Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Fields And Their Consequences(Magnetic Field)

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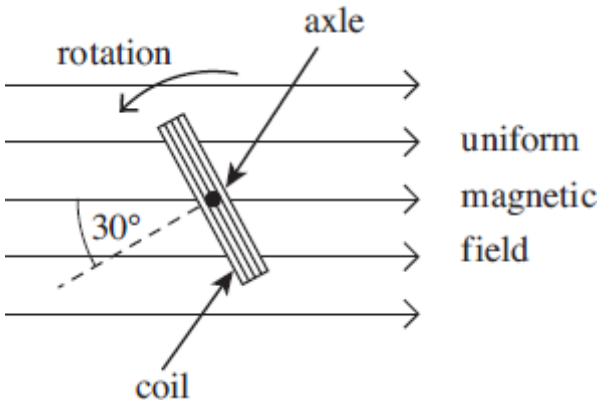
Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Q1.

A rectangular coil is rotating anticlockwise at constant angular speed with its axle at right angles to a uniform magnetic field. **Figure 1** shows an end-on view of the coil at a particular instant.

Figure 1



(a) At the instant shown in **Figure 1**, the angle between the normal to the plane of the coil and the direction of the magnetic field is 30°.

(i) State the minimum angle, in degrees, through which the coil must rotate from its position in **Figure 1** for the emf to reach its maximum value.

angle _____ degrees

(1)

(ii) Calculate the minimum angle, in radians, through which the coil must rotate from its position in **Figure 1** for the flux linkage to reach its maximum value.

angle _____ radians

(2)

(b) **Figure 2** shows how, starting in a different position, the flux linkage through the coil varies with time.

(i) What physical quantity is represented by the gradient of the graph shown in **Figure 2**?

_____

(1)

(ii) Calculate the number of revolutions per minute made by the coil.

revolutions per minute _____

(2)

Figure 2

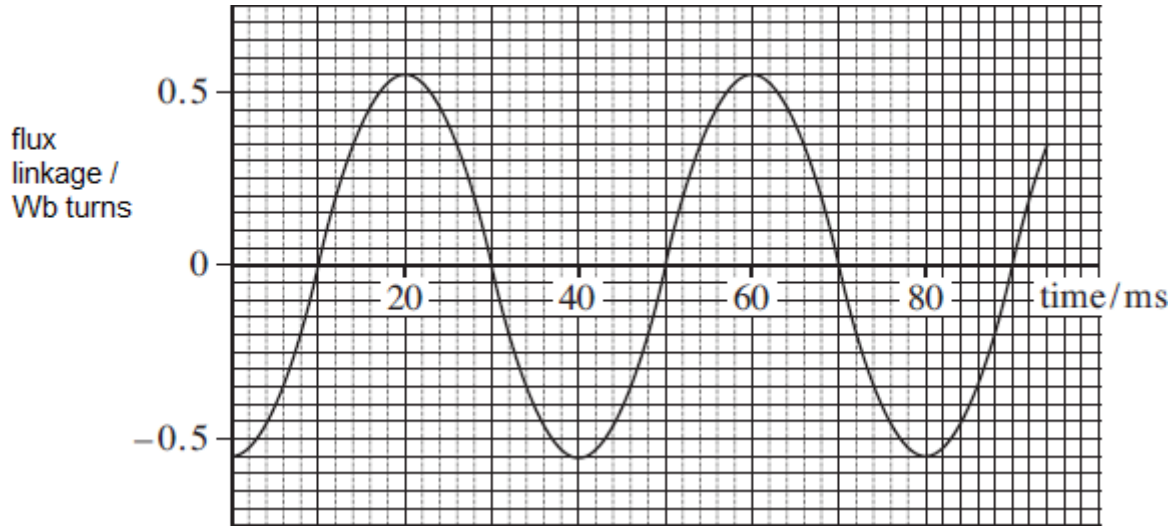
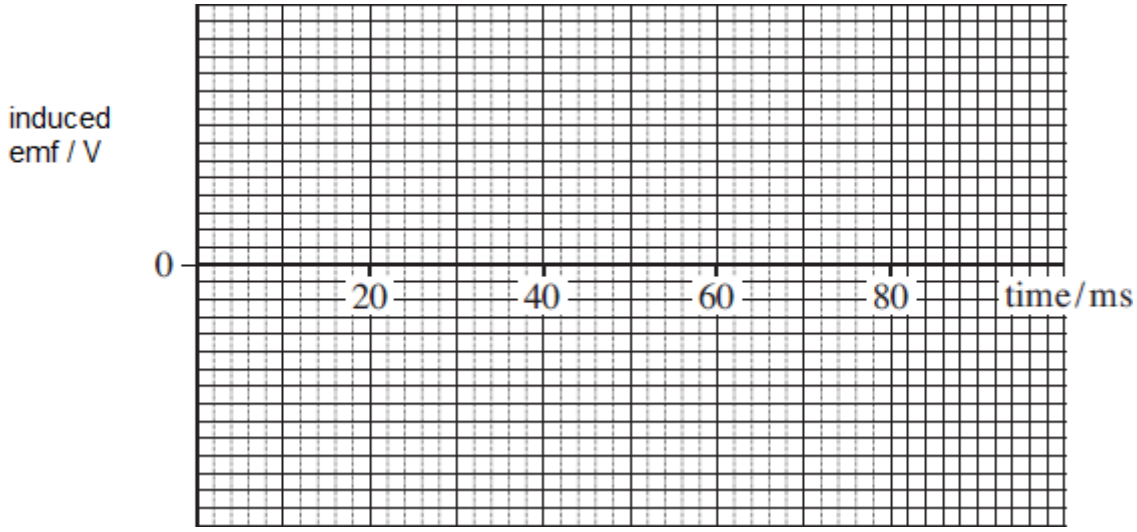


