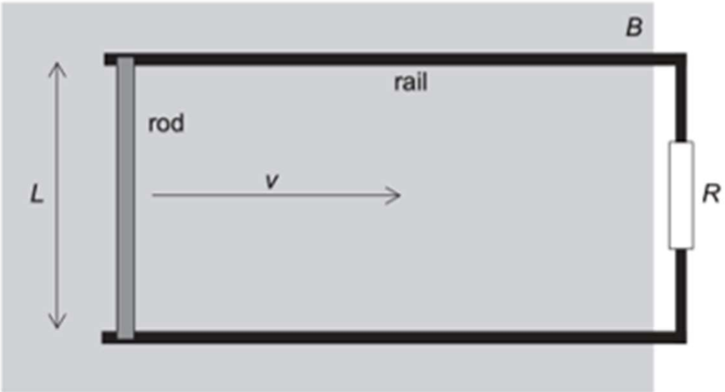
H2 Physics Revision Topic : Electromagnetic Induction

Multiple Choice Questions Name: ______________________________

1 A conducting rod of length L is moved in a region of uniform magnetic field of flux density B. The field is directed at right angles to the plane of the paper. The rod slides on conducting rails at a constant speed v. A resistor of resistance R connects the rails as shown in the figure below.



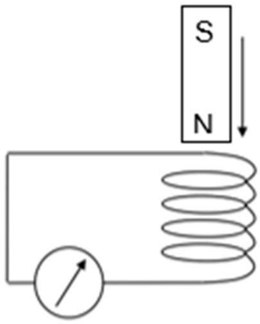
Which statement is true?

A The magnetic force on the rod is directly proportional to B.
B The magnetic force is independent of R.
C Increasing the length of the rod will increase the induced current in the rod.
D The power required to move the rod is proportional to the square of the velocity

2 Which of the following minimises the energy loss in a transformer core due to eddy currents?

A Use of a steel core.
B Use of a higher frequency primary voltage.
C Use of a laminated core.
D Use of a primary coil with smaller resistivity.

3 A bar magnet is dropped vertically above a coil that is connected to a galvanometer. As the magnet approaches the coil, the galvanometer deflects to the right by 10 units.



What is the deflection of the galvanometer as the magnet leaves the coil?

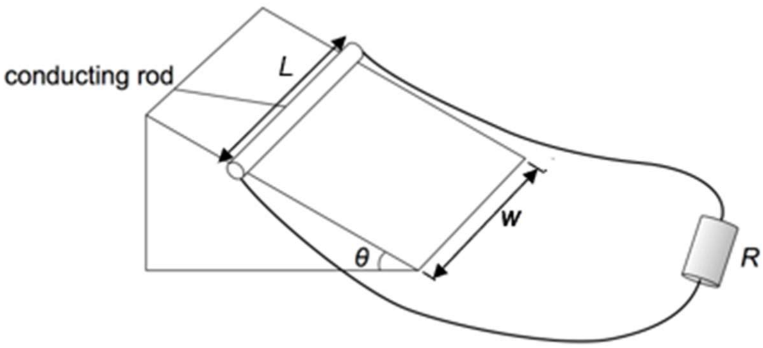
A To the left by less than 10 units

B To the left by more than 10 units

C To the right by less than 10 units

D To the right by more than 10 units

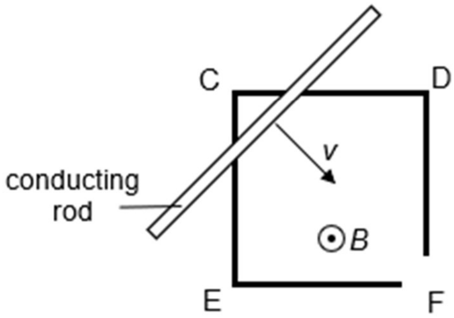
4 A conducting rod of length L and mass m is placed on a very long and smooth plane of width w. The plane makes an angle of θ to the horizontal. The rod is connected to a resistor of resistance R through light and flexible wires. The rod is released from rest at the top of the plane and moves in a uniform magnetic flux density B that is vertically downwards everywhere.



After time t, what is the magnitude of its terminal velocity?

