Magnetic Field

TOPIC QUESTIONS

Level	A Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

1. In which one of the following applications does electromagnetic induction **not** take place?

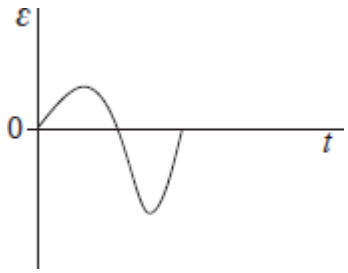
   A the generators at a nuclear power station

   B the ac power adapter for a laptop computer

   C the wings of an aircraft cutting through the Earth's magnetic field

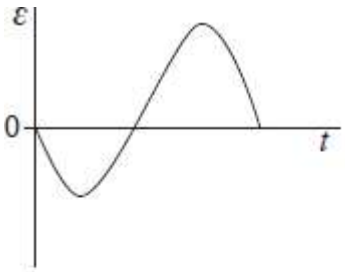
   D the back up capacitor of an electric timer

2. When a magnet is dropped through an aluminium ring an emf is induced. A data logger connected to the ring records the variation of the induced emf ε with time t as shown below.

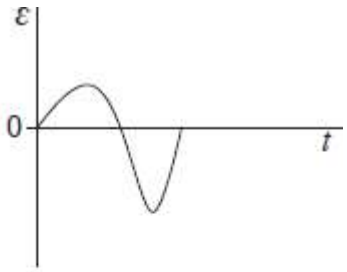


In a second experiment, the magnet is dropped from a greater height.

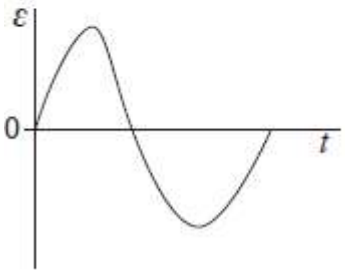
Which one of the following graphs best represents the induced emf in the second experiment?



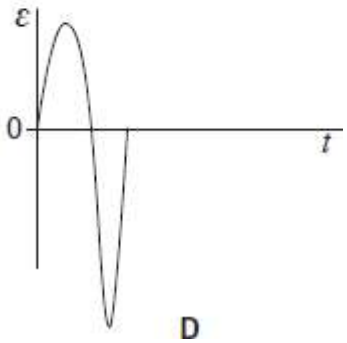
A



B



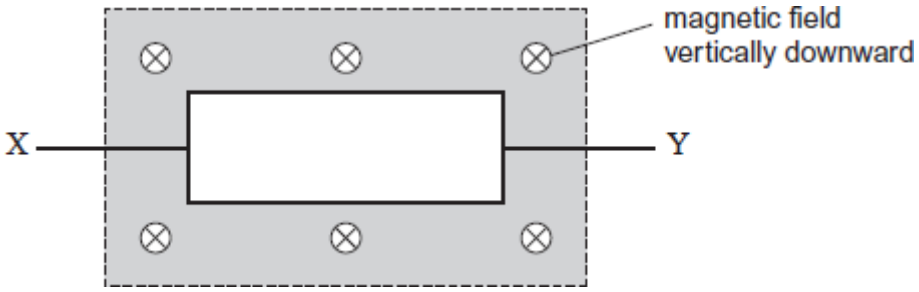
C



D

3. A rectangular coil of area A has N turns of wire. The coil is in a uniform magnetic field, as shown in the diagram.

When the coil is rotated at a constant frequency f about its axis XY, an alternating emf of peak value ε_0 is induced in it.



What is the maximum value of the magnetic flux linkage through the coil?

A $\frac{\varepsilon_0}{2\pi f}$

B $\frac{\varepsilon_0}{\pi f}$

C $\pi f \varepsilon_0$

D $2\pi f \varepsilon_0$

4. A transformer has 1150 turns on the primary coil and 500 turns on the secondary coil.
The primary coil draws a current of 0.26 A from a 230 V ac supply. The current in the secondary coil is 0.50 A. What is the efficiency of the transformer?

