Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 3_ElectricCircuits

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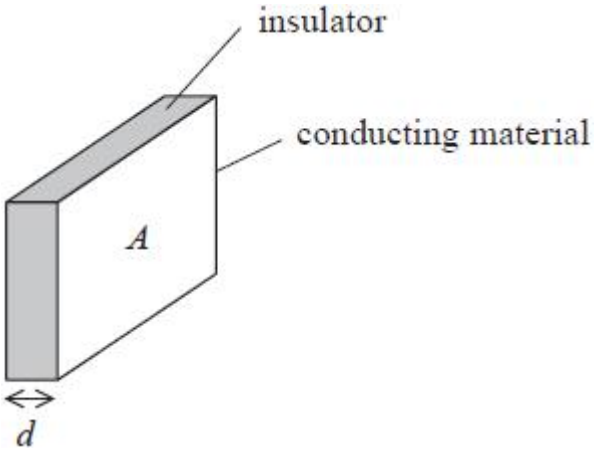
Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

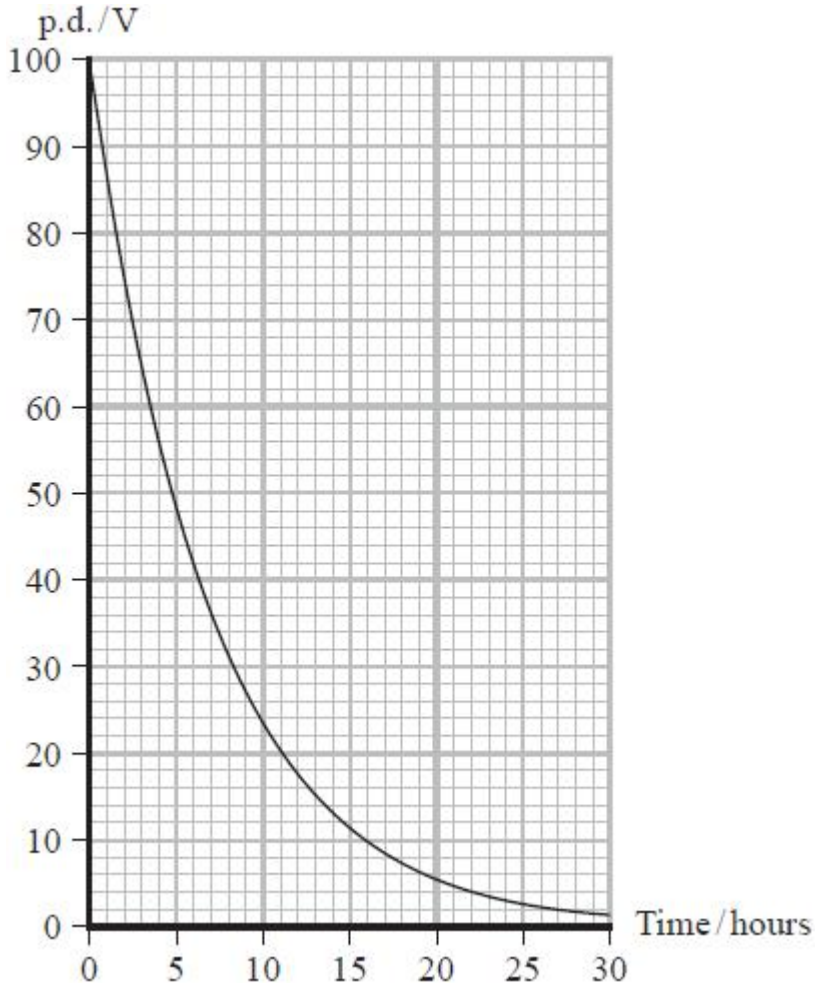
A parallel plate capacitor consists of a thin layer of insulator of thickness *d* between two plates of conducting material of area *A*.



The capacitor has a capacitance 0.1 μF and is charged to a p.d. of 100 V by connecting it to an electrical supply.

The capacitor is then disconnected from the supply and the p.d. between the two plates slowly decreases. This is because the insulator is not perfect and a small charge can flow through it.

The graph shows how the p.d. varies with time.



The insulator is a type of plastic and should have a resistivity greater than 10^{14} Ω m.

Deduce whether the plastic used in this capacitor has a resistivity greater than this value.

$A = 5.6 \times 10^{-3}$ m^2

$d = 0.6 \times 10^{-6}$ m

(5)

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(Total for question = 5 marks)

Q2.
A strain gauge measures changes in the resistance of a metal under strain to find the applied force. The kitchen balance in the photograph uses strain gauges to measure the weight of cooking ingredients.

A student tests this method by measuring the resistance of a wire before a force is applied and while it is under tension.

(a) Calculate the initial resistance of the wire.

length of wire = 1.0 m

cross sectional area of wire = 2.9×10^{-8} m^2

resistivity of wire = 4.9×10^{-7} Ω m

(2)

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Resistance of wire = ...

(b) The student applies a force to the wire and measures the new length. He calculates the increase in the resistance to be 0.035 Ω. He measures the increase in resistance and finds it to be 0.070 Ω.

The student suggests that the difference between these two values is because the cross-sectional area of the wire changes under strain.

Explain why a change in cross-sectional area would cause this difference.

(3)

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(Total for Question = 5 marks)

Q3.
A rechargeable AA cell is labelled 2.0 Ah (ampere hours), 1.2 V.

(a) Show that Ah is a unit of charge.

(2)

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(b) When charging the cell, the current is 0.19 A and the potential difference is 1.5 V for 10 hours.

Calculate the electrical energy supplied while the cell is being charged.

(2)

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Electrical energy supplied = ...

(c) The maximum charge that can be delivered from a fully charged cell is 7200 C.

Calculate the maximum energy which could be transferred by the cell if the output potential difference remained constant at 1.2 V.

(2)

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Maximum energy = ...

(d) Calculate the efficiency of the charging process.

(2)

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Efficiency = ...

(Total for Question = 8 marks)