

# Unit 1

# Technology and the Design Process



How can technology affect our lives?

## I will learn

- about simple and complex machines.
- the steps of the design process.

### 1 Look and label.

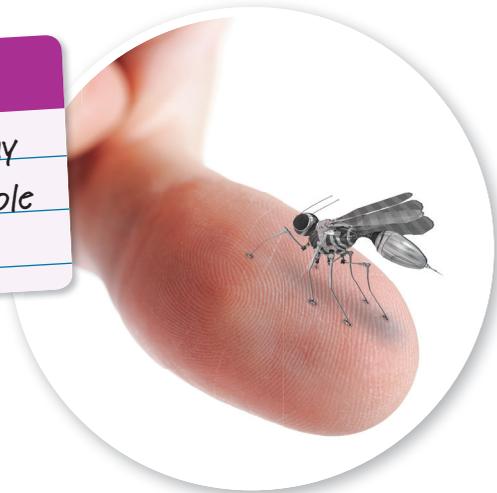
can opener    axe    scissors  
seesaw    wheel    screw



- 2 What are each of the machines used for? Discuss with a partner.
- 3 How can machines help you solve problems? Discuss as a class.

**Think!**

How will this tiny robot help people in the future?



## Lesson 1 • What is a machine?

- 1 Read and complete the graphic organizer.  
Write details about work.

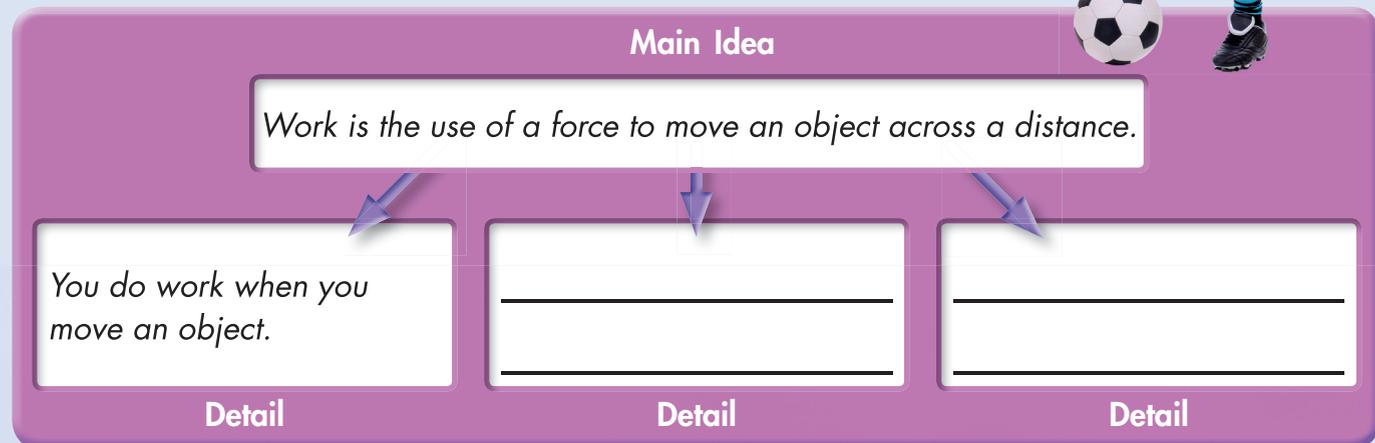
### Work

Is kicking a soccer ball work? To a scientist it is. In science, **work** means the use of a force to move an object across a distance. You do work when you rake leaves, pedal a bike, or kick a soccer ball.

It may be hard to solve a math problem. But it is not work. You may push hard to move a large rock. But it is not work if the rock does not move. You only do work when you move an object. The amount of work you do depends on how much force you use and how far you move the object.

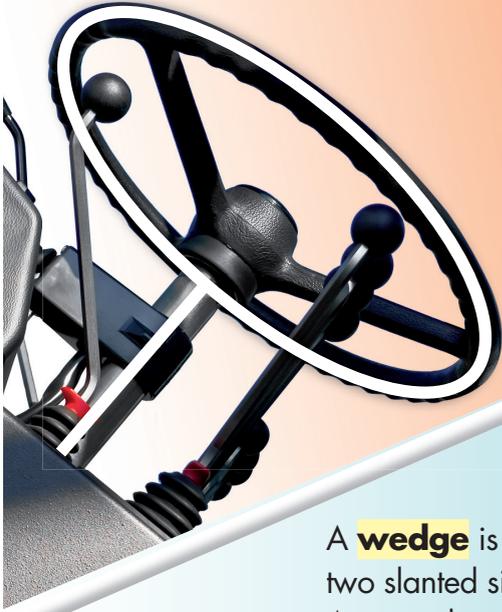
### Key Words

- work
- wheel and axle
- wedge
- lever
- inclined plane
- pulley
- screw



- 2 How does the pole help this vaulter jump higher? Discuss as a class.

