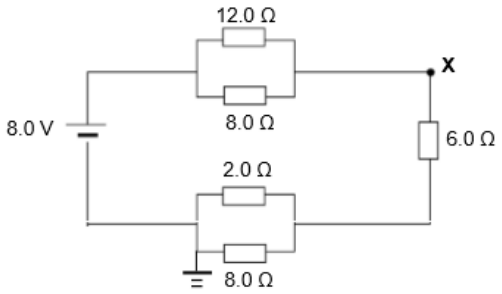
COE AND DC CIRCUITS

Practice Questions

1 What is the value of the potential at point X in the circuit below.



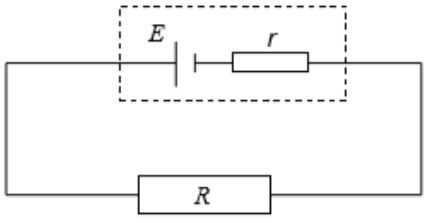
A - 7.0 V

B - 3.9 V

C 3.1 V

D 4.9 V

2 A cell of e.m.f. *E* is connected in series with a resistor *R*.



The potential difference across *R* is V_R. The potential difference across the internal resistance *r* of the cell is V_r.

What is the energy developed across the resistor *R* in driving unit charge across it?

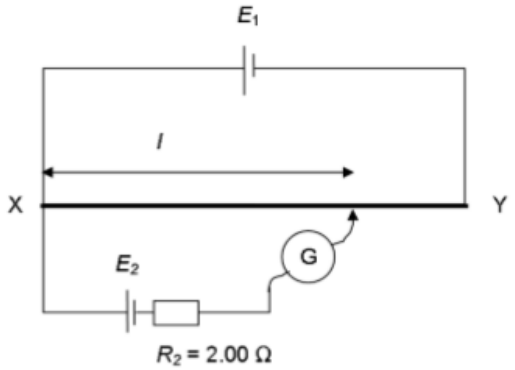
A $V_R - V_r$

B V_R

C Er

D ER

3 A potentiometer consists of a 1.00 m long resistance wire XY in series with a battery of e.m.f. E_1 9.00 V and internal resistance r 1.42 Ω. The resistance of wire XY is 8.30 Ω.



Determine the e.m.f. E_2 if the balance length l is found to be 0.745 m.

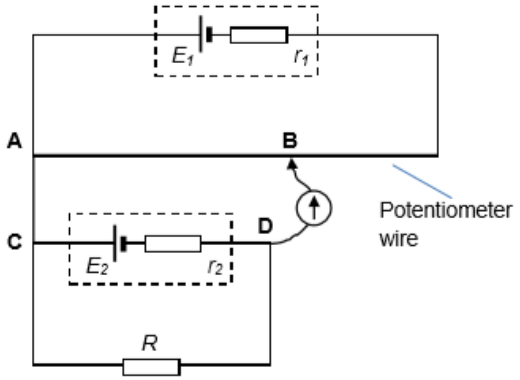
A 0.636 V

B 2.72 V

C 5.73 V

D 9.00 V

4 A potentiometer circuit, with driver cell of e.m.f. E_1, is used to determine the terminal potential difference of the cell of e.m.f E_2. The balance point is B.



Which of the following statements about this potentiometer circuit is true?

A At balance point, the current through AB has the same magnitude as the current through CD.

B At balance point, there is no current running through CD.

C The balance length will be shorter than AB if r_1 is zero.

D The balance length will be shorter than AB if r_2 is zero.

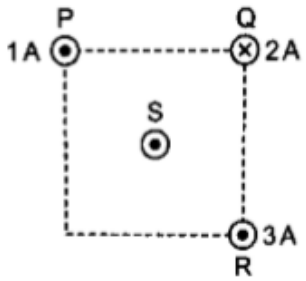
MCQ Answers

1	2	3	4
A	B	C	C

ELECTROMAGNETISM

Practice Questions

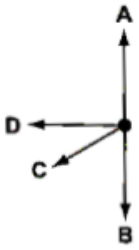
1 The diagram below shows a horizontal plane through which four long straight vertical wires pass.



