

Chapter 8: Static Electricity

Question. 1. Choose the correct option and fill in the blanks:

(always repulsion, always attraction, displacement of negative charge, displacement of positive charge, atom, molecule, steel, copper, plastic, inflated balloon, charged object, gold)

- (1) There is **always repulsion** between like charges.
- (2) **Displacement of negative charge** is responsible for generation of electric charge in an object.
- (3) A lightning conductor is made of a **Copper** strip.
- (4) **Plastic** does not get electrically charged easily by rubbing.
- (5) There is **always attraction** when opposite electric charges come near each other.
- (6) A **charged object** can be detected with an electroscope.

Question. 2. Answer the following questions in one sentence:

(1) How will you protect yourself from lightning?

Answer: Stay indoors or in a car, avoid open spaces, tall objects, and metal during a lightning storm.

(2) How are charges generated?

Answer: Charges are generated by friction, induction, or conduction, such as rubbing two objects together.

(3) In the lightning conductor, what provision is made for spreading the electricity into the ground?

Answer: A lightning conductor is connected to a metal rod buried deep in the ground, allowing the electricity to safely dissipate.

(4) Why do farmers stick an iron staff into the ground while working in the field in rainy conditions?

Answer: The iron staff acts as a lightning conductor, providing a path for lightning to safely reach the ground.

(5) If a glass rod is rubbed against a silk cloth, what kind of electric charge is developed on the cloth?

Answer: The silk cloth acquires a negative charge after being rubbed against the glass rod.

(6) If a plastic rod is rubbed against a woollen cloth, what kind of electric charge is developed on the plastic rod?

Answer: The plastic rod acquires a negative charge after being rubbed against a woollen cloth.

(7) Who named the electric charges as positive charge (+) and negative charge (-)?

Answer: Benjamin Franklin named the electric charges as positive (+) and negative (-).

(8) When is it said that a particular object is electrically neutral?

Answer: An object is electrically neutral when it has an equal number of positive and negative charges.

(9) How is the word electricity derived?

Answer: The word "electricity" is derived from the Greek word "elektron," which means amber, a substance that can acquire an electric charge when rubbed.

(10) Name five things on which electric charge is produced by friction.

Answer: Electric charge is produced by friction on items like glass rods, plastic combs, rubber balloons, woollen cloths, and ebonite rods.

Question. 3. Distinguish between Charging by Conduction and Charging by Induction

Charging by Conduction	Charging by Induction
1. Occurs when a charged object directly touches another object.	1. Occurs without direct contact, using the influence of a nearby charged object.
2. Electrons are physically transferred between objects.	2. No direct transfer of electrons between the objects.

3. The object being charged gets the same type of charge as the charged object.	3. The object being charged gets the opposite charge of the charged object.
4. Example: Touching a charged rod to a metal sphere transfers charge.	4. Example: Bringing a charged rod near a metal sphere without touching it induces opposite charge on the sphere.

Question. 4. Answer the following questions in short:

(1) Explain why it is not safe to go out with an umbrella when there is heavy rain, lightning and thunder.

Answer: Umbrellas often contain metal, which conducts electricity. During lightning, the metal can attract the lightning, making it unsafe to be outside with an umbrella.

(2) Why is lightning not seen every day during the rainy season?

Answer: Lightning occurs only when specific conditions, such as the buildup of electrical charges in clouds, are met. These conditions do not happen every time it rains.

(3) Explain: Frictional electricity and static electricity.

Answer: Frictional electricity is the electric charge generated when two objects are rubbed together, transferring electrons. Static electricity refers to the buildup of electrical charge on the surface of an object, often caused by friction.

(4) Suppose there are two objects A and B. Initially both are electrically neutral. If both are rubbed against each other, the object A becomes positively charged and object B becomes negatively charged. What is the reason for this change?

Answer: The rubbing causes electrons to transfer from one object to the other. If object A loses electrons, it becomes positively charged, and object B gains electrons, becoming negatively charged.

(5) Explain, why the repulsion is used as a test for identifying an electrically charged object?

Answer: Repulsion is a reliable test because only like charges repel each other. If two objects repel, they must both be electrically charged with the same type of charge, confirming their charged state.

(6) What are the characteristics of a static electric charge?

Answer: Static electric charge remains stationary on the surface of an object, it can be positive or negative, and it is produced by friction. Static charges can attract or repel other charges and can cause a spark when discharged.

(7) When you are given a negatively charged ebonite rod and a conductor fixed on a glass stand how till you make it (A) positively charged (B) negatively charged?

Answer:

(A) Positively charged: Touch the conductor with the negatively charged ebonite rod, causing the rod to transfer electrons, leaving the conductor positively charged.

(B) Negatively charged: Bring the negatively charged ebonite rod near the conductor without touching it. Induction will cause electrons to move in the conductor, and grounding the conductor will remove positive charges, leaving it negatively charged.

(8) When a glass rod is rubbed with a silk cloth, what type of charge is produced on the silk cloth? Why?

Answer: The silk cloth becomes negatively charged because it gains electrons from the glass rod during the rubbing process, leaving the glass rod positively charged.

(9) Explain in brief the flash of lightning and lightning strike.

Answer: Lightning occurs when a large electric charge builds up in clouds. When the potential difference between the cloud and the ground becomes too high, it leads to a sudden discharge of electricity in the form of a flash (lightning). If this discharge reaches the ground, it is called a lightning strike.

(10) What is the damage caused by lightning? How will you create awareness to prevent it?

Answer: Lightning can cause fires, damage buildings, harm electrical systems, and even lead to injury or death. To create awareness, I would educate people on safety measures, such as staying indoors during storms, avoiding open fields or metal objects, and installing lightning rods on buildings to direct the charge safely into the ground.