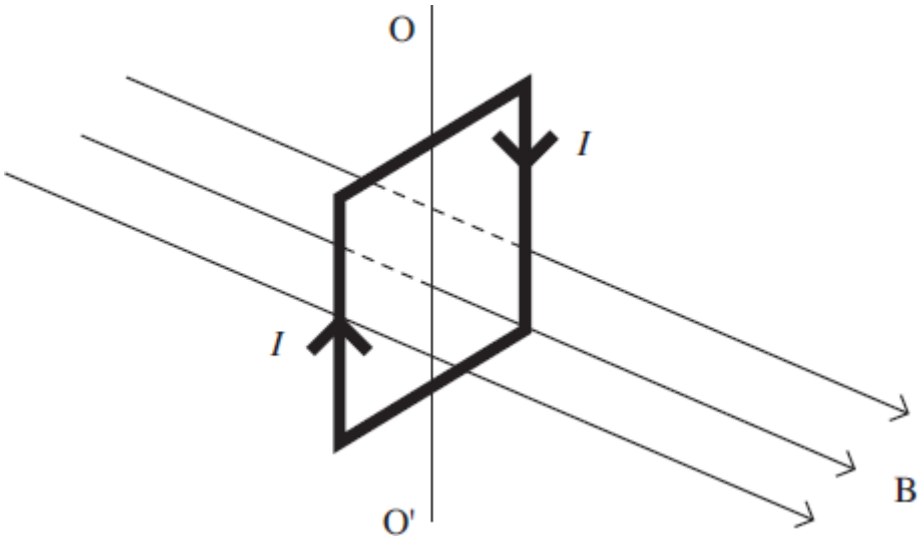
A 42%

B 50%

C 84%

D 100 %

5. The diagram shows a vertical square coil whose plane is at right angles to a horizontal uniform magnetic field B. A current, I, is passed through the coil, which is free to rotate about a vertical axis OO'.



Which one of the following statements is correct?

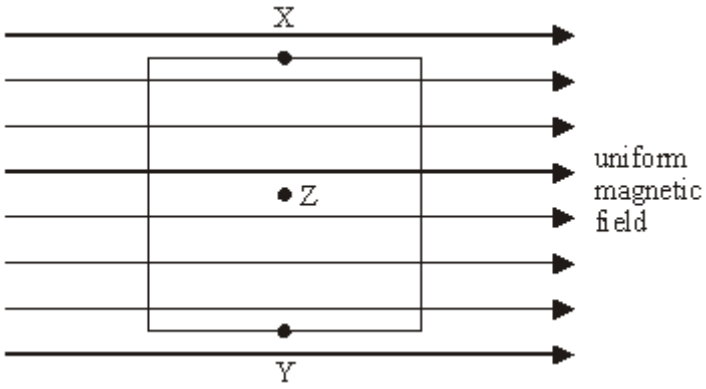
A The forces on the two vertical sides of the coil are equal and opposite.

B A couple acts on the coil.

C No forces act on the horizontal sides of the coil.

D If the coil is turned through a small angle about OO' and released, it will remain in position.

6.



The diagram shows a square coil with its plane parallel to a uniform magnetic field. Which one ofthe following would induce an emf in the coil?

A movement of the coil slightly to the left

B movement of the coil slightly downwards

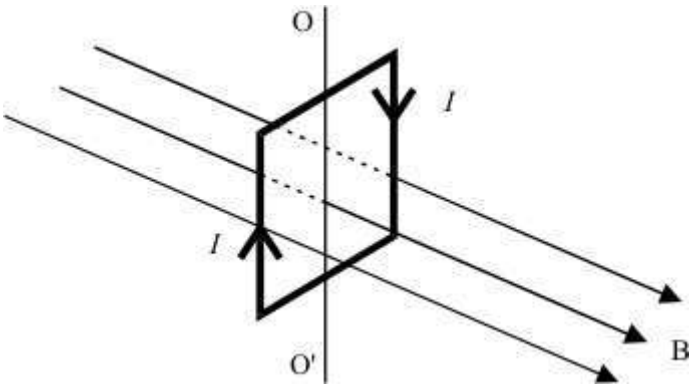
C rotation of the coil about an axis through XY

D rotation of the coil about an axis perpendicular to the plane of the coil through Z

7. Which line, **A** to **D**, correctly describes the trajectory of charged particles which enter, at right angles, (a) a uniform electric field, and (b) a uniform magnetic field?

