Electrical Power:

The rate at which electrical energy is dissipated into other forms of energy is called electrical power i.e.

$$P=Wt=Vi=i_2R=V_2R$$

(1) Units : It's S.I. unit is Joule/sec or Watt Bigger S.I. units are KW, MW and HP, remember 1 HP = 746 Watt

(2) Rated values : On electrical appliances (Bulbs, Heater, Geyser ... etc.). Wattage, voltage, ... etc. are printed called rated values e.g. If suppose we have a bulb of 40 W, 220 V then rated power

$$(P_R)=40W$$

while rated voltage

$$(V_R)=220V$$

.

(3) Resistance of electrical appliance : If variation of resistance with temperature is neglected then resistance of any electrical appliance can be calculated by rated power and rated voltage i.e. by using

$$R=V_{2R}P_R$$

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(4) Power consumed (illumination) : An electrical appliance (Bulb, heater, .. etc.) consume rated power

$$(P_R)$$

only if applied voltage

$$(V_A)$$

is equal to rated voltage

$$(V_R)$$

i.e. If

$$V_A=V_R$$

So

$$P_{consumed}=P_R$$

. If

$$V_A<V_R$$

then

$$P_{consumed}=V_{2A}R$$

also we have

$$R = V_{2R} P_R$$

so

$$P_{Consumed}(\text{Brightness}) = (V_{2A} V_{2R}).P_R$$

(5) Long distance power transmission: When power is transmitted through a power line of resistance R, power-loss will be

$$i^2 R$$

Now if the power P is transmitted at voltage V then

$$P = Vi$$

i.e. $i = (P/V)$

So,

$$\text{Power loss} = P^2 V^2 \times R$$

Now as for a given power and line, P and R are constant so

$$\text{Power loss} \propto (1/V^2)$$

So if power is transmitted at high voltage, power loss will be small and vice-versa. This is why long distance power transmission is carried out at high voltage.