A $\dfrac{mgR\tan\theta}{B^2w^2}$ **B** $\dfrac{mgR\tan\theta}{B^2L^2}$ **C** $\dfrac{mgR\tan\theta}{B^2w^2\cos\theta}$ **D** $\dfrac{mgR\tan\theta}{B^2L^2\cos\theta}$

5 A conducting rod slides at constant velocity v across an incomplete conducting square CDEF. The area bounded by the square is in a uniform magnetic field B that points directly out of the page.



How does the induced e.m.f. change as the rod slides from point C to F?

A constant

B increasing

C first increasing, then decreasing

D first decreasing, then increasing

6 Fig. 26 (a) shows conducting coil Q suspended from the ceiling directly above conducting coil P which is placed on a horizontal table. The variation of current I in coil Q with time t is shown in Fig. 26 (b).

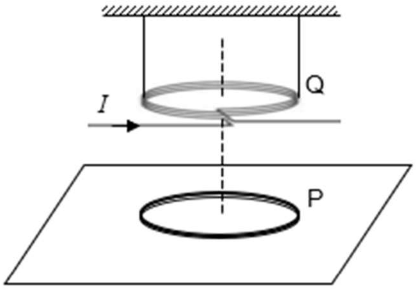


Fig. 26 (a)

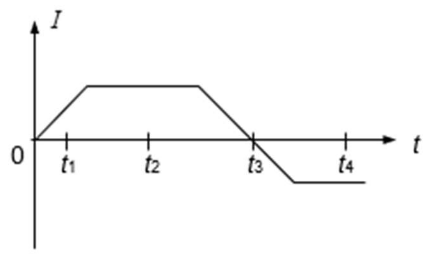


Fig. 26 (b)

Given that the weight of coil P is W, and the normal contact force acting on coil P by the table is N, which of the following is correct?

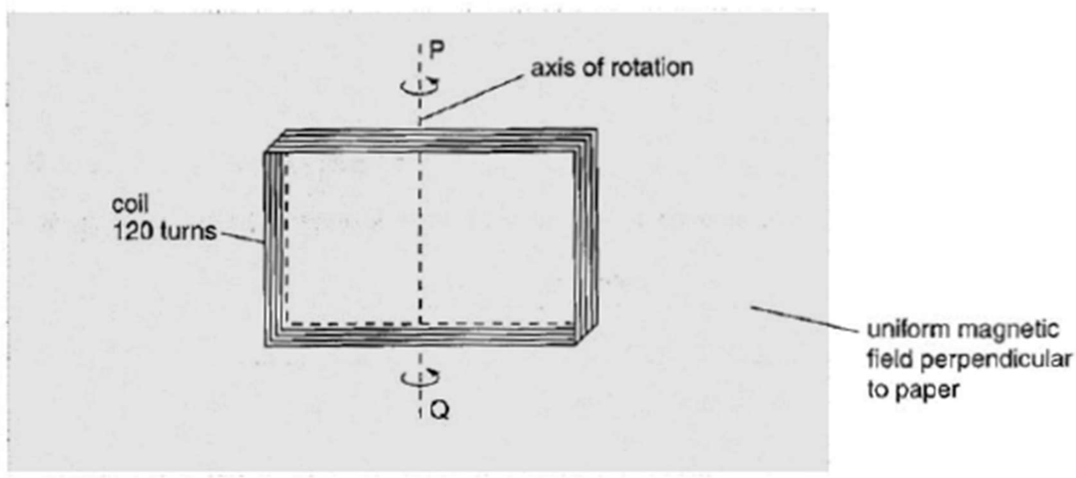
A At t_1, $N < W$

B At t_2, $N > W$

C At t_3, $N = W$

D At t_4, $N < W$

7 The coil in a generator is situated in a uniform magnetic field, as shown.

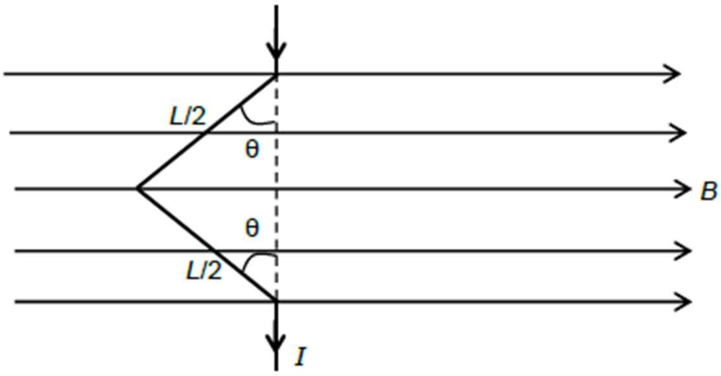


The coil of area A is rotated about the axis PQ with an angular speed ω.

