

# SNC1D PHYSICS

## THE CHARACTERISTICS OF ELECTRICITY

- ☛ Charging by Induction (P.407-408)

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### Charging by Induction

*You have learned that objects can be charged not only by friction when two different objects are rubbed together but they can also be charged by contact when they come in contact with a charged object. However, the same charged object can also be used to charge a neutral object without contact. This process is called **charging by induction**.*



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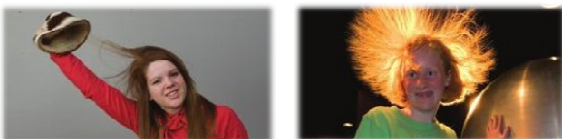
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### Charging by Induction

**NOTE!**  
*Objects can be temporarily or permanently charged by induction.*



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### Charging by Induction – Temporary

Recall that when a charged object is brought near a neutral object (a) it causes (induces) the electrons to shift in position, resulting in an uneven distribution of charges (b).

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### Charging by Induction – Temporary

**NOTE!**  
This will only be temporary as the electrons will move back to their original positions once the charged object is taken away.

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### Charging by Induction – Permanent

When you charge an object permanently by induction, you use a charged object to induce a charge in a neutral object and then ground the charged object so it retains the charge. This newly charged object has the opposite charge to the charge on the charging object.

**CHARGING BY INDUCTION (PERMANENT)**

- ❖ charged object induces a charge separation in a neutral object
- ❖ neutral object is then grounded (i.e. electrons are transferred to/from ground)
- ❖ object now has the opposite charge to the charged object used

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### Charging by Induction – Permanent

*For example, when a negatively charged object comes near a neutral electroscope, it repels the electrons in the neutral electroscope downwards. This causes the leaves to repel one another.*



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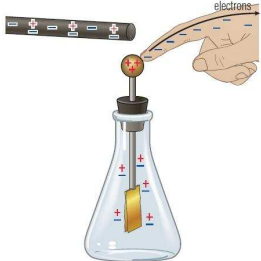
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### Charging by Induction – Permanent

*When the neutral electroscope is grounded, its electrons are provided with a path away from the repulsive influence. As a result, some electrons leave the electroscope. The leaves now return to their neutral position.*



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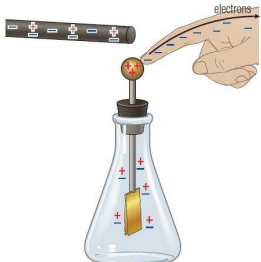
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### Charging by Induction – Permanent

*When the ground and charged object are removed, the electroscope is left with a positive charge because it has lost electrons. The leaves once again repel each other.*



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### Charging by Induction – Permanent

*The opposite is true for a positively charged object. When a positively charged object comes near a neutral electroscope, it attracts the electrons in the neutral electroscope. This causes the leaves to repel one another.*



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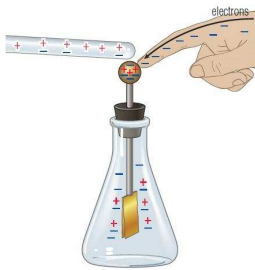
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### Charging by Induction – Permanent

*When the neutral electroscope is grounded, a path for electrons to go toward the positive influence is provided. As a result, some electrons enter the electroscope. The leaves now return to their neutral position.*



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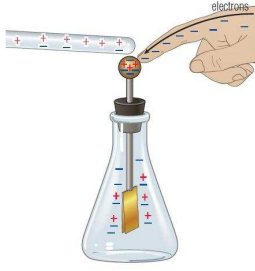
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### Charging by Induction – Permanent

*When the ground and charged object are removed, the electroscope is left with a negative charge because it has gained electrons. The leaves once again repel each other.*



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### Charging by Induction

*An everyday example of charging by induction occurs with the buildup of dust on the screen of a television or computer monitor. When a computer monitor or television screen is turned on it begins to build up a charge. When a neutral dust particle comes near the screen, the charge on the screen induces an opposite charge on the near side of the dust particle. The result is that the dust particle is attracted to the screen.*



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### Charging by Induction

**PRACTICE**

1. Using a sequence of labelled diagrams, explain how a neutral dust particle is attracted to a negatively charged computer screen. Under each diagram, describe the motion of the charges.

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### Charging by Induction

**PRACTICE**

2. Using a sequence of labelled diagrams, explain how a positively charged balloon will stick to a neutral wall. Under each diagram, describe the motion of the charges.

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**Applicatons of ...**

*Charging by induction also has many useful applications including forensics and air-cleaning technologies. Footprints left behind at the scene of a crime help to determine who was present. But how can you make a copy of a footprint if it is very difficult to see?*



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**Applicatons of ...**

*Investigators use an electrostatic lifting apparatus (ESLA). Special film or foil is placed over the footprint which is then electrostatically charged. The dust and dirt particles from the footprint are attracted to the film, revealing the details of the footprint.*



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**✓ Check Your Learning**

1. What is the difference between charging by contact and charging by induction in terms of electron transfer?

charging by:

- contact – electrons move from more negatively charged object to less negatively charged object
- induction – electrons transfer to/from ground depending on the overall charge of the system

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 **Check Your Learning**

2. With the aid of a diagram explain how a substance becomes temporarily charged by induction when a charged object is brought near.

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 **Check Your Learning**

**TEXTBOOK**  
P.415 Q.3,5

**WIKI (PHYSICS)**

- 🔗 1DPHYS - WS2 (Counting Charges) → diagrams 5 & 6
- 🔗 1DPHYS - WS3 (Charging by Contact & Induction)
- 🔗 1DPHYS - QUIZ1 (Electrostatics)

**REMEMBER!**  
Be sure to check, correct, and total your quiz before handing it in.

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