Practice Challenge - Subjective

Subject: Phy

Topic : Electricity Exam Preparation 1

Class: X

Time: 00:20 hrs

1. Which uses more energy, a 250 W TV set in 1 h, or a 1200 W toaster in 10 minutes?

   Energy used by 250 W TV set in 1 h = 250 W $\times$ 1h = 250 Wh

   Energy used by 1200 W toaster in 10 min. (i.e., $\frac{1}{6}$ h) = 1200 W $\times$ ($\frac{1}{6}$) h = 200 Wh

   Thus, a 250 W TV set uses more power in 1 h than a 1200 W toaster in 10 minutes.

2. Explain:
   Why are the conductors of electric heating devices, such as bread-toasters and electric irons, made of an alloy rather than a pure metal?

   The conductors of electric heating devices such as bread toasters and electric irons are made of alloy because the resistivity of an alloy is more than that of metals which produces a large amount of heat. Also, the alloys do not oxidize easily at even at higher temperatures. Alloy does not melt readily or get deformed.

3. Why do we use tungsten filament in bulb or lamps ?

   Incandescent bulb works on the heating effect of currecnt.
   Tungsten has a high melting point (3380°C) and becomes incandescent (i.e., emits light at a high temperature) at 2400 K.
   Because of very high melting point tungsten doesn't melt. That's why in bulb or lamps we use tungsten filament.

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4. In a premise, 5 bulbs each of 100 W, 2 fans each of 60 W, 2 A.Cs each of 1.5 kW are used for 5 h per day. Find:

(a) total power consumed per day,

(b) total power consumed in 30 days.

(c) total electric energy consumed in 30 days.

(d) the cost of electricity at the rate of Rs 6.25 per unit.

Power consumed by
5 bulbs = 5×100 = 500 W
2 fans = 2×60 = 120 W
2 A.C = $2 \times 1.5 \times 1000$ = 3000 W

(a) Total power consumed per day = 3620 W

(b) Total power consumed in 30 days, P = $30 \times \frac{3620}{1000}$ = 108.6 kw

(c) Electric energy is used for 5 h per day.
Total electrical energy consumed in 30 days =$P \times t$ = 108.6×5 = 543 kWh

(d) Cost of electricity = Total electrical energy consumed (in kWh) x Cost of 1 unit (1 kWh) = 543×6.25 = Rs. 3393.75

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5. Several electric bulbs designed to be used on a 220 *V* electric supply line, are rated 10 W. How many lamps can be connected in parallel with each other across the two wires of 220 *V* line if the maximum allowable current is 5 A?

Resistance R_1 of the bulb is given by the expression,
Supply voltage, V = 220 V
Maximum allowable current, I = 5 A
Rating of an electric bulb, P = 10 Watts
Because $R = \frac{V^2}{P}$
$R_1 = \frac{(220)^2}{10} = 4840\Omega$
According to Ohm's law, V = IR
Let R is the total resistance of the circuit for X number of electric bulbs.
R = $\frac{V}{I} = \frac{220}{5} = 44\Omega$
Resistance of each electric bulb, $R_1 = 4840\Omega$
$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots . upto\ X\ times.$
$\frac{1}{R} = \frac{1}{R_1} \times X$
$X = \frac{R_1}{R} = \frac{4840}{44} = 110$
∴ Number of electric bulbs connected in parallel are 110.

6. Two lamps, one rated 100 W at 220 V, and the other 60 W at 220 V, are connected in parallel to an electric mains supply. What current is drawn from the line if the supply voltage is 220 V?

Both the bulbs are connected in parallel.
Therefore, the potential difference across each of them will be 220 V, because no division of voltage occurs in a parallel circuit.
Current drawn by the bulb of rating 100 W is given by,
$Power = Voltage \times Current$
$Current = \frac{Power}{Voltage} = \frac{100}{220} A$
Current drawn by the bulb of rating 60 W is given by,
$Power = Voltage \times Current$
$Current = \frac{Power}{Voltage} = \frac{60}{220} A$
Hence, current drawn from the line = $\frac{100}{220} + \frac{60}{220} = 0.727A$

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7. An electric heater of resistance 8Ω draws 15 A from the service mains 2 hours. Calculate the rate at which heat is developed in the heater.

   Rate of heat produced by a device is given by the expression for power as,
   $P = I^2R$
   Where, resistance of the electric heater, $R = 8\Omega$
   Current drawn, I = 15 A
   $P = (15)^2 \times 8 = 1800J/s$
   Therefore, heat is produced by the heater at the rate of 1800 J/s.

8. What is the role of fuse, used in series with any electrical appliance? Why should a fuse with defined rating not be replaced by one with a larger rating?

   A fuse in a circuit prevents damage to the appliances and the circuit due to overloading. The use of an electric fuse prevents the electric circuit and the appliance from a possible damage by stopping the flow of unduly high electric current. The Joule heating that takes place in the fuse melts it to break the electric circuit. If a fuse with a defined rating replaced by one with a larger rating, then the joule heating fails to melt the fuse and hence, the circuit is not broken. This results in burning of the appliance.