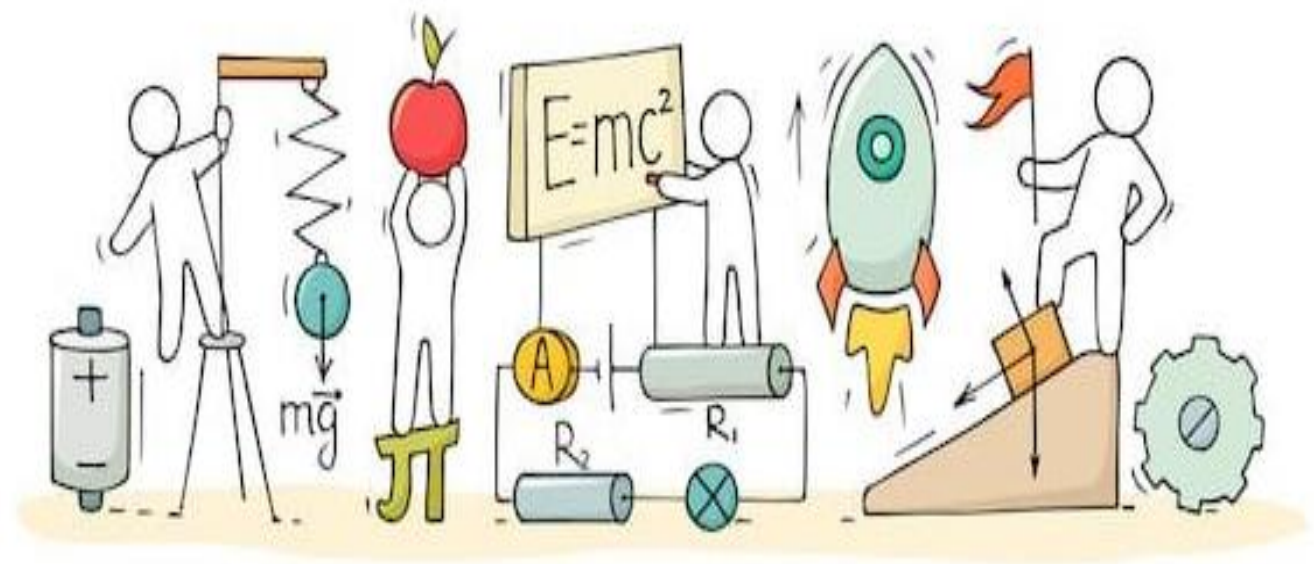


# SCIENCE

## Chapter 15: Some Natural Phenomena



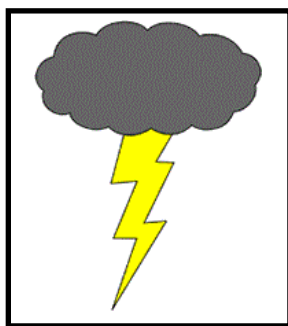
## Some Natural Phenomena

- Natural phenomena which cause damage to human life and property can be harmful and destructive.
- Some natural disasters or calamities are storms, cyclones, earthquakes, lightning and landslides.

### Lightning

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- Lightning is caused by accumulation of charges in the clouds.



- In 1752, Benjamin Franklin, an American scientist, showed lightning as static charge which is the same as the electric sparks produced with crackling sound while taking off woollen or polyester clothes, especially in the dark.

#### Occurrence of Lightning

- The formation of clouds involves friction between the water particles in the atmosphere.
- This friction charges the particles.
- There are two types of charges:
  - a. Positive charge
  - b. Negative charge
- The negative charge accumulates at the bottom of the cloud, and the positive charge at its top.
- As the accumulation of the charge increases, the cloud will create a positive charge on the ground.
- This creation of charges tends to make a path towards the ground which results in a narrow streak of electrical discharge which is called lightning.

### Types of Charges and their Interaction

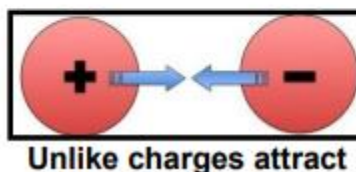
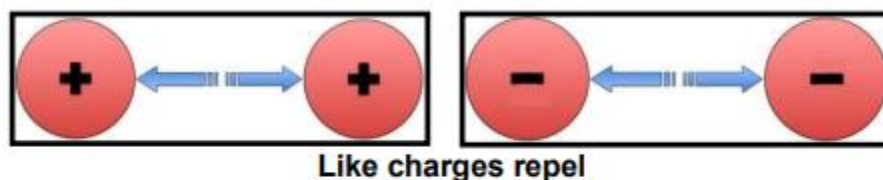
#### Charged Bodies

