Electric Charge

- What produces a net electric charge?
- An excess or shortage of electrons produces a net electric charge.

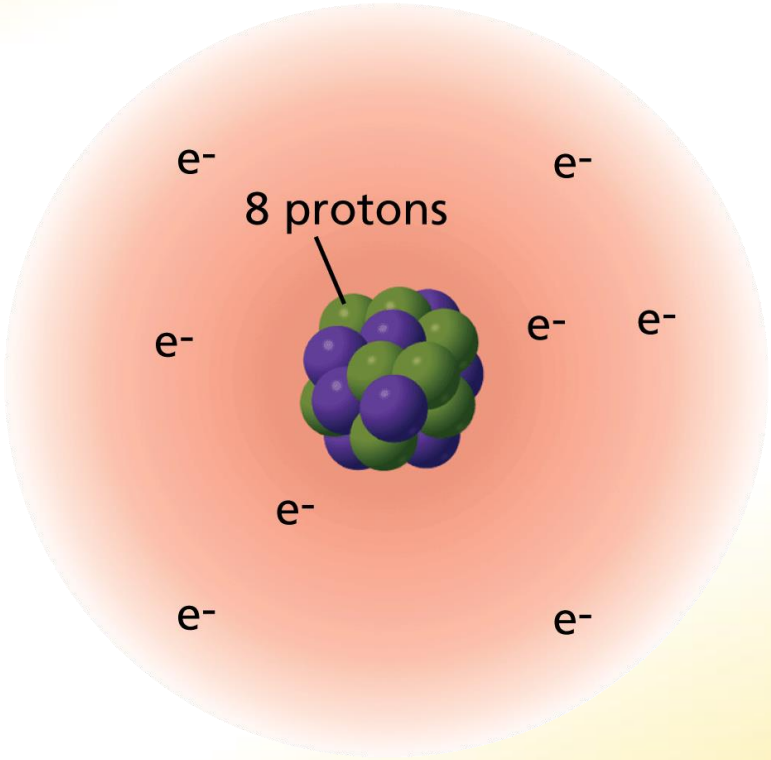
Electric Charge

Electric charge is a property that causes subatomic particles such as protons and electrons to attract or repel each other.

- Protons have a positive charge.
- Electrons have a negative charge.

Electric Charge

A neutral atom has equal numbers of protons and electrons.



Electric Charge

The SI unit of electric charge is the coulomb (C).

- It takes about 6.24×10^{18} electrons to produce a single coulomb.
- A lightning bolt is about 10 to 20 coulombs of charge, and a camera flash is about 0.025 coulombs.

Electric Forces

- **What determines whether an electric force is attractive or repulsive?**
- **Like charges repel, and opposite charges attract.**

Electric Forces

The force of attraction or repulsion between electrically charged objects is **electric force.**

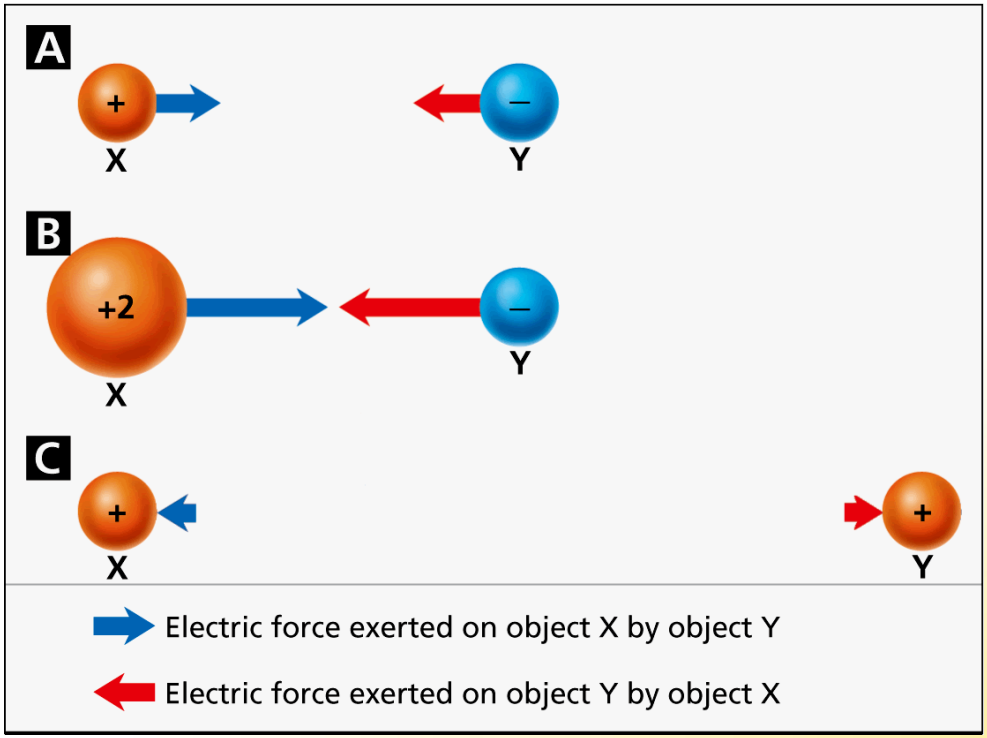
- The electric force between two objects is directly proportional to the net charge on each object.
- The electric force is inversely proportional to the square of the distance between the objects.

