notes to help you conduct a brainstorming session with your partner. After the brainstorming session, write an outline of your investigation. The outline should be in a format similar to that shown in Figure 10.2.

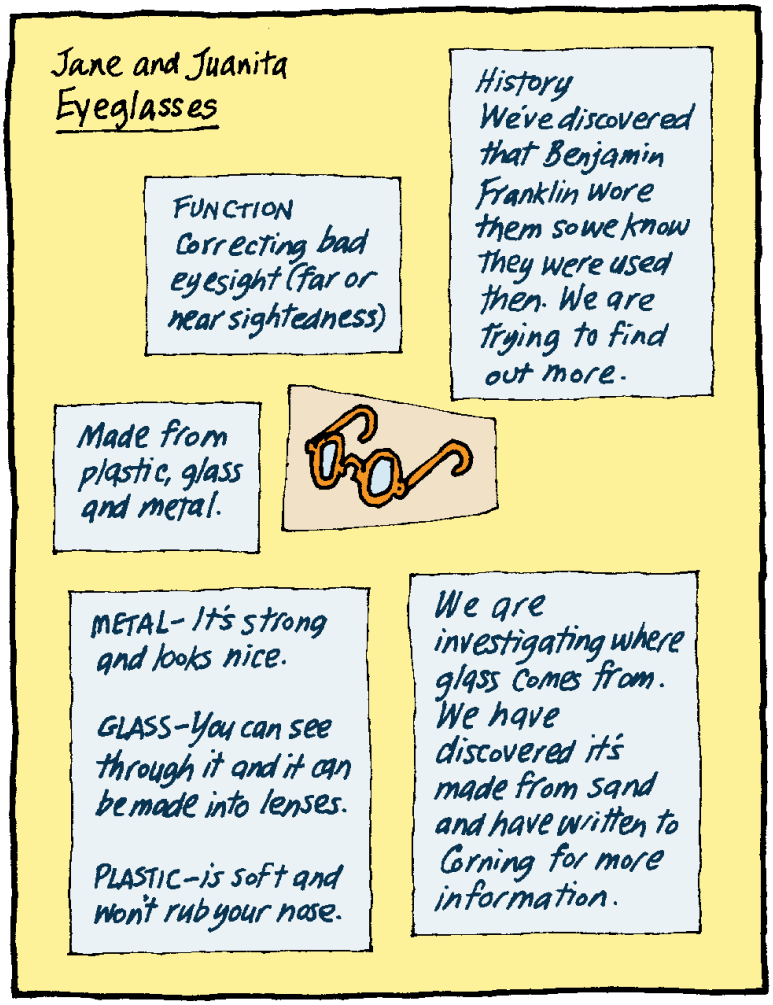


Figure 10.2 *Example of an outline of Anchor Activity research*

4. On another sheet of paper, write a bibliography. The bibliography can include books, newspapers, magazines, and TV programs. You should have at least one Internet and one CD-ROM or DVD reference (see Figure 10.3).

5. Hand in your outline and bibliography on or before the due date on your schedule. Your teacher will use this information to make sure your research is heading in the right direction.