A **wheel and axle** is made of a round object, a wheel, attached to a post, called an axle. Turning the wheel causes the axle to turn. The axle turns a small distance as the wheel turns a greater distance.



**3** Read and write the names of the six machines shown on pages 6 and 7.

### Simple Machines

Do you recognize any of the objects in the pictures? They are all simple machines. Simple machines have just one or two parts. These machines do not lessen the amount of work you do, but they help make work easier. Six kinds of simple machines help you do work.

---

---

---

---

---

A **wedge** is a simple machine made from two slanted sides that end in a sharp edge. As a wedge is pushed through material such as wood or food, it cuts or splits the material.

**4** What is the common name for the wedge you use to cut a cake? Discuss with a partner and write its name.

---

A **lever** is a stiff bar that rests on a support. A lever is used to lift and move things. When you push down on one end, the other end lifts up.



5 Look at this shape ▼. Draw an X on the simple machine that has this shape. How does the shape help this machine work? Discuss with a partner.

6 Which simple machine would you use for each task below? Discuss with a partner.

A. Raise a flag on a pole. \_\_\_\_\_

B. Open a can of paint. \_\_\_\_\_

C. Cut an apple. \_\_\_\_\_

7 How is a jar lid a screw? Discuss as a class.

A **screw** is an inclined plane wrapped around a center post. Screws can be used to hold things together and to raise and lower things.



A **pulley** can make work easier in two ways. It can decrease the amount of force needed to move an object. It can also change the direction that the force is applied.



An **inclined plane**, or a ramp, is a slanted surface. It connects a lower level to a higher level. Less force is needed to move an object over a longer distance.



- 8 Read and look at the machines on pages 6 and 7. Complete the captions with words from the box.

### Complex Machines

Simple machines are often put together to do bigger jobs. These complex machines are made up of simple machines that work together.

The can opener below is a complex machine. Find the simple machines that it is made of. These simple machines work together to grip, turn, and slice through a can lid.

