

Charging and Discharging Objects

9.3, 9.8, 9.5, 9.7

1

Charging by Friction

- Remember, that when electrons are transferred from one object to another, both objects become electrically charged.
- There are three ways in which objects become electrically charged:
 - By friction
 - By contact
 - By induction

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Charging by Friction

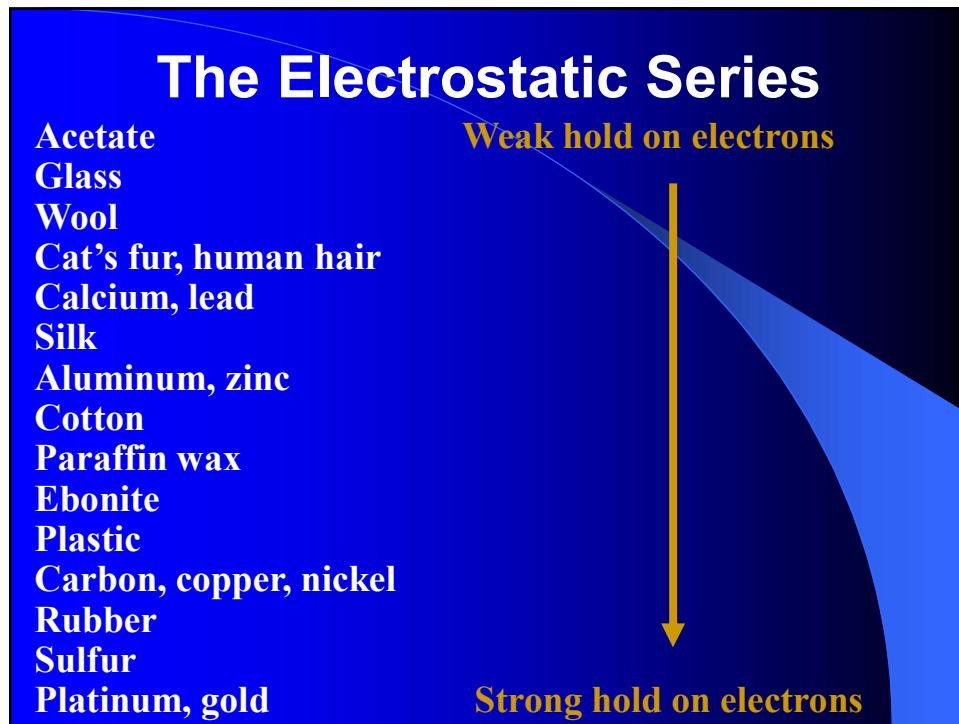
- Causes many of the effects produced by static electricity.
- When two substances are charged by friction, one becomes positively charged and the other becomes negatively charged.
- Some obvious examples:
 - Hair and a balloon.
 - Walking across a carpet.
 - Clothes tumbling in a dryer.
- Less obvious examples:
 - Pumping gasoline through a hose at a gas station
 - Air rushing over the body of a car or an airplane

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Charging by Friction*

- Charging by friction occurs because the positively charged nuclei of one of the objects attracts the electrons from the other object.
- Remember, some types of matter have a stronger hold on their electrons than other types of matter.
- The Electrostatic Series is useful for determining the type of electric charge produced on each substance when any two substances are rubbed together.

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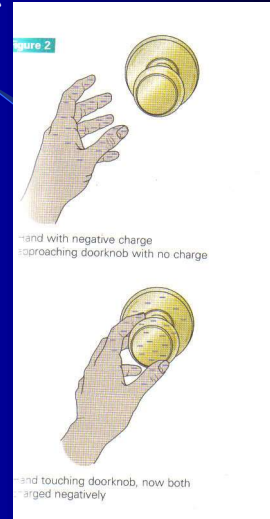
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Charging by Conduction (contact)

- The touching of any kind of matter (solid, liquid, or gas) can transfer a charge. There doesn't need to be rubbing or friction for a transfer to occur.
- In charging by contact, one object is already charged and the other may or may not be.