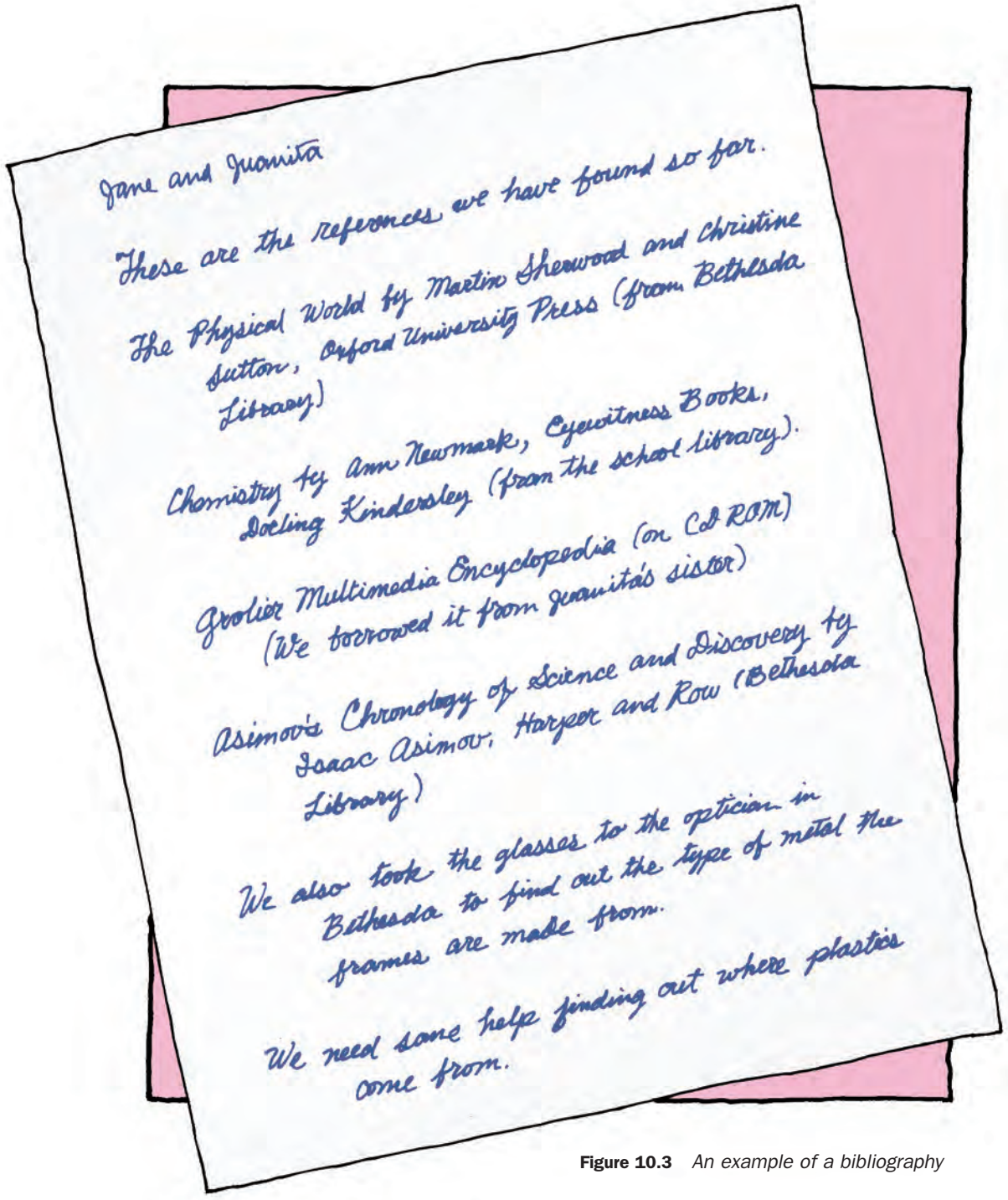


Figure 10.3 *An example of a bibliography*

Part 3: Creating the Cube

1. Continue your research. *At least* a week before the due date for the completed exhibit, gather together all of your information.

2. Table 10.1 explains what is required for each section of your exhibit. Read it carefully because it tells you how you can obtain high scores for your exhibit. Notice that points are awarded for the bibliography and for the presentation, including use of imaginative artwork and decoration of your exhibit. Remember, points will be deducted for late work.

Table 10.1 Scoring Rubric for the Cube

Section	What You Should Include	Total Points (Percentage)
Function	An accurate description of what your object does or what it is used for	5
Major materials	An accurate description of the major materials that make up your object	5
Why these materials were chosen	Accurate and complete reasons (or good suggestions) why the major materials were chosen (including the properties that make them suitable for use in the object)	10
Origin of one of the materials	Brief descriptions (a sentence or two) of the following: • One of the materials in the object • The raw materials from which the material is made • The geographical source or sources of the raw materials • The processes the raw materials undergo to make them usable in your object	10
History of the object	• The person who invented your object (it may or may not have been invented by a particular person) • When and where it first appeared • How the original designs and choice of materials differ from those in use today	5
Bibliography	At least five references (one must be an Internet source; one must be a CD-ROM/DVD source)	5
Presentation of the cube	• Correct spelling • Clear pictures and/or diagrams • Imaginative design and decoration	15

3. Write each section of your exhibit (use the headings listed in Part 2, Step 1 of the Anchor Activity Guidelines). If you can, use a word processor to type the final text. You have very limited space for each of the sections. Choose the content, including pictures and diagrams, very carefully.

4. Construct your exhibit. If you are making a cube, follow the instructions in Steps 5 and 6.

5. Make the cube from lightweight cardboard, card stock, or poster board. The dimensions of the cube should be about 15 × 15 × 15 cm. Figures 10.4 and 10.5 show how to assemble the cube.

