

2003 A/L Structured Essay Question No (04)

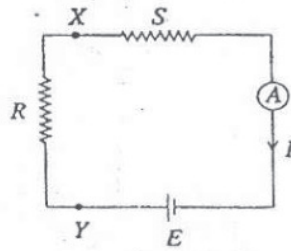


Figure 1

A resistor S , a milliammeter A and a battery E are connected in series across the points X and Y as shown in figure 1. The milliammeter has an internal resistance of $25\ \Omega$ and it requires a current of $1\ \text{mA}$ for full scale deflection. The dial of the milliammeter is shown in figure 2. The battery has an e.m.f. of $10\ \text{V}$ and a negligible internal resistance. R is any resistor connected externally between the points X and Y . Let I be the current through the milliammeter.

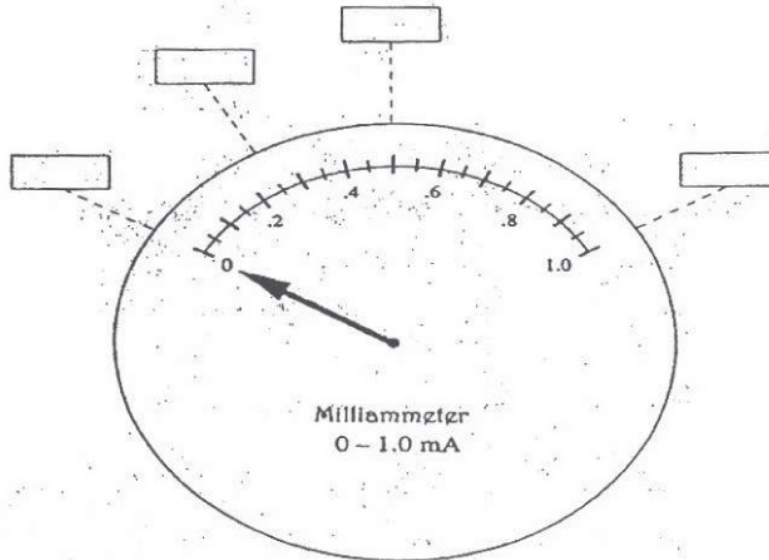


Figure 2

b) When $R = 0$, the milliammeter reads a full scale deflection ($I = 1.0\ \text{mA}$).

(i) Find the value of the resistance S .

.....

(ii) Practically how do you achieve $R = 0$?

.....

Write the above value of R (i.e. 0) in the box corresponding to the pointer position of the deflection of the milliammeter in figure 2.

(i) When $R = \infty$ (infinity), what is the current (I) through the milliammeter?

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Write the value of R (i.e. ∞) in the corresponding box in figure 2.

(ii) Practically how do you achieve $R = \infty$?

.....

What resistances of R give the following deflections of the milliammeter?

Half the full scale deflection

.....
.....

Quarter of the full scale deflection :

.....
.....

Write the above values of R also in the corresponding boxes in figure 2.

(d) If the section of the circuit with the milliammeter (i.e. section of the circuit to the right of XY) shown in figure 1 is calibrated also for other values marked in the dial of the milliammeter, this set up can be used to measure an unknown resistance. The unknown resistance is connected across X and Y and the value of the resistance can be read from the calibrated scale.

(i) Propose a suitable standard name for this set up.

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(ii) Is the milliammeter scale linear or non-linear?

.....

Is the scale calibrated to measure the resistance linear or non-linear?

.....

(iii) Draw a rough sketch to show the variation of R with I .

[Hint : You may look at the values marked in the boxes in figure 2.]

