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Q1.

Electrical energy consumed by an electrical appliance depends on:

1. Power rating of the appliance.
2. Time for which the appliance is used.

Q2.

60 watt bulb, because power is inversely proportional to the resistance.

Q3.

Kilowatt-hour is the commercial unit of electric energy.

Q4.

$$V = 220 \text{ V}, P = 100 \text{ W}$$

$$R = ?$$

We know that

$$P = V^2/R$$

Thus

$$R = V^2/P = 220^2/100 = 484 \text{ ohm}$$

Q5.

(i) joule

(ii) watt

Q6.

(i) Electric power

(ii) Electric energy

Q7.

Electric power has the unit of watt.

Q8.

kWh is the short form of kilowatt-hour, which is the commercial unit of electrical energy.

Q9.

$$P = V^2/R$$

R is fixed.

V becomes double.

$$\text{Now, } P = (2V)^2/R = 4 V^2/R$$

So, the electric power becomes four times its previous value.

Q10.

Other information is that it will consume energy at the rate of 36 J/s.

Q11.

$$P = 920 \text{ W}, V = 230 \text{ V}, I = ?$$

We know that

$$P = V \times I,$$

$$920 = 230 \times I$$

$$I = 920/230 = 4 \text{ amp}$$

Q12.

When an electrical appliance consumes electrical energy at the rate of 1 joule per second, its power is said to be 1 watt.

$$1 \text{ watt} = 1 \text{ volt} \times 1 \text{ ampere.}$$

Q13.

One watt hour is the amount of electrical energy consumed when an electrical appliance of 1 watt power is used for 1 hour.

$$1 \text{ watt hour} = 3600 \text{ joules.}$$

Q14.

$I = 5 \text{ amp}$, $R = 100 \text{ ohms}$, $t = 2\text{h}$

We know that

Electric energy consumed $= P \times t = I^2 R t$

$$= 5^2 \times 100 \times 2$$

$$= 5000 \text{ Wh}$$

$$= 5 \text{ kWh}$$

We know that $1\text{kWh} = 3.6 \times 10^6 \text{ J}$

Therefore, $5\text{kWh} = 5 \times 3.6 \times 10^6 \text{ J} = 18 \times 10^6 \text{ J}$

Q15.

$V = 220\text{V}$, $I = 0.5\text{amp}$, $P = ?$

We know that

$$P = VI = 220 \times 0.5$$

$$P = 110 \text{ watt}$$

Q16.

(i) $R = 300 \text{ ohm}$, $I = 1 \text{ A}$, $t = 1\text{h}$

$$P = I^2 R = 1^2 \times 300 = 300 \text{ W}$$

$$E = P \times t = 300 \times 1 = 300 \text{ Wh}$$

(ii) $R = 100 \text{ ohm}$, $I = 2 \text{ A}$, $t = 1\text{h}$

$$P = I^2 R = 2^2 \times 100 = 400 \text{ W}$$

$$E = P \times t = 400 \times 1 = 400 \text{ Wh}$$

Hence, in case (ii), the electrical energy consumed per hour is more.

Q17.

$V = 220\text{V}$, $P = 2.2 \text{ kW} = 2200 \text{ W}$, $t = 3\text{h}$

We know that

Electrical energy consumed $= P \times t = 2.2 \times 3 = 6.6 \text{ kWh}$

We have, $P = V \times I$

$$2200 = 220 \times I$$

$$I = 10\text{amp}$$

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Q18.

Case 1:

Power, $P_1 = 60\text{W}$

Number, $n_1 = 2$

Time for use, $t_1 = 4\text{h}$ everyday

Electrical energy consumed everyday, $E_1 = n_1 \times P_1 \times t_1$

$$= 2 \times 60 \times 4 = 480 \text{ Wh} = 0.48\text{kWh}$$

Electrical energy consumed in 30 days $= 30 \times 0.48 = 14.4\text{kWh}$

Case 2:

Power, $P_2 = 100\text{W}$

Number, $n_2 = 3$

Time for use, $t_2 = 5\text{h}$ everyday

Electrical energy consumed everyday, $E_2 = n_2 \times P_2 \times t_2$

$$= 3 \times 100 \times 5 = 1500 = 1.5\text{kWh}$$

Electrical energy consumed in 30 days $= 30 \times 1.5 = 45\text{kWh}$

Total electrical energy consumed in 30 days $= 14.4\text{kWh} + 45\text{kWh} = 59.4\text{kWh}$

Q19.