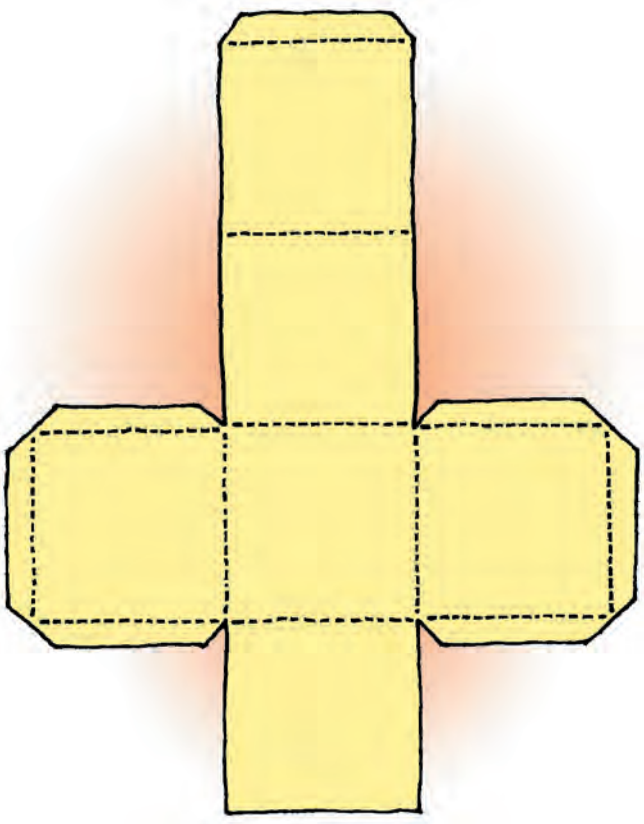


Figure 10.4 *Cut out an outline like this one on a piece of lightweight cardboard.*

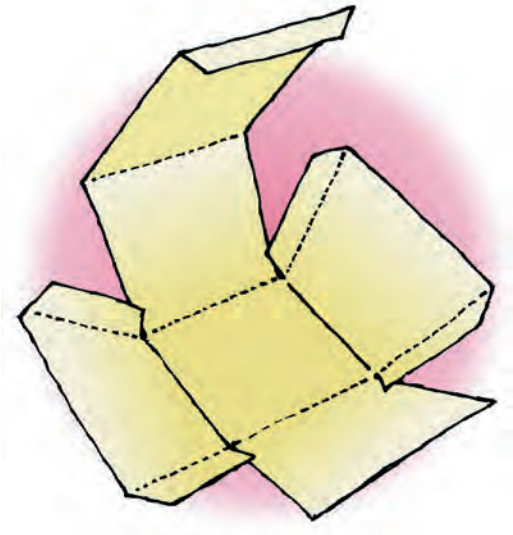


Figure 10.5 *Fold the cardboard to form a cube.*

6. Use one side of the cube for each section you have written (this will use five sides). Make sure that at least four sides of the cube read the same way up (see Figure 10.6). Put a picture or photograph (or, if possible, the object) on the sixth side. It is important that your names and bibliography appear somewhere on the exhibit. Figures 10.7 and 10.8 show completed cubes.

7. If your cube is too small for all your information to fit, include the additional information in your oral presentation.

8. Hand in your exhibit on or before the due date.

Figure 10.6 *At least four sides of the cube should read the same way up.*

Figure 10.7 *The students who built these cubes had fun researching and decorating them!*

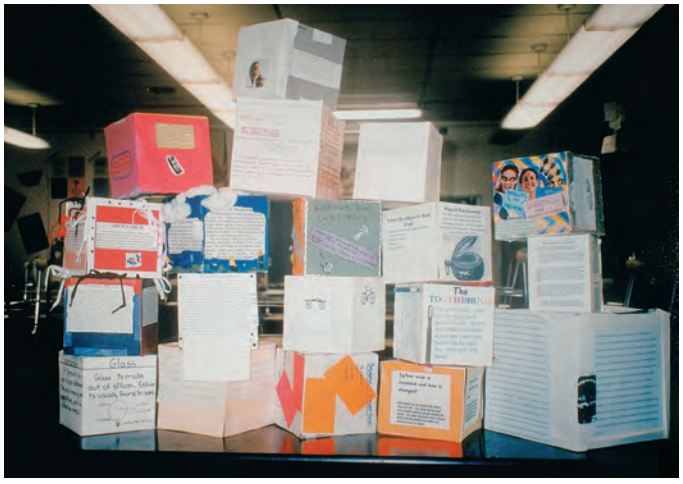


Figure 10.8 *Once complete, the cubes from your class will make an exciting exhibition about materials and how we use them. Although each cube follows the same format, your personal touches will make your cube unique.*

