The ratio between lamp power dissipation and resistor power dissipation

Theory:

For electrical circuit which consist of power source and load, the power “input or dissipated” can be calculated from the following relation:

$$\boldsymbol{P = \frac{V^2}{R}} \qquad \text{or} \qquad \boldsymbol{P = I^2 R} \qquad \text{or} \qquad \boldsymbol{P = I \times V}$$

Where ***P*** is power, ***V*** is voltage, ***I*** is current and ***R*** is load resistance. One thing to be observed in such type of circuits is that the load should have specifications match with the electrical source used in term of voltage and power. When the source voltage is 220V, the load should work exactly at that voltage. Assuming we have a lamp of 110V and we want to use it on 220V source, the circuit for this lamp should bear the voltage, this can be accomplished by introducing additional load in series (for example a resistor can bear the voltages difference¸ in condition that the current passing in the lamp is still as assumed in the first place to make sure that its output power is not changing. This can be calculated by dividing the voltage on the resistor value. The circuit resistance will dissipate an amount of power from the input power:

$$P_{in} = P_L + P_R$$

Where P_{in} the input power, P_L is the power dissipated by the lamp, and P_R is the power dissipated by the resistor.

Instruments:

- DC power supply.
- Lamp.
- Voltmeter.
- Ammeter.
- Resistors box.
- Connection wires.

Methods:

1. Connect the circuit as shown in **Figure 1**.
2. Set V_{in}= 6 volt and get maximum brightness, R_B=0.
3. Record the readings for I and V_L with changing the resistor value gradually from (1) to (6) Ohm.
4. Find V_R which:

$$V_R = V_{in} - V_L$$

5. Fill the table below, where:

$$P_L = V_L \times I \qquad \text{and} \qquad P_R = V_R \times I$$

R	V_L	I	P_L	V_R	P_R

6. Draw a graph for the relation between power dissipated on the lamp and power dissipated on the resistor **(Fig. 2a)**! Find the slope!
7. Draw a graph for the relation between lamp voltage and resistor voltage **(Fig. 2b)**! Find the slope!
8. What is the relation between graphs in 6 and 7.

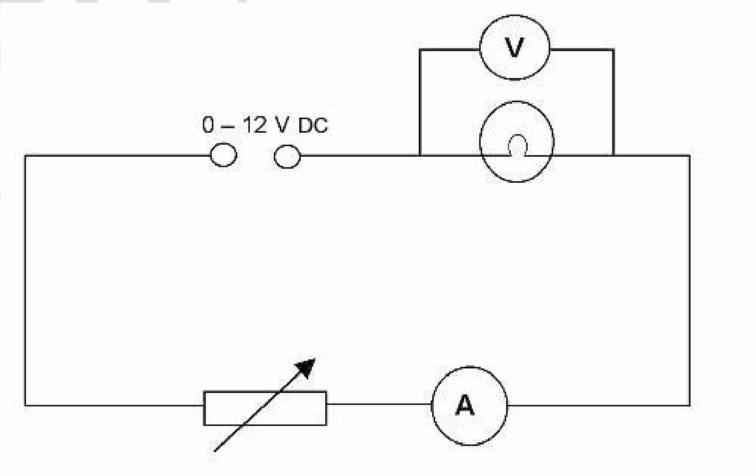

Figure 1. Lamp and resistor circuit.

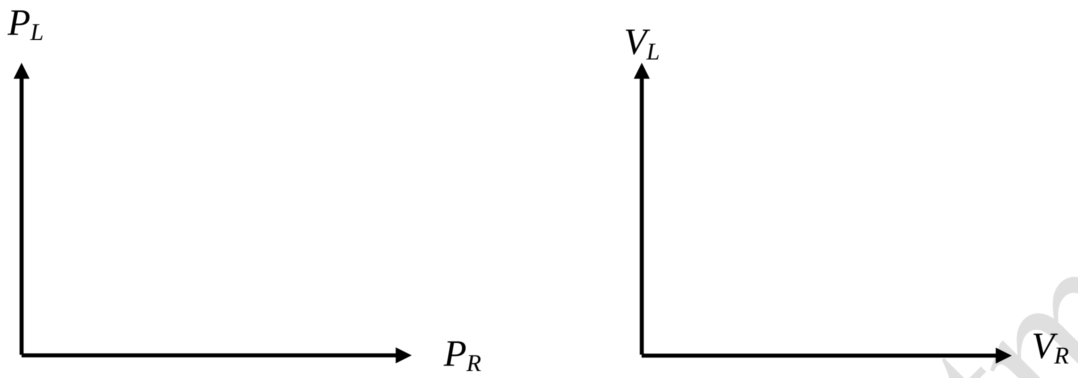

Figure 2. Relation for (a) power dissipated on the lamp and power dissipated on the resistor, (b) lamp voltage and resistor voltage.

Discussion:

Q1) What is power? What its unit?

Q2) What is the effect of changing the DC power supply by AC power supply?

Q3) Which is less power consumption, lamp on 6V DC source or 6V AC source?