Question. 6. Answer the following questions with neat and well-labelled diagrams:

(1) Describe the construction and the working of an electroscope.

Answer:

Construction: An electroscope consists of a metal rod with two thin metal leaves (usually gold or aluminum) attached at the bottom. The rod is enclosed in a glass container to prevent air currents from disturbing the leaves. The top of the rod is fitted with a metal disk or sphere.

Working: When a charged object touches or comes near the metal disk, the electric charge is transferred to the rod and spreads to the leaves. The leaves acquire like charges and repel each other, causing them to spread apart. The degree of separation indicates the presence and magnitude of the charge.

(2) With a neat diagram, explain the method of charging a gold leaf electroscope with a negative charge.

Answer:

Method: Bring a negatively charged object close to the metal disk of the electroscope. Electrons from the charged object will transfer to the electroscope, causing the metal leaves to acquire negative charge. The leaves repel each other and move apart due to the like charges.

Observation: The more the negative charge, the greater the separation between the leaves.

(3) Explain briefly the construction and working of lightning conductor.

Answer:

Construction: A lightning conductor is a metal rod (usually copper) fixed to the top of a building and connected to the ground via a thick wire. The rod is pointed at the top to encourage ionization of the air and attract lightning.

Working: When lightning strikes, the charge is conducted safely through the metal rod and wire into the ground, preventing damage to the building by dispersing the electrical energy harmlessly into the earth.

Question. 6. Give scientific reasons for the following:

(1) The diverged leaves of a positively charged gold leaf electroscope collapse if its disc is touched with a charged ebonite rod.

Answer: When the positively charged electroscope is touched by a negatively charged ebonite rod, electrons from the rod neutralize the positive charge on the electroscope. As a result, the leaves lose their like charges and collapse due to the loss of repulsion.

(2) Leaves of a gold leaf electroscope diverge if a charged body is brought near its disc, but they collapse if the body is taken away.

Answer: When a charged body is brought near the electroscope, it induces opposite charges on the leaves, causing them to diverge due to repulsion. Once the charged body is removed, the induced charges disappear, causing the leaves to lose their repulsion and collapse back together.

(3) Small bits of paper are attracted by a plastic comb which has been moved vigorously through dry hair.

Answer: When a plastic comb is rubbed through dry hair, it becomes electrically charged (usually negative) due to the transfer of electrons. The charged comb polarizes the bits of paper, attracting them due to the force of electrostatic attraction.

(4) Dust and other small particles are attracted by a plastic comb which has been moved vigorously through dry hair.

Answer: The plastic comb, after being moved through dry hair, becomes charged and creates an electric field. This field polarizes nearby dust and small particles, causing them to be attracted to the comb through electrostatic forces.

(5) When dry hair is combed vigorously, a crackling sound is produced.

Answer: Vigorous combing of dry hair causes the transfer of electrons between the hair and the comb, generating static electricity. The crackling sound is caused by the discharge of this static electricity through small sparks, which ionize the air and create sound.

(6) Experiments on static electricity are not successful during rainy season. (HOTS)

Answer: During the rainy season, humidity in the air is higher, which allows moisture to conduct electricity. This prevents the build-up of static charges, as they easily dissipate into the air, making it difficult to conduct static electricity experiments.

(7) A metal rod which is to be charged by friction is held by an insulating handle. (HOTS)

Answer: If the metal rod were held directly by hand, the charge would flow through the body and escape. An insulating handle prevents the charge from escaping to the ground, allowing the metal rod to retain the static charge generated by friction.

Question. 8. Use your brain power!

(1) Do all objects get charged by rubbing? (Textbook page 52) (HOTS)

Answer: No, not all objects get charged by rubbing. Only materials that are good insulators, like plastic, rubber, and glass, tend to accumulate static charges when rubbed. Conductors, like metals, do not typically get charged this way because the charges move freely through them and dissipate.

(2) Why does a charged balloon stick to a wall. (Textbook page 54)

Answer: When a balloon is charged by rubbing, it accumulates either positive or negative charges. When placed near a wall, the balloon induces opposite charges on the surface of the wall, creating an electrostatic attraction between the balloon and the wall, causing the balloon to stick.

(3) Can we use leaves of some other metal instead of gold, in the electroscope? Which properties must that metal have? (Textbook page 55) (HOTS)

Answer: Yes, leaves of other metals can be used in an electroscope as long as they have similar properties to gold. The metal must be thin, lightweight, and a good conductor of electricity to detect small charges and easily diverge. Suitable alternatives could include aluminum or silver.

(4) What kind of damage is caused by a lightning strike? (Textbook page 56)

Answer: A lightning strike can cause severe damage, including destruction of buildings, electrical fires, and damage to electronic devices due to the surge of electrical energy. It can also result in injuries or death to humans and animals due to the intense heat and electrical discharge.

(5) What measures will you take to prevent the damage caused by lightning? (Textbook page 56)

Answer: To prevent damage from lightning, you can install lightning conductors on tall buildings, avoid standing under trees or using electrical devices during storms, and stay indoors. It's also important to ensure proper grounding of electrical systems.

(6) Why is the upper end of the lightning conductor pointed? (Textbook page 57)

Answer: The upper end of the lightning conductor is pointed to create a strong electric field at the tip, which helps attract lightning and directs the electrical discharge safely to the ground through the conductor.

(7) Why are coal and salt added to the pit in the ground? (Textbook page 57)

Answer: Coal and salt are added to the pit in the ground to improve conductivity. Salt retains moisture and coal acts as a conductor, ensuring that the electrical charge from the lightning is efficiently transferred to the earth, reducing the risk of damage.