Part 4: Giving the Oral Presentation

1. Work with your partner to prepare a short oral presentation. It should focus on the origin of one of the materials that make up your object. You should provide *detailed* information on the following topics:

   - One of the materials from which your object is made
   - The properties of the material
   - The properties of the material that make it a good choice for use in your object
   - One of the raw materials from which the material is made
   - The geographical source or sources of the raw material
   - How the raw material is extracted and/or processed before it is used in your object

2. Both you and your partner should be involved in giving the presentation. During your presentation, use some visual aids such as posters, maps, and overhead transparencies. If you can, use Web pages or a short video.

3. Carefully read Table 10.2. It tells you how your oral presentation will be assessed. Use the table to plan your presentation.

4. With your partner, practice giving the presentation. Time yourselves so that the presentation is between 3 and 5 minutes long.

5. Make sure you have all of your materials ready before you give your presentation. You may refer to notes during your presentation, but you should avoid reading them.

Table 10.2 Scoring Rubric for the Oral Presentation

Component	What You Should Include	Total Points (Percentage)
Content	Detailed descriptions of the following: • One of the materials from which your object is made • The properties of the material • The properties of the material that make it a good choice for use in your object • One of the raw materials from which the material is made • The geographical source or sources of the raw material • How the raw material is extracted and/or processed before use in your object	10
Presentation and use of visual aids	• Speaking loudly and clearly • Appropriate visual aids for your presentation • Visual aids large enough to be read from the back of the room	10
Organization	• A short introduction, main section, and a conclusion or short summary • Equal contribution by you and your partner	10

What Is Each Part of the Anchor Activity Worth?

The completion of each item listed on the Anchor Activity Schedule by its due date is worth 15 percent of your total grade for the Anchor Activity; the cube is worth 55 percent; and the oral presentation is worth 30 percent.

When Will You Do All of This Work?

You will be given several homework assignments and a small amount of class time to do this work. However, you will have to do most of it on your own time. At the end of the module, two to three class periods will be used for the Anchor Activity presentations.

BICYCLE INGREDIENTS

AP/WIDE WORLD PHOTOS

Bicycles like this one, made partially from carbon composites, are lighter than metal bikes and can be designed to be more aerodynamic than those made from metals.

Compared to cars, bicycles look pretty simple. But this appearance is deceiving. Even an inexpensive bike can be made of more than a hundred different materials. These include several kinds of steel, other metals such as chrome and aluminum, several kinds of rubber, a few oils, and different types of plastic.

Dan Connors is an engineer with Cannondale Corporation, a company in Connecticut that makes bikes. He says choosing the material for each bicycle part always boils down to a trade-off between strength, weight, and price. "You want all the parts to be strong, but they can't weigh too much. Nobody wants to pedal around with a bunch of excess weight," he says. But price is important, too. "You can design the greatest thing in the world. But if that means putting a thousand dollar part on a bike you want to sell for five hundred bucks, you won't get too far," Connors says.

The single biggest part of a bicycle is the frame. The first bike frames were made of wood.

Today, most bike frames are made of steel. Steel has a good balance between strength and weight. It is easy to work with. It also doesn't cost much. For more expensive frames, designers often choose aluminum. Aluminum or aluminum alloys can have the same strength as steel, but they weigh less. Aluminum is also cheap to buy. Unfortunately, it is tricky to weld aluminum pieces together, so aluminum frames cost more.

Some very high-priced bikes have frames made of carbon composites. These new materials are made by setting strong carbon fibers in a solid plastic matrix. Frames made of carbon composite can be as strong as steel but weigh only one-third as much, says Connors.

