

Charging by Contact and Induction



Warm-up:

1. What is the study of static electricity called?
2. If you rubbed each of the following together which would be + and which would be -
 - a. cotton and silk
 - b. rubber and human hair

Charging by Contact

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Transferring Charge by Contact:

one object that is already charged is brought into contact (touched) with a neutral or an object with a different charge.

Ex. your hand transferring a charge to a doorknob very quickly, your hand transferring a charge to the gas pump etc

Safety clothing is required in grain elevators, flour mills, coal mines and hospital operating rooms.

Charging by Contact

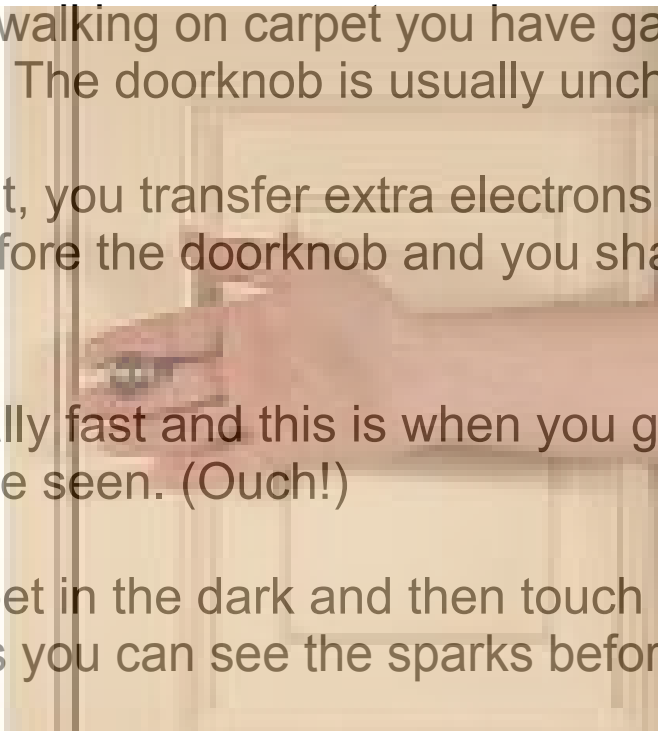
Why/How?

If you have been walking on carpet you have gained a negative charge. The doorknob is usually uncharged.

When you touch it, you transfer extra electrons to the doorknob. Therefore the doorknob and you share a negative charge.

This happens really fast and this is when you get a shock and sparks can be seen. (Ouch!)

Walk across carpet in the dark and then touch the light switch sometimes you can see the sparks before you even touch the switch.



Induction

There is a third way in which objects can become charged, **charging by induction**. When the term induction is used in physics it means that something happens without direct contact.



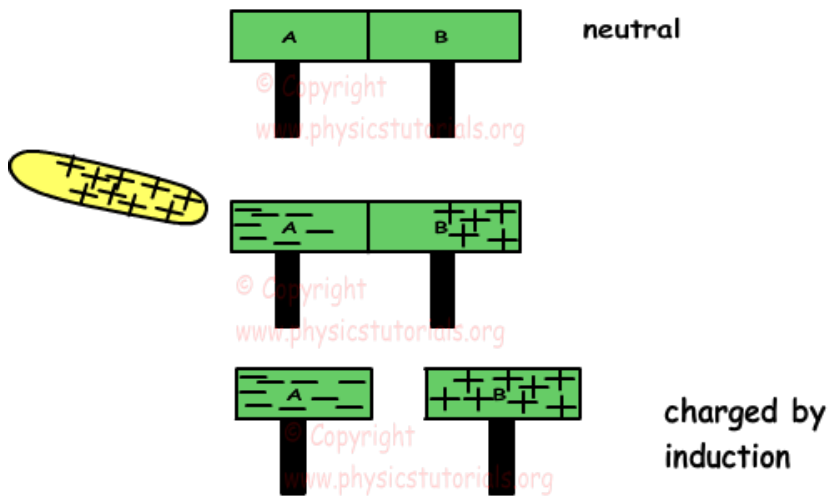
i.e. dust being attracted to your tv or computer screen

Let's look at a dust particle. When dust particles become charged they don't actually touch an object, instead a charge is **induced** on the particle when it nears the object. This happens when dust gets close to a television screen or a computer monitor.