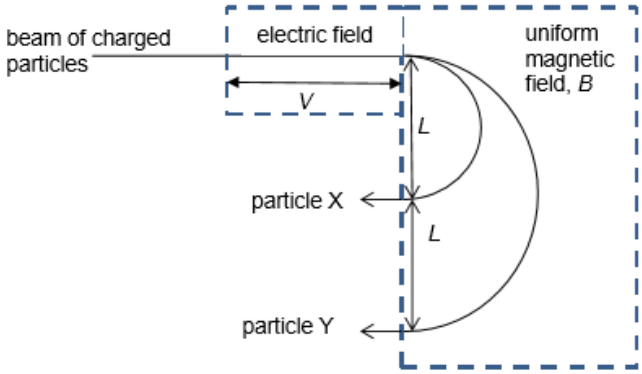
Wires P,Q and R are at three corners of a square and wire S is at the centre.

Wire P carries a current of 1 A out of the paper. Wire Q carries 2 A into the paper. Wire R carries 3 A out of the paper. Wire S carries a current out of the paper.

Which one of the arrows below shows the direction of the force on wire S?



2 A beam consists of two different particles X and Y. Initially of negligible energy, they are both accelerated through the same potential difference V before entering a region with uniform magnetic field of strength B. Particles X and Y exit from the magnetic field at distance L and $2L$ from the entry point respectively.



a_X and a_Y are the mass to charge ratio of particles X and Y respectively. Which of the following is correct?

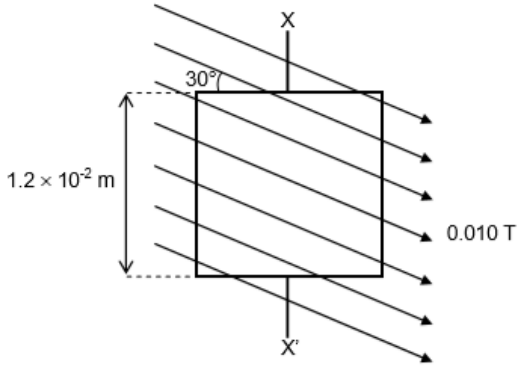
A $2\,a_X = a_Y$

B $a_X = 2\,a_Y$

C $4\,a_X = a_Y$

D $a_X = 4\,a_Y$

3 A square coil of 40 turns and sides 1.2×10^{-2} m is pivoted about the axis XX' through its centre as shown. A uniform magnetic field of flux density 0.010 T is in the plane of the coil and makes an angle of 30° to the horizontal sides of the coil.



What is the torque on the coil about the pivot when the current in the coil is 8.0 mA?

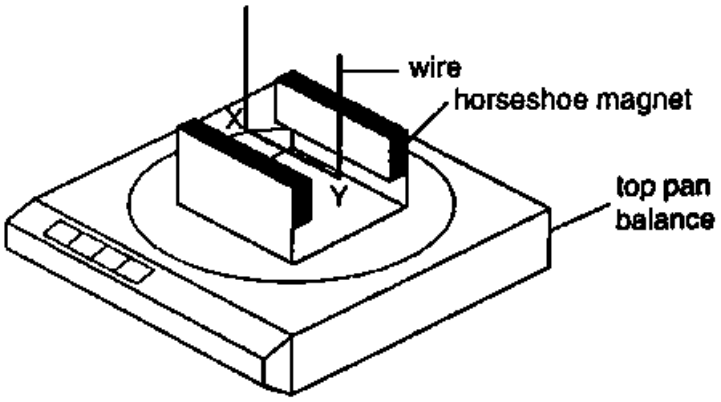
A 1.0×10^{-8} N.m

B 2.3×10^{-7} N.m

C 4.0×10^{-7} N.m

D 3.3×10^{-5} N.m

4 A horseshoe magnet rests on a top-pan balance with a wire situated between the poles of the magnet.



With no current in the wire, the reading on the balance is 142.0 g. With a current of 2.0 A in the wire in the direction XY, the reading on the balance changes to 144.6 g.

