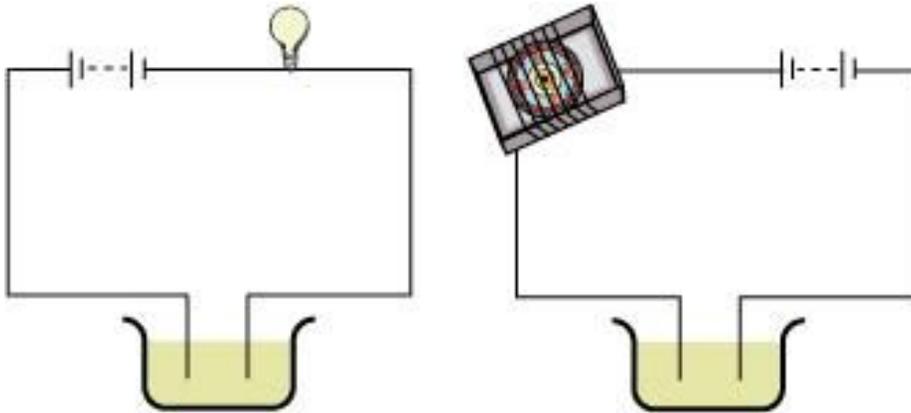


Electricity



- The bulb will glow or the magnetic needle will show deflection if the liquid in the beaker is a good conductor of electricity.
- Greater the deflection of needle or brighter the light, better is the conductivity of the liquid.

Good conductor	Poor conductor
Lemon Juice	Coal tar
Vinegar	Distilled water
Acid solutions	Honey
Basic solutions	Vegetable oil
Salty water	Kerosene

- Conducting liquids are also called electrolytes.
- The electric current passing through a conducting liquid (electrolyte) causes chemical reactions (electrolysis).
- Electric potential: The Electric potential of a point in an electric field is defined as the work to be done to move a unit positive charge from infinity to that point.
- Potential difference: The potential difference between two separate points is defined as the work done to move a unit positive charge from one point

to another.

$$V = \frac{W}{Q}$$

Unit: Volt

$$1 \text{ Volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}}$$

$$\boxed{1 \text{ V} = 1 \text{ J C}^{-1}}$$

- **Electric power:** Electric power is defined as the rate of consumption of energy or simply the rate of doing work.

$$P = VI = I^2 R = \frac{V^2}{R}$$

- **SI unit of power is watts (W)**
- **1 kWh is the commercial unit of electric energy.**
 - **1 Unit** – $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$
- $1 \text{ W} = 1 \text{ V} \times 1 \text{ A}$

1. Electricity produced in a power station is transmitted for industrial and domestic uses with the help of transformers, wires, towers, etc.

2. After generating electricity, a power transformer is used, at heavy load, for its transmission.

3. At the initial stage of power transmission a step-down transformer is used to step-down (decrease) the voltage of electricity.

4. In an electric line, energy is lost in the form of heat. This loss is known as **transmission loss**.

5. Energy loss in the form of heat, during the transmission of electricity is minimal when the electricity is transmitted at a high voltage for a given power. This is because at high voltage, the current flowing through the wire is minimal.

