Name Date

Section 7.1 Summary

Static Charge

Textbook pages 248–257

Before You Read

Why do you get a shock when you walk across a carpet in wool socks and then touch a metal door handle? Record your thoughts on the lines below.

_____

_____

Mark the Text

Identify Concepts

Highlight each question head in this section. Then use a different colour to highlight the answers to the questions.

What is static charge?

When materials are rubbed together, you might see them cling to each other or move away from each other. Materials that behave in this way are said to carry an electric charge. When a charge stays in place for some length of time, it is described as static electricity or **static charge**.

Why does rubbing make materials charged?

Recall that all matter is made up of atoms. Most of the mass of an atom is in its nucleus—its central core region. The nucleus is made up of two types of particles. Protons are particles that have a positive (+) charge. Neutrons are particles that do not have a charge so they are neutral. The space around the nucleus contains fast-moving particles called electrons. Electrons have a negative (–) charge.

The overall charge of a material depends on the balance between the positive and negative charges in all the atoms of the material. A material may be neutral, have a positive charge, or have a negative charge.

When two materials are rubbed, electrons from the atoms of one material may move to the atoms of the other material. The movement of electrons from one atom to another changes the charge on the atoms. When an atom loses electrons, it is left with more protons than electrons, so its charge is positive. When an atom gains electrons, it has more electrons than protons, so its charge is negative.

Reading Check

1. Name the two types of charged particles in an atom.

_____

_____

Charges in a material that is neutral (uncharged)	Charges in a material that is positively charged	Charges in a material that is negatively charged
+ + − + − − − − + − + +	+ + + + + − − − + + + +	− − − + − + − − − + − +
equal protons and electrons	more protons than electrons	more electrons than protons

How else can charges be produced?

You already know that charges can be produced by rubbing (friction). This can happen in nature when air rubs against ice crystals and dust particles in clouds, producing lightning. Scientists also use a friction-producing machine called a **Van de Graaff generator** to create charges that they can study.

How easily do charges move in different materials?

Electrons cannot move easily in materials such as **acetate** (a type of plastic), rubber, wool, and glass. Materials that do not let electrons move through them easily are called **insulators**. Charges tend to build up on insulators.

Electrons can move easily through materials such as metals. Materials that let electrons move through them easily are called **conductors**. Sometimes, a conductor is used to transfer static charges from an object to the ground. Allowing charge to flow into Earth's surface is called **grounding**.

Reading Check

2. What does a conductor allow to move easily through it?

How are charges measured?

Electric charges are measured in units called **coulombs** (C). A bright light bulb, for example, allows about 1 C (one coulomb) of electric charge to pass through it each second.

Charges on insulator

Charges on conductor

Name Date

Cloze Activity
Section 7.1

Use with textbook pages 248–254.

Charge it

Vocabulary	
acetate	negative
atoms	neutral
conductors	neutrons
coulomb	nucleus
electric	positive
electrons	protons
grounding	static charge
insulators	Van de Graaff generator

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

1. Static electricity is also known as _____. This refers to the build-up of electric charge in one place.

2. All matter is made of tiny particles called _____.

3. The positively charged _____ is the centre of the atom. It consists of positively charged subatomic particles called _____ and subatomic particles with no charge called _____.

4. The negatively charged subatomic particles called _____ occupy the area around the nucleus.

5. An object is uncharged or _____ when the number of positive charges equals the number of negative charges.

6. If an atom loses an electron, it has more protons than electrons. This atom will have an overall _____ charge.

7. If an atom gains an electron, it has more electrons than protons. This atom will have an overall _____ charge.

8. Glass and acetate are examples of _____ because they do not allow electrons to move easily through them. Metals like copper and aluminum are good _____ because they allow electrons to move freely through them.

9. The _____ is a unit of electric charge.

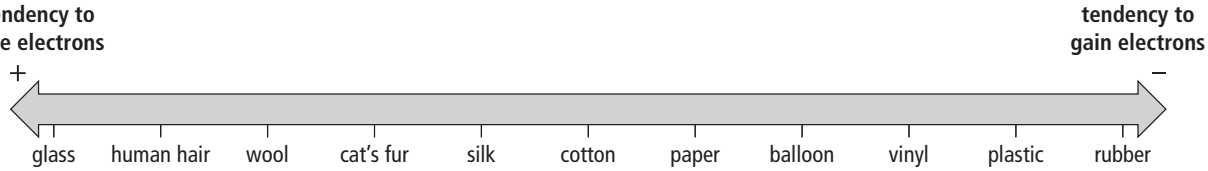
10. Scientists use a(n) _____ to create static charge.