$V = 250\text{V}$, $I = 0.4\text{amp}$

(i) We know that

Power $= VI = 250 \times 0.4 = 100\text{watt}$

(ii) We have

$$P = I^2 R$$

$$100 = 0.4^2 \times R$$

$$R = 625\text{ohm}$$

Q20.

Given

$$P=4\text{kw}, V=220\text{v}$$

(a) $I=?$

$$\text{Power}=VI=250I$$

$$4000=250I$$

$$I=16\text{amp}$$

(b) $R=?$

$$P=I^2R$$

$$P=16^2XR$$

$$R=4000/16^2$$

$$R=15.25\text{ohm}$$

(c) Energy consumed in two hour= PXt

$$=4X2$$

$$=8\text{kw-hr}$$

(d) If $1\text{kwh}=\text{Rs } 4.6$

$$\text{total cost}=8 \times 4.6=\text{Rs } 36.8$$

Q21.

$$I=5\text{amp}, V=220\text{volt}, t=2\text{h}$$

$$P=?, E=?$$

$$P=VI$$

$$=220X5$$

$$=1100\text{watt}$$

$$=1.1\text{kW}$$

Energy consumed, $E=PXt$

$$=1.1X2$$

$$=2.2\text{kWh}$$

Q22.

Case 1: TV set

$$P=250\text{W}=0.25\text{kWh}$$

$$t=1\text{h}$$

$$\text{Energy consumed}=PXt=0.25X1=0.25\text{kWh}$$

Case 2: Toaster

$$P=1200\text{W}=1.2\text{kW}, t=10\text{min}=10/60=1/6\text{h}$$

$$\text{Energy consumed}=PXt=1.2X(1/6)=0.2\text{kWh}$$

Thus, TV uses more energy.

Q23.

(i) $V=6\text{volt}$, $R_1=1\Omega$, $R_2=2\Omega$

Equivalent resistance $= R_1 + R_2 = 1 + 2 = 3\Omega$

Total current, $I = \frac{V}{R} = \frac{6}{3} = 2\text{A}$

Current through $R_2 = I_2 = I = 2\text{A}$

Voltage across $R_2 = V_2 = I_2 R_2 = 2 \times 2 = 4\Omega$

Power used in $R_2 = I_2 V_2 = 2 \times 4 = 8\text{W}$

(ii) $V=4\text{volt}$, $R_1=12\Omega$, $R_2=2\Omega$

Voltage across $R_2 = V_2 = V = 4\text{V}$

Current across $R_2 = I_2 = \frac{V_2}{R_2} = \frac{4}{2} = 2\text{A}$

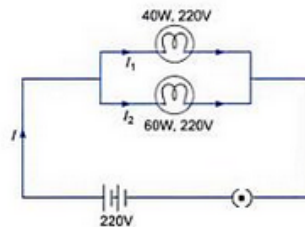
Power used in $R_2 = I_2 V_2 = 2 \times 4 = 8\text{W}$

Q24.

Given 2 lamps: $P_1=40\text{W}$, $P_2=60\text{W}$

$V=220\text{V}$

(a)



(b) Voltage across both the bulbs is same and is equal to 220V .

Current through 40W lamp $= I_1 = P_1/V = 40/220\text{A}$

Current through 60W lamp $= I_2 = P_2/V = 60/220\text{A}$

Total current drawn from the electric supply $= 40/220 + 60/220 = 0.45\text{A}$

(a) Energy consumed by 40W lamp in 1hr , $E_1 = P_1 \times t = 40 \times 1 = 40\text{Wh}$

$1\text{Wh} = 3.6\text{kJ}$

$E_1 = 40 \times 3.6 = 144\text{kJ}$

Energy consumed by 60W lamp in 1hr , $E_2 = P_2 \times t = 60 \times 1 = 60\text{Wh} = 216\text{kJ}$

Total energy consumed $= 144 + 216 = 360\text{kJ}$

Q25.

Given $V=230\text{V}$, $I=10\text{amp}$

(a) $P=VI$

$P=230 \times 10$

$P=2300\text{watt} = 2300\text{J/s}$

(b) Energy consumed in minute $= P \times t = 2300\text{J/s} \times 60\text{s} = 138000\text{J}$

Q26.

