

Class 8 Physics Some Natural Phenomena

Introduction

We have heard a lightning many times, isn't it? Have you ever wondered how and why it occurs? Is it dangerous? In this chapter we will discuss two naturally occurring phenomena - **Lightning and Earthquake** and its characteristics.



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Electric Charges

Lightning is caused due to **static charges**. So, before we understand lightning, let us understand about electric charges.

- **Electric charges at rest** (without motion) is referred to as Static Electricity.
- There are 2 types of static charges **Positive (+) and Negative (-)**
- Static charges are produced by the **friction** between two interacting bodies (See examples below)
- Static electric charges exert a **force** on each other. This force could be **attractive or repulsive** depending on the charge

- **Two like charges repel each other.**



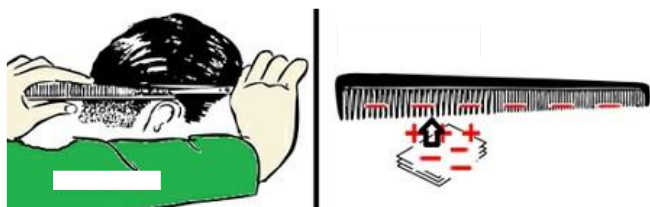
- **Unlike charges attract each other**



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In the previous section, we understood some **basic characteristics of charges**. Now, let us **demonstrate and understand them using experiments**.

Experiment 1: Comb and Pieces of Paper



Experiment

- Rub your hair with a comb.
- Place it near small pieces of paper.

Observation

- The pieces of paper are **attracted** towards the comb.

Analysis

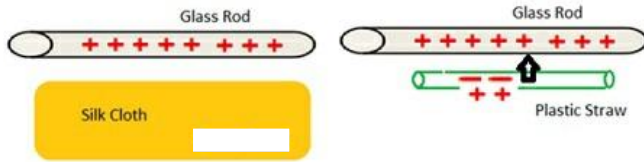
- Earlier, the comb and the pieces of paper were **neutral**
- When we rubbed the comb on our hair, the electrons were transferred from hair to the comb. Now the comb is **charged negatively**.
- When the comb is brought near the pieces of paper, the **electric field of the comb influences the paper** and it gets **polarised** i.e. the **positive charges move near the comb and the negative charges on the other side of the comb**. And hence they **attract** each other.

Conclusions

- Static charges are produced by the **friction** between two interacting bodies
- They exert a force on each other - **Unlike charges attract each other**

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Experiment 2: Glass Rod and Straw



Experiment

- Rub a **glass rod** with a piece of **silk cloth**.
- Place it near a plastic **straw**.

Observation

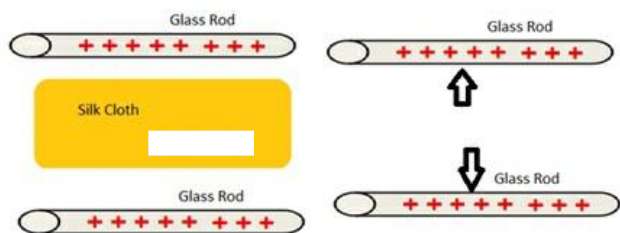
- The straw is **attracted** towards the glass rod.

Analysis

- Earlier, the glass rod and the straw were
- When we rubbed the **glass rod** on a piece of **silk cloth**, the **positive charges** were transferred from silk to the glass rod. Now the rod is **charged positively**.
- When the rod is brought near the **pieces of straw**, the **electric field** of the rod influences the straw and it gets **polarized** i.e. the **negative charges move near the rod and the positive charges on the other side of the rod**. And hence they **attract** each other.

Conclusions

- Static charges are produced by the **friction** between two interacting bodies
- The charges exert a force on each other - **Unlike charges attract each other**



Experiment

- Rub 2 glass rod with a piece of silk cloth
- Bring the two glass rods closer

Observation

- **They repel each other.**

Analysis

- Earlier, the glass rods were
- When we rubbed the glass rods on a piece of silk cloth, the positive charges were transferred from **silk to the glass rods**. Now the rods are charged **positively**.
- When 2 such glass rods are brought closer, **they repel each other**.

Conclusions

- Static charges are produced by the **friction** between two interacting bodies

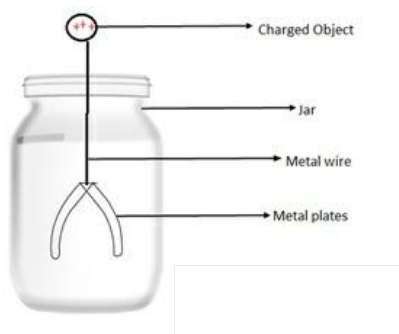
Like charges repel each other

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Electroscope

It is an instrument used to detect **electric charges**. A simple electroscope can be constructed as follows.

