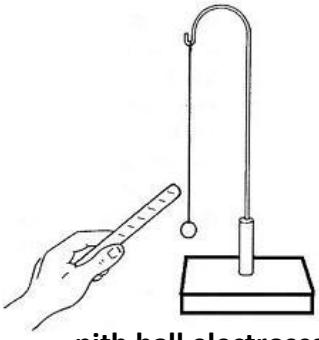
SNC1D
UNIT 3: CHARACTERISTICS OF ELECTRICITY
CHAPTER 10: STATIC CHARGES & ENERGY

10.2: CHARGING BY CONTACT & BY INDUCTION

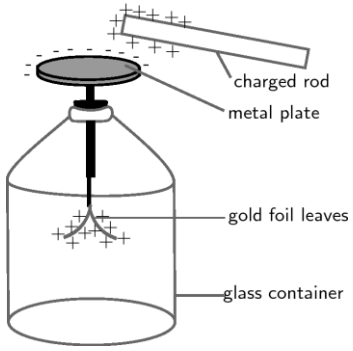
DETECTING CHARGES

See Page 411

The **pith ball electroscope** and **metal leaf electroscope** are used for detecting the presence of an electric charge.



pith ball electroscope



metal leaf electroscope

CHARGING by CONTACT

See Page 412

A **neutral object** can be charged by touching it to a **charged object**. In both diagrams below, note that it is the ***negative charges*** that flow between objects.

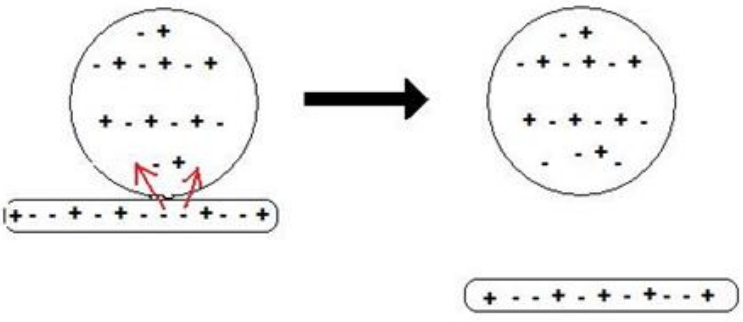


FIGURE 1:
When a **negatively charged rod** touches a **neutral object**, **some electrons will move into the neutral object,** leaving both rod and object **negative**.

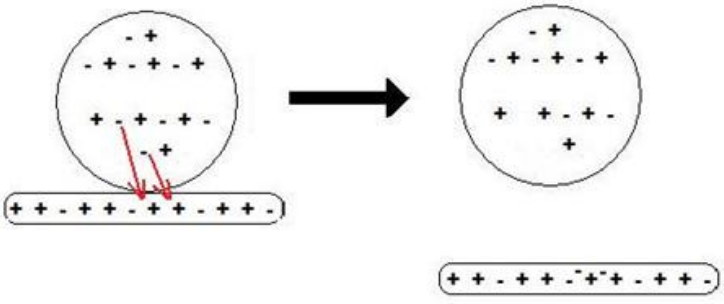


FIGURE 2:
When a **positively charged rod** touches a **neutral object**, **some electrons will move from the object into the rod** leaving both rod and object **positive**.

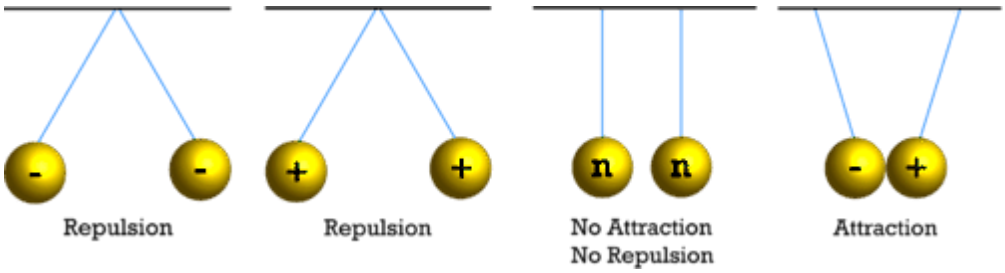
THE LAWS of ELECTRIC CHARGES

See Page 413

There are **3 laws** that describe what happens when charged objects are brought together:

1. **Like charges repel**
2. **Unlike charges attract**
3. **Charged objects attract neutral objects**

The interaction between charged objects is also **dependent on the distance**; the **farther apart** they are **the less force** they will have on each other.



