

2000 A/L Structured Essay Question No (04)

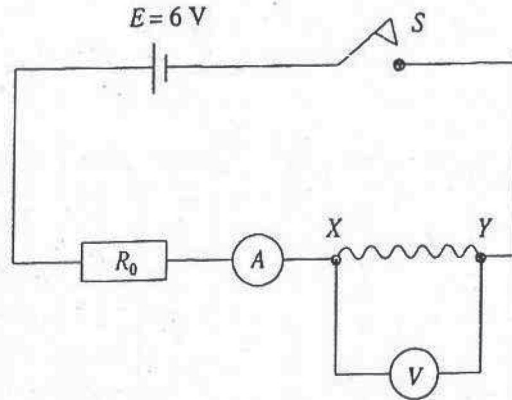


Figure shows a simple experimental arrangement to find the resistivity of a nichrome wire  $XY$ . Resistance of the wire is found to be in the order of  $100\Omega$ .  $A$  is a micro ammeter having a full scale deflection of  $100\mu\text{A}$ .  $E$  is a  $6\text{V}$  cell with negligible internal resistance.  $R_0$  is a fixed resistor, and  $V$  is a voltmeter. (Both  $A$  and  $V$  can be considered as ideal instruments).

- (a) Write down an expression relating the length  $l$ , radius  $r$  and resistivity  $\rho$  of the wire  $XY$  to its resistance  $R$ .

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- (b) In order to measure the resistance of the wire  $XY$  using the above arrangement, it is required to setup a current in the order of  $50\mu\text{A}$  through  $XY$ . If you are provided with a bunch of resistors with values  $100\Omega$ ,  $1\text{k}\Omega$ ,  $10\text{k}\Omega$ ,  $100\text{k}\Omega$ ,  $1\text{M}\Omega$  and  $10\text{M}\Omega$  what value would you choose for  $R_0$ ? Show your calculations. (Avoid lengthy calculations.)

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- (c) Voltmeters with the following full scale deflections are available for you to measure the voltage across  $XY$ .

$50\mu\text{V}$ ,  $100\mu\text{V}$ ,  $1\text{mV}$ ,  $10\text{mV}$  and  $100\text{mV}$

State the most suitable full scale deflection for the voltmeter. Show relevant calculations.

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- (d) Indicate by marking '+' and '-' signs on either side of  $A$  and  $V$  symbols in the circuit above, the proper terminal connections of the ammeter and the voltmeter.

- (e) Is there any advantage of using a low current in this experiment? Explain your answer.

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(f) In this experiment following results were obtained by a student.

Measured value of the resistance of the wire =  $105 \Omega$

Length of the wire =  $1.0 \text{ m}$

Radius of the wire =  $5 \times 10^{-5} \text{ m}$

Calculate the resistivity of the material of the wire.

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(g) If you are planning to obtain the resistivity of this wire by means of a graph, what modification would you suggest to the above experimental arrangement in order to obtain a set of readings.

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