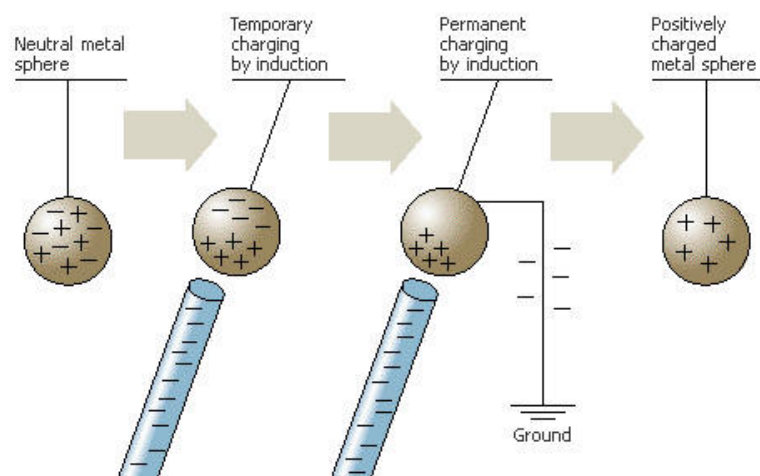
As the dust particle, which is neutral, gets close to a television screen, which has a negative charge, the electrons on the particle move away from the screen causing the side of the dust particle closest to the screen to be mostly positive. The dust particle is still neutral but most of its electrons are located on one side of the particle. This effect is known as **induced charge separation**. Look at figure 1 on page 285 in your textbook.

When induced charge separation occurs in conductors, electrons will move from atom to atom and you can actually induce a permanent charge on an object through induction.

Look at figures 2 and 3 on page 286. In figure 2 a charged object is brought close to a neutral object, inducing a charge on part of the neutral object. This is similar to the dust particle from before.



In figure 3, a conducting wire (allows electrons to flow through it) is attached to the neutral object as a charged strip is brought close to it. Since like charges are repelled, the negative charges escape via the conducting wire. When the strip and wire are removed, the once neutral object now has a slight positive charge.

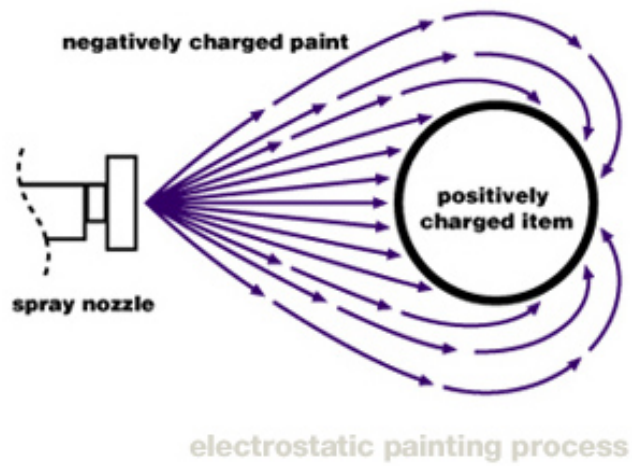


Using Static Electricity and Induction to our Advantage

Induction is used in home air purifiers to take particles out of the air we breathe. As air passes through the purifier it is sprayed with positive ions which are attracted to the dust via induction. The dust then acquires a positive charge. As the air continues through the purifier it is passed between two negatively charged plates that attract the positively charged dust particles allowing clean air to leave the device.



A similar procedure is used when painting some objects. See figure 5 on page 287.



Homework:

pg 273 #1,2a

pg 275 #1b, 3a

pg 279 #2,3,4

pg 287 #1-3