When two oppositely charged objects are placed close together they will be attracted to each other – this also includes a charged object, either positive or negative, placed near a neutral object. Two objects with the same charge will repel.

EXERCISE: Draw a diagram (using images as shown above) to show what happens when...

1. a positively charged object (+) is brought close to a neutral object (n)
2. a negatively charged object (-) is brought close to a neutral object (n)

CHARGING by INDUCTION

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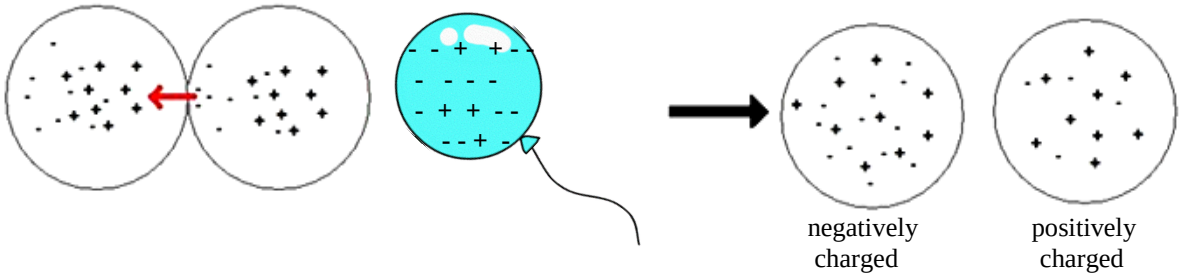
How can an object be charged without touching it?

Recall two of the facts about static charges:

- like charges repel each other
- electrons can move from one object to another

Opposite charges can be **induced** on **two neutral objects in contact** by bringing a **charged object** close to but **not touching** the two neutral objects.



In the above example, a negatively charged balloon repels the electrons in the spheres resulting in the electrons being transferred to the sphere on the left. If the spheres are moved apart with the balloon still close by, then the electrons are not able to redistribute back to the two neutral spheres. As a result, the sphere on the left remains negatively charged leaving the sphere on the right with a positive charge equal to the negative charge.

Behaviour of Electric Charges

BLM 10-14

PART 1: The Laws of Electric Charge

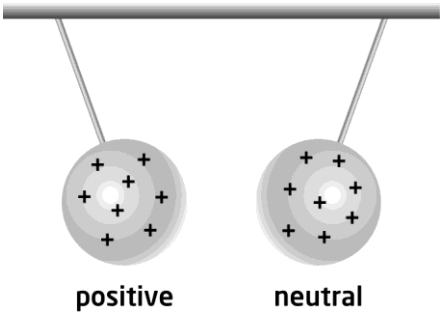
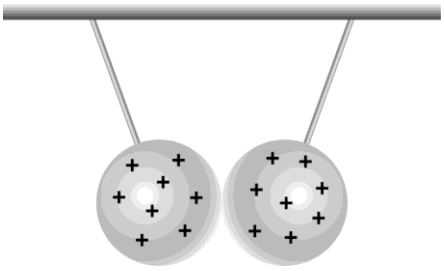
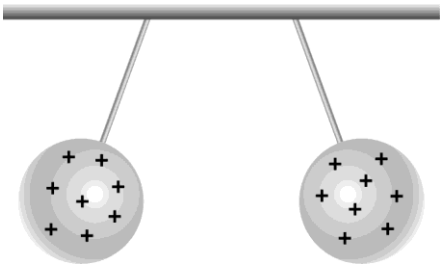
1. Write the three laws of electric charge.

   A. _____

   B. _____

   C. _____

2. Below are figures of pith balls suspended from threads. There are 8 positive charges shown on each pith ball. Assume that you have a total of 12 negative charges. Add the correct number of negative charges to the diagrams to correspond with the descriptions given.

a. 	There is an attraction between the two pith balls. Distribute the 12 negative charges to make the ball on the right neutral and the ball on the left positive
b. 	There is a strong attraction between the two pith balls. Under what circumstances will this attraction happen? Add the 12 negative charges to show your answer.
c. 	The pith balls repel each other. Add the 12 negative charges to show the number of negative charges on each pith ball.