#### What is Charge?

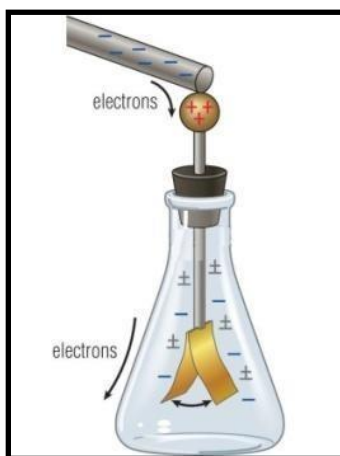
Charge is most commonly used to refer to electric charge. It is a fundamental property of matter like mass. It is a physical property because of which matter experience a force in an electromagnetic field.

Electric charges may be positive or negative in nature. If there is no net electric charge, the matter is considered neutral or uncharged.

- Like charges repel and unlike charges attract each other.



- An electroscope detects the type of charge on a body.



- It consists of a glass jar fitted with a cork lid and a metallic wire passing through it.
- There are two metallic strips at the bottom of the wire.
- The upper end of the wire is connected to a metal disc.
- A positively charged object is touched to the metal disc, so that the charge is transferred to the metal strips through the wire and they diverge from each other on gaining a like charge.
- A negatively charged object is brought into contact with the disc so that the strips converge towards each other, indicating the unlike charge on the body.
- If the metal disc of the electroscope is touched with the hand, then it loses its charge to the ground by transfer of charge through the human body. This is called earthing.

### What are electrons, protons, and neutrons, and where is it present?

Electrons, protons and neutrons are fundamental particles. Electrons are negatively charged particles that move around the nucleus of an atom.

Protons are positively charged particles. Neutrons are electrically neutral which means that they carry no charge.

Both protons and neutrons are concentrated at the center of an atom known as the nucleus of the atom. Electrons surround the nucleus.

### How the object becomes positively charged and negatively charged?

When an object loses electrons, it becomes positively charged because it has more protons than electrons. After gaining electrons, the objects become negatively charged.

When a glass rod is rubbed with silk cloth, for example, it becomes positively charged, whereas the silk cloth becomes negatively charged.

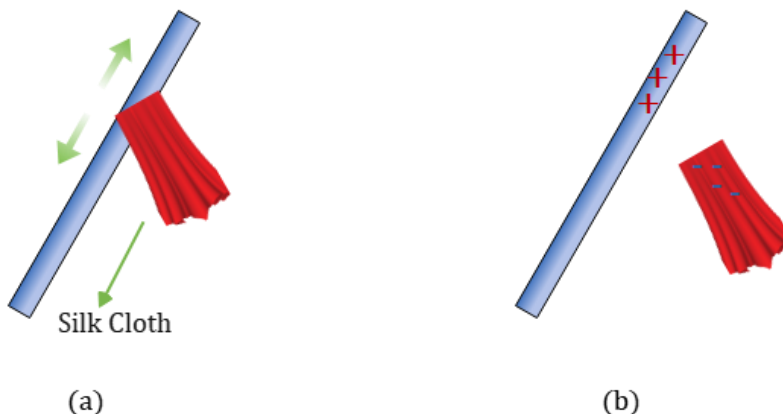


Figure (a) shows a glass rod being rubbed with a silk cloth. Figure (b) shows that on rubbing with silk cloth glass rod becomes positive in charge because electrons are rubbed off glass rod. Due to this silk cloth becomes negative.

### Charging by rubbing or friction

It means that when two objects rub against each other, electrons are transferred between them and they become charged.

For example, rubbing a plastic comb through dry hair charges it. This charged object (plastic comb) can now attract other charged and uncharged objects. The charged plastic comb is capable of attracting scraps of paper.

### Properties of charge

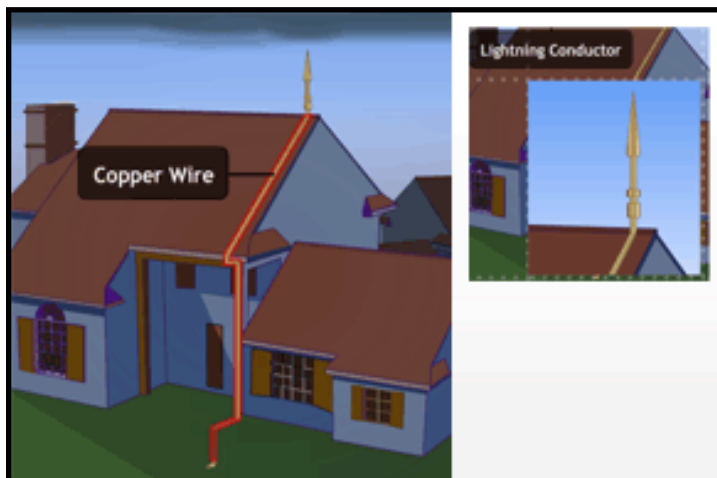
Like charges repel each other. This means that two positive charges repel each other. Similarly, two negative charges would also repel each other.