Which of the following changes to A and ω increases the electromotive force (e.m.f.) in the coil?

	A	ω
A	increase	increase
B	increase	decrease
C	decrease	increase
D	decrease	decrease

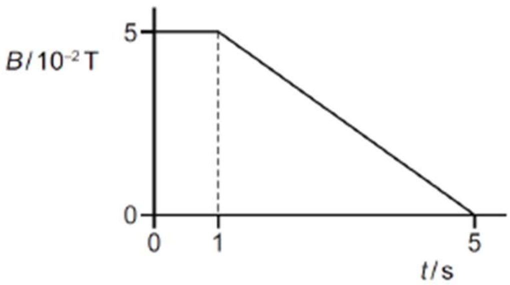
8 The diagram shows a V-shaped wire in the magnetic field of flux density B. The length of the wire in the field is L and the first half of the wire is inclined with an angle θ normal to the field direction. The current in the wire is I.



Which row gives the magnitude and direction of the force acting on the wire?

	magnitude	direction
A	$BIL\cos\theta$	into of the page
B	$BIL\cos\theta$	out of the page
C	$BIL\sin\theta$	into the page
D	$BIL\sin\theta$	out of the page

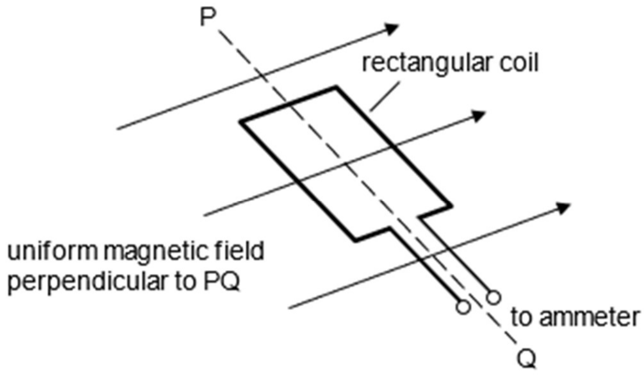
9 A 120 turn coil of area 5.0×10^{-4} m^2 is placed in a magnetic field of strength 5.0×10^{-2} T. The magnetic flux density B is then varied as shown.



What is the induced electromotive force when t = 3 s?

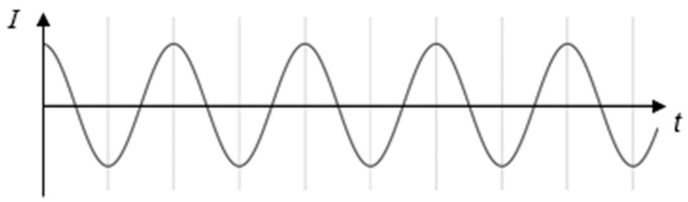
A 6.25 μV **B** 600 μV **C** 750 μV **D** 1250 μV

10 A rectangular coil, which is free to rotate about the axis PQ, is placed in a uniform magnetic field perpendicular to PQ. The coil is connected to an ammeter and given an initial angular speed to start rotation.

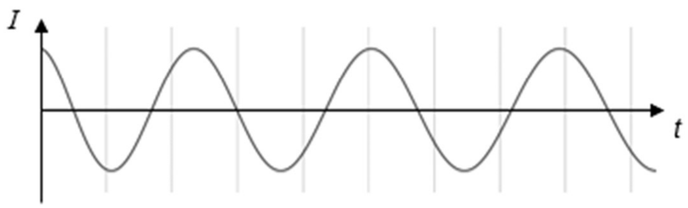


Which graph correctly shows the variation with time of the reading on the ammeter? Ignore the effects of air resistance.