<u>PART 2</u>: Methods of Charging Objects

Name the correct method—charging by friction, charging by contact, or charging by induction—for each of the descriptions below.

1. involves a charged object brought near a neutral object _____
2. begins with two neutral objects made of different materials _____
3. involves a charged object touching a neutral object _____
4. upon contact, the neutral object acquires the same type of charge as the charged object _____
5. does not involve negative charges moving from one object to the other_____
6. results in two oppositely charged objects _____

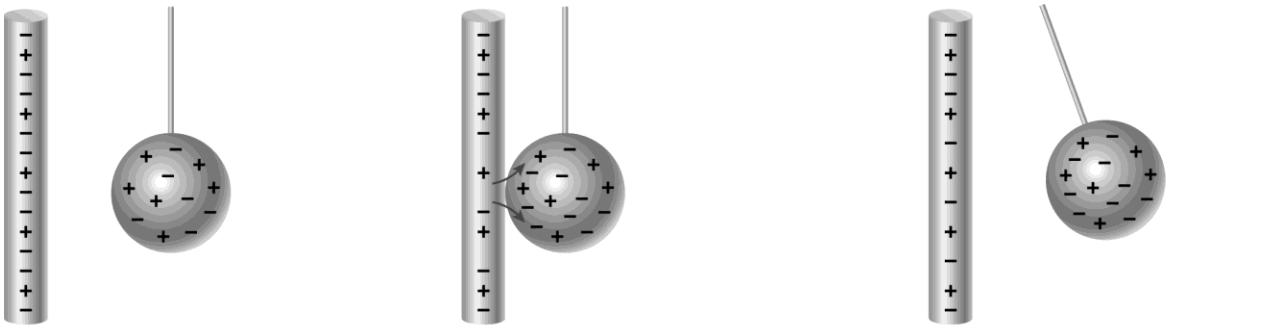
Charging by Contact and by Induction

BLM 10-15

Look carefully at the charges in each object. What is happening in each stage of charging?

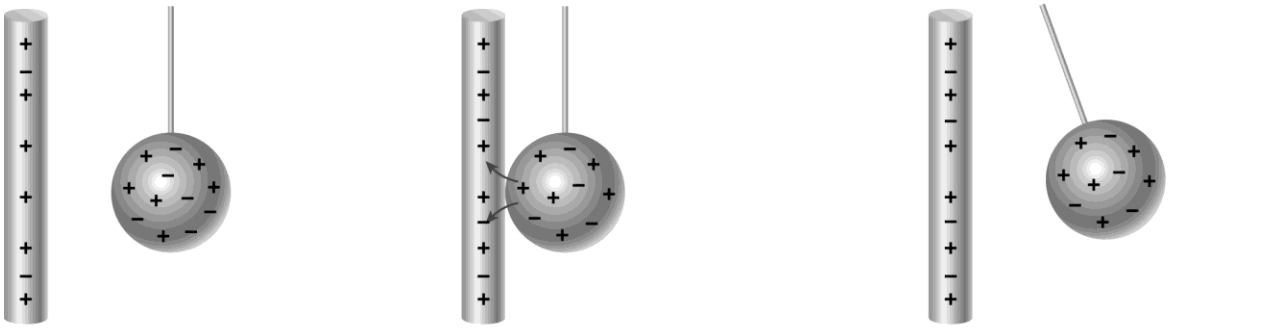
CHARGING by CONTACT

A.



_____ _____ _____

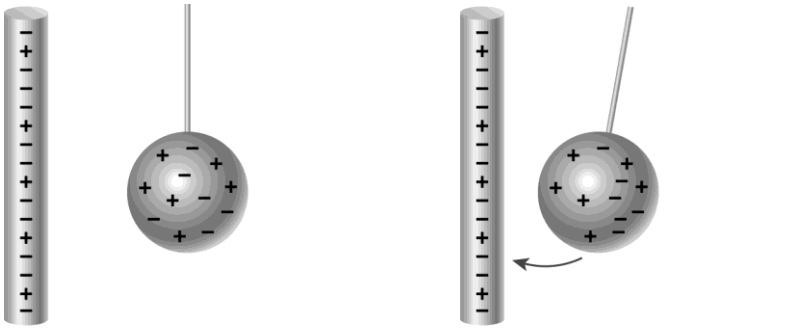
B.



