

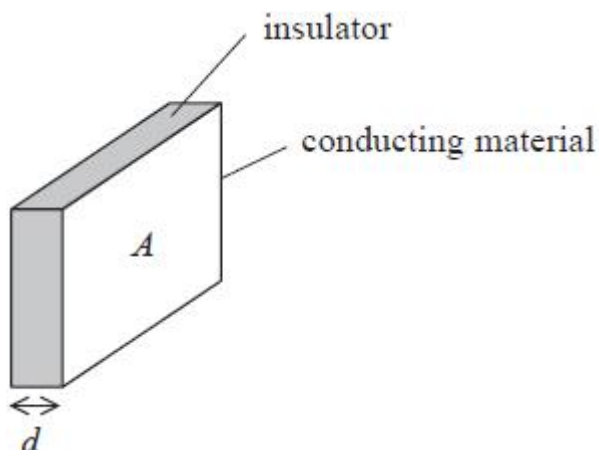
Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

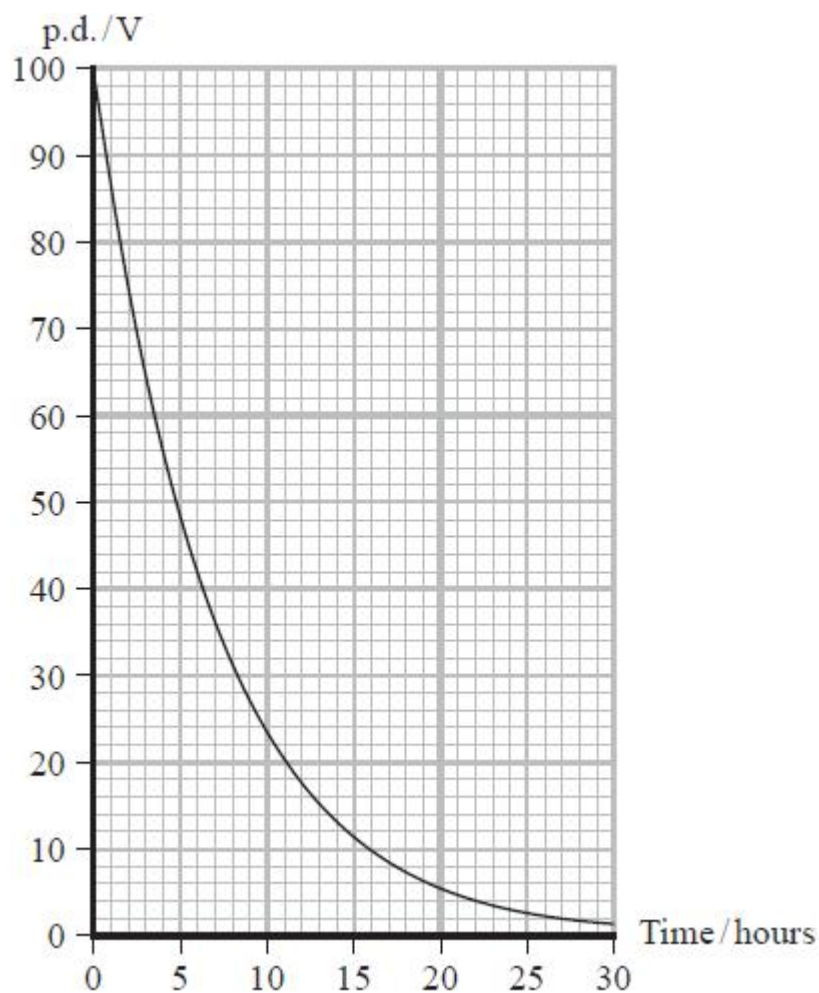
A parallel plate capacitor consists of a thin layer of insulator of thickness d between two plates of conducting material of area A .



The capacitor has a capacitance $0.1 \mu\text{F}$ 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 $10^{14} \Omega \text{ m}$.

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

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

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

(5)

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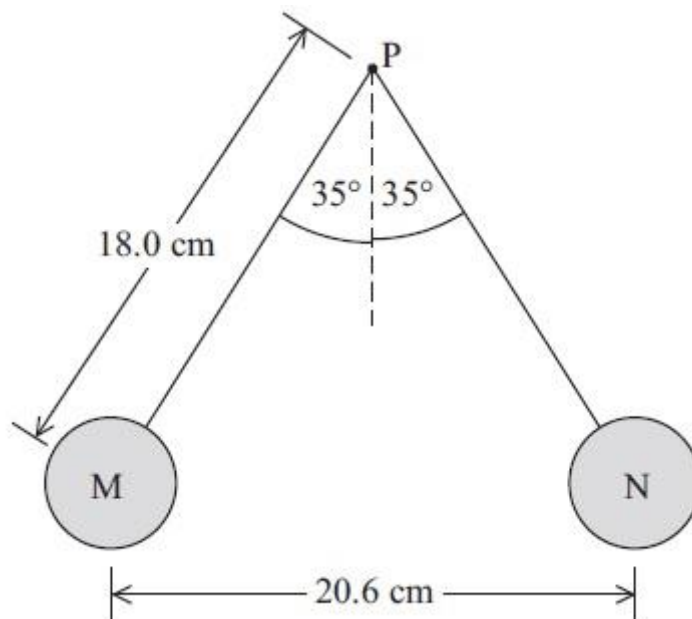
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(Total for question = 5 marks)

Q2.

Two identical table tennis balls, M and N, are attached to non-conducting threads and suspended from a point P. The balls are each given the same positive charge and they hang as shown in the diagram. The mass of each ball is 2.7 g.



(a) Draw a free-body force diagram for ball M, label your diagram with the names of the forces.

(2)



(b) (i) Show that the tension in one of the threads is about 3×10^{-2} N.

(3)

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(ii) Show that the electrostatic force between the balls is about 2×10^{-2} N.

(2)

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(iii) Calculate the charge on each ball.

(3)

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Charge =

(c) State and explain what would have happened if the charge given to ball M was greater than the charge given to ball N.

Calculate the charge on each ball.

(2)

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(Total for question = 12 marks)