	(a) uniform electric field	(b) uniform magnetic field
A	circular	circular
B	circular paraboli c	paraboli ccircular paraboli
C	paraboli c	c
D		

8. The diagram shows a vertical square coil whose plane is at right angles to a horizontal uniform magnetic field B. A current, *I*, flows in the coil, which can rotate about a vertical axis OO'.



Which one of the following statements is correct?

A The forces on the two vertical sides of the coil are equal and opposite.

B A couple acts on the coil.

C No forces act on the horizontal sides of the coil.

D If the coil is turned through a small angle about OO', it will remain in position.

9. An α particle and a β^- particle both enter the same uniform magnetic field, which is perpendicular to their direction of motion. If the β^- particle has a speed 15 times that of the α particle, what is the value of the ratio

$$\frac{\text{magnitude of force on } \beta^- \text{particle}}{\text{magnitude of force on } \alpha \text{ particle}} ?$$

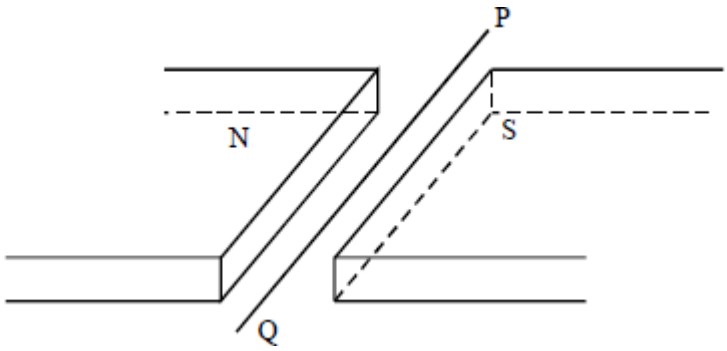
A 3.7

B 7.5

C 60

D 112.5

10.



A wire lies perpendicularly across a horizontal uniform magnetic field of flux density 20×10^{-3} T so that 0.30 m of the wire is effectively subjected to the field. If the force exerted on this length of wire due to a current in it is 30×10^{-3} N downward, what is the current in the wire?

A 0.45 A from P to Q

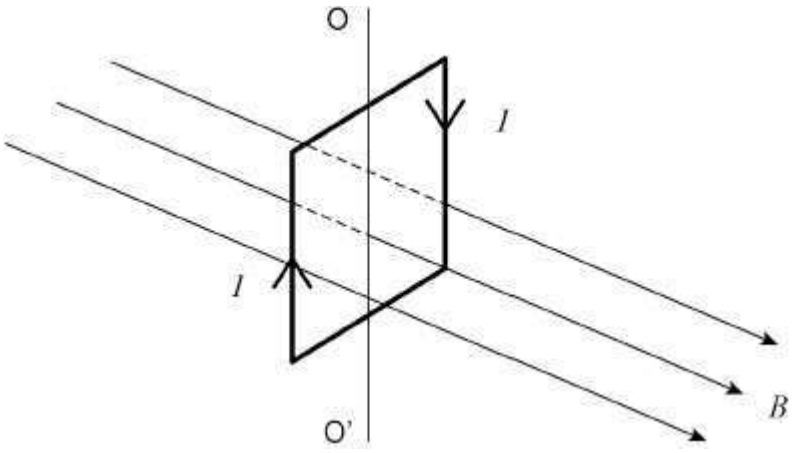
B 0.45 A from Q to P

C 5.0 A from P to Q

D 5.0 A from Q to P

11. The diagram shows a current I in a vertical square coil.The coil can rotate about an axis OO'.

The plane of the coil is at right angles to a uniform horizontal magnetic field of flux density B.



Which statement is correct?