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- For example, after you walk on a carpet your body may be negatively charged. The door knob is usually uncharged.
- Your body transfers the electric charge with the doorknob on "contact".
 - Actually, your hand does not even get to touch the doorknob before the charge begins to transfer in the form of a spark.



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Charging by Conduction*

Think about it:

- Why would we have to wear special shoes and clothes in:
 - A coal mine?
 - A hospital operating theatre?
 - Parts of an oil refinery?

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Charging by Induction

- A neutral object becomes charged without direct contact with a charged object.
- In the case of the uncharged dust particle and the television screen, the charged television screen causes or induces the electrons to shift in the dust particle.*
- This shifting means that the side of the dust particle facing the screen is now positive and is attracted to the electrons on the television screen.*

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Charging by Induction*

- Take 5 minutes and with a partner, hypothesize what happens when a neutral object, such as a dust particle is brought near a charged object such as a television screen. Don't only explain what happens, but why it happens.
- Group demonstration with positives and negatives.

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Discharging Electrically Charged Objects

- If an object has all the excess electric charges removed, it is said to be discharged or neutralized.
- All matter wants to reach a neutral state, which means that it is neither positive nor negative.*
- This means that if an object is charged, negatively or positively, it wants to lose the charge to return to a neutral state.*

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Methods for Discharging Charged Objects

- **Grounding**
 - By connecting an object to a conductor wire, we are sending the extra charges into the ground. The charge is shared with the entire Earth.
 - Remember the example of gas flowing through the hose at a gas station. If a charge built up and a spark occurred - ka-boom!!!*
 - The hose and all parts of the gas pump are carefully connected to the Earth or ground using a wire which is connected to a metal rod buried in the ground.*
 - If a charge is generated, it is immediately conducted to ground safely away from the gasoline.*

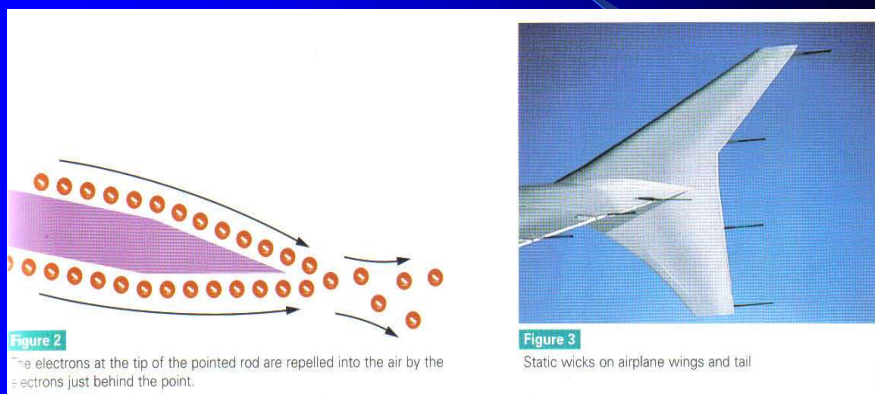
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Methods for Discharging Charged Objects