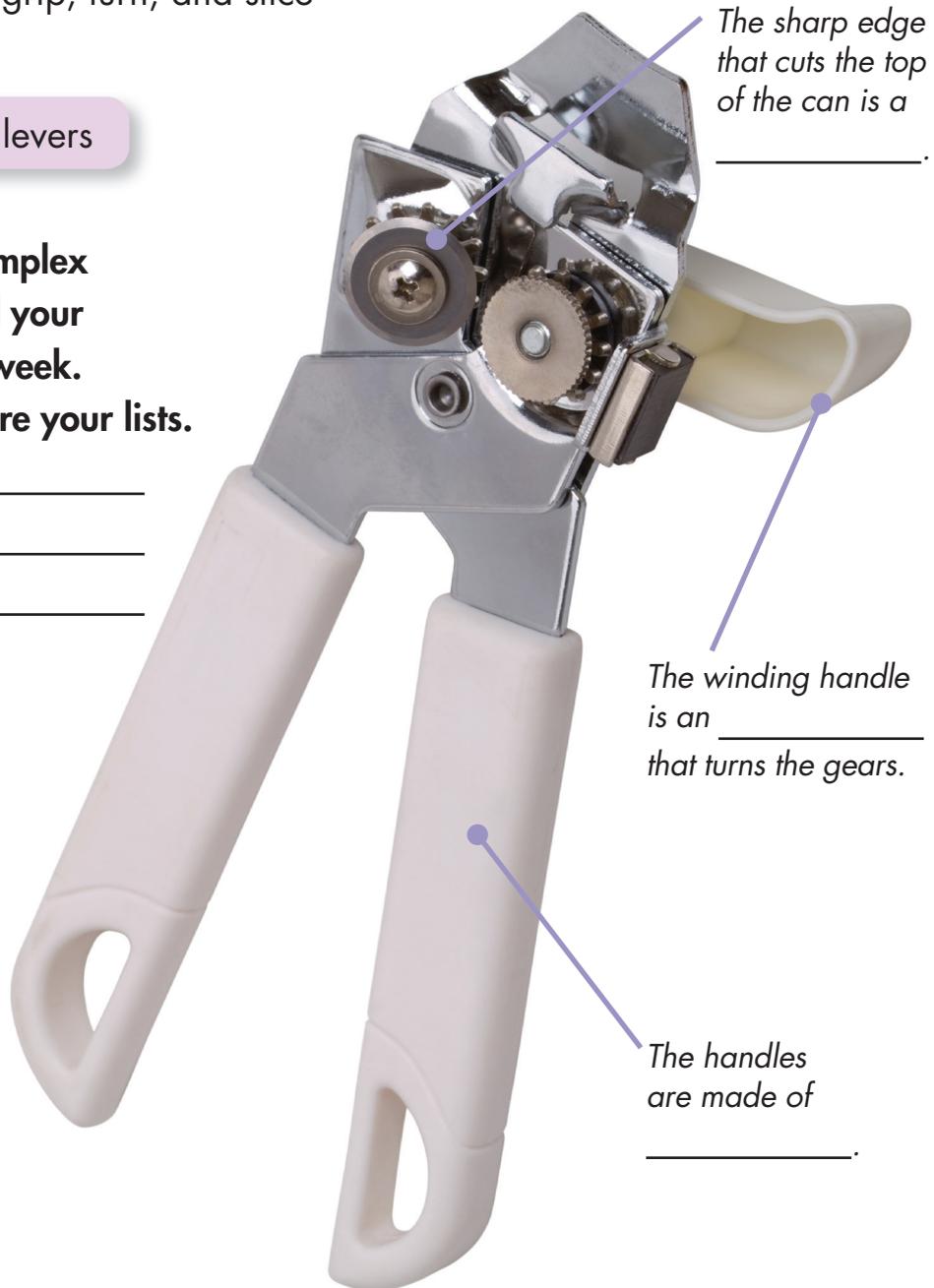
wedge    axle    levers

- 9 Write a list of three complex machines that you and your family have used this week. With a partner, compare your lists.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**Think!**  
How do you know when a complex machine is at work?

**At-Home Lab**  
**Complex Machines**  
Search your home for one complex machine. Draw and label the complex machine. Identify each simple machine in the complex machine.



The sharp edge that cuts the top of the can is a \_\_\_\_\_.

The winding handle is an \_\_\_\_\_ that turns the gears.

The handles are made of \_\_\_\_\_.

- 10** Read. Where would you find a wedge inside a lawn mower? Discuss with a partner and write your answer.

## Lawn Mowers

Engineers design and develop large and small machines. These machines are made of simple and complex machines. A simple machine can be a lever, wheel and axle, pulley, wedge, inclined plane, or screw.



Simple machines are often put together to make a complex machine, such as a lawn mower. It is made of different parts. Some of these parts are simple machines, such as a wheel and axle. A wheel and axle is used in a lawn mower to help it move. A screw is another simple machine. Screws are used to hold the lawn mower pieces together. Lawn mowers have wedges that end in sharp edges. Where would you find a wedge inside a lawn mower?

## Bicycles

The bicycle is a complex machine, too. What simple machines make it up? How does each simple machine help make the bicycle work?

- 11** Draw a line from each simple machine to its correct part on the bicycle.

- A. lever
- B. pulley
- C. wheel and axle



## Lesson 2 • What is the design process?

- 1 Look at the pictures. How are the two computers similar? How are they different? Discuss with a partner.

### Key Words

- design process
- engineer
- research
- prototype

### Design Process

When people design something new, they follow the steps of the design process. The **design process** is a step-by-step method used to solve a problem.

People use the design process to find a solution. A solution is an answer to a problem. The design process allows **engineers** to produce and test possible solutions. An engineer is any person who designs new technologies.

- 2 Why is it important for engineers to follow the steps of the design process? Discuss as a class and write the answer.

