11.1 Electromagnetic Induction

Question Paper

Course	DP IB Physics
Section	11. Electromagnetic Induction (HL only)
Topic	11.1 Electromagnetic Induction
Difficulty	Medium

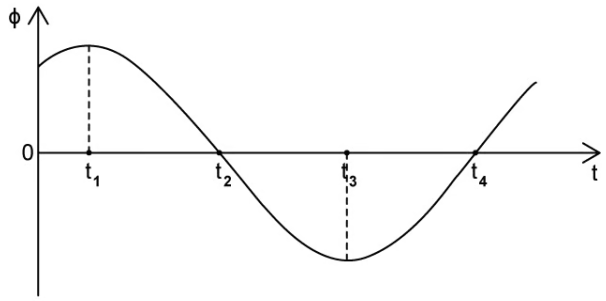
Time allowed: 20

Score: /10

Percentage: /100

Question 1

A coil rotates in a uniform magnetic field. The graph shows the variation with time t of the magnetic flux φ through a coil.



Determine the times when the magnitude of the induced emf measured across the ends of the coil is at a minimum.

A. t_1 only

B. t_1 and t_4

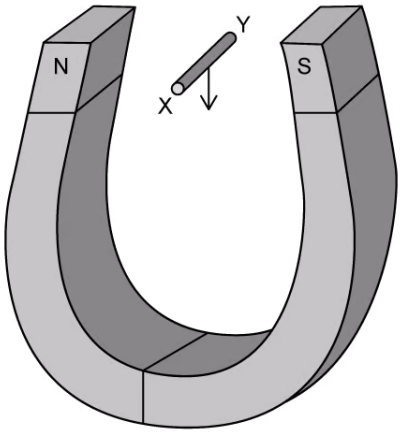
C. t_2 and t_3

D. t_2 and t_4

[1 mark]

Question 2

A length of conducting wire XY is moved downwards through the poles of a horseshoe magnet.



This will change the ends of the wire so that compared to end Y of the wire, end X will have

A. More electrons

B. Fewer electrons

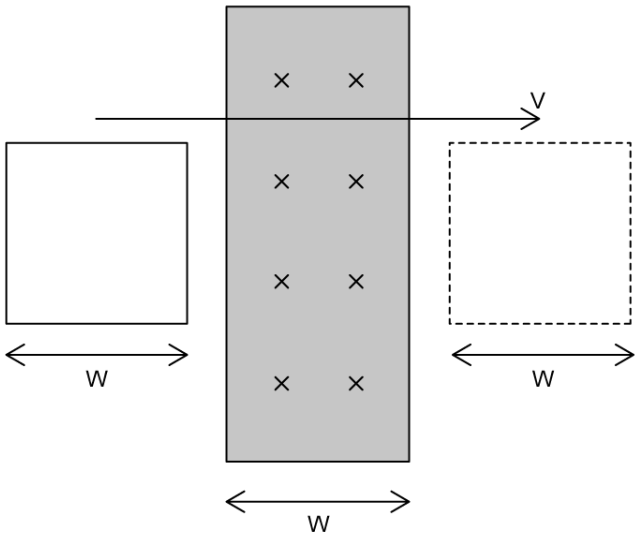
C. More protons

D. Fewer protons

[1 mark]

Question 3

A square coil of conducting wire with sides of length *W* is moved at constant speed *v* left to right, through a uniform magnetic field which is directed into the page and has width *W*.



From the point where the coil enters the field until the point where it leaves it, which description best fits the direction of the current induced in the coil?

