

Board – ICSE

Class – 10

Topic – Electric power and household circuit

1. Write an expression for the electrical power spent in flow of current through a conductor in terms of

(a) Resistance and potential difference, (b) current and resistance.

Answer:

(a) Electrical power, $P = V^2/R$

(b) Electrical power, $P = I^2R$

2. State and define the household unit of electricity.

Answer:

The household unit of electricity is kilowatt-hour (kWh).

One kilowatt-hour (kWh) is the electrical energy consumed by an electrical appliance of power 1 kW when it is used for one hour.

3. Distinguish between kilowatt and kilowatt-hour.

Answer:

Kilowatt is the unit of electrical power whereas kilowatt-hour is the unit of electrical energy.

4. What do you mean by power rating of an electrical appliance? How do you use it to calculate the resistance of the appliance.

Answer:

An electrical appliance such as electric bulb, geyser etc. is rated with power (P) and voltage (V) which is known as its power rating. For example: If an electric bulb is rated as 50W-220V, it means that when the bulb is lighted on a 220 V supply, it consumes 50 W electrical power.

5. An electric bulb is rated '100 W, 250 V'. What information does this convey?

Answer:

It means that if the bulb is lighted on a 250 V supply, it consumes 100 W electrical power (which means 100J of electrical energy is converted in the filament of bulb into the light and heat energy in 1 second).

6. Calculate the current through a 60 W lamp rated for 250 V. If the line voltage falls to 200 V, how is the power consumed by the bulb affected?

Answer:

Given,

Power, $p = 60 \text{ w}$

Voltage, $v = 250 \text{ v}$

As power, $P = VI$

$$I = \frac{60}{250} = 0.24 \text{ A}$$

$$\text{Resistance of bulb } R = \frac{V^2}{p} = \frac{250^2}{60} = 1041.6 \Omega$$

Now if voltage falls to 200 v, power consumes will be

$$p = \frac{V^2}{R} = \frac{200^2}{1041.6} = 38.4 \text{ W}$$

7. A bulb of 40 W is used for 12.5 h each day for 30 days. Calculate the electrical energy consumed.

Answer:

Energy consumed per day, $E = p \times t$

$$= 40 \times 12.5$$

$$= 500 \text{ wh}$$

Energy consumed for 30 days

$$E = 500 \times 30 = 15000 \text{ wh} = 15 \text{ kwh}$$

8. A current of 0.2 A flows through a wire whose ends are at a potential difference of 15 V.

calculate:

(i) the resistance of the wire and

(ii) the heat energy produced in 1 minute.

Answer:

Given,

Current, $I = 0.2 \text{ A}$

Potential difference, $v = 15 \text{ v}$

Time, $t = 60 \text{ sec}$

As $v = IR$

$$(a) R = \frac{15}{0.2} = 75 \Omega$$

(b) Heat energy, $H = I^2 Rt$

$$H = (0.2)^2 \times 75 \times 60$$

Or $H = 180 \text{ J}$

9. Water in an electric kettle connected to a 220 V supply took 5 minutes to reach its boiling point. How long would it have taken if the supply voltage had fallen to 200 V?

Answer:

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

$$\text{Heated gained} = \left(\frac{V^2}{R} \right) \times t$$

$$\left(\frac{V_1^2}{R} \right) \times t_1 = \left(\frac{V_2^2}{R} \right) \times t_2$$

$$t_2 = \left(\frac{V_1}{V_2} \right)^2 \times t_1$$

$$= \left(\frac{220}{200} \right)^2 \times 300 = 363 \text{ s} = 6.05 \text{ min}$$

10. A geyser is rated 1500 W, 250 V. This geyser is connected to 250 V mains.

Calculate:

- (i) the current drawn
- (ii) the energy consumed in 50 hours, and
- (iii) the cost of energy consumed at Rs. 4.20 per kWh

Answer:

Given,

Power of geyser, $p = 1500 \text{ w}$

Voltage, $v = 250 \text{ v}$

(i) Current, $I = \frac{P}{V}$

$$I = \frac{1500}{250} = 6 \text{ A}$$

(ii) Time, $t = 50 \text{ h}$

Energy, $E = p \times t$

$$= 1500 \times 50 = 75000 \text{ wh} = 75 \text{ kwh}$$

(iii) Cost per unit of energy = Rs. 4.20

$$\text{Cost for 75 kwh of energy} = 4.20 \times 75 = \text{Rs. 315}$$

11. (a) Name the three connecting wires used in a household circuit
(b) Which of the two wires mentioned in part (a) are at the same potential?
(c) In which of the wire stated in part (a) the switch is connected?

