Q1- A lightbulb designed to operate in a 120.0 V circuit has a resistance of 192 ohms. At what rate does the bulb use electric energy?

The potential difference V between two points is the amount of work done (energy supplied) per coulomb charge to take it from one point (lower potential) to the other (higher potential). When a current is flowing from high potential to low potential through a wire and a charge ΔQ will flow in time Δt then the energy supplied to it will be

$$\Delta U = \Delta Q * V$$

And hence the power delivered is given by

$$P = \frac{\Delta U}{\Delta t} = \frac{\Delta Q}{\Delta t} * V = V * I$$

Hence the power dissipated in a resistor R is given by using Ohm's law (V = I*R)

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

Thus, the power rating of the bulb will be given by

$$P = \frac{V^2}{R} = \frac{120^2}{192} = 75 \text{ W}$$

Q2- What is the monthly energy cost of leaving a 60 W bulb on continuously if electricity costs Rs 3.0 per kWh?

Kilo watt hour (kWh) is the unit of energy generally taken for the electricity consumed. It is the energy consumed at a rate of one kilowatt (1000 W) in one hour. And hence

Energy = power*time

1 kWh = (1000 W) *(3600 s) = $3.6*10^6$ J

Now our bulb of power 60 W is on for time one month, hence the energy consumed in one month is given by

U = power*time

Or U = (60 W) *(1*30*24*3600 s) = $60*2.592*10^6 = 1.5552*10^8$ J

Hence the energy consumed in kWh is given by

$$U = \frac{1.5552*10^8}{3.6*10^6} = 43.2 \text{ kWh}$$

Thus, the monthly cost will be

43.2*3.0 = 129.6 Rs