A. Anti-clockwise

B. Clockwise

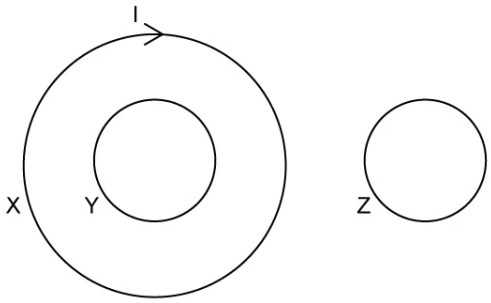
C. Anti-clockwise then clockwise

D. Clockwise then anti-clockwise

[1 mark]

Question 4

Three loops of wire are arranged so that the current flowing in loop X in a clockwise direction induces a current in both in loops Y and Z. The three loops are all on the same plane.



What is the direction of the induced currents in loop Y and loop Z?

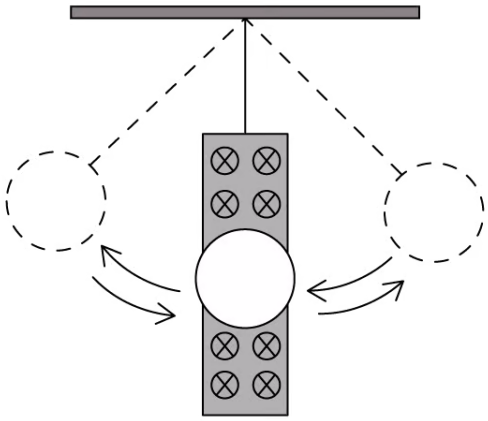
	Loop Y	Loop Z
A.	clockwise	clockwise
B.	clockwise	anti-clockwise
C.	anti-clockwise	anti-clockwise
D.	anti-clockwise	clockwise

[1 mark]

Question 5

A pendulum made from a flat disk of copper is suspended in a region of uniform magnetic field by an insulating rod connected to a horizontal support. The disk is pulled to one side of the field and then released.

The uniform magnetic field is directed into the plane of the paper.



Which of the following is true for both the direction of the induced current in the disk and the change in amplitude of the oscillations of the pendulum with time?

	Direction of induced current	Change in amplitude
A.	changes	decreases
B.	changes	stays constant
C.	stays constant	decreases
D.	stays constant	stays constant

[1 mark]

Question 6

A flat coil with *N* turns has a diameter *d*. The coil has a flux density of *B* in a direction of 90° to the plane of the coil.

A second coil has 3*N* turns and diameter 2*d*.

Select the correct ratio of $\frac{magnetic\ flux\ linkage\ coil\ A}{magnetic\ flux\ linkage\ coil\ B}$

A. $\frac{3}{2}$

B. $\frac{1}{12}$

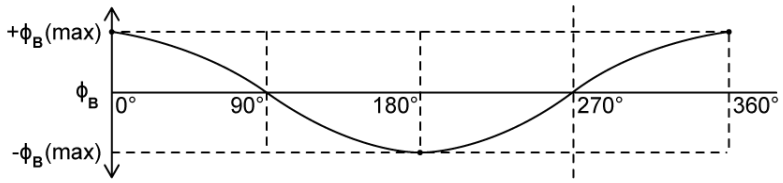
C. $\frac{2}{3}$

D. $\frac{4}{3}$

[1 mark]

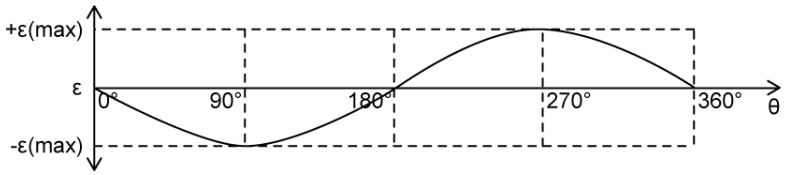
Question 7

The graph shows the variation with angle θ of the magnetic flux φ through a coil that is rotating in a uniform magnetic field. θ is measured between the coil and the plane of the magnetic field lines.

