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PRACTICE PAPER – 08 SOLUTION

CLASS X PHYSICS | TOPIS : ELECTRICITY

Date : 28/04/20 | MM :25

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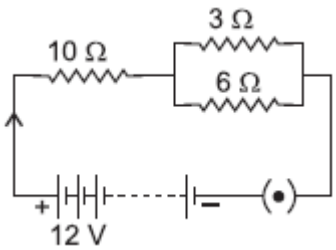
1 Consider the circuit shown in the diagram. Find the current in 3 Ω resistor. 3



ANS: 3 Ω and 6 Ω are in parallel. ∴

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$$

$$R_P = 2\ \Omega$$

R_P and 10 Ω are connected in Series. So, $R_S = R_P + R_3 = 2 + 10 = 12\ \Omega$ Total current in the circuit,

$$I = \frac{V}{R_S} = \frac{12}{12} = 1\ \text{A}$$

P.d across $R_P = IR_P = 1 \times 2 = 2\ \text{V}$

So, p.d. across $3\ \Omega = 2\ \text{V}$

Current through 3 Ω, $I_1 = \frac{V}{R_1} = \frac{2}{3} = 0.67\ \text{A}$

2 A student boils the water in an electric kettle for 20 minutes after being switched on. Using the same mains supply, he wants to reduce the boiling time of water. To do so, should he increase or decrease the length of the heating element? Justify your answer. 3

ANS: To reduce the boiling time of water, using the same mains supply, the rate of heat production should be large. We know that P = $\frac{V^2}{R}$ 'clearly R should be decreased. Since R ∝ l, therefore, the length of heating element should be decreased.

3 An electric geyser rated 1500 W, 250 V is connected to a 250 V line mains.
Calculate :
(i) the electric current drawn by it. 3
(ii) energy consumed by it in 50 hours.
(iii) cost of energy consumed if each unit costs ₹ 6.00.

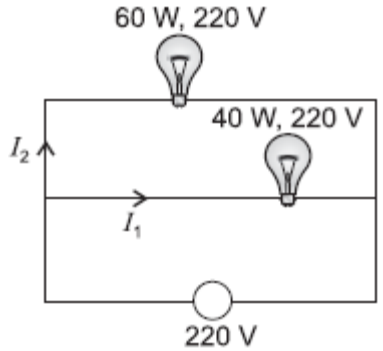
ANS: Given : P = 1500 W, V = 250 V

(i) Current drawn, I = $\frac{P}{V} = \frac{1500}{250} = 6\ \text{A}$ (ii) Electric energy consumed by geyser in 50 hours = Power × time
= 1500 × 50 = 75000 Wh = 75 kWh
Since
1 kWh = 1 unit
So, energy consumed = 75 units.
(iii) Cost of one unit = ₹6.00
∴ Cost of 75 units = ₹75 × 6.00 = ₹450.00

4 An electric bulb of resistance 200 Ω draws a current of 1 Ampere. Calculate the power of the bulb, the potential difference at its ends and the energy in kWh consumed in burning it for 5h. 3

ANS: Power of the bulb,
$P = I^2R = (1)^2 \times 200$
⇒ P = 200 W
Energy consumed by bulb in 5h in burning = Power × Time = 200 × 5 = 1000 Wh = 1 kWh

5 Two lamps, one rated 60 W at 220 V and the other 40 W at 220 V, are connected in parallel to the electric supply at 220 V.
(a) Draw a circuit diagram to show the connections.
(b) Calculate the current drawn from the electric supply. 3
(c) Calculate the total energy consumed by the two lamps together when they operate for one hour.



ANS: (a) (b) Current drawn by 40 W lamp: $I_1 = \frac{P}{V} = \frac{40}{220} = \frac{2}{11}$ A Current drawn by 60 W lamp: $I_2 = \frac{60}{220} = \frac{3}{11}$ A Total current drawn from the electric supply $I = I_1 + I_2 = \frac{2}{11} + \frac{3}{11} = \frac{5}{11}$ A = 0.45 A (c) Total energy consumed in one hour = 60 × 1 + 40 × 1 = 100 Wh = 0.1 kWh

6 (a) Write two point of difference between electric energy and electric power.
(b) Out of 60 W and 40 W lamps, which one has higher electrical resistance when in use. 5
(c) What is the commercial unit of electric energy? Convert it into joules.

ANS: (a) Difference between electric energy and electric power:

Electrical energy	Electric power
(i) The work done or energy supplied by the source in maintaining the flow of electric current is called electrical energy. It appears in the form of heat given by $H = VIt = \frac{V^2t}{R} = I^2RT$ (ii) It is equal to the product of power and time $E = P \times t$ (iii) Its SI unit is joule (J) 1 J = 1 W × 1s	(i) The time rate at which electric energy is consumed or dissipated by an electrical device is called electric power and is given by $P = VI = \frac{V^2}{R} = I^2R$ (ii) It equal to the rate of doing work by an energy source. $P = \frac{W}{t}$ (iii) Its SI unit is watt (W) 1 W = 1 J s^{-1}

(b) For the same applied voltage, $P \propto \frac{1}{R}$ or $R \propto \frac{1}{P}$

i.e. less the power of electrical device, higher is its electrical resistance.

Therefore, a 40 W lamp has higher electrical resistance when in use.

(c) Kilowatt hour – Commercial unit of electrical energy

$$1 \text{ kWh} = 1000 \text{ Wh} = 1000 \frac{J}{S} \times 3600 \text{ sec} = 3600000 \text{ J} = 3.6 \times 10^6 \text{ J}$$

7 An electric geyser consumes 2.2 'units' of electrical energy per hour of its use. It is designed to work on the mains voltage of 220 V.

(a) What is the 'power-rating' of this device?

(b) What is the current flowing through this device when it is connected across the 'mains'? 5

(c) What is the 'resistance' of this device?

(d) Does the resistance of this device remain constant during its operation/working?

(e) Cost of energy consumed if each unit cost ₹ 6.00.

ANS:

(i) Using $\text{Power } (P) = \frac{\text{Electrical energy dissipated } (E)}{\text{Time } (t)}$

$$\Rightarrow \quad P = \frac{E}{t} = \frac{2.2 \times 1000 \text{ Wh}}{1 \text{ h}} = 2200 \text{ W}$$

$\therefore$ Power rating = 2200 W – 220 V

(ii) Current, $I = \frac{P}{V} = \frac{2200}{220} = 10 \text{ A}$

(iii) Resistance, $R = \frac{V^2}{P} = \frac{220 \times 220}{2200} = 22\ \Omega$

(iv) No, Resistance increases with the increase in temperature.

(v) Cost of energy consumed per hour = Number of electrical unit × Cost per unit = 2.2 × ₹ 6 = ₹ 13.2