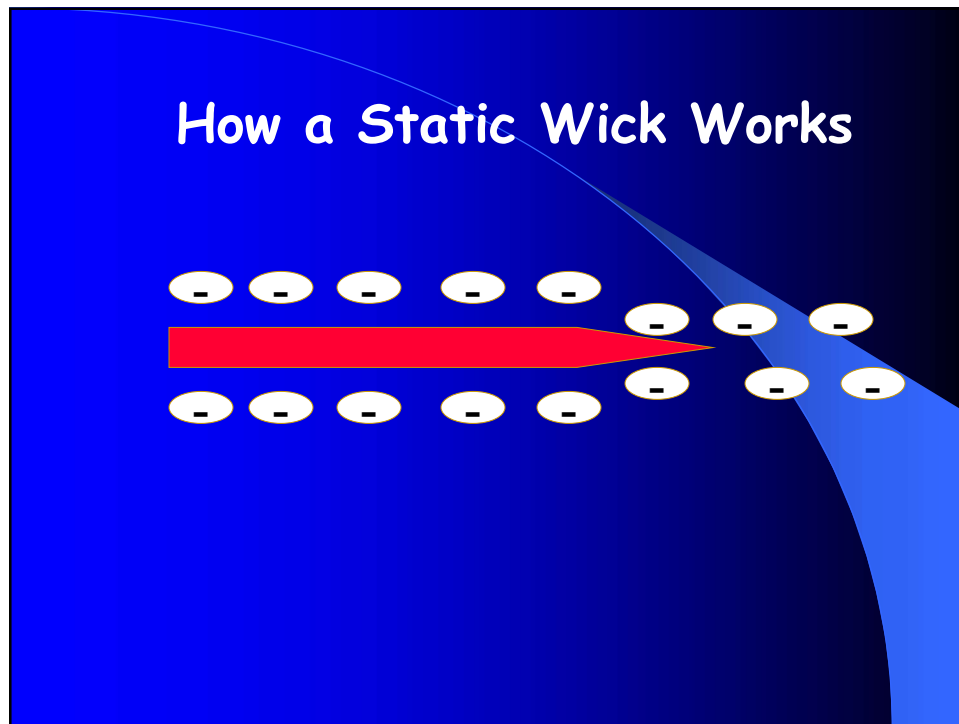
- **Discharge at a Point (Fig 2, page 283)**
 - In some cases, a grounding wire is not a practical idea.
 - Smooth spherical conductor rods retain charges indefinitely because the charge is spread evenly over the surface.
 - **Airplanes will use pointed rods called "static wicks" on their wings and tails for discharging the accumulated charge.**
 - **An air wick is pointed at the tip. This means that the electrons at the tip will be repelled into the air by the electrons just behind the point. (Fig 3, p. 283)**

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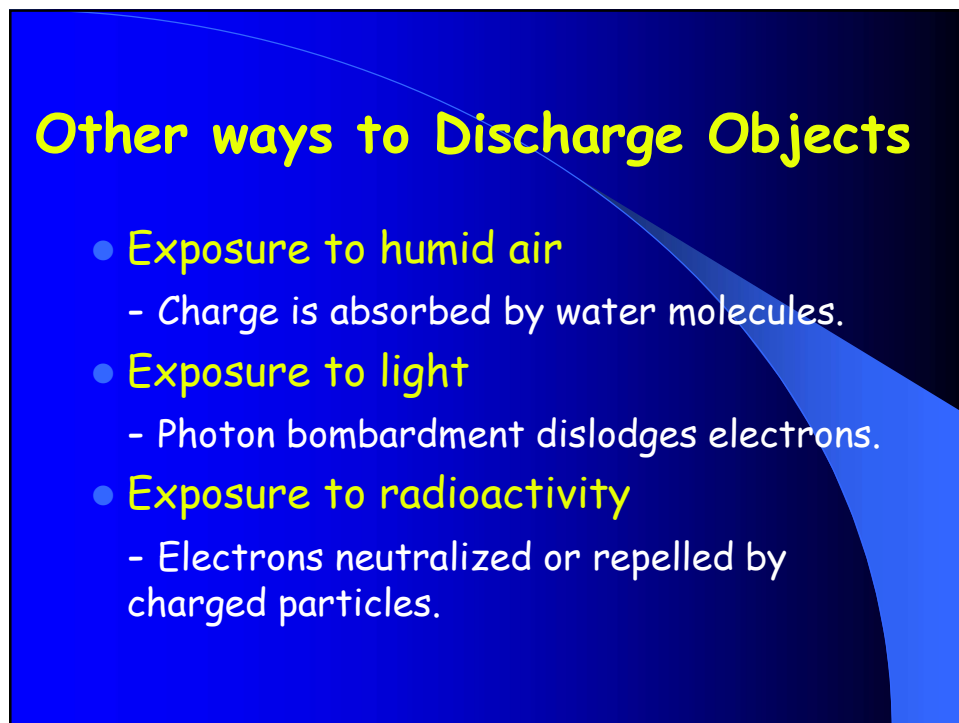
How a Static Wick Works



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