

Forces

Textbook pages 276-289

Before You Read

You push on a small boulder and it does not move. If you push with the help of a few friends, the boulder moves. What makes the difference? Write your ideas below.

Make Flash Cards

For each paragraph, think of a question that could be on a test. Write the question on one side of a flash card. Write the answer on the other side. Quiz yourself until you can answer all the questions.

What is a force?

A **force** is a push or a pull that acts on an object. A force can cause an object to move or change. For instance:

- ◆ A force can set a motionless object in motion or make a moving object stop.
- ◆ A force can make a moving object slow down, speed up, or change direction.
- ◆ A force can change the shape of an object.

What types of forces are there?

You can group forces into two main types, contact forces and action-at-a-distance forces. Contact forces have an effect only on objects that they touch. Examples of contact forces:

- ◆ **Friction** works to slow down or stop motion due to surfaces rubbing against each other.
- ◆ Tension force is experienced by a rope when it is pulled at either end.
- ◆ Elastic force is exerted when a spring returns to its normal shape after being stretched.

Action-at-a-distance forces act on objects without touching them. Examples of action-at-a-distance forces:

- ◆ **Gravitation** pulls objects toward each other. A ball that is tossed in the air falls to the ground because of this force.
- ◆ **Magnetic** force pulls or pushes on metals and compounds such as iron, nickel, and cobalt.
- ◆ Static electricity, such as in lightning, causes pushing and pulling forces. ✓

✓ Reading Check

1. What is the difference between a contact force and an action-at-a-distance force?

How are forces measured?

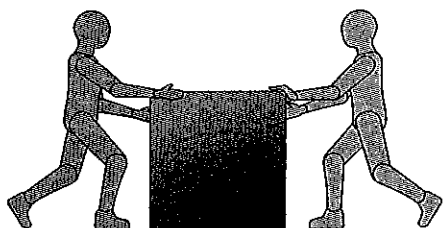
Force is measured in units called newtons. It takes about one newton (1 N) of force to lift or to hold up the mass of a medium apple against the force of gravity.

The newton is related to the weight of an object. **Weight** is the amount of force that gravity exerts on the mass of an object. This means that weight is not the same as mass. The mass of an object measures the amount of matter in it. The weight of an object measures how strongly gravity pulls on that amount of matter. Gravity pulls more strongly on objects that have more mass. ✓

What happens when forces are balanced and unbalanced?

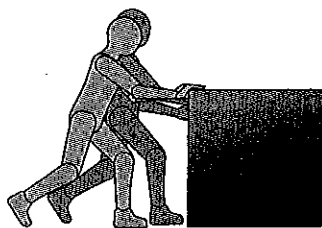
Balanced forces are forces that are equal in size and act in opposite directions. If balanced forces act on an object that is not moving, it will not move. If the object is moving, it will keep moving in the same direction and at the same speed.

Unbalanced forces are not equal in size. They do not have to act in opposite directions. If unbalanced forces act on an object that is not moving, it can move. The movement is in the direction of the stronger force.



$$\begin{array}{c} \rightarrow + \leftarrow = 0 \\ \text{net force} = 0 \end{array}$$

These forces are balanced. They are equal in size (amount of force), and they act in opposite directions. The box does not move.



$$\begin{array}{c} \rightarrow + \rightarrow = \rightarrow \\ \text{net force} = \rightarrow \end{array}$$

These forces are unbalanced. They are not equal in size. The box moves in the direction of the stronger force.

✓ Reading Check

2. How is weight different from mass?

Use with textbook pages 276-285.

What is a force?

Vocabulary

action-at-a-distance	magnetic
balanced	mass
can	newtons
contact	static electricity
elastic	tension
force	unbalanced
friction	volume
grams	weight
gravitation	will not

Use the terms in the vocabulary box to fill in the blanks. Each term may be used only once. You will not need to use all the terms.

1. A(n) _____ is a push or a pull that acts on an object.
2. _____ forces only have an effect on objects that they touch.
_____ forces act on an object without touching it.
3. _____ works to slow down or stop motion due to surfaces rubbing against each other. _____ force is experienced by a rope when it is pulled at either end. _____ force is exerted when a spring returns to its normal shape.
4. A(n) _____ force pulls objects toward each other.
A(n) _____ force pulls or pushes on metals such as iron.
_____ causes pushing and pulling forces.
5. Force is measured in units called _____.
6. The _____ of an object measures the amount of matter in it.
The _____ of an object measures how strongly gravity pulls on that amount of matter.
7. _____ forces are forces that are equal in size and act in opposite directions.
8. _____ forces are not equal in size. They do not have to act in opposite directions.

Name _____

Date _____

Use with textbook pages 276–285.

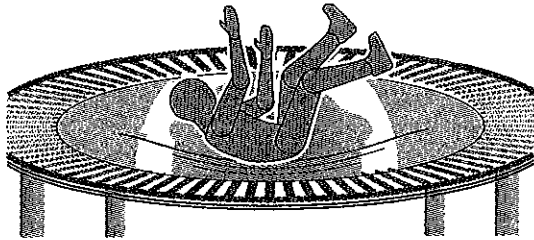
Name the force

On the first blank line, state what type of force is illustrated in the picture.

Choose from the following list: tension, friction, elastic, gravitational, static electricity, magnetic.

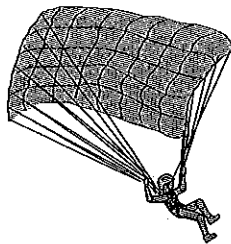
On the second blank line, state whether it is a contact force or an action-at-a-distance force.

1.



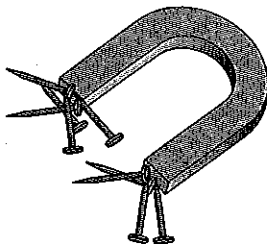
The trampoline stretches.

2.



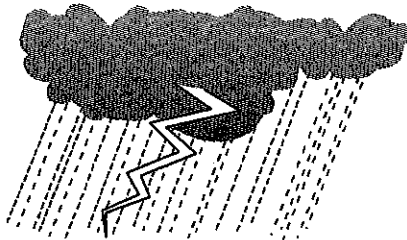
A person parachutes from the sky.

3.



A magnet collects the iron nails.

4.



A rain cloud produces lightning.

Use with textbook pages 276–285.

True or false?

Read the statements given below. If the statement is true, write “T” on the line in front of the statement. If it is false, write “F” and rewrite the statement to make it true.

1. _____ A force cannot set a motionless object in motion.

2. _____ A force can make a moving object change direction.

3. _____ A force can change the shape of an object.

4. _____ Tension force slows down or stops motion due to surfaces rubbing against each other.

5. _____ Elastic force pulls objects toward each other.

6. _____ An example of magnetic force is lightning.

7. _____ The weight of an object measures how strongly friction pulls on that amount of matter.

8. _____ Force is measured in units called newtons.

9. _____ Balanced forces are forces that are equal in size and act in opposite directions.

10. _____ If unbalanced forces act on an object that is not moving, it can move.