- Take a **glass container**.
- Insert a **metal wire** inside it.
- To the ends of the wire, which are inside the jar **attach 2 metal plates** (say aluminium plates).
- The **other end** is outside the glass container is connected or brought in contact with **charged body**.



The electroscope **detects** charge in the following way:

- A **charged object** is brought in contact with **the open end of the wire**.
- The charges are transferred via the **wire which is a good conductor of electricity**
- The aluminium plates also get charged and since they are similarly charged, **they repel and move away from each other**
- This confirms the presence of charge on the body.

Grounding & Discharging

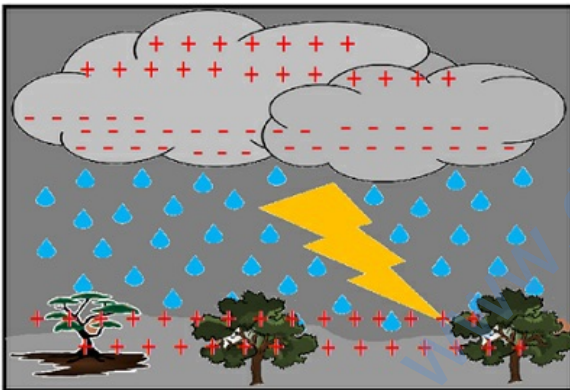
If the **charged body** was brought close to the **electroscope** and then, we **simultaneously** touch the **metal plates with your hand**, then this would cause the charges to **flow through your body** (your body is a good conductor of electricity) to the **ground**. This is called **grounding**. The plates no longer repel because their charges are '**discharged**' to the ground because of **grounding**.

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Lightning

Now that we have studied about charges and its properties, let us look at lightning. We can see that lightning is also caused due to static electricity.

- During a rain, **the air currents move upwards** and **water droplets** (in the form of rain) moved **downwards**.
- In this process, the charges also gets separated i.e. **the positive charges accumulate near the upper layers of the clouds** and the **negative charges accumulate near the lower layers**.
- On the ground, **positive charges accumulate**.
- The magnitude of these **charges grow larger and larger** with time and intense rainfall.
- Under such circumstances, **air** (which normally is a poor conductor of electricity), **loses its resistance to electricity and begins to conduct**.
- When **the air begins to conduct**, the **positive charges on the ground**, **meets the negative charges on the cloud** and **streaks of light is produced**. This light is an **electric discharge** and we see and call this as **Lightning**.
- The process of electric discharge can occur between clouds and earth surface or even between 2 clouds because ultimately we are looking at an interaction **between + and - charges**.



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Safety during lightning

Do's during lightning

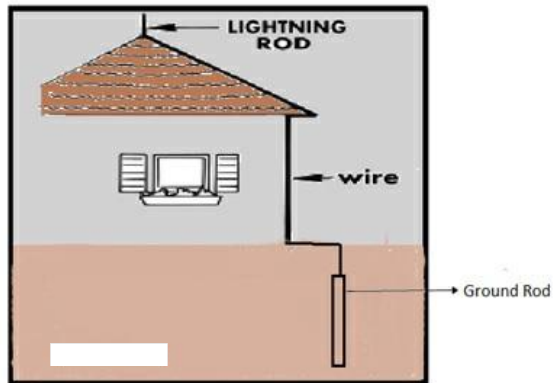
- **Rush to a safe place** Generally, a lightning is preceded by thunder which serves as an alert to hide in closed buildings.
- A house **or a building or a car with closed windows** and doors is a safe place to take shelter during a lightning.
- If you don't find a place to hide, just **squat on the ground** or hide under shorter trees.

Don'ts during lightning

- During a lightning, **no open place is safe** because for obvious reasons as explained above. There could be current discharge right over your head or body. You could be the medium of conduction for the charges. **So avoid open fields & open terraces**
- **Open vehicles** like a motorbike, scooter and also open cars is
- **Never stand under tall trees** and tall buildings.
- **Don't carry umbrellas**
- Don't **lie down** on the ground
- **Avoid bathing during thunderstorms** to avoid contact running water which can conduct electric charges.
- **Avoid contact with metal wires** telephone cords, electrical wires since these can conduct the charges.