---

---

---

---

---

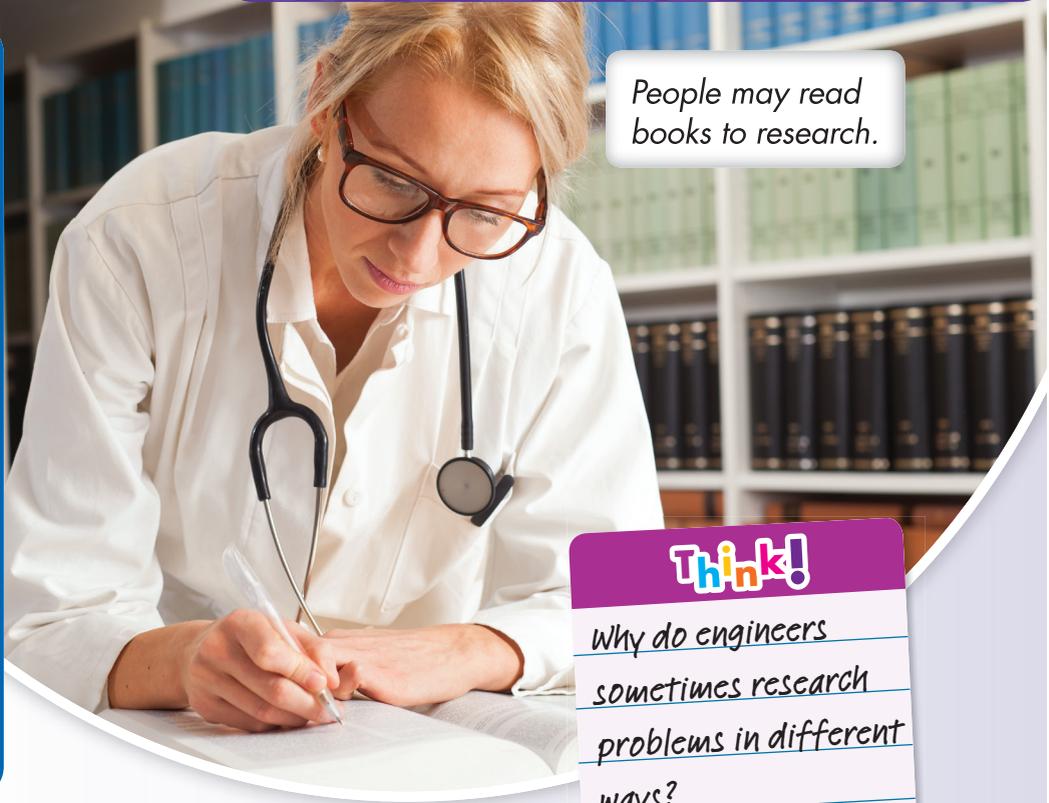




## Go Green

### Saved Solution

Save some items instead of throwing them away. Think of a simple problem. Use the items to build something to solve your problem. Test what you build to see if it works. Evaluate your solution. Share your results with someone in your class.



People may read books to research.

**Think!**

Why do engineers sometimes research problems in different ways?

- 3** Read and complete the information related to Kramer's invention. Check your answers with a partner.

## Identify the Problem

Engineers identify the problem during the first step of the design process. Before producing a design, engineers consider if there is a need for it. In 1979, there were only large music players that needed tapes or records to play music. British inventor Kane Kramer identified this as a problem. Kramer wanted to design a smaller music player that did not need tapes or records. His idea led to the invention of the digital audio player.

## Do Research

The next step is to research the problem. **Research** means to look for facts about something. People can research problems in different ways. Some engineers research by talking to other people and reading articles. Kramer researched ways to make a digital audio player. Kramer took notes about what he learned.

### 1. Problem:

---



---



---



---

### 2. Research:

a.

---



---



---

b.

---



---



---

#### 4 Read and underline what Kramer did at each stage.

### Develop Possible Solutions

After doing research, engineers think of possible solutions. They consider what designs would best meet the needs of the problem. Kramer considered different materials that were available. He knew he needed to use materials that would produce a player people would use. It had to be small enough to fit in a pocket. He made different sketches of how the player could look.

### Choose One Solution

People consider many things in order to choose the best solution. They think about how they will build the solution. They also think about what kinds of materials will work. Kramer chose the best solution. His player would be made of strong materials and be small in size.

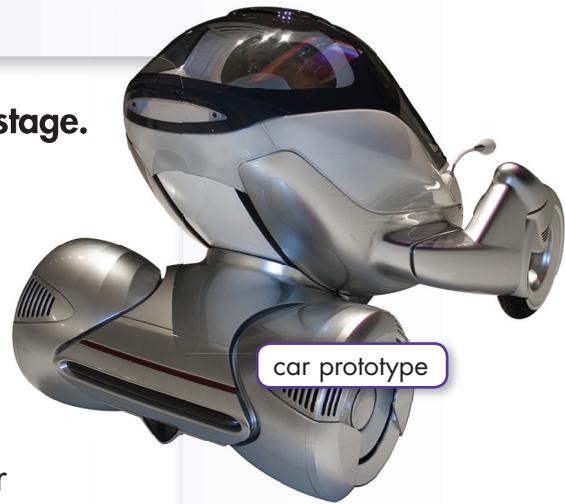
### Design and Construct a Prototype

After sketching the digital audio player, Kramer constructed, or built, a prototype. A **prototype** is the first working product that uses a design. Kramer made the player small and easy to use.

