

Electric Force

Textbook pages 258–265

Before You Read

If you rub a balloon on a sweater it will stick to the wall. Why? Write your ideas on the lines below.

Make Flash Cards

For each paragraph, think of a question that might be on a test. Then 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.

Reading Check

1. What will happen if a pen with a positive charge comes near paper with a negative charge?

What laws describe electric charges?

Electric force is a pull (attraction) or a push (repulsion) between objects that are charged. The **laws of static charge** describe what happens when charged and uncharged objects come close to each other.

The Laws of Static Charge

1. Objects with the same charge repel each other.
2. Objects with opposite charges attract each other.
3. Charged objects attract neutral objects. 

The electric force that acts on any pair of objects depends on:

- ◆ the type of charge on the objects (positive, negative, or neutral)
- ◆ the amount of charge on the objects
- ◆ the distance between the objects

If you increase the amount of charge on objects, you increase the electric force. If you increase the distance between objects, you decrease the electric force.

What is an electroscope?

An electroscope is a device that can be used to detect the presence of charge. A typical electroscope has one or two lightweight strips of metal that bend easily. These metal strips, called leaves, are attached to a central metal rod that has a metal sphere at the top. Sometimes, the leaves and metal rod are enclosed in glass or plastic so that air movement does not affect the device. When the leaves repel each other, you know they are charged.

What is charging by conduction?

When you charge a neutral object by touching it to a charged object, it is called **charging by conduction**. For example, if you touch a neutral electroscope with a negatively charged rod, electrons are added to the electroscope and spread over the surface of the metal leaves. The leaves then become negatively charged and repel each other.

What is charging by induction?

You do not have to touch the sphere of an electroscope to make the leaves separate. If you bring a negatively charged rod near—but not touching—the sphere, the rod will repel the electrons in the sphere. The negative charges will move down to the leaves and the leaves will repel each other. This is called **charging by induction**. The sphere will be left with a temporary positive charge. If the negatively charged rod is removed, the electrons will move back to the sphere, and the sphere will be neutral again. ✓

Why are neutral objects attracted to charged objects?

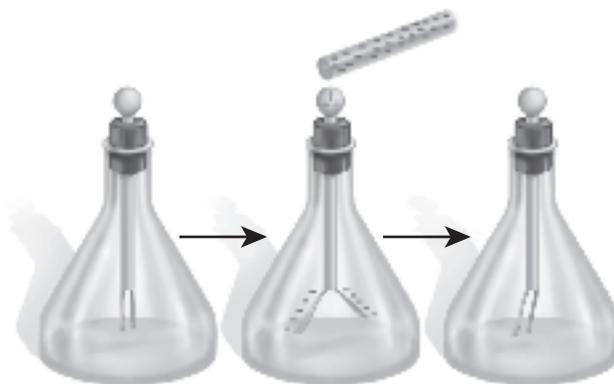
Neutral objects are attracted to charged objects because the neutral objects are temporarily charged by induction. For example, a negatively charged balloon sticks to a neutral wall because the balloon's negative charges repel the wall's negative charges. In other words, a positive charge is induced on the surface of the wall. The negative balloon is attracted to the positive wall surface.

✓ Reading Check

2. Why are neutral objects attracted to charged objects?



Charging an electroscope by conduction



Charging an electroscope by induction

Name _____

Date _____

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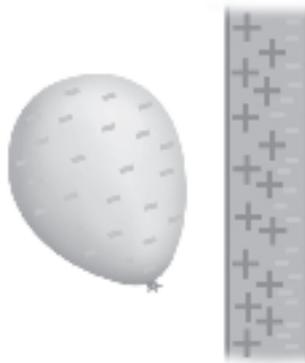
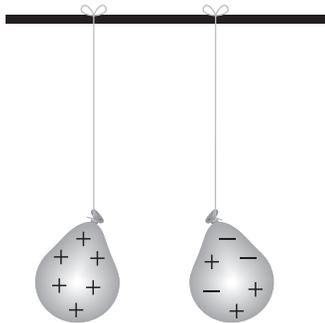
Neutral, positive, or negative charges?

Answer the questions below in the spaces provided.