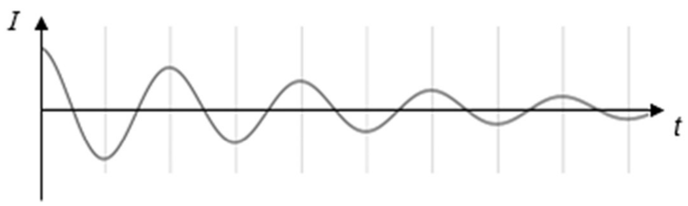
A



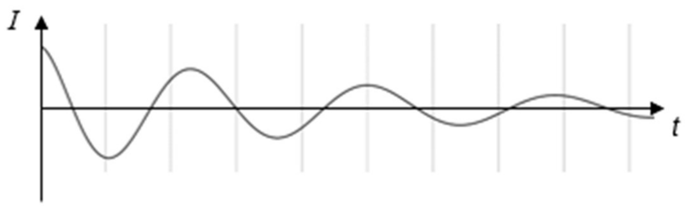
B



C

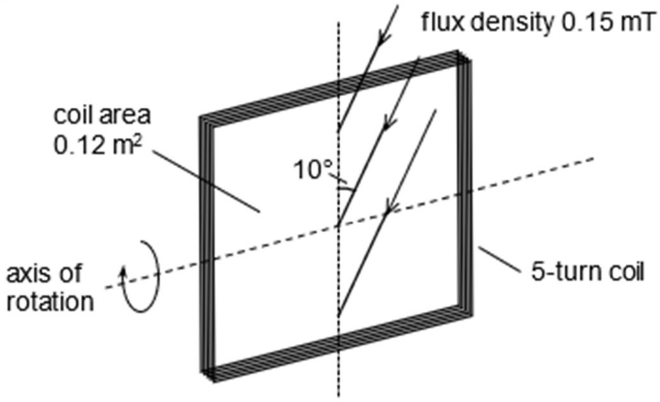


D



11

A coil has area 0.12 m^2 and 5 turns. A uniform magnetic field of flux density 0.15 mT acts at an angle 10° to the plane of the coil.

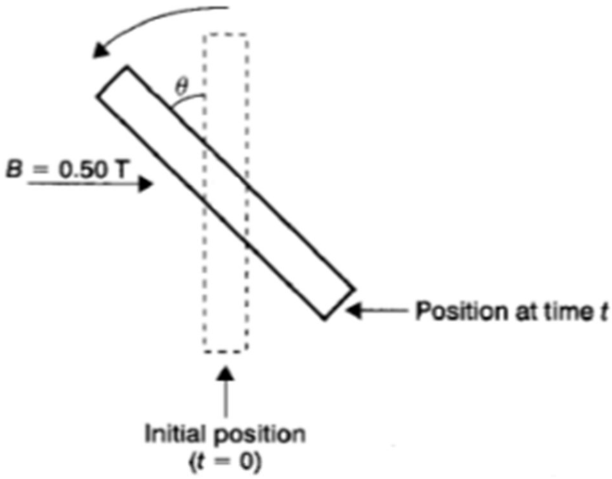


What is the change in magnetic flux linkage when the coil rotates such that the angle between the flux density and the plane of the coil is reduced to zero?

A 1.56×10^{-5} Wb **B** 8.86×10^{-5} Wb **C** 1.56×10^{-2} Wb **D** 8.86×10^{-2} Wb

12

A flat circular coil of wire 30 turns, each of area 0.025 m^2, is initially placed with its plane at right angles to a uniform magnetic field of flux density 0.50 T.



What is the magnitude of the induced e.m.f. in the coil when t = 1.0 s, if the coil is rotating at 60° s^{-1}?

A 0.20 V **B** 0.34 V

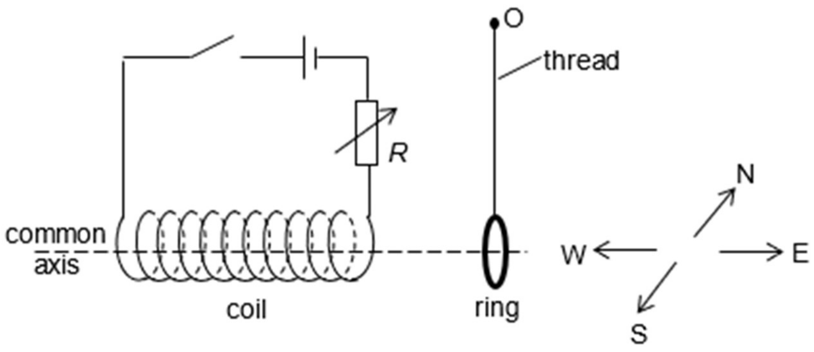
C 0.38 V **D** 0.39 V

13 A metal disc of radius r is spinning with an angular velocity ω about an axis through its centre and perpendicular to its plane. The disc is in a uniform magnetic field B which is perpendicular to the plane of the disc.

