

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

- 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**. ✓

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

✓ Reading Check

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

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.

- Static electricity is also known as _____.
This refers to the build-up of electric charge in one place.
- All matter is made of tiny particles called _____.
- The positively charged _____ is the centre of the atom.
It consists of positively charged subatomic particles called _____
and subatomic particles with no charge called _____.
- The negatively charged subatomic particles called _____
occupy the area around the nucleus.
- An object is uncharged or _____ when the number of
positive charges equals the number of negative charges.
- If an atom loses an electron, it has more protons than electrons. This atom will have
an overall _____ charge.
- If an atom gains an electron, it has more electrons than protons. This atom will have
an overall _____ charge.
- 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.
- The _____ is a unit of electric charge.
- Scientists use a(n) _____ to create static charge.
- Lightning rods on top of buildings allow static charges from lightning to flow into
Earth's surface. This is known as _____.

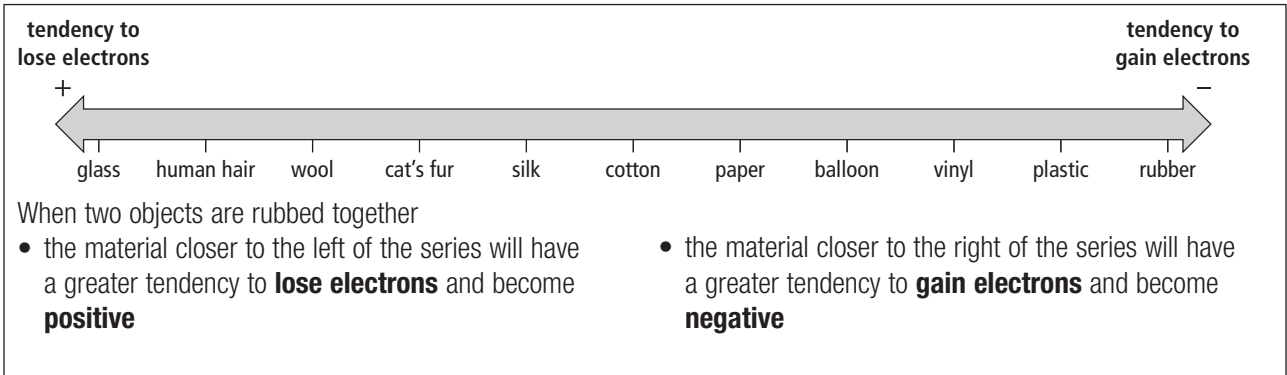
Name _____

Date _____

Use with textbook pages 248–254.

Static charge detective

Use the following diagram to answer the questions.



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 _____

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)  _____

Name _____

Date _____

Use with textbook pages 248–254.

Static charge

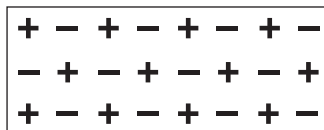
Match each Term on the left with the corresponding Diagram label on the right. Each label may be used more than once.

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

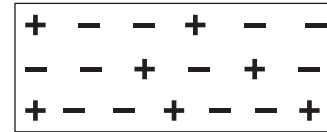
Use the following diagram to answer question 10.



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