What is the reading on the balance, when there is a current of 3.0 A in the wire in the direction YX?

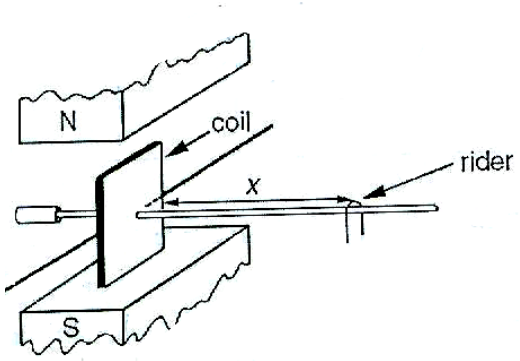
A 138.1 g

B 140.7 g

C 145.9 g

D 148.5 g

5 A small square coil of *N* turns has sides of length *L* and is mounted so that it can pivot freely about a horizontal axis **PQ**, parallel to one pair of sides of the coil, through its centre as shown in the diagram above. The coil is situated between the poles of a magnet which produces a uniform magnetic field of flux density *B*.



The coil is maintained in a vertical plane by moving a rider of mass *M* along a horizontal beam attached to the coil. When a current *I* flows through the coil, equilibrium is restored by placing the rider a distance *x* along the beam from the coil.

What is the expression for *B*?

A $\frac{Mg}{ILN}$

B $\frac{Mgx}{2IL^2N}$

C $\frac{Mgx}{IL^2N}$

D $\frac{2Mgx}{IL^2N}$

MCQ Answers

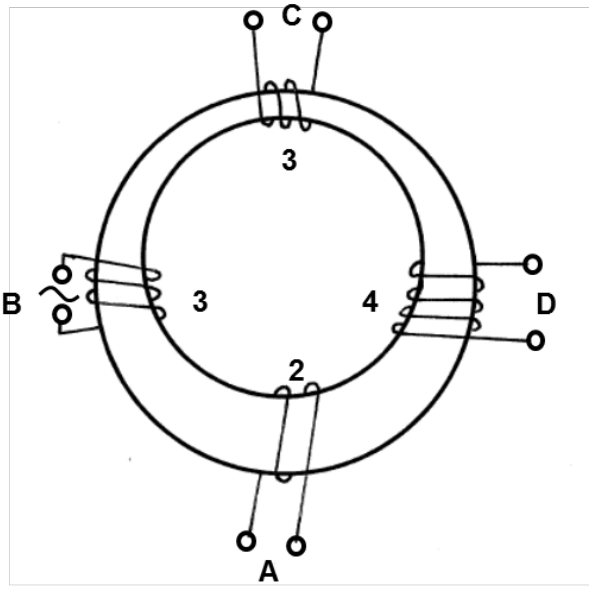
1	2	3	4	5
B	C	C	A	C

ELECTROMAGNETIC INDUCTION

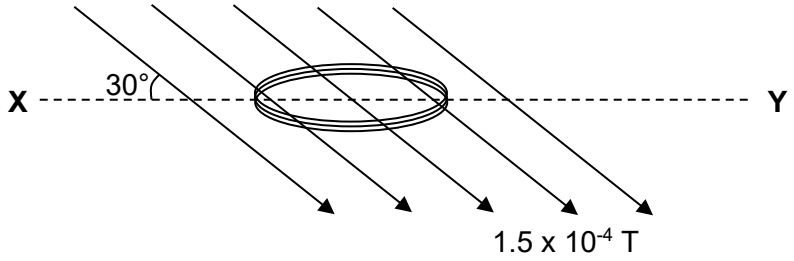
Practice Questions

1 A soft-iron ring of variable cross-section has four coils wound round it at the positions shown. The coils have 2, 3, 3 and 4 turns. The 3-turn coil is connected to an a.c. supply.