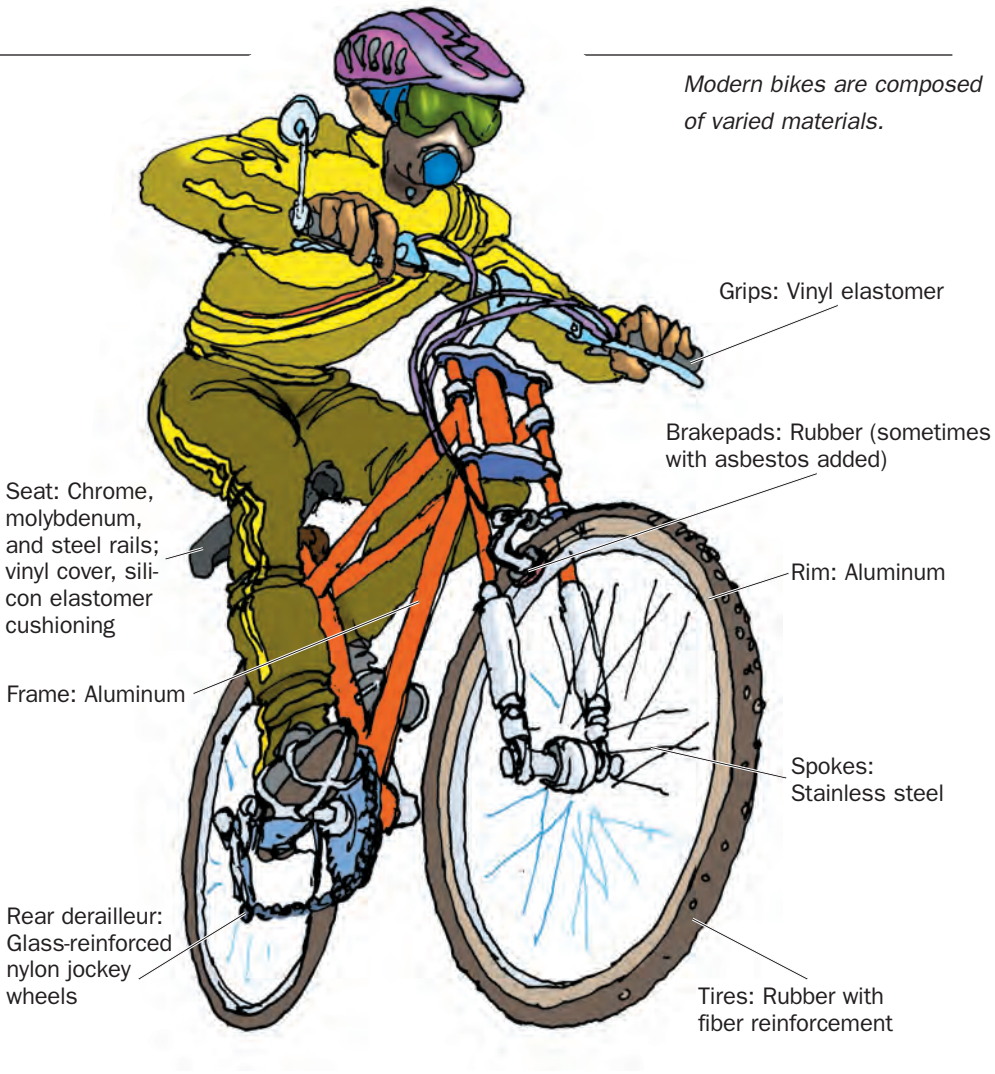
Strength, weight, and cost are important for other parts of a bike, too. Take the gears, for example. The big front gear

turned by the pedals does not need to be as strong as the gears on the back wheel. Designers often save a little weight by using aluminum alloy for the front gear, says Connors, but this trick won't work at the back. "You might save a little weight if you put aluminum alloy gears in the back, but the gears would wear out after a couple of months," he says. The back gears are usually made from more durable steel.

Tires are made of rubber. Rubber is flexible and holds air, but by itself, it is not very strong. To compensate for the lack of strength of rubber, bicycle tire makers embed long fibers, often made from nylon, inside the rubber. The fibers help the tire hold its shape and resist punctures.

The ball bearings inside the axles of the wheels are especially hardened steel. They may be sealed with lubricants that have special additives to withstand heat.

You might think that it would be very difficult to improve on something that has been around for more than a hundred years, like the bicycle. Fortunately, new materials are constantly being discovered or invented. This gives engineers like Dan Connors new options for designing bicycles. □



Modern bikes are composed of varied materials.

The draisienne, invented in 1818, was the first two-wheeled machine for personal transport. It had no pedals and was made from iron and wood, the most practical materials available at that time.