Unlike charges, they attract each other. This means that a Positive-Negative charge would attract each other.

For example, a charged rubber balloon is repelled by another charged balloon, whereas an uncharged balloon is attracted by another charged balloon.

## Lightning Safety

- Lightning is caused by the heavy electric discharge from the clouds to the Earth.
- If lightning is not controlled, it can cause heavy damage to life and property.
- Buildings are safe places to protect ourselves from lightning strikes, so we must take shelter in buildings and not stay in open areas.
- We must not take shelter under trees or go to an open area if we are outside.
- If we are in a vehicle, then we should not come out of it. The doors and windows of the vehicle should also be closed.
- Tall buildings are provided with a lightning conductor which is a metal rod that is erected at the top of a building.

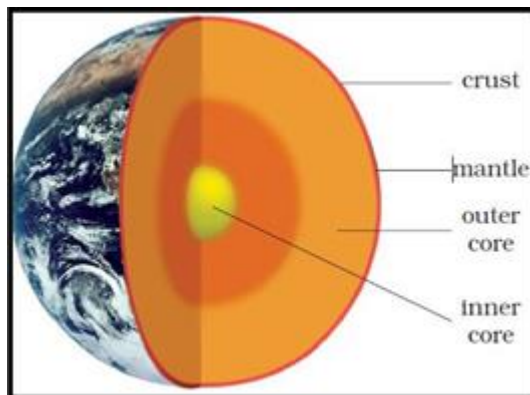


## Earthquakes

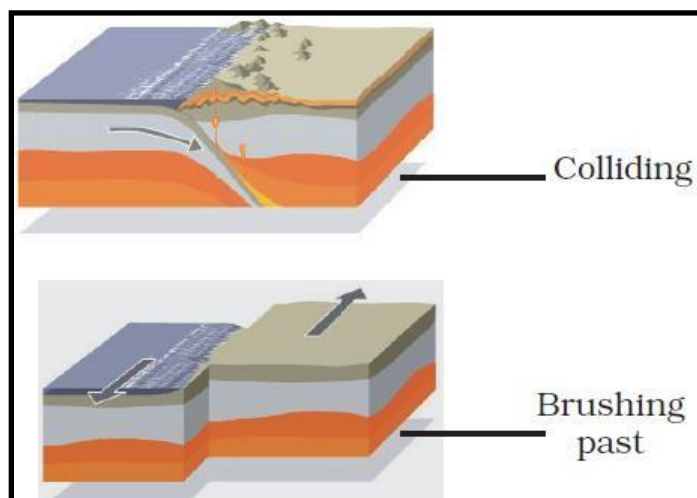
- An earthquake is a natural phenomenon which cannot be predicted. It is a sudden shaking or trembling of the Earth which lasts for a short time.
- It can cause large-scale damage to human life and property.
- It can cause floods, landslides and tsunamis.
- A major tsunami occurred in the Indian Ocean on 26 December 2004.

### Cause of Earthquakes

- Tremors are caused by a disturbance in the uppermost layer of the Earth called the crust.
- The Earth consists of three major layers—core, mantle and crust.



- The core is divided into the inner core and the outer core.
- The mantle consists of a semi-solid material above which the crust floats.
- The crust consists of oceans and continents, and it is fragmented.
- Each fragment is called a plate, and these plates are in continuous motion.
- When these plates brush against each other or collide, they cause disturbance in the Earth's crust.



- The region where one plate slides against the other is referred to as a fault zone. This is where an earthquake occurs. Hence, such zones are referred to as seismic zones.
- The place in the interior of the Earth where an earthquake occurs is called the focus, and the region on the surface of the Earth which is the closest to the focus is called the epicentre of the earthquake.
- The instrument which measures the severity of an earthquake is called a seismograph.
- The severity of an earthquake is measured on the Richter scale.
- A major earthquake measures 7 or more on the Richter scale.
- A major earthquake occurred on 8 October 2005 in Uri and Tangdhar towns of North Kashmir and on 26 January 2001 in Bhuj District of Gujarat.



### Protection against Earthquakes

- We should take necessary precautions to protect ourselves from earthquakes.

**If you are at home:**

- Take shelter under a table and stay there till the shaking stops.
- Stay away from tall and heavy objects which may fall on you.
- If you are in bed, then do not get up but protect your head with a pillow.