6. Heat loss in the transmission network depends on the following three factors:

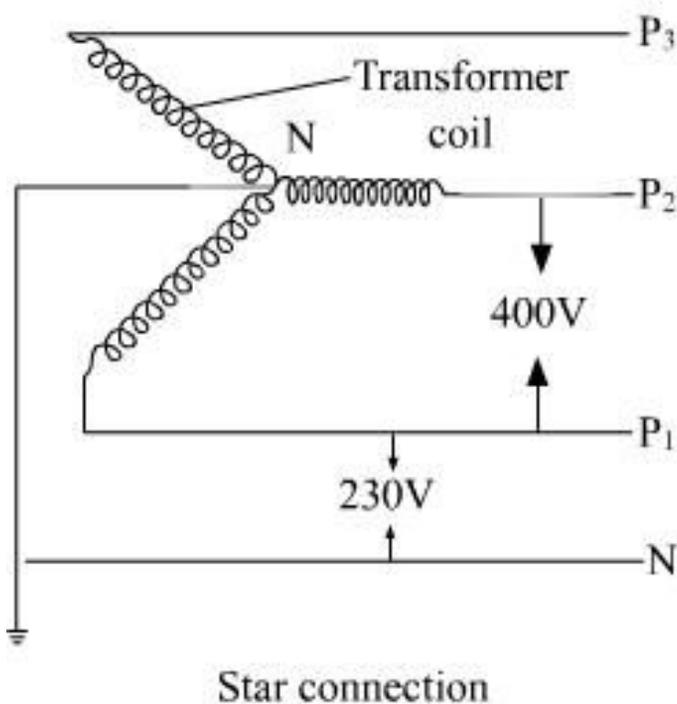
(i) Magnitude of the electric current flowing through the wires

(ii) Resistance of the wires

(iii) Time for which current is flowing

7. At the last stage of transmission, a distribution transformer is used for the distribution of electricity at low voltage. This voltage is less than 33 kilo volts for industrial purposes and around 220V for domestic purposes.

8. Wires are connected in star mode connection in the secondary coil of the distribution transformer for three phase line.



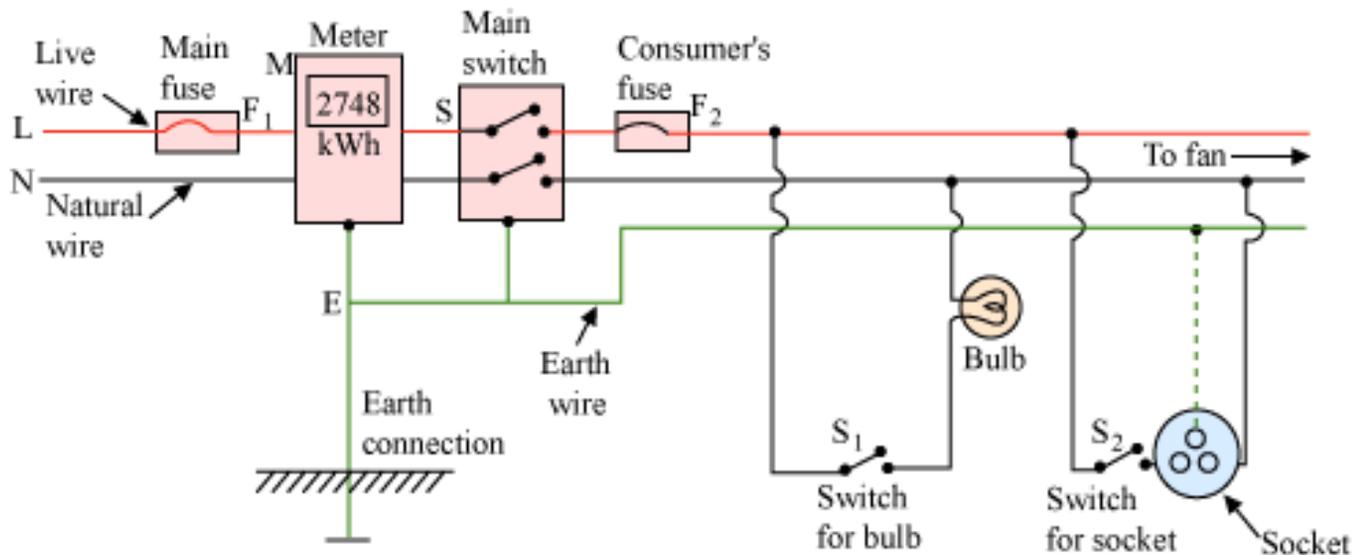
We get four lines out of the distribution transformer; three phase lines and one neutral line.

From this distribution system, we can see that P₃ and N line are used for the domestic purpose

- **Domestic wiring**

Electricity is transferred to our homes through a pair of wires consists of a red colour wire (called **live wire, L**), and a black colour wire (called **neutral wire, N**). In addition to these wires, a green colour wire known as the **Earth wire, E** is also connected with the circuit. In India, 220 V

potential is supplied through live wire, while neutral wire has ground potential of zero volts.