_____ _____ _____

CHARGING by INDUCTION

C.



_____ _____

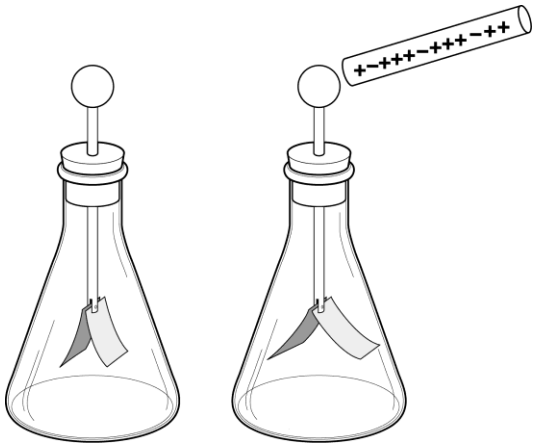
REVIEW 10.2

BLM 10-16

1. Match each term with its effect by writing the correct letter on each line.

A. charging by contact	changes distribution of electrons on another object, but does not change the object's overall charge ____
B. charging by friction	generates opposite charges on the materials rubbed together ____
C. charging by induction	generates the same type of charge on the neutral object as the charged object ____

2. A metal leaf electroscope is charged. A positively charged rod moves near the sphere.

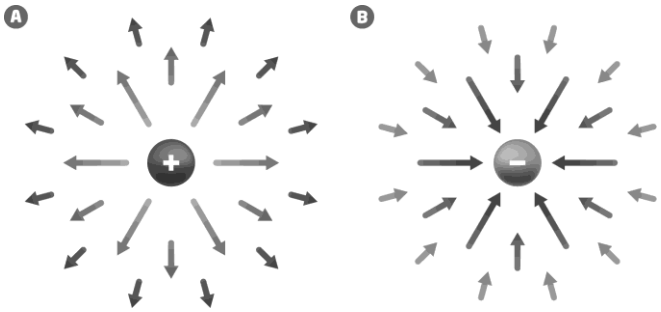


   a) Draw charges on the electroscope.

   b) The charge on the electroscope is _____ (positive / negative).

   c) How would the diagram change if the sphere and rod were insulators?
   A. The leaves would get closer together.
   B. The leaves would move apart.
   C. No change.
   Explain how you know.

3. Look at this figure.



   The strength of an object's electric field _____ (increases / decreases) as distance increases.

4. You can charge a balloon by rubbing it against your clothing. Then you can stick the charged balloon to a wall.

   a) The wall is charged by _____ (contact / friction / induction) because _____

   b) The balloon eventually falls from the wall because _____

   _____

5. A negatively charged ebonite rod is held near a pith ball electroscope.

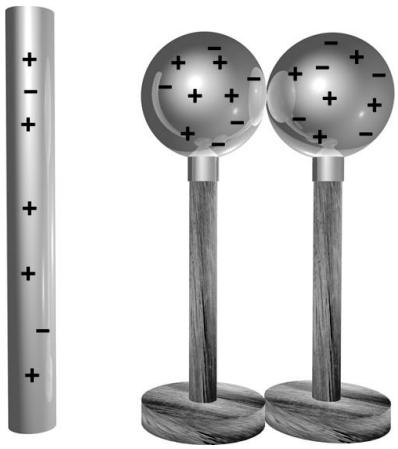
   If the charge of the pith ball is positive, then the pith ball will _____.

   If the charge of the pith ball is neutral, then the pith ball will _____.

   If the charge of the pith ball is negative, then the pith ball will _____.

6. You are given wool and material X. You have a pith ball electroscope.
   How can you tell which material holds on to its electrons more strongly?

7. This diagram shows representative charges on a rod and two identical metal spheres.



a) What is the charge on the rod? _____

b) The rod is moved closer to the spheres. Draw the resulting charges.

c) One sphere is moved away. Draw the resulting charges.

d) The rod is moved away. Draw the charges on the spheres and the rod.