**If you are outdoors:**

- Find a clear place away from buildings, trees and overhead power lines.
- If you are in a car or a bus, do not come out till the tremors stop and ask the driver to drive slowly to a clear spot.

## Static charge vs Current Electricity

The electric charge produced by rubbing is known as a static charge, whereas charges that move together form an electric current. A static charge is one that does not move.

Current electricity on the other hand is study of moving charges.

### Transfer of Charge

There are two ways to transfer charge from one object to another.

**Conduction:** When a charged object makes contact with a conductor, charges are transferred through the conductor. The object gains the same charge as the charged body. This method requires physical contact between the objects.

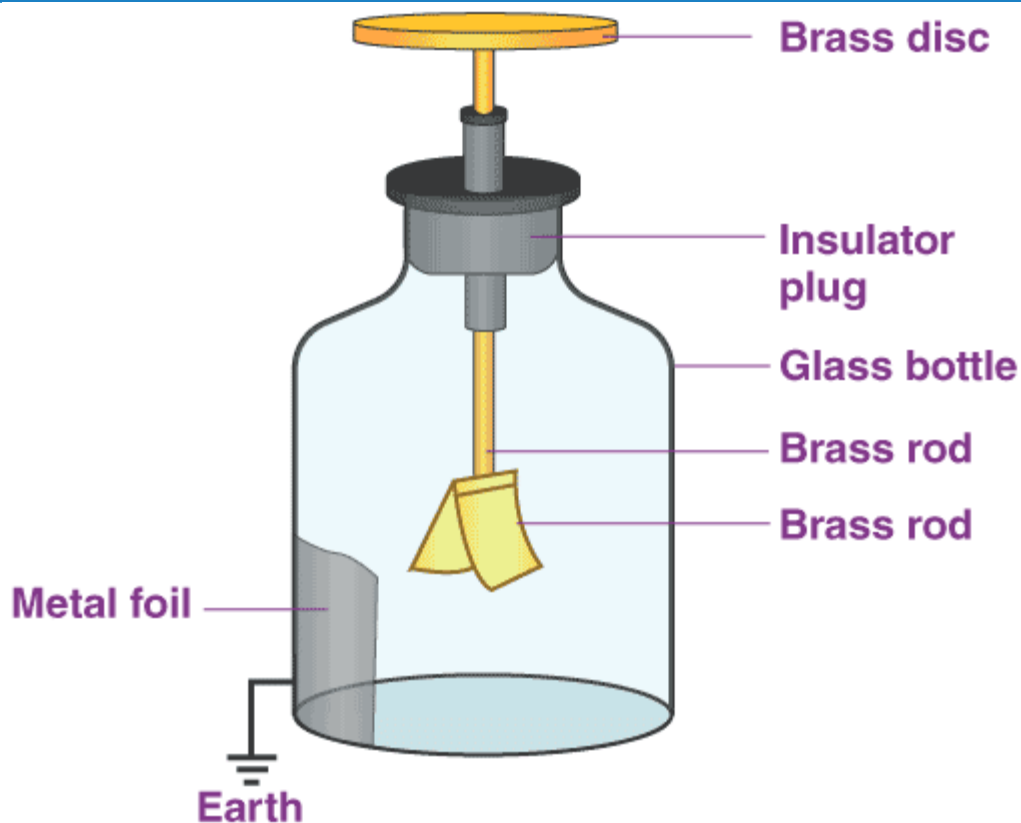
**Induction:** When a charged object is brought near a neutral object, the object gets induced and becomes charged. The object acquires the opposite charge to that of the charged body. This process doesn't require physical contact.

The transfer of electric charges does not create or destroy charges and in this process charge remains conserved.

## Electroscope

It is a device or an instrument that can be used to test whether an object is carrying a charge or not. An electrical charge can be transferred from one charged object to another through a metal conductor. It consists of a metal rod with a thin metal strip or leaf attached to it at the bottom.

Because gold and silver are good conductors of electricity, they are commonly used to make electroscopes.



### How does the electroscope detect the charge?

- A charged object is brought in contact with the open end of the wire.
- The charges are transferred through the wire, which is a good conductor of electricity.
- The gold plates also get charged and repel each other as they are similarly charged.

### Discharged bodies

The body is said to be discharged if it loses its charge to the earth or any other body.