In which coil does the magnitude of the magnetic flux density have the largest variation?



2 A magnetic field of flux density 1.5×10^{-4} T passes through a coil of wire placed horizontally. The field makes an angle of 30° with the horizontal, as shown in the diagram below. The coil has 200 turns and an area of 2.0×10^{-4} m^2.



What is the change in magnetic flux linkage if the coil is rotated 180° through axis **XY**?

A 0 Wb

B 1.0×10^{-5} Wb

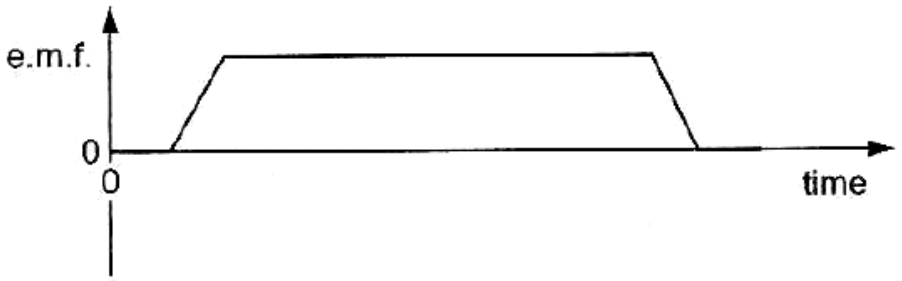
C 3.0×10^{-6} Wb

D 6.0×10^{-6} Wb

3 The magnetic flux linkage through a coil varies with time as shown.

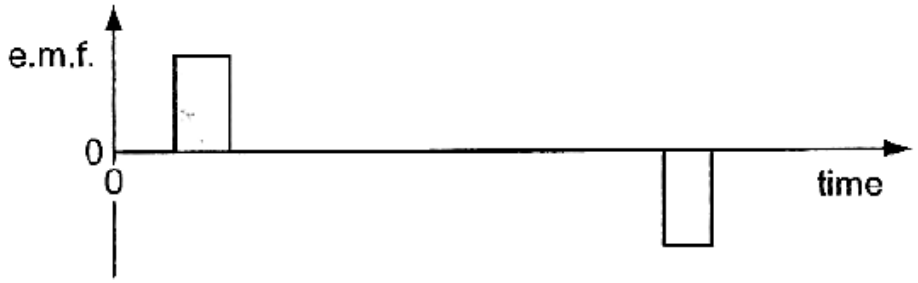
Which graph shows the variation with time of the e.m.f. generated by the coil?