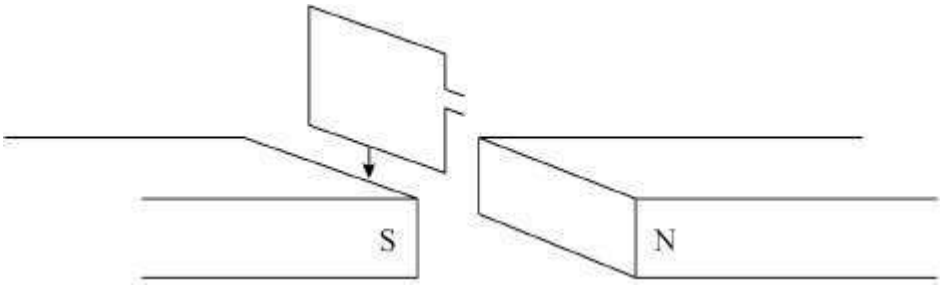
A The forces on the vertical sides of the coil are equal in magnitudeand opposite in direction.

B A non-zero couple acts on the coil.

C No forces act on the horizontal sides of the coil.

D The forces on all sides of the coil act toward the centre of the coil.

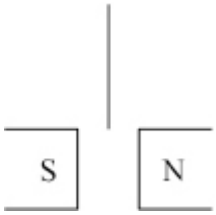
12. The diagram shows a small rectangular coil falling between two magnetic poles.



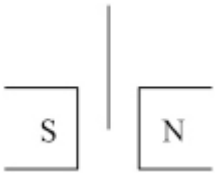
The coil is shown at four instants as it passes through the magnetic field.

At which instant will the induced emf be a maximum?

A

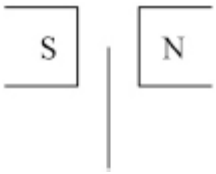


B



C

D



13. An alternating emf is induced in a coil rotating in a magnetic field.

What is the phase difference between the magnetic flux linkage through the coil and the emf?

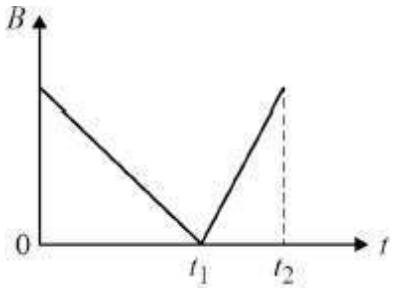
A 0

B $\frac{\pi}{3}$ rad

C $\frac{\pi}{2}$ rad

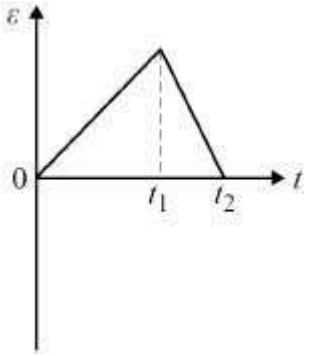
D π rad

14. The diagram shows the variation with time t of the magnetic flux density B of the field linking acoil.

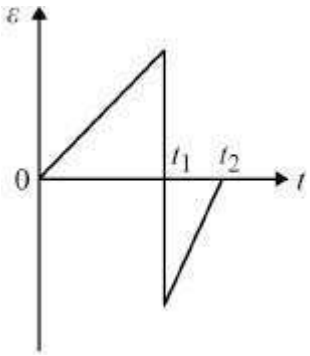

B
0
t1
t2
t

Which graph shows the variation of induced emf ε in the coil during this time interval?

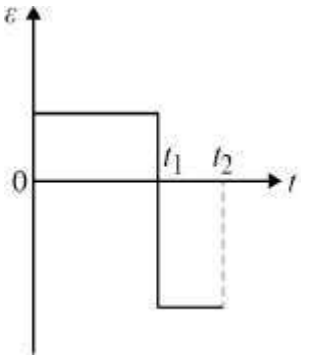
A



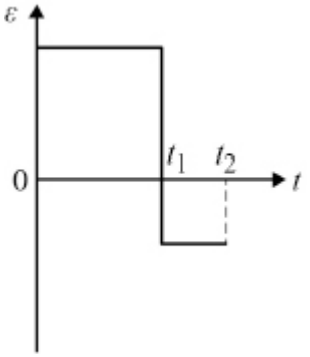
B



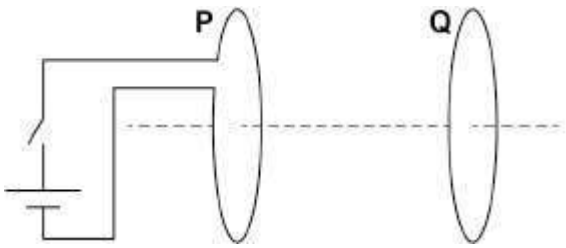
C



D



15. A coil **P** is connected to a cell and a switch.
A closed coil **Q** is parallel to **P** and is arranged on the same axis.