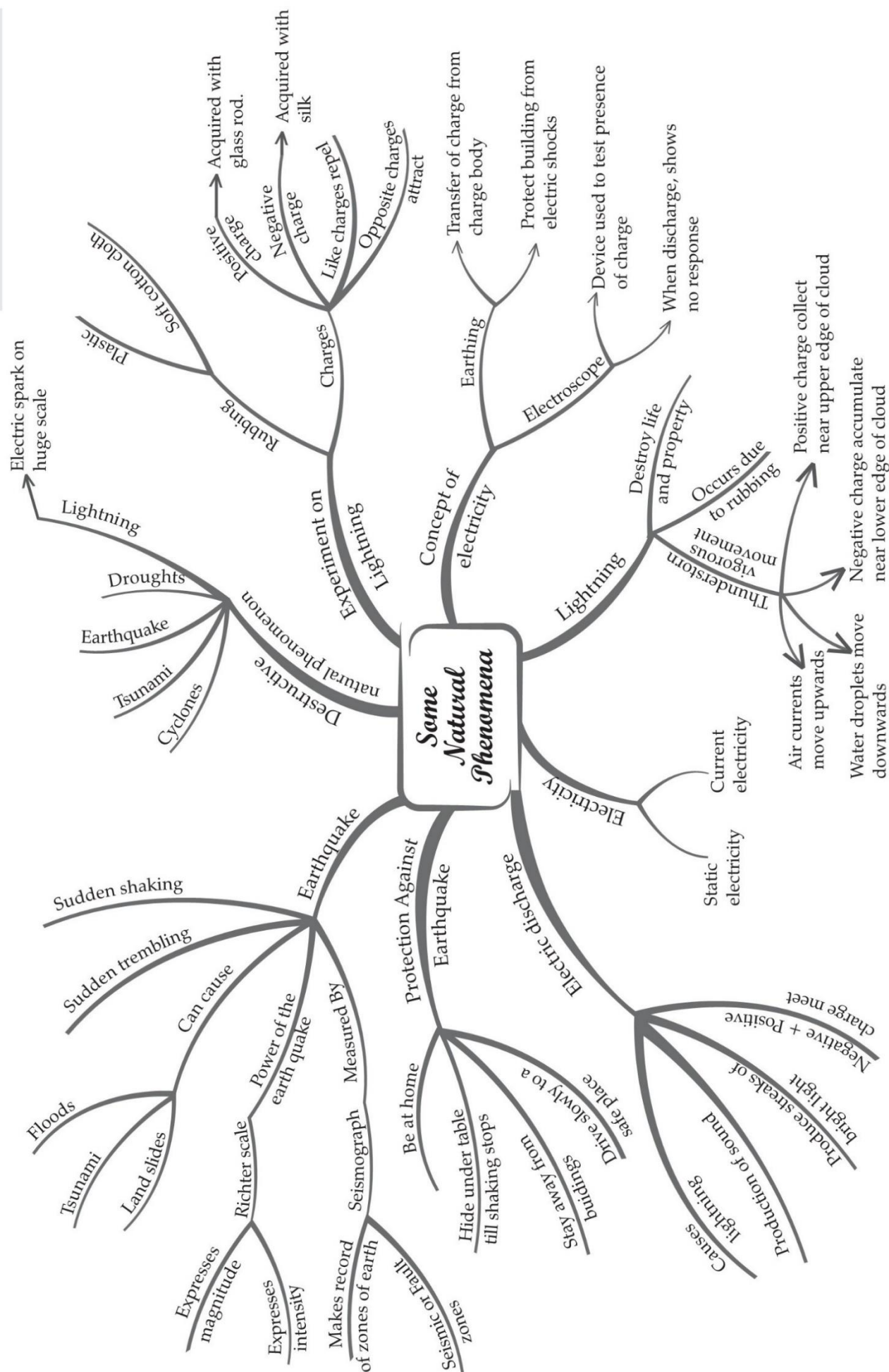
### why a charged body loses its charge if we touch it with our hand?

When a charged body is touched by our hand, our body conducts its charge to the earth as the human body is a good conductor of electricity.

The process of transfer of charges from a charged object to the earth takes place is called earthing. In general, every tall building has earthing to protect it from electrical shocks caused by electric current leakage.



# MIND MAP : LEARNING MADE SIMPLE CHAPTER-17



# Important Questions

## Multiple Choice questions-

Question 1. The process of transfer of charges from a charged object to the earth is called

- (a) earthing
- (b) lightning
- (c) oscillation motion
- (d) electron movement

Question 2. The power of an earthquake is expressed on a scale called

- (a) seismic scale
- (b) iron scale
- (c) richter scale
- (d) large scale

Question 3. Which instrument is used to measure earthquake?

- (a) Richter scale
- (b) Seismograph
- (c) Polygraph
- (d) None of these

Question 4. Which is not a natural phenomena?

- (a) Earthquakes
- (b) Cyclones
- (c) Lightning
- (d) Earthing

Question 5. How many types of charges are gained by rubbing objects?

