

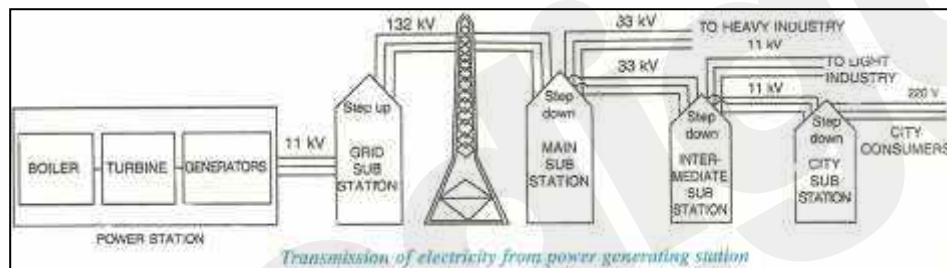
X PHYSICS SHORT NOTES

9. Household Circuits

A) TRANSMISSION OF POWER & HOUSE WIRING

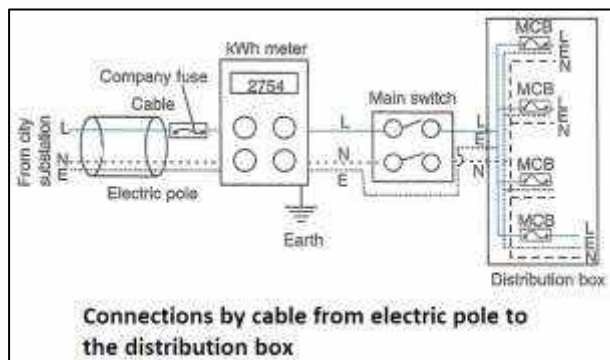
➤ Transmission of power from the generating station to the consumer:

- Electric power is generated at the power generating stations, located far from the areas where it is consumed.
- **For a given electric power:**
 - The current becomes low at high voltage and
 - Thus the loss of energy due to heating ($= I^2RT$) in line wires become less.



- **At the generating station:** The electric power is generated at **11,000 volt (or 11 kV)**
- **At grid sub-station:** The alternating voltage generated is first stepped up from **11kV to 132kV** using the step up transformer.
- **At main sub-station:** The voltage is stepped down from **132kV to 33 kV** using the step down transformer.
- **At intermediate sub-station:** The voltage is stepped down from **33kV to 11kV** using a step down transformer.
- **At the city sub-station:** The voltage is further stepped down from **11kV to 220V** using the step down transformer to supply to the domestic consumers.

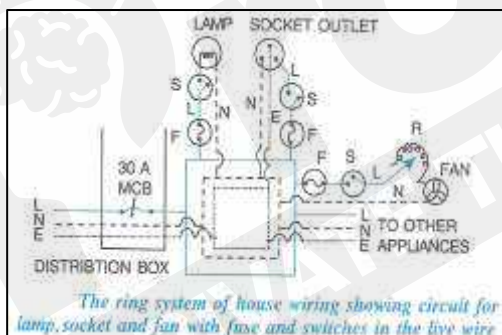
➤ Power distribution to a house:



- **Power supply from city substation to a house is done with:**
 - Overhead wires
 - Cable on poles or
 - Underground cable
- **Connection from electric pole to the distribution box in a house:**
 - The live or phase wire carries current from the source to the distribution board.
 - The neutral wire is for the return path of the current.
 - The neutral and the earth wire are connected together at the local sub-station so that the neutral and the earth wire are at the same potential of 0 V.
 - **Sequence of connection:** The cable from the pole - pole fuse – kWh meter – local earthing and Main fuse – Main switch – distribution box with MCB or ELCB.

➤ **House wiring (ring system):**

- **Definition:** Ring system is the system of house wiring in which, a wire from the main fuse box, runs around each room of the house connecting every appliance separately with the live wire of the ring, through a separate fuse and separate switch and then returns to the distribution box again.
- **The ring system: (Every appliance in parallel)**



- **Advantages of ring system:**
 - The current can travel to an individual appliance through two separate paths, hence the wire used for main ring is of a lower current carrying capacity, which reduces the cost of wiring considerably.
 - The plugs and sockets used are all of the same size, but each has its own fuse of suitable rating for specific appliances.
 - Each appliance has a separate fuse, hence due to any fault if fuse of one appliance burns off, it does not affect the working of the other appliances.
 - **While installing a new appliance in a room:**
 - A new line up to the distribution box is not required.
 - The appliance can be directly connected to the ring circuit in any room.
 - **Precaution:** Total load on a ring circuit should not exceed the main fuse rating of 30A.

B) SOME ESSENTIAL COMPONENTS OF HOUSE WIRING SYSTEM.

➤ Fuse – nature and functions:

- **Definition:** An electric fuse is a safety device which limits the current in an electric circuit so as to safeguard the circuit and the appliances connected in that circuit.
- **Principle:** A fuse works on the principle of heating effect of current.
- **Material used as fuse:**
 - A fuse is a short piece of wire made up of a material having **high resistivity** and **low melting point**.
 - A fuse wire is made of an **alloy of lead and tin**.
 - A copper wire is **unsuitable** for use as fuse wire.
- **Types of fuse:**
 - Common fuse.
 - Cartridge type fuse.
- **MCB: (Miniature Circuit Breaker):** They switch off the circuit in a very short duration in case of short circuiting or some fault causing heavy current to flow in the line.

➤ Switches:

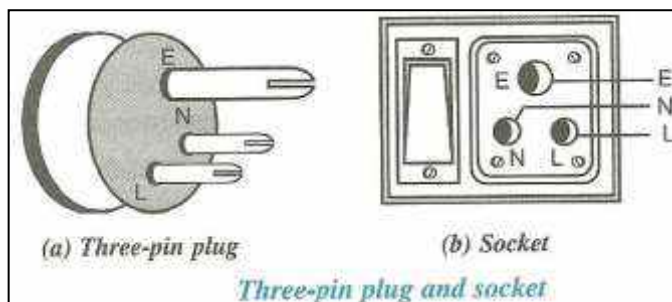
- **Definition:** A switch is an on-off device which is connected in the live wire, to start or stop the current in a circuit/ appliance.
- **Types of switches:** Single pole switch and Double pole switch.

➤ Earthing: There are two types of earthing: local and appliance earthing.

- **Local earthing:** The local earthing is connecting all appliances of a household to the earth, near the kWh meter, in a building/house.
- **Earthing of an appliance:** The earth wire of the cable is connected to the earth terminal of an appliance for earthing.

➤ Three pin plug and socket:

- **Three-pin plug:** Plug is a fixture provided in an appliance having three metallic (brass) pins in an ebonite case.



- **Socket:** A socket is a fixture to insert a plug in an electric circuit.

- **Safety precautions while using the electricity:** The two major dangers while using electricity are (1) fire and (2) electric shock.

- **Colour coding of a wire in a cable:**

- Each electric appliance is provided with 3 – core cable.
- The insulation is provided with different colours as under:

WIRE	COLOUR	
	Old convention	New convention
Live	Red	Brown
Neutral	Black	Light blue
Earth	Green	Green or yellow

- **High tension wires:**

- **Definition:** A high tension wire is a special wire having **low resistance** and **large surface area**, used for transmission of heavy current at high voltage.
- It is made by twisting together a number of thin wires insulated from each other.
 - **Reason:** To provide a large surface area compare to a single thick wire.
- It has low resistance.
 - **Reason:** To allow a heavy current at heavy voltage to pass through it easily.
- It has a large surface area.
 - **Reason:** To radiate the heat produced more readily into the surroundings.