- **Switches:** It is a device which is connected in the live wire so as to turn 'ON' or 'OFF' the current in the circuit.

Types of switches:

- 1) Single pole switch:
 - 2) Double pole switch:
- Fuse is the most important safety device, used for protecting the circuit due to short-circuiting or overloading of the circuit.

Characteristic of electric fuse

- Fuse wire has low melting point. It is generally made up of an alloy of lead and tin.
- Fuse wire is always connected in the series with the live wire. Its resistance is higher than that of the copper wires. So it gets heated up much faster than the copper wire when excessive current flows through it.
- Current rating of the fuse wire decides its thickness. More the current rating of the fuse wire, more will be its thickness.
- Objects get charged when rubbed with another material.

Objects that get charged	Material used for rubbing
--------------------------	---------------------------

Refill	Polythene, woollen cloth
Balloon	Polythene, woollen cloth, dry hair
Eraser	Wool
Steel spoon	Polythene, woollen cloth
Ebonite comb	Dry hair, silk cloth
Glass rod	Woollen cloth, silk cloth

- Rubbing induces electrical charge.
- Charges are of two type:
 - Positive charge
 - Negative charge
- Like charges repel each other.
- Opposite charges attract each other.
- Charge generated by rubbing is static-charge.

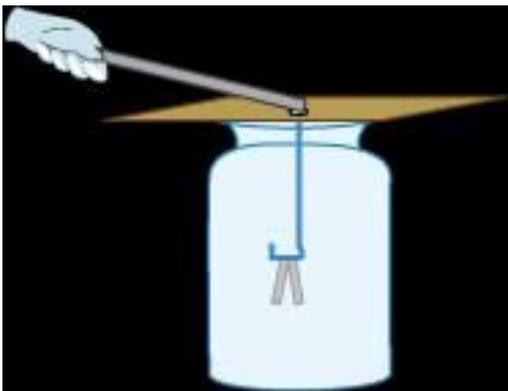
Modern theory of electrification

- The free electrons transfer from one body to another on rubbing, making one body positive and the other negative.
- Conductors – Allow current to flow through them; have large number of free electrons
- Insulators – Do not allow the current to flow through them; few free electrons
- Gold Leaf Electroscope (G.L.E.)—Used for detecting whether a body is charged or not; cannot identify nature of charge
- Materials which allow electric current to pass through them are called **conductors** of electricity.
- Materials which do not allow electric current to pass through them are called **insulators**.
- Differences between Conductors and Insulators:

Electrical conductors	Electrical insulators
Electricity can pass through certain	Electricity cannot pass through

materials. These materials are known as electrical conductors.	certain materials. These materials are known as electrical insulators.
All metals (for example, aluminium, copper, iron, and steel) are good conductors of electricity. Therefore, electrical wires are made up of metals such as aluminium and copper.	Few examples of good electrical insulators are plastic, wood, glass, and rubber. Therefore, plastic or rubber is often used to cover electrical wires.

- Conductors and insulators are equally important for us.
- Electric charge can be transferred from a charged object to another through a conductor.
- **Earthing** is a process of transferring charge from a charged object to the earth.
- Removing charge from a charged body is known as **discharging**.
- Buildings are provided with earthing so that in case of leakage of an electrical charge, people inside the building are not affected, and the charge is transferred to the ground safely.
- Electroscope is used to detect whether an object is charged or not.
- A simple electroscope



- It cannot detect the nature of charge.

- Pith-ball electroscope and the gold-leaf electroscope are two classical types of electroscopes.
- The static charge in the clouds is the cause of lightning.
- Generally lower portion of clouds get negatively charged and positive charge is induced on the objects below the cloud.
- When a huge amount of charge builds up, the insulating property of air breaks down which results in discharging of charge to the earth surface.
- The electrical discharge that causes lightning may take place between two clouds or between a cloud and the Earth.