

## Answers to Exercises

- A. 1. (a) On rubbing a plastic ruler with a woollen cloth, the ruler gets negatively charged and the cloth gets positively charged.
- (b) The glass rod gets positively charged. If we bring it near a negatively charged paper cylinder, it will attract the cylinder.
- (c) When a positively charged rod is moved slowly towards an uncharged paper cylinder, the cylinder will be attracted to it. Once the rod touches the cylinder, the cylinder will move away with a jerk.
- (d) A negatively charged body reduces the positive charge on the leaves of the electroscope and reduces the divergence.
- (e) It gets discharged through our body, or the charge gets earthed.
- B. 1. On rubbing Styrofoam with paper, some negative charges from the paper travel to the Styrofoam. Thus, the Styrofoam piece has an excess of negative charges, or acquires a net negative charge. The paper, which loses negative charges, has an excess of positive charges, or acquires a net positive charge.
2. Suppose the rod is negatively charged. When we bring it close to an uncharged paper cylinder suspended by a string, the negative charges in the cylinder move away from the rod, leaving positive charges near the rod. This is why the cylinder moves towards the rod. When the rod touches the cylinder, some of the excess negative charges on the rod get transferred to the cylinder. The cylinder then acquires a net negative charge and is repelled by the rod.
3. When a charged body is brought in contact with the metal disc of an electroscope, the gold leaves get charged by conduction. They then diverge (repel each other) since they carry like charges. The extent to which they diverge is not always the same and gives an idea of the magnitude of the charge on the body.
4. When the electroscopes are connected by a conductor, charge flows from the first electroscope to the other, until they both carry the same charge. The leaves of the second electroscope will diverge and the divergence of the leaves of the first electroscope will decrease, until the divergence of both is the same.
5. A lightning conductor is a tall metal rod, which is fixed to buildings to protect them from being damaged by lightning. The top of the rod ends in spikes. The lower end of the rod is connected to a metal plate, which is buried underground. If lightning happens to strike a building which has a lightning conductor, the charge passes harmlessly through the metal rod into the earth, or gets earthed.
- C. 1. A body can be charged by friction (rubbing it with another body), conduction or induction.
- Let us do an activity to show charging by induction. Make two metal spheres (say A and B) using aluminium foil. Attach them to sticks, and stand them up on a table with the help of modelling clay. Let the spheres touch each other. Bring a negatively charged ruler close to sphere A and then move sphere B away from it. Now move the ruler away. If we test spheres A and B, we will see that the first is positively charged, while the second is negatively charged.
- If we had moved the ruler away before moving sphere B, the charges inside the spheres would have rearranged themselves, and the two spheres would have remained electrically neutral.
2. The gold-leaf electroscope is used to detect, measure and find the nature of a charge. It consists of two thin strips (leaves) of gold attached to a metal rod, which is suspended inside a glass jar. The mouth of the jar is fitted with a rubber stopper, through which the rod passes. The other end of the rod is attached to a metal disc. Some electroscopes have strips of silver, copper or brass instead of gold.
- When a charged body is brought in contact with the metal disc of an electroscope, the gold leaves get charged by conduction. They then diverge, indicating the presence of a charge. And the amount by which they diverge gives an idea of the magnitude of the charge on the body. Refer to Figure 10.9 on page 109.
3. The leaves of the electroscope will diverge whether the body being tested has a positive or negative charge. To determine the nature of the charge, we have to first charge the electroscope with a known charge. Suppose we charge it with a positively charged glass rod. The leaves will get positively charged and move apart. Then touch the disc of the electroscope with the body we want to test. If the distance between the leaves increases, it means that the body we are testing is positively charged. In case the distance between the leaves decreases, it would mean that the body we are testing is negatively charged.
4. Clouds contain tiny crystals of ice and droplets of water, which move against each other. This can cause huge amounts of charge to build up. Ordinarily nothing happens due to this charge build-up, because air does not conduct the charge from the clouds. But when the accumulation of the charge is great enough and the wind brings the clouds close together, the charge can jump from one cloud to another through the air. This electric discharge is called lightning. During this process, a huge amount of energy is released in the form of light and sound.
- D. 1. (a)            2. (c)            3. (b)            4. (d)            5. (b)            6. (a)            7. (a)
- E. 1. negative    2. repulsion    3. amount       4. electric discharge    5. earth
- F. (a) The leaves will come closer/collapse.
- (b) The leaves of the first electroscope will remain as they were and those of the second will not move.
- (c) The leaves of the second electroscope will diverge and those of the first will come closer till the divergence both is the same.
- (d) The leaves will collapse.