- (a) 2
- (b) 1
- (c) 3
- (d) 4

Question 6. Where is the lightning rod attached to protect the building from lightning?

- (a) On the top of the building
- (b) On the bottom of the building
- (c) In the middle of the building
- (d) All of these

Question 7. Lightning always follows

- (a) a thunder
- (b) rain pour
- (c) the easiest path
- (d) a straight path

Question 8. Tsunami means

- (a) earthquake
- (b) floods
- (c) earthquake under the sea
- (d) eruption of volcano in a sea

Question 9. The waves produced on the earth's surface is called

- (a) seismic wave
- (b) longitudinal wave
- (c) Micro wave
- (d) Radio wave

Question 10. Amber is a

- (a) metal
- (b) rubber
- (c) resin
- (d) sugar

Question 11. Which is the surest test of charge on a body?

- (a) Repulsion
- (b) Lightning
- (c) Combustion
- (d) Insulation

Question 12. Which of the following can be charged with static electricity ?

- (a) Metal
- (b) Alloy
- (c) Insulator
- (d) Semiconductor

Question 13. Which of the following occurs during lightning?

- (a) Acid rain
- (b) Nitrogen fixation
- (c) Green house effect
- (d) Earthing

Question 14. Which of the following can be charged by rubbing?

- (a) Ebonite
- (b) Plastic
- (c) Amber
- (d) All of these

Question 15. When two bodies are rubbed against each other, they acquire

- (a) equal and like charges
- (b) equal and unlike charges
- (c) unequal and like charges
- (d) unequal and unlike charges

### Very Short Question :

1. What are the three destructive natural phenomena?
2. Name two other destructive phenomenon.
3. What are the two types of charges?
4. What are the interactions of these two types of charges with each other?
5. What is lightning?
6. What is the cause of lightning?
7. What is amber?
8. What happens when amber is rubbed with fur?
9. What is static electricity?

10. Who discovered the static electricity or lightning in clouds?

### Short Questions :

1. Why does a plastic comb rubbed with dry hair attract tiny pieces of paper?
2. Why a copper rod cannot be charged by friction, if held by hand?
3. Mention three ways by which a body can be charged.
4. What do you mean by earthing? What is the purpose of providing it in buildings?
5. Suppose you are outside your home and an earthquake strikes. What precaution would you take to protect yourself?
6. Suppose you are at home and an earthquake strikes. What precaution would you take to protect yourself?
7. Explain earthing.
8. What do you mean by lightning conductor?
9. How an electroscope can be charged through conduction?
10. A crackling sound is heard while taking off sweater during winters. Explain the reason behind this.

### Long Questions :

1. What is lightning? How does lightning strike?
2. Explain the process of electric discharge.
3. What safety measures should be taken during lightning and thunderstorm?
4. What is a lightning conductor? How does it work?
5. What is an earthquake? What causes an earthquake? Explain.

## ANSWER

### MCQ Answer:

1. Answer: (a) earthing
2. Answer: (c) richter scale
3. Answer: (b) Seismograph
4. Answer: (d) Earthing
5. Answer: (a) 2
6. Answer: (a) On the top of the building
7. Answer: (a) a thunder
8. Answer: (c) earthquake under the sea
9. Answer: (a) seismic wave
10. Answer: (c) resin

11. Answer: (a) Repulsion
12. Answer: (c) Insulator
13. Answer: (b) Nitrogen fixation
14. Answer: (d) All of these
15. Answer: (b) equal and unlike charges

### Very Short Answer :

1. **Answer:** Winds, storms and cyclones are the three natural phenomenon which are destructive.
2. Answer: Lightning, earthquakes.
3. Answer: There are two types of charges:
  - (i) Positive charges
  - (ii) Negative charges.
4. Answer: (i) Like charges repel each other.  
(ii) Unlike charges attract each other.
5. Answer: Lightning is an electric spark on huge scale.
6. Answer: Lightning is caused by the accumulation of charges in clouds.
7. Answer: The amber is a kind of resin.
8. Answer: When amber is rubbed with fur, it attracts light object.
9. Answer: The electricity generated by rubbing is called static electricity because the charges do not move.
10. Answer: Benjamin Franklin in 1752.

### Short Answer :

1. Answer: Plastic comb gets electrically charged due to rubbing & therefore it attracts tiny pieces of paper which are neutral, as charged body can attract an uncharged body.
2. Answer: Copper is a conducting object, as soon as it gets charged by rubbing with another material, the electric charge produced on its surface flows through our hand & body into the earth and it remains uncharged.
3. Answer: Three ways are:

Charging by rubbing: Charging of an object by rubbing it with another object is called charging by rubbing. The body which loses electrons acquires positive charge whereas the body which gains electrons acquires negative charge.