Which describes the force acting on **Q** after the switch is closed?

A steady and directed to the left

B steady and directed to the right

C short-lived and directed to the left

D short-lived and directed to the right

16. The magnetic flux through a coil of 5 turns changes uniformly from 15×10^{-3} Wb to 7.0×10^{-3} Wbin 0.50 s. What is the magnitude of the emf induced in the coil due to this change in flux?

A **14 m V**

B **16 m V**

C **30 m V**

D **80 m V**

17. Which one of the following statements concerning power losses in a transformer is incorrect?

Power losses can be reduced

by

A laminating the core.

B using high resistance

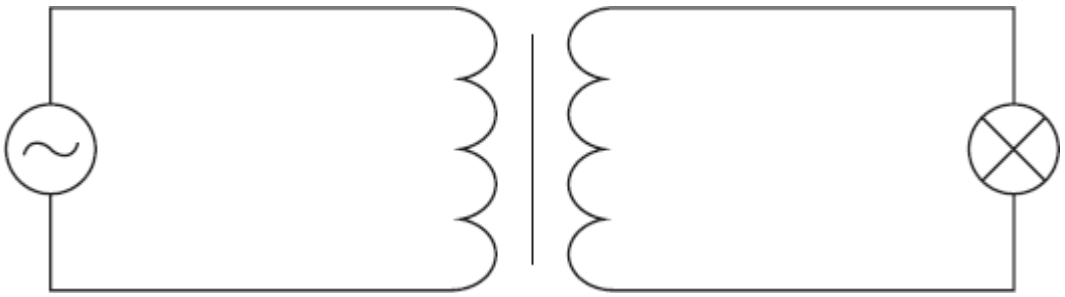
windings.

C using thick wire.

D using a core made of special iron alloys which are easily magnetised.

18. A transformer with 3000 turns in its primary coil is used to change an alternating pd from an rmsvalue of 240 V to an rms value of 12 V.

When a 60 W, 12 V lamp is connected to the secondary coil, the lamp lights at normalbrightness and a rms current of 0.26 A passes through the primary coil.



Which line, A to D, in the table gives correct values for the number of turns on the secondarycoil and for the transformer efficiency?

	number of turns on the secondary coil	efficiency
A	150	96%
B	60 000	96%
C	150	90%
D	60 000	90%

19. A section of current-carrying wire is placed at right angles to a uniform magnetic field of flux density B. When the current in the wire is I, the magnetic force that acts on this section is F.

What force acts when the same section of wire is placed at right angles to a uniform magneticfield of flux density $2B$ when the current is 0.25 I?

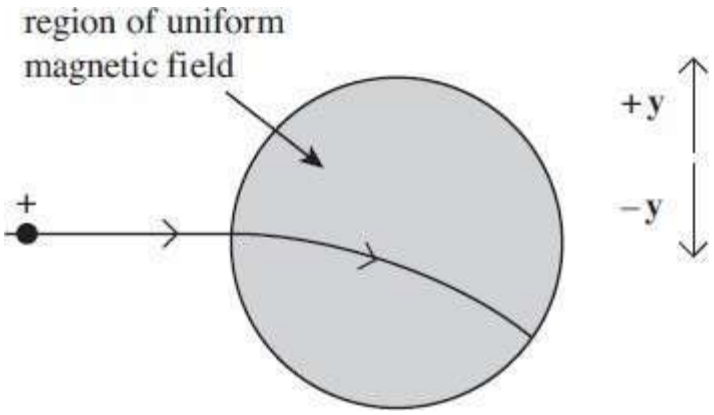
A $\frac{F}{4}$

B $\frac{F}{2}$

C F

D $2F$

20. A beam of positive ions enters a region of uniform magnetic field, causing the beam tochange direction as shown in the diagram.



What is the direction of the magnetic field?

A out of the page and perpendicular to it

B into the page and perpendicular to it

C **in the direction indicated by +*y***

D **in the direction indicated by -*y***