2010 A/L Structured Essay Question No (04)

4. You are asked to investigate the variation of the resistance of a coil of a metal wire with temperature, and to determine the temperature coefficient of resistance. The coil is formed by winding the wire on a wooden rod in such a way that no two turns touch each other. A Wheatstone bridge is to be used to measure the resistance of the coil.

(*a*) Resistance of the wire at a given temperature is given by the equation

$$R_\theta = R_0 (1 + \alpha\theta)$$

All the symbols have their usual meaning. Identify all the symbols.

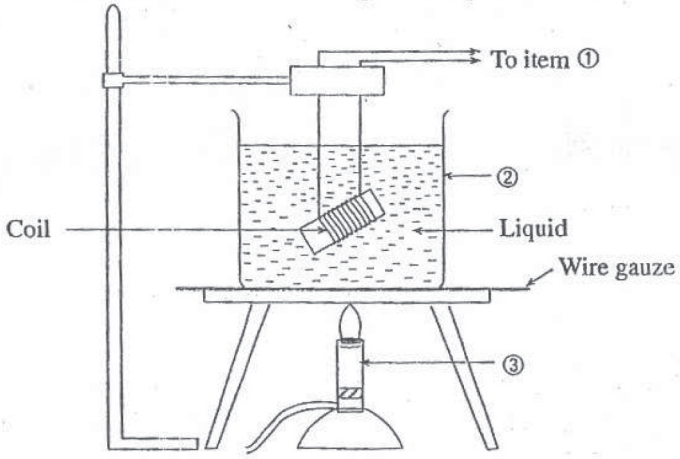
$R_\theta \equiv$ .....

$R_0 \equiv$ .....

$\alpha \equiv$ .....

$\theta \equiv$ .....

(*b*) The figure shows a rough sketch of an incomplete setup that can be used for this experiment.



(i) What are the items marked as ①, ② and ③?

① .....

② .....

③ .....

(ii) What is the main purpose of using a wire gauze when heating the liquid?

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(iii) Apart from the Wheatstone bridge arrangement and stands, two other items which are not shown in the above figure are necessary to perform this experiment. What are they?

(1) .....

(2) .....

(*c*) It has been decided to use coconut oil instead of water as the liquid in this experiment. Give **two** scientific reasons for this decision.

(1) .....

(2) .....

(*d*) A student argues that when using a Wheatstone bridge arrangement a current has to be setup through the coil, and that current may affect the accuracy of the measurements. Would you agree with this argument? (Yes/No)

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Explain your answer.

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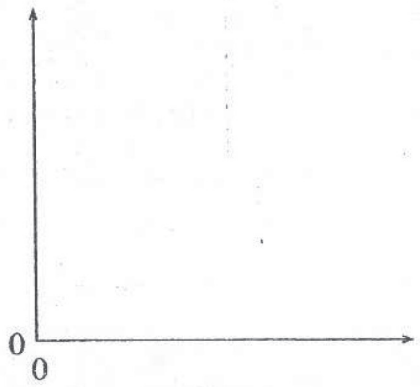
(*e*) Draw a rough sketch of a graph that shows the expected variation of the resistance of the coil with temperature. Label the axes with appropriate symbols identified in (*a*) above.



(*f*) Write down an expression for the temperature coefficient of resistance in terms of the quantities that can be **extracted from the graph** above.

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