Lightning Conductors



- It is a **device used in building during construction** to protect the buildings from the effect of **lightning**.
- A **metallic rod** is erected along the walls of the **building during construction** such that the **tip is protruding outwards at the top of the building**
- The **top end is in air** and is not in touch with any metallic surface.
- The **other end is buried in the ground**
- When a lightning strikes, **this provides a direct path for the charges to discharge to the ground, thereby not affecting anybody.**

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Earthquakes

An earthquake is a sudden shaking or tremors on the surface of earth lasting for a very short time but causing major devastation to human life and property.



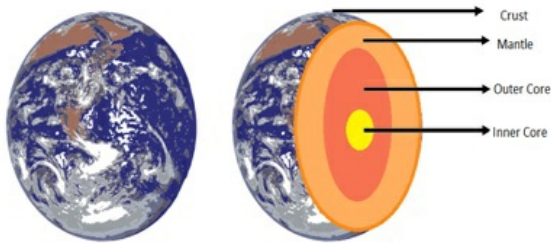
Although, the surface of the earth tends to shake mildly frequently, earthquakes of large magnitude which cause devastation are quite rare.

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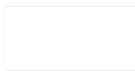
Causes of an earthquake

Causes of an earthquake

The surface of the earth is not one smooth piece. It is fragmented into pieces called **Plates** which are always in **motion**. When one plates **rubs or slides over another** it causes an earthquake.



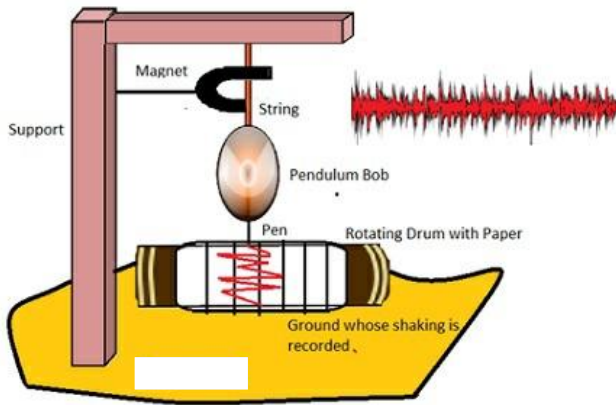
Plates on Earth Surface



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Measurement of Earthquake

A device called **Seismograph** is used to record seismic waves produced during earthquakes on the surface of the earth. The purpose is to measure the motion or movement of ground during an earthquake.



- Seismographs are generally connected to **bedrocks which are considered comparatively more stable** to earthquakes than buildings, other concrete structures, trees etc.
- In order to ensure that the seismograph itself is stable and does not shake, we **tie a heavy weight (like a pendulum shown here)** to the seismograph body.
- When the **ground shakes**, the **pendulum shakes** and the **pen begins to write on the paper on the rolling drum**. As the drum rotates, the pen **continues to write like a waveform**.
- Then the **waveform** which is similar to what is shown in the figure is analysed to determine the **magnitude of earthquake**.
- The power of an earthquake is expressed in terms of a magnitude on a scale called **Richter scale**.
- **Destructive earthquakes generally have a magnitude of greater than 7 or 7.5**. Earthquakes of magnitude 5-7 are moderate and below 5 are small or negligible.

Protection against earthquakes



- In seismic areas, houses have to be built such that they are '**Quake Safe**'. Special care has to be taken for this purpose.
- During earthquakes, there are changes that fire might erupt and worsen the condition. So, buildings need to take **precautionary fire fighting measures**.
- **Mud/Timber is lighter** and it is preferred over heavy construction material.
- **Roofs need to be as light** as possible to minimise the damage in case of a fall.
- While designing interiors, we should take care that **cupboards are fixed to the wall** so that they don't fall easily.
- Similarly, hang photo frames, clocks and other design **articles on the wall** such that they don't fall on people.
- **Don't stand under heavy** and tall objects, buildings, power lines, trees etc. If you are driving, please move towards open spaces.
- If you are at home, **take protection under a table**.
- If you are in bed, **cover your head with a pillow**. In seismic areas, beds should not be near heavy objects.
- Beware of falling objects and protect your head with a bag/coat or pillow.
- Don't use elevators.

Seismic regions

The earthquake prone regions are called as **seismic or fault zones**. Some of seismic regions are Kashmir, Bhuj, Western and Central Himalayas, most of the regions in North-East, Rann of Kutch, Rajasthan, Nepal etc

Recent earthquakes

- 2015 Nepal (Magnitude-8.8) and some parts of North Eastern India.
- 2014 China (Magnitude - 6.2)
- 2013 Pakistan (Magnitude-7.7)
- 2012 Philippines(Magnitude-8.6)
- 2010 Haiti (Magnitude-8.8)
- 2005 India (Magnitude-8.6)