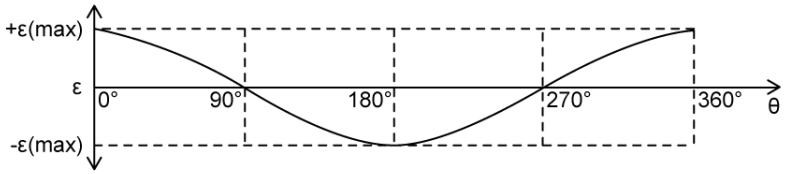


Select the graph which correctly shows the variation in emf, ε with angle θ for the same coil.

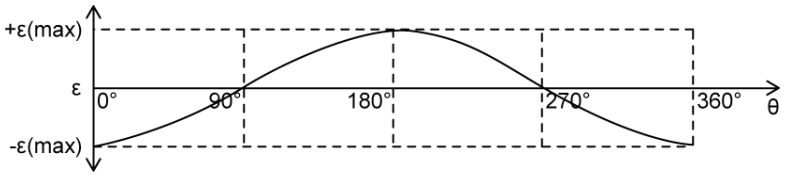
A.



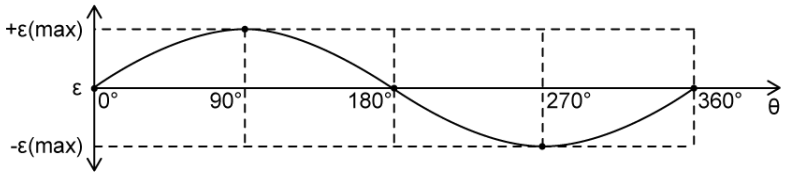
B.



C.



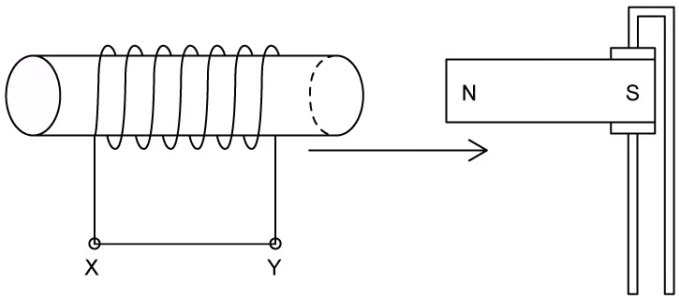
D.



[1 mark]

Question 8

A coil of conducting wire having *N* turns is wrapped around a cardboard cylinder. The ends of the coil are connected using a straight piece of conducting wire. The coil is moved towards a permanent bar magnet fixed in position. The coil moves at velocity *v*.



The induced current in the straight section of wire is

A. Alternating

B. Zero

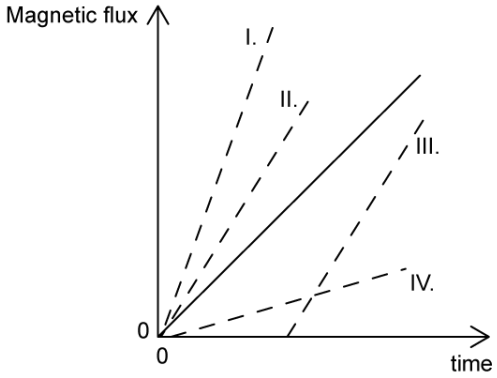
C. From X to Y

D. From Y to X

[1 mark]

Question 9

The solid line on the graph shows the variation with time of a magnetic flux passing through a loop of wire. Both the magnetic field strength and the area of the loop are increased but no other changes are made.



The new graph of magnetic flux and time can be represented by the dashed lines labelled

A. I only

B. I and II

C. III only

D. IV only

[1 mark]

Question 10

Two coils are arranged so that one fits inside the other with the axes parallel. The larger coil has 200 turns and cross-sectional area of 30 cm^2. A changing current in the small coil causes the magnetic field to increase at a rate of 0.5 T s^{-1}.

The induced emf in the large coil will be

A. 300 n V

B. 300 μ V

C. 300 m V

D. 300 V

[1 mark]