11. Lightning rods on top of buildings allow static charges from lightning to flow into Earth's surface. This is known as _____.

Use with textbook pages 248–254.

Static charge detective

Use the following diagram to answer the questions.



When two objects are rubbed together

- the material closer to the left of the series will have a greater tendency to **lose electrons** and become **positive**
- the material closer to the right of the series will have a greater tendency to **gain electrons** and become **negative**

1. As you take your clothes out of the dryer, your wool socks are clinging to your silk skirt. What is the charge on the wool socks and on the silk skirt?

Charge on socks

Charge on skirt

2. You use a plastic comb to comb your hair. What is the charge on your hair and on the comb?

Charge on comb

Charge on hair

3. You use a paper towel to rub off some dirt on a glass window. What is the charge on the glass and on the paper towel?

Charge on window

Charge on paper towel

4. You rub a balloon along your cat's back, causing the cat's fur to stand up. What is the charge on the balloon and on the cat's fur?

Charge on balloon

Charge on cat's fur

Name Date

Comprehension
Section 7.1

Use with textbook pages 248–254.

Conductors and insulators

Define and identify conductors and insulators as directed below.

1. Define the following terms.

(a) conductor _____

_____

(b) insulator _____

_____

2. On the first line, indicate whether the object is a conductor or an insulator. On the second line, state whether or not the material allows electrons to move freely.

(a) 

_____

_____

(b) 

_____

_____

(c) 

_____

_____

(d) 

_____

_____

(e) 

_____

_____

(f) 

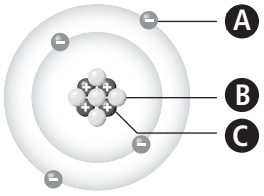
_____

_____

Use with textbook pages 248–254.

Static charge

Match each Term on the left with the corresponding Diagram label on the right. Each label may be used more than once.

Term	Diagram
1. _____ proton **2.** _____ neutron **3.** _____ electron **4.** _____ has no charge **5.** _____ has a positive charge **6.** _____ has a negative charge **7.** _____ can move from one atom to another **8.** _____ and _____ make up the nucleus (name 2 parts of the atom)	

Circle the letter of the best answer.

9. A neutral object has exactly the same number of

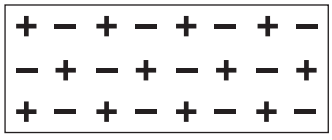
A. protons and neutrons

B. protons and electrons

C. neutrons and electrons

D. protons, neutrons, and electrons

Use the following diagram to answer question 10.



10. What is the electric charge on the object shown above?

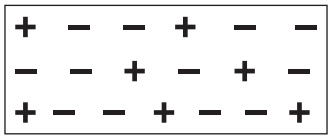
A. neutral

B. positive

C. negative

D. It is impossible to tell.

Use the following diagram to answer questions 11 and 12.



11. What is the electric charge on the object shown above?

A. neutral

B. positive

C. negative

D. It is impossible to tell.

12. Which of the following describes the object shown above?

A. It lost protons.

B. It lost electrons.

C. It gained protons.

D. It gained electrons.

13. A vinyl rod is rubbed with a cotton cloth. The vinyl rod becomes negatively charged and the cotton cloth becomes positively charged. Which of the following describes the cotton cloth?

A. It has gained electrons.

B. It has more electrons than protons.

C. It has more protons than electrons.

D. It has the same number of protons as electrons.

14. Which of the following is a good conductor?

A. glass

B. wood

C. copper

D. fur

Name Date

Section 7.2 Summary

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.

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. ✔

Reading Check

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

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.

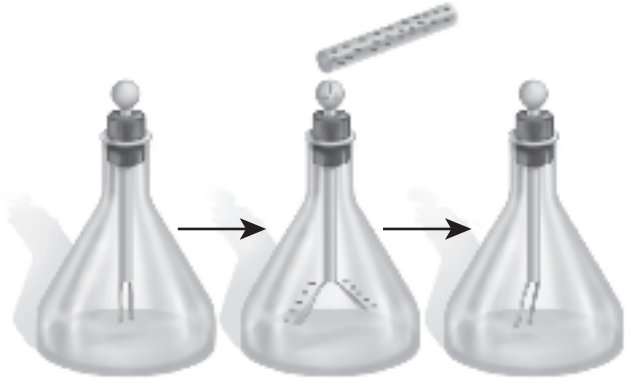
Why are neutral objects attracted to charged objects?