For heater:

$P=2\text{kW}$, $t=4\text{h}$

$E=P \times t = 2 \times 4 = 8\text{kWh}$

For TV:

$P=200\text{W}=0.2\text{kW}$, $t=4\text{h}$

$E=P \times t = 0.2 \times 4 = 0.8\text{kWh}$

Lamps:

$P=100\text{W}=0.1\text{kW}$, $t=4\text{h}$, $n=3$

$E=n \times P \times t = 3 \times 0.1 \times 4 = 1.2\text{kWh}$

Total energy consumed $= 8 + 0.8 + 1.2 = 10\text{kWh}$

Cost of $1\text{kWh} = \text{Rs. } 5.50$

Cost of $10\text{kWh} = \text{Rs. } 5.50 \times 10 = \text{Rs. } 55$

Q27.

$$\begin{aligned}
 I &= 13 \text{ amp, } V = 230 \text{ V} \\
 \text{Power} &= VI \\
 &= 230 \times 13 \\
 &= 2990 \text{ W} \\
 P &= 2.99 \text{ kW}
 \end{aligned}$$

Q28.

$$\begin{aligned}
 \text{Given :- } V &= 230 \text{ V, } I = 0.4 \text{ amp} \\
 \text{Rate at which electric energy is transferred} &= \text{Power} \\
 \text{Power} &= V \times I \\
 &= 230 \times 0.4 \\
 &= 92 \text{ W} = 92 \text{ J/s}
 \end{aligned}$$

Q29.

(a) The rate at which electrical work is done or the rate at which electrical energy is consumed, is known as electric power.

It is given by

$$P = VI = \text{watt}$$

(b) Given: $V = 3 \text{ V}$, $I = 0.5 \text{ amp}$

(i) $R = ?$

We know that $V = IR$
 $3 = 0.5R$

$$R = 6 \text{ ohms}$$

(ii) Power of lamp $= VI$

$$= 3 \times 0.5$$

$$= 1.5 \text{ watt}$$

(c) One kilowatt hour is the amount of electrical energy consumed when an electrical appliance having a power rating of 1 kilowatt is used for 1 hour.

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

(d) Given $P = 500 \text{ W} = 0.5 \text{ kW}$, $t = 20 \text{ hr}$

We know that

$$\text{Energy consumed} = P \times t = 0.5 \times 20$$

$$= 10 \text{ kWh}$$

$$\text{Total cost} = 10 \times \text{cost per unit}$$

$$\text{Cost per unit} = \text{Rs. } 3.9 \text{ per unit}$$

$$\text{Therefore, total cost} = 10 \times 3.9 = \text{Rs } 39$$

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Q41.

By reducing the length of element the resistance will decrease.
 Power is inversely proportional to resistance. So, this will result in more consumption of energy.

Q42.

(a) Lamp; because least current is flowing through it.

(b) Large current drawn by the kettle; Earth connection needed.

(c) We know that

$$P = VI$$

$$V = 240 \text{ V, } I = 8.5 \text{ A}$$

$$P = 240 \times 8.5 = 2040 \text{ W} = 2.04 \text{ kW}$$

(d) When connected to 240 V supply, $P = 2040 \text{ W}$

$$R = V^2/P = 240^2/2040$$

$$R = 28.23 \text{ ohm}$$

Now, when $V = 120 \text{ V}$, $R = 28.23 \text{ ohm}$

$$I = V/R = 120/28.23 = 4.25 \text{ A}$$

Q43.

(a) 42919

(b) 42935

(c) $42935 - 42919 = 16$ units

(d) 24 hours

(e) Cost of 1 unit = Rs. 5

$$\text{Cost of 16 units} = 16 \times 5 = \text{Rs. } 80$$

Q44.

$$P = 10 \text{ W, } V = 220 \text{ V, } I = 5 \text{ A}$$

We know that

$$P = VI$$

$$= 220 \times 5$$

$$P = 1100 \text{ W}$$

$$\text{Power of one bulb} = 10 \text{ W}$$

Total no. of bulbs that can be connected = $1100/10 = 110$
Q45.

Let resistance of each lamp = R ohms.

Case 1: Parallel connection

$$\text{Resultant resistance} = \frac{1}{\frac{1}{R} + \frac{1}{R}} = \frac{R}{2}$$

$$\text{Electric power consumed } P_1 = \frac{V^2}{R} = \frac{220^2}{R/2} = \frac{96800}{R}$$

Case 2: Series connection

$$\text{Resultant resistance} = R + R = 2R$$

$$\text{Electric power consumed } P_2 = \frac{V^2}{2R} = \frac{24200}{R}$$

$$\therefore \frac{P_1}{P_2} = \frac{96800}{R} \bigg/ \frac{24200}{R} = \frac{4}{1}$$

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