What is the electromotive force induced between the centre of the disc and its edge?

A $\pi r^2 \omega B$ **B** $\pi r \omega^2 B$ **C** $\dfrac{\omega r^2 B}{2}$ **D** $\omega r^2 B$

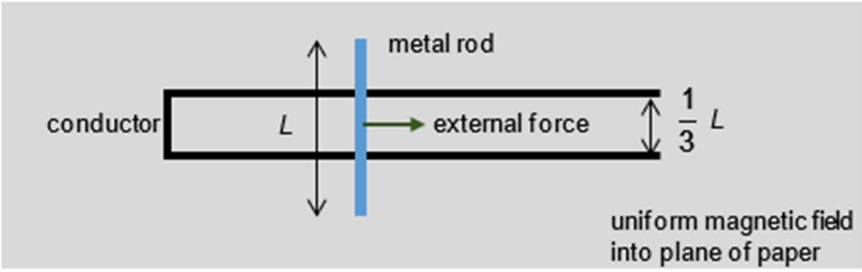
14 An aluminium ring hangs vertically from a thread with its axis pointing east-west and is free to swing about point O, as shown in the diagram below. A coil is fixed near to the ring and coaxial with it. With the switch closed, the rheostat R is adjusted to increase the current in the circuit to a maximum.



What will the motion of the aluminium ring be during this time?

A swings in the direction of E and remains there.
B swings in the direction of W and remains there.
C swings in the direction of E then drops back.
D swings in the direction of W then drops back.

15 A metal rod of length L and resistance per unit length r is placed on the parallel section of a smooth conductor of negligible resistance. A uniform magnetic field B is directed perpendicularly into the paper.



The two parallel sections are separated by $\frac{1}{3}L$. An external force causes the metal rod to slide at constant speed v.

Which expression gives the magnitude of the external force?

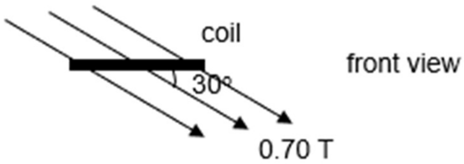
A $\frac{3B^2Lv}{r}$

B $\frac{B^2Lv}{r}$

C $\frac{B^2Lv}{3r}$

D $\frac{B^2Lv}{9r}$

16 A square coil of area 16.0 cm^2 and resistance $2.0 \times 10^{-3}\ \Omega$ is mounted with its plane horizontal The coil is situated in a magnetic field of strength 0.70 T directed downwards at 30° to the plane of the coil.



When the magnetic field is switched off, it decreases to zero at a uniform rate in 0.80 s.

What is the charge induced in the loop during the change in the magnetic field?

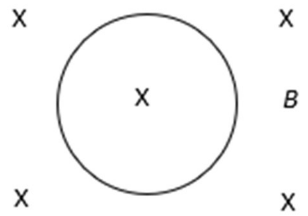
A 0.28 C

B 0.48 C

C 0.56 C

D 0.96 C

17 A circular loop of wire of electrical resistance R and radius r is oriented with its plane perpendicular to a magnetic field B as shown. What must be the rate of change of the magnetic flux density in order to produce a current I in the loop?



A $IR/\pi r^2$ **B** $I\pi r^2/R$ **C** $IR/\pi r$ **D** $I\pi r/R$

18 A square loop of copper wire is initially placed perpendicular to the lines of a constant uniform magnetic field of flux density 5.0×10^{-3} T. The area enclosed by the loop is 0.20 m^2. The loop is then turned through an angle of 60°. The turn takes 0.10 s. The average e.m.f. induced in the loop during the turn is

A 1.3 mV **B** 5.0 mV **C** 8.7 mV **D** 10 mV