Contents

TEACHER GUIDE

STUDENT HANDOUTS

NAME: _____

Before You Read

Other Forces That Act Without Touching

1. Put a check mark (✓) next to the answer that is most correct.

a) Which forces can either attract (pull) or repel (push)?

- ○ **A** magnetic and electrostatic
- ○ **B** electrostatic and gravity
- ○ **C** gravity and magnetic
- ○ **D** friction and gravity

b) Which kind of metal is attracted to a magnet?

- ○ **A** aluminum
- ○ **B** copper
- ○ **C** iron
- ○ **D** silver

c) What are the poles of a magnet called?

- ○ **A** left and right
- ○ **B** plus and minus
- ○ **C** north and south
- ○ **D** metal and nonmetal

2. Circle the word True if the statement is true. Circle the word False if it is false.

a) The Earth is a large magnet.

True **False**

b) Electrical charges are either minus or zero.

True **False**

c) Things made of iron are attracted to magnets.

True **False**

d) A magnet can pick something up off the ground without touching it.

True **False**

e) Electrical charges can attract each other but cannot repel.

True **False**

Reading Passage

NAME: _____

Other Forces That Act Without Touching

Like gravity, magnetic force and electrostatic force can also act without touching. Magnetic force is the force between magnets, and electrostatic force is the force between things with electrical charges. Gravity only pulls, but magnetic and electrostatic forces can push *or* pull. Pulling together is called attraction, and pushing apart is called **repelling**.

Magnets have two ends, called the **north pole** and the **south pole**. When the north pole of one magnet is brought near the south pole of another magnet, the magnets attract each other, and they stick together. Things made of iron, like nails and paper clips, also stick to magnets. When two north poles or two south poles are brought together, the magnets repel each other, and they move apart.

You may have heard of Earth's North and South Poles. These places are called poles because the Earth is actually a huge magnet.

Electrical charges are either **positive** or **negative**. Things with a positive charge are marked with a plus (+), and things with a negative charge are marked with a minus (–). Electrostatic forces act much like magnetic forces. Like charges attract, and opposite charges repel. After a balloon is rubbed on cloth, the balloon will then stick to the wall. The balloon has become charged, and electrostatic force is holding it to the wall.

Force is greater for stronger magnets and for larger charges. Force gets smaller as the charges or magnets get farther apart. In these ways, magnetic and electrostatic forces are a lot like the force of gravity.

STOP

Name three things that you could pick up with a magnet.

_____

_____

After You Read

NAME: _____

Other Forces That Act Without Touching

1. Tell which force goes with each sentence. In the spaces to the left, write **G** if it is about GRAVITY. Write **M** if it is about MAGNETIC force. Write **E** if it is about ELECTROSTATIC force.

a) _____ A north pole is attracted to a south pole.

b) _____ It pulls, but it can't push.

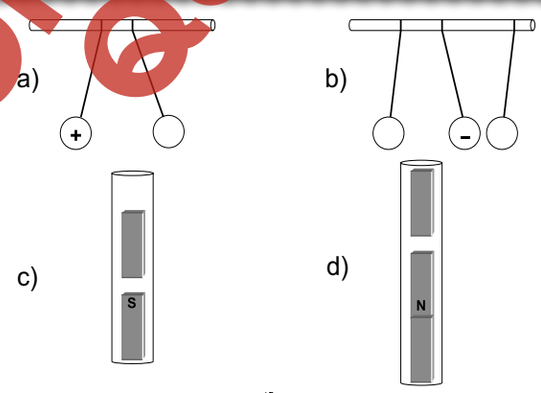
c) _____ This could be used to separate pins from toothpicks.

d) _____ Plus repels plus, and minus repels minus.

e) _____ It makes all falling objects speed up.

2. In the pictures below the balls on strings have **electrical charges.** The bars are **magnets** that have been dropped into glass tubes.

Write the sign for the charges on the balls that are blank. Write **+** for a POSITIVE charge. Write **–** for a NEGATIVE charge.
Show the names of the magnet **poles** that are not already shown. Write **N** on the NORTH POLE ends of the magnets. Write **S** on the SOUTH POLE ends of the magnets.



After You Read

NAME: _____

Other Forces That Act Without Touching

Answer the questions in complete sentences.

3. What are the names of the electrostatic charges? Which pairs repel? Which pairs attract?

_____

_____

4. What are the names of the magnetic poles? Which pairs repel? Which pairs attract? What else is attracted to magnets besides other magnets?

_____

_____

Extension & Application

5. a) Use the chart on the next page to show what you have learned about the forces of **friction, air resistance, gravity, magnets,** and **electrostatic charges**. Write **Yes** or **No** in each box. Do not write in the black boxes.

b) Which of the forces is *always* pulling on you? _____

c) Which of the forces helps you walk up a steep hill? _____

d) Which force could be used to separate steel cans from aluminum cans?

_____

Hands-On Activity #3

Activity Three

Balanced and Unbalanced Forces

In this activity you will see how motion changes when forces are unbalanced. This is when the net force is *not* zero. You will also see that motion does not change when forces are balanced. This is when the net force *is* zero. The two forces you will combine to make the net force are the force of **gravity** and the **buoyant force.**

The BUOYANT FORCE is the force that pushes up on objects that are under water. When the buoyant force is *greater* than the force of gravity, the object will float. This is why wood floats.

