

## Charging by Conduction and Grounding

Read from **Lesson 2** of the **Static Electricity** chapter at **The Physics Classroom**:

<http://www.physicsclassroom.com/Class/estatics/u8l2b.html>

<http://www.physicsclassroom.com/Class/estatics/u8l2d.html>

**MOP Connection:** Static Electricity: sublevel 4

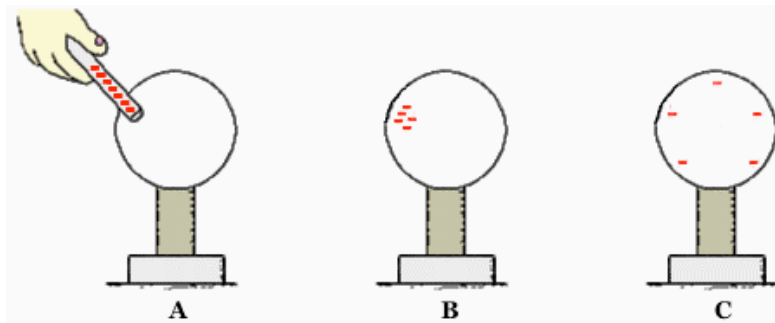
### Review:

1. Fill in the following blanks with the words **electrons** or **protons**.

\_\_\_\_\_ are negatively charged and \_\_\_\_\_ are positively charged. The \_\_\_\_\_ reside in the nucleus of atoms and are tightly bound; they will never leave an atom as a result of electrostatic procedures. On the other hand, \_\_\_\_\_ are located outside the nucleus and are easily removed from or added to atoms. As an object begins to gain or lose \_\_\_\_\_ from its atoms, it becomes positively or negatively charged. A negatively charged object has more \_\_\_\_\_ than \_\_\_\_\_. A positively charged object has more \_\_\_\_\_ than \_\_\_\_\_.

2. A metal sphere is resting upon an insulating stand. A teacher holds a metal bar (with an insulating handle). The teacher uses the metal bar to charge the metal sphere by **conduction**. Which one of the processes describes what the teacher likely did to charge the sphere by conduction?
- The teacher rubbed the bar and the sphere together.
  - The teacher held the bar near the sphere and then touched the sphere with her hand.
  - The teacher charged the bar and then contacted it to the sphere.

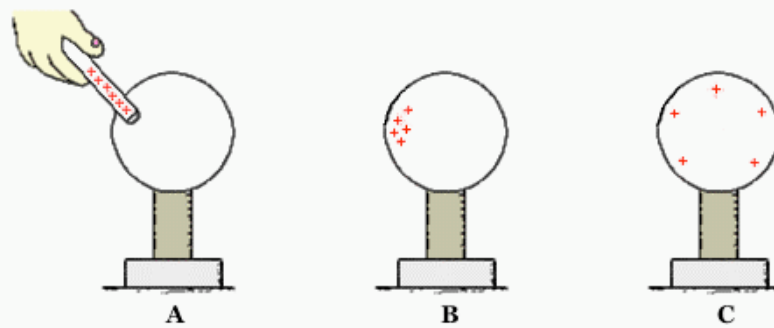
Consider the conduction charging process described below:



- A: A teacher holds a negatively charged metal bar by its insulating handle and touches it to a metal sphere (attached to an insulating stand).  
 B: The teacher pulls the metal bar away and the metal sphere acquires a charge.  
 C: The excess negative charge spreads uniformly about the surface of the metal sphere.
3. Diagram A is the charging step. How does the sphere become charged?
- Electrons move from the insulating stand into the sphere.
  - Electrons move from the charged metal bar into the sphere.
  - Protons move from the sphere into the negatively charged bar.
4. When the metal bar is pulled away in Diagram B, the metal bar is \_\_\_\_\_.  
  - positively charged
  - electrically neutral
  - still negatively charged, but has fewer excess electrons than it previously did.
5. Diagram C shows the excess negative charge distributed differently than it is in Diagram B. Explain why the excess negative charge would distribute itself as it does in Diagram C.

## Static Electricity

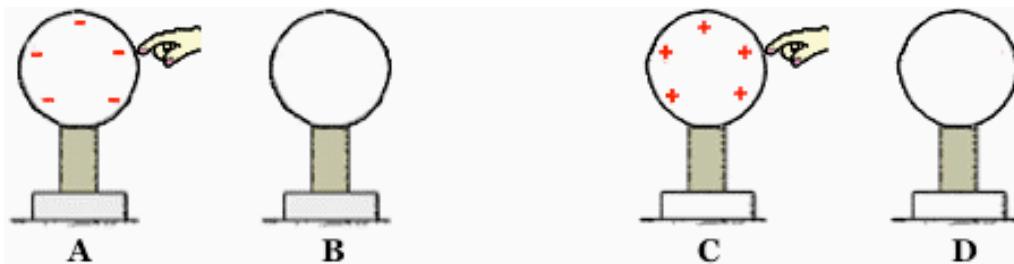
Now consider the conduction charging of the sphere using a positively charged metal bar:



- A: A teacher holds a positively charged metal bar by its insulating handle and touches it to a metal sphere (attached to an insulating stand).  
 B: The teacher pulls the metal bar away and the metal sphere acquires a charge.  
 C: The excess positive charge is spread uniformly about the surface of the metal sphere.

6. Diagram A is the charging step. How does the sphere become charged?
  - a. Protons move from the insulating stand into the sphere.
  - b. Protons move from the charged metal bar into the sphere.
  - c. Electrons move from the sphere into the positively charged bar.
7. When the metal bar is pulled away in Diagram B, the metal bar is \_\_\_\_\_.
  - a. negatively charged
  - b. electrically neutral
  - c. still positively charged, but has fewer excess protons than it previously did.

Two different processes are shown in the diagrams below:



- A: A negatively charged metal sphere is touched.  
 B: The hand is pulled away and the sphere is then electrically neutral.
- A: A positively charged metal sphere is touched.  
 B: The hand is pulled away and the sphere is then electrically neutral.
8. The process of neutralizing the charged spheres as depicted above is known as \_\_\_\_\_.
    - a. charging
    - b. polarization
    - c. induction
    - d. grounding
  9. When the negatively charged sphere is touched, \_\_\_\_\_ move from the \_\_\_\_\_ to the \_\_\_\_\_.
    - a. electrons, sphere, hand
    - b. electrons, hand, sphere
    - c. protons, sphere, hand
    - d. protons, hand, sphere
  10. When the positively charged sphere is touched, \_\_\_\_\_ move from the \_\_\_\_\_ to the \_\_\_\_\_.
    - a. electrons, sphere, hand
    - b. electrons, hand, sphere
    - c. protons, sphere, hand
    - d. protons, hand, sphere