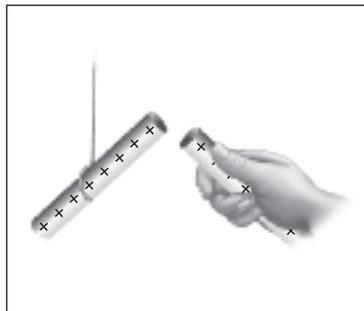
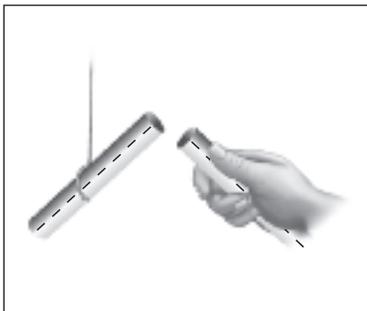
1. What are the three laws of static charge?

- (a) _____
 (b) _____
 (c) _____

2. For each situation illustrated below, will the objects shown attract or repel each other?



- (a) _____ (b) _____ (c) _____



- (d) _____ (e) _____ (f) _____

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Charging by conduction or induction

Analyze the situations below. Do they describe charging by conduction or induction?

1. Identify whether the situation is describing charging by conduction or induction.

(a) You notice the build-up of dust on a computer screen when it is on.

(b) You walk across a carpet and experience a shock when you touch a metal doorknob. _____

(c) You rub a balloon against your hair and bring it close to a pile of salt on the table. This causes the salt crystals to “jump up and dance.” _____

2. Identify whether the illustration shows charging by conduction or induction.

(a)



(b)



(c)



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Positive, negative, and neutral objects

Vocabulary

amount of charge	electroscope
attract	increase
conduction	induction
contact forces	laws of static charge
decrease	neutral
distance between objects	repel
electric force	type of charge

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

1. A(n) _____ is a push or pull between charged objects.
2. The _____ state that like charges _____ and opposite charges _____.
Charged objects are attracted to _____ objects.
3. The electric force that acts on any pair of objects depends on the _____ and _____ on the objects and on the _____.
4. If you increase the amount of charge on objects, you _____ the electric force. If you _____ the distance between objects, you decrease the electric force.
5. A device that can detect the presence of charge is the _____.
6. If the leaves of an electroscope become charged, they will _____ each other.
7. If a charged rod is brought close to an electroscope and then removed, the electroscope will become _____.
8. Charging by _____ occurs when objects touch and an electric charge is transferred from one object to the other.
A(n) _____ can be used to demonstrate this.
9. Charging by _____ occurs when objects are charged without touching. A(n) _____ can be used to demonstrate this.
10. Neutral objects are attracted to charged objects because they are charged by _____.

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Electric force

Match each Diagram on the left with the best Descriptor on the right. Each Descriptor may be used more than once.

Diagram	Descriptor
1. 	A. suspended spheres will move away from each other B. suspended spheres will move toward each other C. suspended spheres will not move
2. 	
3. 	
4. 	

Circle the letter of the best answer.

5. Which of the following applies to a neutral object?

I.	It is attracted to a positive surface.
II.	It is attracted to a negative surface.
III.	It has the same number of protons as electrons.

- A.** I and II only
B. I and III only
C. II and III only
D. I, II, and III

6. A negatively charged ruler is brought near a suspended ball. The ball is repelled by the ruler. What can you conclude from this observation?
- A.** The ball is neutral.
B. The ball is positively charged.
C. The ball is negatively charged.
D. The ball is either neutral or positively charged.
7. Two suspended balloons repel each other when brought close together. What can you conclude about the balloons?
- A.** They have opposite charges.
B. They both have the same charge.
C. One balloon is neutral and the other balloon is positively charged.
D. One balloon is neutral and the other balloon is negatively charged.
8. How does the electric force change as the amount of charge is increased?
- A.** It increases.
B. It decreases.
C. It stays the same.
D. It increases and then decreases.
9. Which of the following statements is true about the relationship between distance and electric force?
- A.** If the distance between charged objects decreases, the electric force decreases.
B. If the distance between charged objects decreases, the electric force stays the same.
C. If the distance between charged objects increases, the electric force increases.
D. If the distance between charged objects increases, the electric force decreases.