Electric Forces

A. Opposite charges attract each other.

B. Doubling one charge doubles the force on both charges.

C. Like charges repel. Doubling the distance makes the force one fourth as great.



Electric Fields

- What determines the strength of an electric field?
- The strength of an electric field depends on the amount of charge that produces the field and on the distance from the charge.

Electric Fields

The effect an electric charge has on other charges in the space around it is the charge's **electric field.**

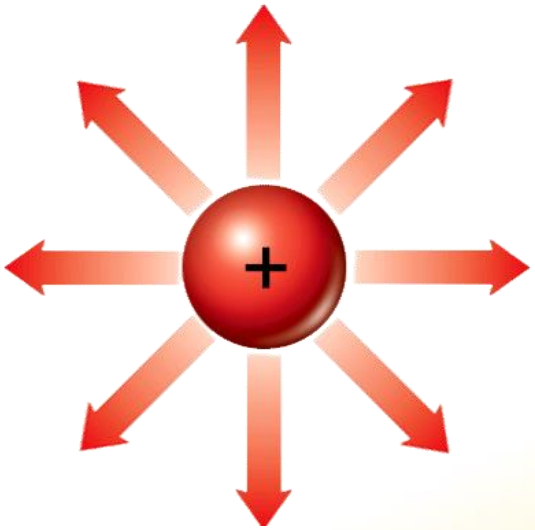
- An electric field exerts forces on any charged object placed in the field.
- The force depends on the net charge on the object and on the strength and direction of the field at the object's position.
- The direction of each field line shows the direction of the force on a positive charge.

Electric Fields

A. The electric field around a positive charge points outward.

B. The electric field around a negative charge points inward.

A Field of a positive charge



B Field of a negative charge

Static Electricity and Charging

What are three ways in which charge is transferred?

Charge can be transferred by friction, by contact, and by induction.

Static Electricity and Charging

Static electricity is the study of the behavior of electric charges.

According to the **law of conservation of charge,** the total charge in an isolated system is constant. When there is a charge transfer, the total charge is the same before and after the transfer occurs.

Static Electricity and Charging

A. The balloon attracts the hair because opposite charges attract.

B. The hairs repel each other because like charges repel.

Static Electricity and Charging

Charging by Induction

Walking on a carpet builds a negative charge on your body. The negative charge in your hand repels electrons in a metal doorknob.

The doorknob is still neutral, but charge has moved within it. This is **induction,** a transfer of charge without contact between materials.

Static Discharge

- **How does a static discharge occur?**
- **Static discharge occurs when a pathway through which charges can move forms suddenly.**

Assessment Questions

1. Which of the following would double the electric force between two charged objects?
   a. doubling the mass of the objects
   b. doubling the net charge of both objects
   c. doubling the net charge of one of the objects
   d. cutting the distance between the objects in half

   ANS: C

Assessment Questions

2. The attractive or repulsive effect an electric charge has on other charges in the space around it is the charge's
   a. electric force.
   b. electric field.
   c. static electricity.
   d. static discharge.

   ANS: B

Assessment Questions

3. An object becomes charged by induction when there is a
   a. transfer of electrons, as the object rubs against another object.
   b. transfer of charge, as it contacts another charged object.
   c. transfer of charge by motion of electrons within the object.
   d. a sudden movement of electric charge from another object.

   ANS: C