### Test the Prototype

Engineers test a prototype to determine if it meets their expectations. They perform multiple tests to get accurate results. Kramer tested the prototype to see how well it worked.

#### 5 What did Kramer learn from his test? Discuss as a class.

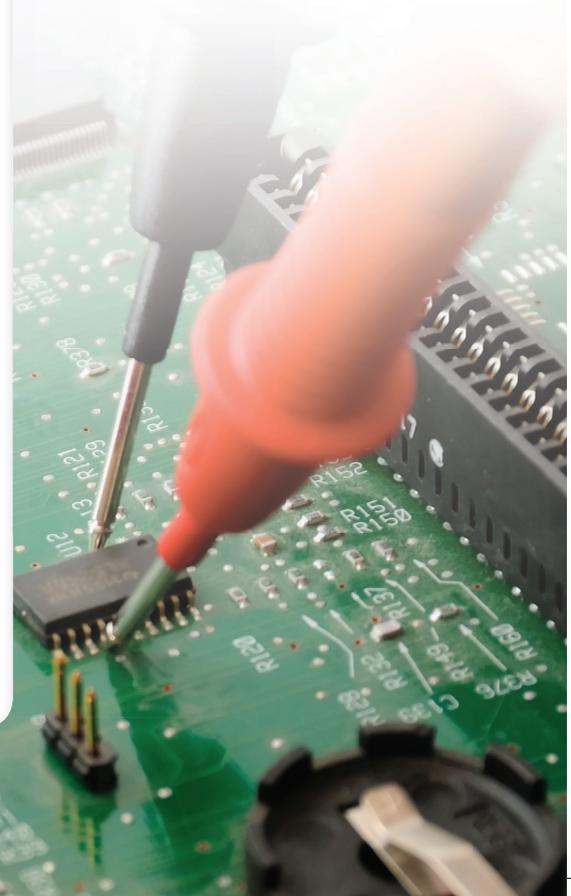


car prototype

**Think!**

*How can this car prototype help engineers?*

*Someone may test an inner part of a computer to see how well it works.*



## 6 Read and answer the questions.

### Communicate Results

Engineers communicate results about their tests to people working with them. Engineers may share how they designed and built the prototype. They also explain how the experiment was carried out. After testing it, Kramer sent a report of his invention to a group of people. He hoped the people would invest money in his invention. The report described the way his invention worked. It also explained how the player could change the way people listened to music.

1. How did Kramer communicate his results?

---

2. What did the report say?

---

---



*This is what the inside of a digital audio player looks like. Showing it to others can help them understand the design.*

### Evaluate and Redesign

The final step is to evaluate and redesign the prototype. Evaluate means to find out how well something works. People try to make a prototype better by redesigning it. When people heard about Kramer's idea of the digital audio player, they designed their own versions. The first digital audio player became available to the public in 1997. It could play about one hour of music. Newer digital audio players can hold enough music to play for more than 100 days!

7 Look at the photos. How are these audio players different? Discuss with a partner.



## Materials



ruler



4 books



10 craft sticks



10 stir sticks



note card



tape



coins



plastic cup

## Let's Investigate!

### What makes a bridge strong?

1. Place two stacks of books 25 centimeters apart.
2. Make a model of a bridge between the books. Use stir sticks, tape, and a note card. Brainstorm potential solutions.
3. Place the cup on the bridge.



4. Predict how many coins the bridge will hold. Record your prediction.
5. Put coins in the cup one at a time. Record how many coins the bridge holds before it falls.
6. Repeat Steps 2 to 5. Use craft sticks this time.

Model	Number of Coins	
	Prediction	Result
Stir sticks		
Craft sticks		

# Unit 1 Review



## How can technology affect our lives?

### Lesson 1



#### What is a machine?

- 1 The nail clippers are a complex machine made up of two simple machines. Label each simple machine.

### Lesson 2

#### What is the design process?

- 2 The first working product that uses a design is called a \_\_\_\_\_.
  - a. method
  - b. technology
  - c. redesign
  - d. prototype
- 3 After you test a prototype, you communicate information to other people. This information is called \_\_\_\_\_.
  - a. a hypothesis
  - b. the results
  - c. a story
  - d. an investigation