A

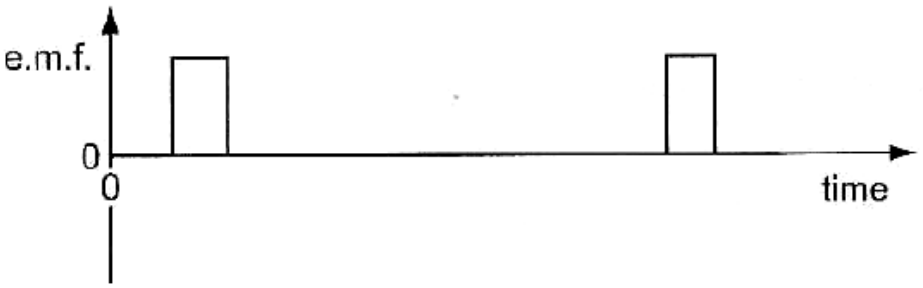


B

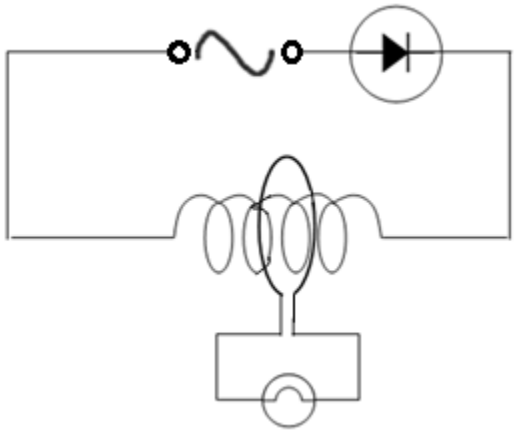
C



D



4 A circuit containing a circular loop of wire connected to a low power light bulb is positioned around a solenoid connected to a sinusoidal AC source and a diode as shown in the diagram below.



Which of the following statements is true?

A The light bulb does not light up at all because the diode prevents current from flowing and thus producing any magnetic flux in the solenoid.

B The light bulb does not light up at all because the magnetic flux linkage through the loop does not reverse its direction.

C The light bulb lights up because the magnetic flux linkage through the loop reverses its direction every cycle.

D The light bulb lights up because the magnetic flux linkage through the loop varies with time.

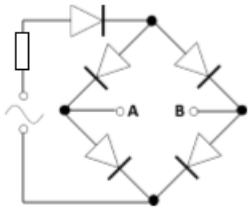
MCQ Answers

1	2	3	4
C	D	C	D

AC - CIRCUITS

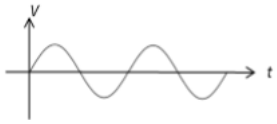
Practice Questions

1 A student sets up a circuit using 5 identical ideal diodes and a resistor as shown below.



Which diagram shows the variation of the voltage across the points AB?

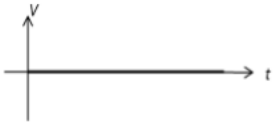
A



C

B

D



2 A sinusoidal current of peak value I_0 is passed through a resistor R with a diode connected in series with it. The average rate of heat dissipated in R is

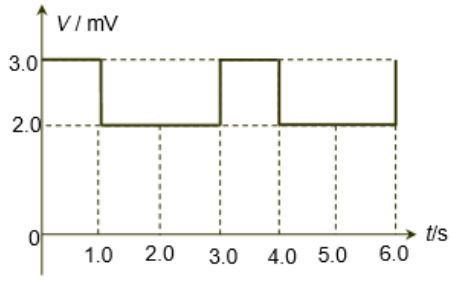
A $0.25\ I_0^2R$

B $0.50\ I_0^2R$

C $0.71\ I_0^2R$

D $1.41\ I_0^2R$

3 The diagram below shows a varying voltage signal.



What is the root mean square value of this signal?

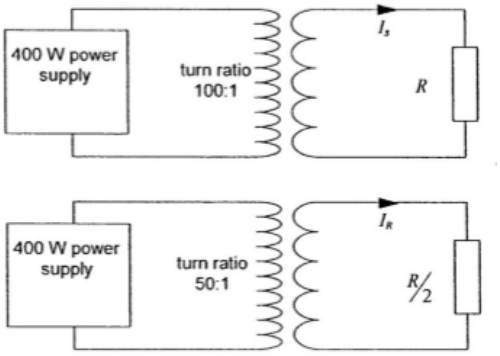
A 1.65 mV

B 1.77 mV

C 2.38 mV

D 2.54 mV

4 A resistive load R is connected across the secondary coil of a step-down transformer with turns ratio 100:1. When a sinusoidal source designed to supply a mean power of 400 W is connected across the primary coil, the current through the resistor is I_0.



The transformer is now changed to one with turns ratio 50:1 and the load resistance is reduced to $R/2$. Assuming that the transformer is 100% efficient, and that the connecting wires have negligible resistance, what is the new current I_R if it is supplied by the same 400 W source?

A $0.71\ I_R$

B $1.0\ I_R$

C $1.4\ I_R$

D $2.0\ I_R$

MCQ Answers

1	2	3	4
D	A	C	C