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

Use with textbook pages 258–262.

Neutral, positive, or negative charges?

Answer the questions below in the spaces provided.

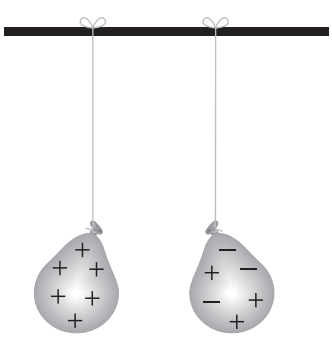
1. What are the three laws of static charge?

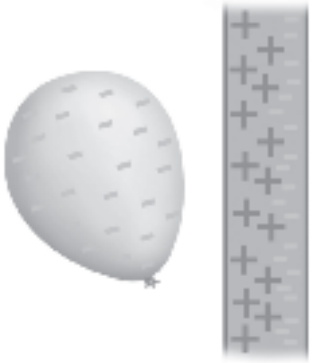
(a) _____

(b) _____

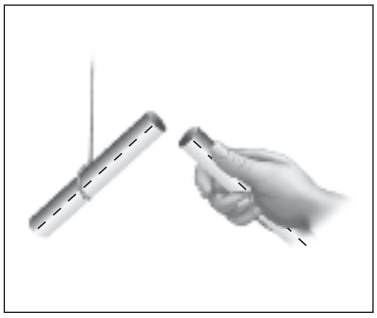
(c) _____

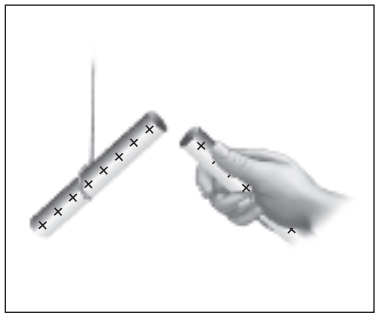
2. For each situation illustrated below, will the objects shown attract or repel each other?

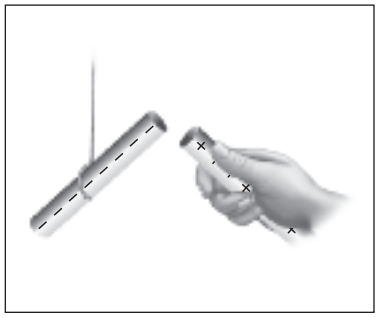




(a) _____ **(b)** _____ **(c)** _____







(d) _____ **(e)** _____ **(f)** _____

Use with textbook pages 258–262.

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. _____

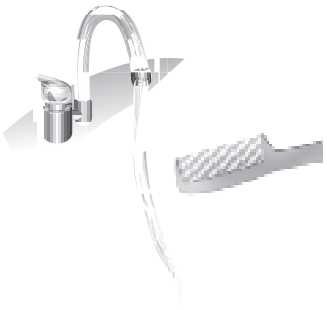
(c) You rub a balloon against your hair and bring it close to a pile of salt on the table. This causes the salt crystals to "jump up and dance." _____

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

(a)

_____

(b)



_____

(c)

_____

Name Date

Cloze Activity
Section 7.2

Use with textbook pages 258–262.

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.

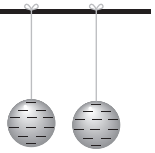
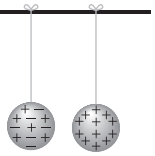
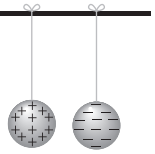
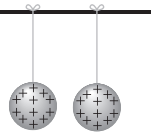
9. Charging by _____ occurs when objects are charged without touching. A(n) _____ can be used to demonstrate this.

10. Neutral objects are attracted to charged objects because they are charged by _____.

Use with textbook pages 258–262.

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. ____  2. ____  3. ____  4. ____ 	**A.** suspended spheres will move away from each other **B.** suspended spheres will move toward each other **C.** suspended spheres will not move

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.