

SHAKE UP

SCIENCE 4



STUDENT BOOK

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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.

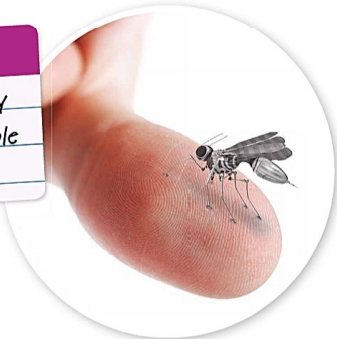
- can opener
- axe
- scissors
- seesaw
- wheel
- screw



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.

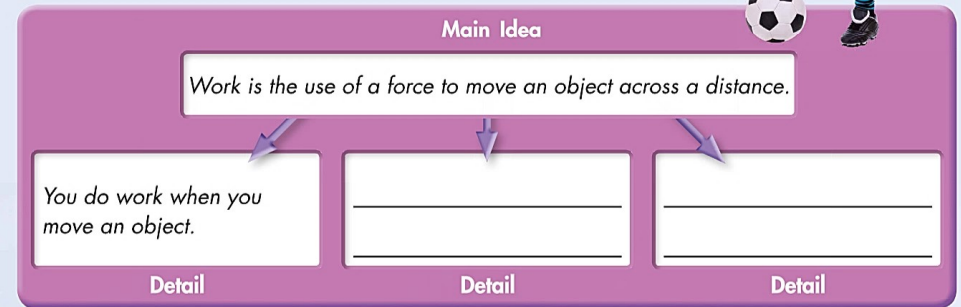
Work

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.



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.



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.

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

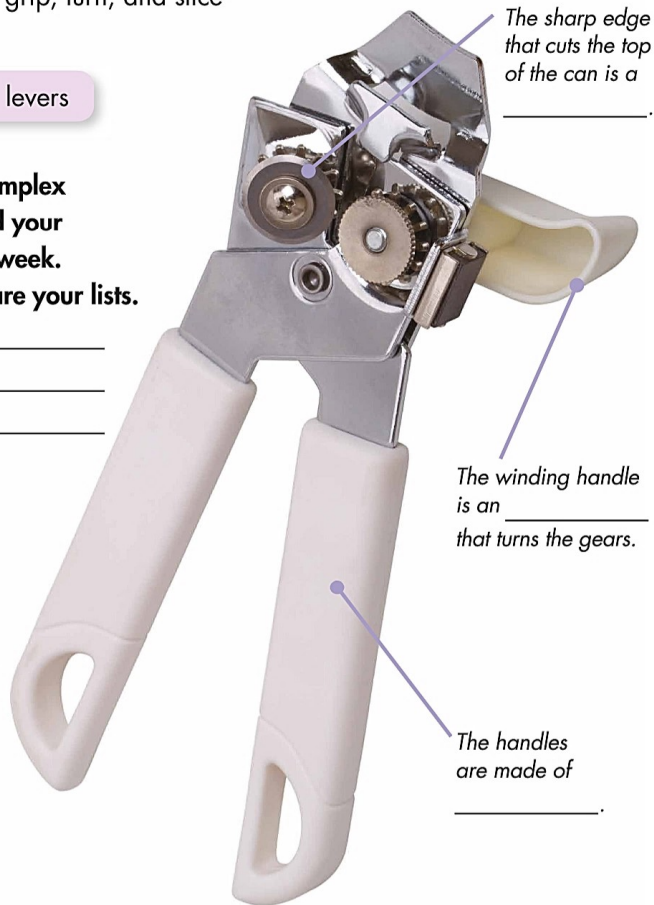
- ▶ **9** Write a list of three complex machines that you and your family have used this week. With a partner, compare your lists.

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.



- ▶ **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?

Key Words

- design process
- engineer
- research
- prototype

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

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. _____