Charging by conduction: Charging a neutral body by bringing it in contact with a charged body is called charging by conduction.

Charging by induction: Charging a neutral body by bringing it near a charged body is called charging by induction

4. Answer: The process of transferring of charge from a charged object to the earth is called earthing. For our safety, most of the electrical appliances and the mains of the house are connected to earth, so that we can be prevented from getting an electric shock.
5. Answer: The following precautions should be taken are as follow:
  - Find a clear spot, away from buildings, trees, poles and electric poles, signboards and overhead power lines and drop to the ground
  - Do not use elevators if they are available at some place outside your house.
  - If you are in a car or a bus, do not come out and drive slowly to a clear spot.
6. Answer: The precautions that should be taken are as follow:
  - Take shelter under a table and stay there only, till the shaking stops
  - Stay away from the objects which are tall and heavy that may fall on you.
  - If you are on bed, do not get up and remain there only and protect your head with pillow.
7. Answer: The process of transferring of charge from a charged object to the earth is called earthing. For our safety, most of the electrical appliances and the mains of the house are connected to earth, so that we can be prevented from getting an electric shock.
8. Answer: Lightning conductor is a device used to protect buildings from the damaging effects of lightning. It runs from the top to the bottom, along the outer wall of the buildings or any other object, which is to be protected. If lightning strikes the buildings or any other objects, then the lightning conductor provides an easy and direct path for the lightning bolt to pass to the ground without effecting them.
9. Answer: An electroscope is used to detect the charge on a body. A plastic comb is taken and it is rubbed on hair. Now, the plastic comb gets charged. The comb is touched with the electroscope plate. The static charges which are developed on the comb travels down the conducting wire and reach the two leaves of aluminium foil. Similar charges are acquired by both the leaves and as a result, they repel each other. Thus, the method of charging an uncharged body by bringing another charged body directly in contact is called charging by conduction. By this way, an electroscope can be charged through conduction.
10. Answer: As we know that electrical charges that are generated through friction are static, i.e., they do not move by themselves and Motion of charges constitutes an electric current. When we take off our sweater there is a motion between the charges on the sweater and our body that produces electric current, which produces a crackling sound. Infact we can see a spark if we take off the sweater in the dark.

### Long Answer:

1. Answer:



Lightning is an electric spark, but on a huge scale. It is caused by the accumulation of charges in the clouds. When two clouds carrying opposite charges come very close to each other, the charges flow with great speed from one cloud to another through the air between them. Consequently, a very bright spark is produced.

The spark caused due to the transfer of electric charge between two clouds causes lightning. It can occur when electric charges flow from one part of a cloud to another or from a cloud to the ground. Lightning is accompanied by large amounts of electric charges and very high temperatures. The huge amount of heat produced makes the air expand very suddenly what causes vibration to occur, resulting in a loud sound called thunder.

**2. Answer:**

During the development of a thunderstorm, the air currents move upward while the water droplets move downward. These vigorous movements cause separation of charges. By a process, the positive charges collect near the upper edges of the clouds and the negative charges accumulate near the lower edges. There is accumulation of positive near the ground also.

When the magnitude of the accumulated charges becomes very large, the air which is normally a poor conductor of electricity, is no longer able to resist their flow. Finally negative and positive charges meet, producing streaks of bright light and sound called lightning and thunderstorm respectively. This process is known as electric discharge. This can occur between two or more clouds, or between clouds and the earth.

**3. Answer:**

The following safety measures are advisable to be adopted to protect from lightning and thunderstorm:

- No open place is safe. A house or a building is a safe place. If travelling by car or by bus, it is safe to stay inside with windows and doors of the vehicle shut.
- If we are outside, the following things are important to be kept in mind:
  - (a) Open vehicles, like motorbikes, tractors, construction machinery, fields, tall trees, shelters in parks, elevated places do not protect us from lightning strikes.
  - (b) Carrying an umbrella is not at all a good idea during thunderstorms.
  - (c) If no shelter is available and we are in an open field, we should keep away from all trees. We should stay away from poles or other metal objects. We should not lie on the ground. Sitting in a pose as given in the Fig. 15.8 is advisable.



