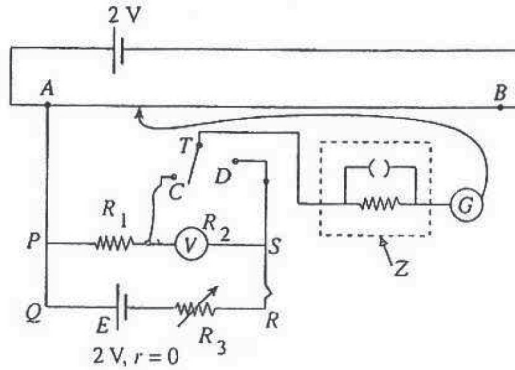


2009 A/L Structured Essay Question No (04)

You are asked to use a potentiometer to measure the internal resistance (R_2) of a voltmeter (V). Its value is known to be of the order of 1000Ω . The full scale deflection of the voltmeter, V , is 1.5 V . The experimental arrangement that is made for this purpose is shown below.



R_1 is a suitable fixed resistance and R_3 represents the resistance of a resistance box.

- What is the importance of having the circuit inside the broken lines marked as Z?
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- Show how you would connect the voltmeter V to circuit $PQRS$ properly, by labelling the polarities of the terminals of the voltmeter V with + and - in the circuit given above.
- When the circuit is connected, if you observe that the voltmeter reading tends to exceed its full scale deflection, how would you rectify this?
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- Write down the test that you would perform to check if all the components of the experimental arrangement are properly connected.
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- If the balanced length of the potentiometer wire when the switch T is connected to C and D are l_1 and l_2 respectively derive an expression relating l_1 , l_2 , R_1 and R_2 .
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- Rearrange the expression in (e) to plot a graph of l_2 versus l_1 with l_2 as the dependent variable.
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- How would you obtain a set of measurements for l_1 and l_2 in order to plot the graph?
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(h) A student has suggested another method to find the internal resistance of the voltmeter V . According to his method, the $PQRS$ section of the circuit shown above is to be isolated, and the value of R_3 is to be adjusted until the reading of the voltmeter, V becomes 1 V.

(i) If you adopt this method, write down the expression that will give the internal resistance of the voltmeter.

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(ii) Give reasons as to why this method is **not** as accurate as the potentiometer method.

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