FOR THIS ACTIVITY, you will need:

- A pot of water
- A spring scale
- Several of these objects:

a piece of wood	a hollow ball, like a table tennis ball or a tennis ball
an egg	a stone
a metal object, like a pair of pliers, a lead fishing weight, or a large bolt	

- A spring scale looks like this:

STEPS:

1. Put each of the objects in the pot of water, hold the object on the bottom, and let go.
2. Does it float or sink?
   - If it **floats,** how fast does it move to the top?
   - If it **sinks,** how fast does it sink?
   - What does the speed of rising or sinking tell you about the **direction** and **amount** of the net force?
   - On which object is the net force closest to being balanced?
3. Tie a string to each of the objects that sank.
4. Weigh them on the spring scale.
5. Now weigh them again while they are hanging in the water.
   - Is the weight different in water?
   - How much **buoyant force** is acting on the object?

After You Read

NAME: _____

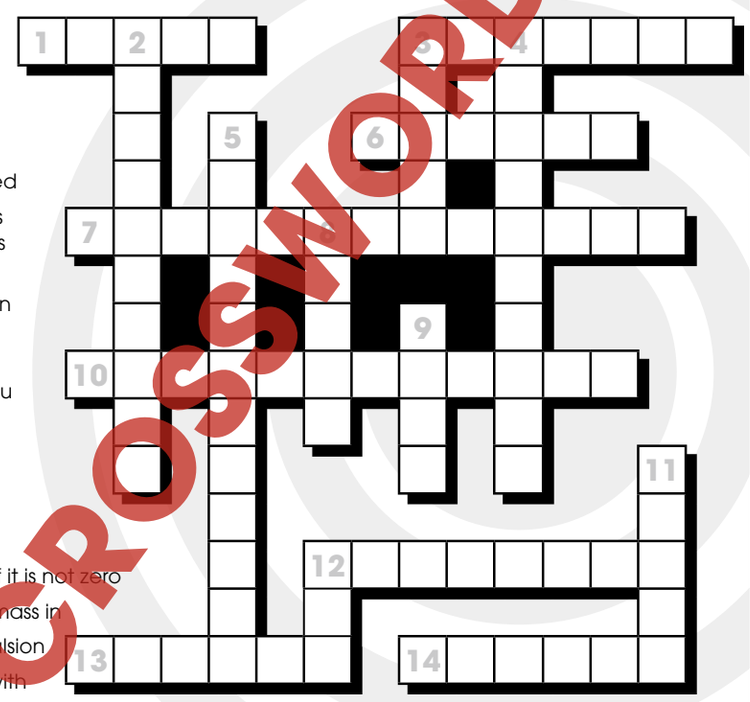
Crossword Puzzle!

Across

1. If it's not the north pole it must be the ____ pole
3. It's what makes you fall
6. What scientists call "stuff"
7. The kind of force between electrical charges
10. The kind of motion with increasing speed
12. This kind of charge is marked with a minus sign
13. It can pick up an iron nail
14. The force of Earth's gravity pulling on you is your ____

Down

2. What a net force is if it is not zero
3. What you measure mass in
4. The opposite of repulsion
5. The kind of motion with decreasing speed
8. Push away
9. Something all matter has
11. Gravity can ____ a force at a distance
12. Combining all the forces acting on something gives the ____ force



NAME: _____

After You Read

Comprehension Quiz

Part C

Answer the questions in complete sentences.

1. Name **two** forces acting on a falling object. Tell the **direction** in which each force acts. /3

2. When an arrow is used to show a force, what **two** things does the arrow show about the force? /3

3. Tell what a **contact** force is. Give two examples of contact forces. /3

4. Give an example of something that is acted on by **balanced** forces. Name the forces that are in balance. /3

5. Name the **two poles** of a magnet. When do two poles attract each other? When do two poles repel each other? /3

SUBTOTAL: /15

The Force of the Moon's Gravity

"The Moon's gravity pulls at the Earth so hard that is makes the water in the oceans slosh towards the moon! We see this when we see the ocean tides rising and falling."

After You Read

NAME: _____

Other Forces That Act Without Touching

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_____

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Extension & Application

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c) Which of the forces helps you walk up a steep hill? _____

d) Which force could be used to separate steel cans from aluminum cans?

_____

Force CCP4508-7

3.

Charges are either plus (+) or minus (–). Like charges repel; unlike charges attract.

4.

Magnetic poles are either north (N) or south (S).
Like poles repel; unlike poles attract.

5.

a)
A: No, ---
B: No, ---
C: Yes, No
D: Yes, Yes
E: Yes, Yes

b) gravity

c) friction

d) magnetic

10

Answers will vary

12

Answers will vary.

1.

Mass does not affect air resistance.

2.

Surface increases air resistance.

3.

a) No

b) No

c) No

(Helium balloons are acted on by the buoyant force of air.)

13

2.

The greater the speed of rising or sinking, the greater the net force. Closest to being balanced on the egg

5.

Yes, weight is different in the water. Buoyant force is weight in air minus weight in water.

14

5.

No

7.

Magnet has more force

15

EZ

Across:

1. south

3. gravity

6. matter

7. electrostatic

10. acceleration

12. negative

13. magnet

14. weight

Down:

2. unbalanced

3. grams

4. attraction

5. deceleration

8. repel

9. mass

11. exert

12. net

16