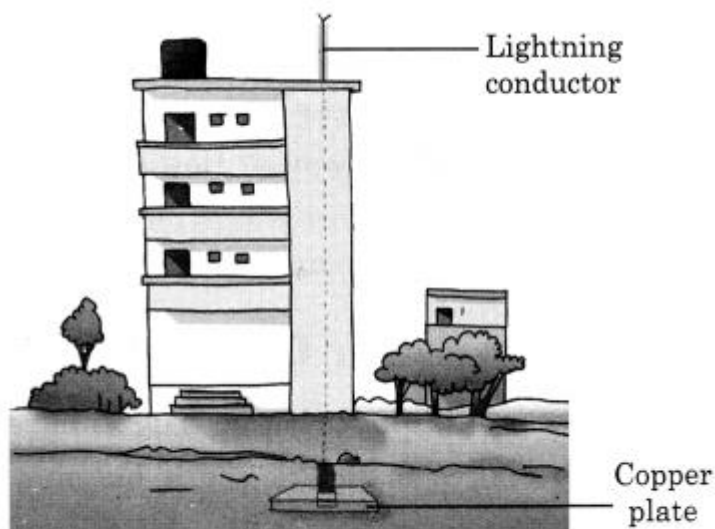


► Fig. 15.8 Safe position during lightning

- If we are inside the house, we should take care as advised further: Lightning can strike telephone cords, electrical wires and metal pipes. During a thunderstorm, contact with these should be avoided. It is safer to use mobile phones and cordless phones. However, it is not wise to call up a person with a wired phone. Bathing should be avoided. Electrical appliances should be unplugged.

4. Answer:

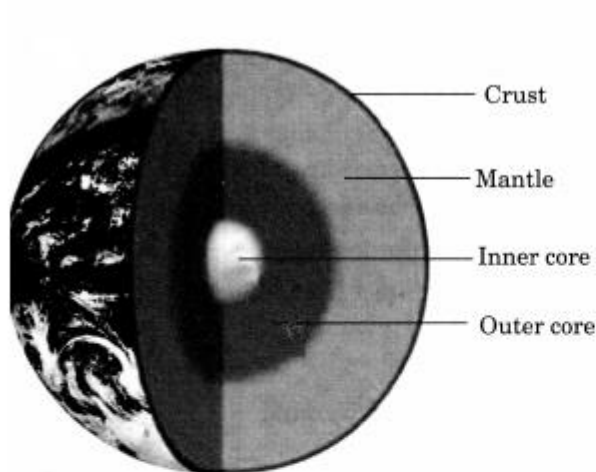
Lightning conductor is a device used to protect buildings from the effect of lightning. A metallic rod, taller than the building, is installed in the walls of the buildings during its construction. One end of the rod is kept out in the air and the other is buried deep in the ground as shown in the figure. The rod provides easy route in the transfer of electric charge to the ground. The metal columns used during construction, electrical wires and water pipes in the buildings also protect us to an extent. But we should not touch them during thunderstorm.



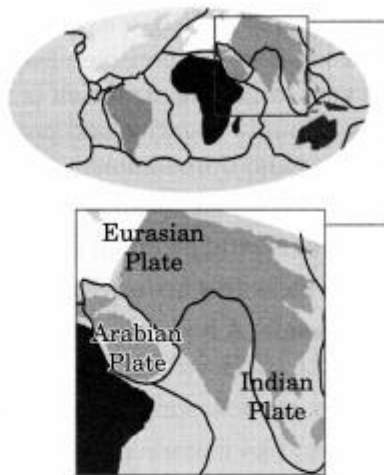
► Fig. 15.9 Lightning conductor

5. Answer:

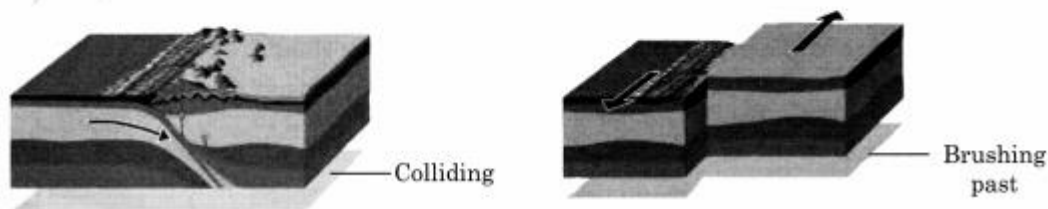
An earthquake is a sudden shaking or trembling of the earth. It lasts for a very short time. It is caused by a disturbance deep inside the earth's crust. We know that tremors are caused by the disturbance deep down inside the uppermost layer of the earth called crust (Fig. 15.10). The outermost layer of the earth is fragmented. Each fragment is called a plate (Fig. 15.11). These plates are in continual motion. When they brush one another, or a plate goes under another due to collision (Fig. 15.12), they cause disturbance in the earth's crust. It is this disturbance that shows up as an earthquake on the surface of the earth.



► Fig. 15.10 Structure of the earth



► Fig. 15.11 Earth plates



► Fig. 15.12 Movements of earth's plates