4. The potential divider shown in Figure (1) provides a variable potential difference (V_{XY}) across the terminals X and Y. R is a 5 kΩ variable resistor with the sliding contact P. E is a 6 V battery with negligible internal resistance.

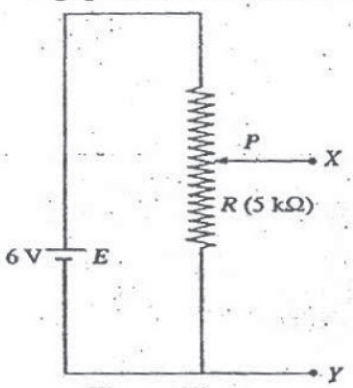


Figure (1)

(a) Following items are provided for you to plan an experiment to verify Ohm's law by using the above potential divider.

An ammeter with negligible internal resistance —Ⓐ—

A voltmeter with 10 MΩ internal resistance —Ⓥ—

A 60 Ω resistor —WW—

(i) Complete the circuit diagram in figure (1), using these items in order to obtain the circuit employed for this experiment.

(ii) Mark the positive terminals of ammeter and the voltmeter in the above circuit using the "+" sign.

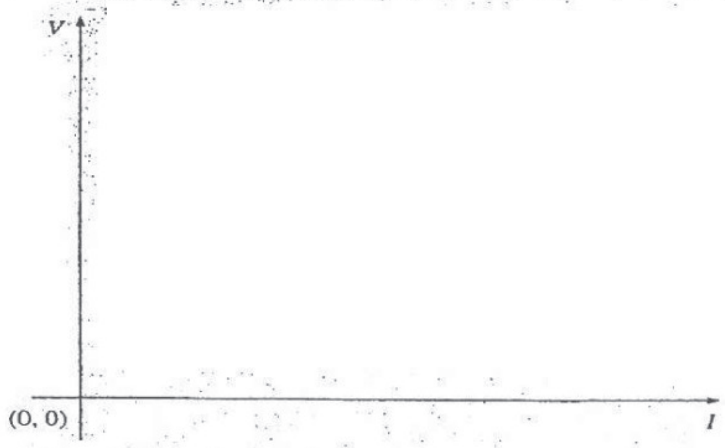
(iii) Suggest a suitable value for the full scale deflection of the ammeter.

.....

(iv) What is the advantage of using an ammeter with a full scale deflection suggested in (iii) above?

.....

(v) Draw a rough sketch of the graph that you would expect from this experiment.



(*b*) The 60 Ω resistor was then replaced by a torch bulb and the *V* versus *I* graph in figure (2) was obtained.

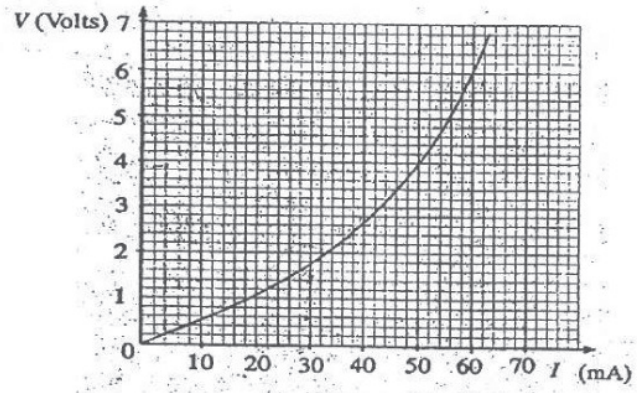


Figure (2)

(i) What is the reason for the deviation of the *I* - *V* characteristic of the filament from the Ohms law?

.....

(ii) Rating of the torch bulb is given as 6 V, 0·36 W.
Calculate the resistance of the filament of the bulb when operating at the above recommended rating.

.....

(iii) Mark the operating point of the bulb on the above curve with '×' sign when it glows with its recommended rating.

(c) A 6 V torch bulb produced by another manufacturer requires 360 mA to produce similar brightness to the bulb mentioned under (*b*) (ii).

(i) Which bulb would you prefer in your torch?

.....

(ii) What is the advantage of your selection?

.....