Figure 3



(iii) Calculate the peak value of the emf generated.

peak emf _____ V

(3)

(c) Sketch a graph on the axes shown in **Figure 3** above to show how the induced emf varies with time over the time interval shown in **Figure 2**.

(2)

(d) The coil has 550 turns and a cross-sectional area of $4.0 \times 10^{-3} m^2$.

Calculate the flux density of the uniform magnetic field.

flux density _____ T

(2)

(Total 13 marks)

Q2.

(a) State Lenz's law.

_____

_____

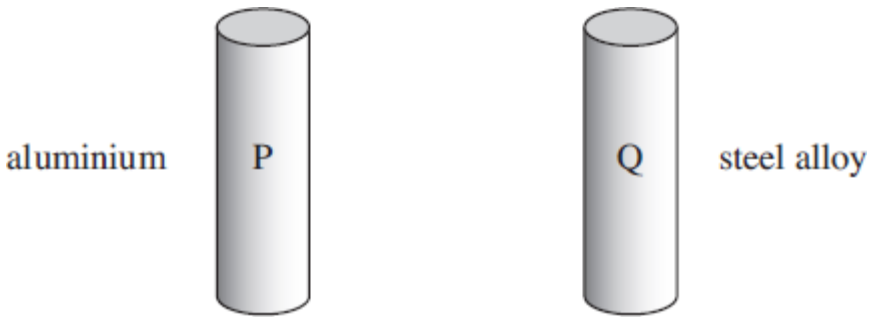
_____

_____

(2)

(b) **Figure 1** shows two small, solid metal cylinders, **P** and **Q**. **P** is made from aluminium. **Q** is made from a steel alloy.

Figure 1



(i) The dimensions of **P** and **Q** are identical but **Q** has a greater mass than **P**. Explain what material property is responsible for this difference.

_____

_____

_____

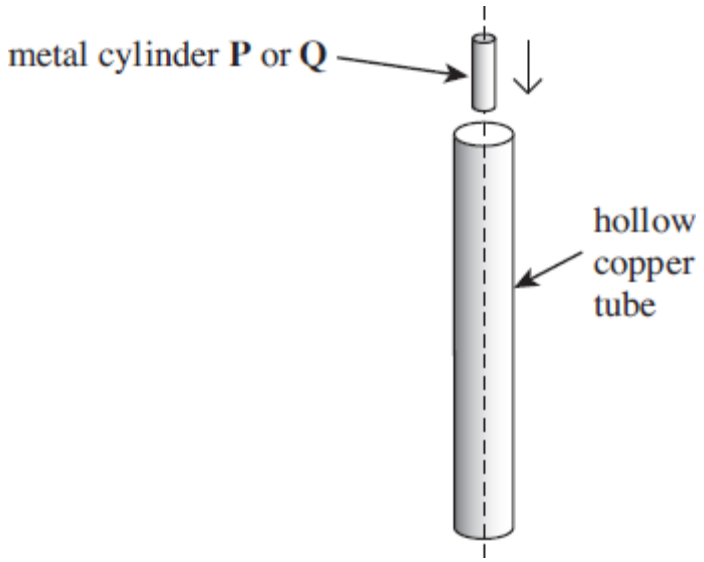
(1)

(ii) When **P** and **Q** are released from rest and allowed to fall freely through a vertical distance of 1.0 m, they each take 0.45 s to do so. Justify this time value and explain why the times are the same.

(2)

(c) The steel cylinder **Q** is a strong permanent magnet. **P** and **Q** are released separately from the top of a long, vertical copper tube so that they pass down the centre of the tube, as shown in **Figure 2**.

Figure 2



The time taken for **Q** to pass through the tube is much longer than that taken by **P**.

(i) Explain why you would expect an emf to be induced in the tube as **Q** passes through it.

(2)

(ii) State the consequences of this induced emf, and hence explain why **Q** takes longer than **P** to pass through the tube.

_____

_____

_____

_____

(3)

(d) The copper tube is replaced by a tube of the same dimensions made from brass. The resistivity of brass is much greater than that of copper. Describe and explain how, if at all, the times taken by **P** and **Q** to pass through the tube would be affected.

P: _____

_____

_____

_____

Q: _____

_____

_____

_____

(3)

(Total 13 marks)