Answer:

- (a) The three connecting wires used in a household circuit are:
(i) Live (or phase) wire (L),
(ii) Neutral wire (N), and
(iii) Earth wire (E).
(b) Among them neutral and earth wires are at the same potential.
(c) The switch is connected in the live wire

12. State the function of each of the following in a house circuiting?

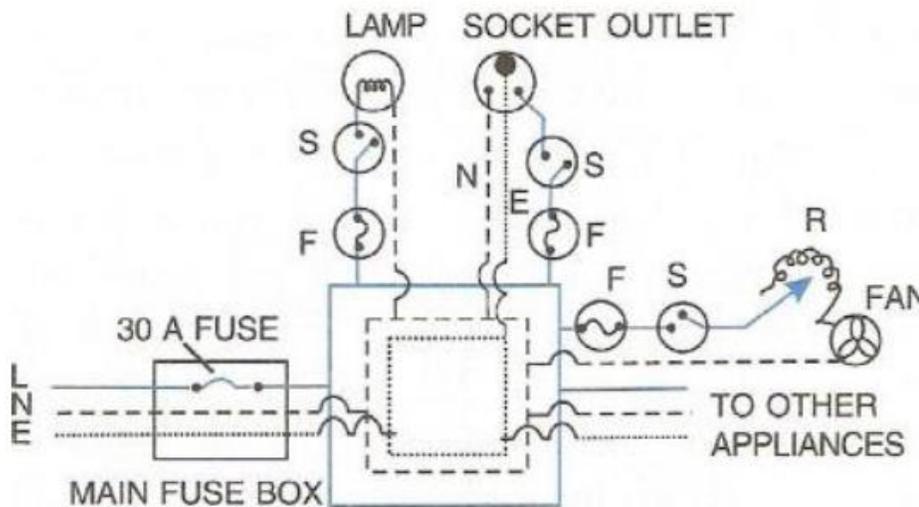
- (a) kWh meter (b) main fuse, and (c) main switch

Answer:

- (a) After the company fuse, the cable is connected to a kWh meter and from this meter; connections are made to the distribution board through a main fuse and a main switch.
(b) Main fuse is connected in the live wire and in case of high current it gets burnt and cut the connections to save appliances.

(c) Main switch is connected in the live and neutral wires. It is used to cut the connections of the live as well as the neutral wires simultaneously from the main supply.

13. Draw a labelled diagram with necessary switch, regulator, etc. to connect a bulb and a fan with the mains. In what arrangement are they connected to the mains: series or parallel?



These appliances are connected to the mains in a parallel arrangement.

14. Two sets A and B of four bulbs each are glowing in two separate rooms. When one of the bulbs in set A is fused, the other three bulbs also cease to glow. But in set B, when one bulb fuses the other bulbs continue to glow. Explain the difference. In set A, the bulbs are connected in series.

Answer:

Thus, when the fuse of one bulb blows off, the circuit gets broken and current does not flow through the other bulbs also.

In set B, the bulbs are connected in parallel. Thus, each bulb gets connected to its voltage rating ($= 220\text{ V}$) and even when the fuse of one bulb blows off, others remain unaffected and continue to glow.

15. What is a fuse? Name the material of fuse. State on characteristic of material used for fuse.

Answer:

An electric fuse is a safety device, which is used to limit the current in an electric circuit. The use of fuse safeguards the circuit and appliances connected in that circuit from being damaged.

An alloy of lead and tin is used as a material of fuse because it has low melting point and high resistivity.

16. A fuse is always connected to the live wire of the circuit. Explain the reason.

Answer:

The fuse wire is always connected in the live wire of the circuit because if the fuse is put in the neutral wire, then due to excessive flow of current when the fuse burns, current stops flowing in the circuit, but the appliance remains connected to the high potential point of the supply through the live wire. Now if a person touches the appliance, he may get a shock as the person will come in contact with the live wire through the appliance.