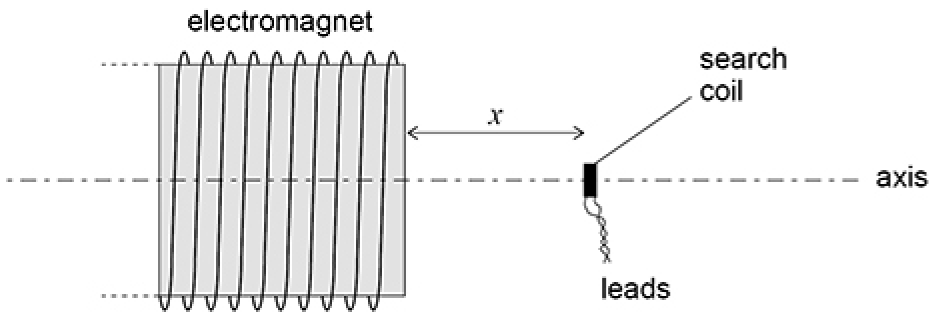
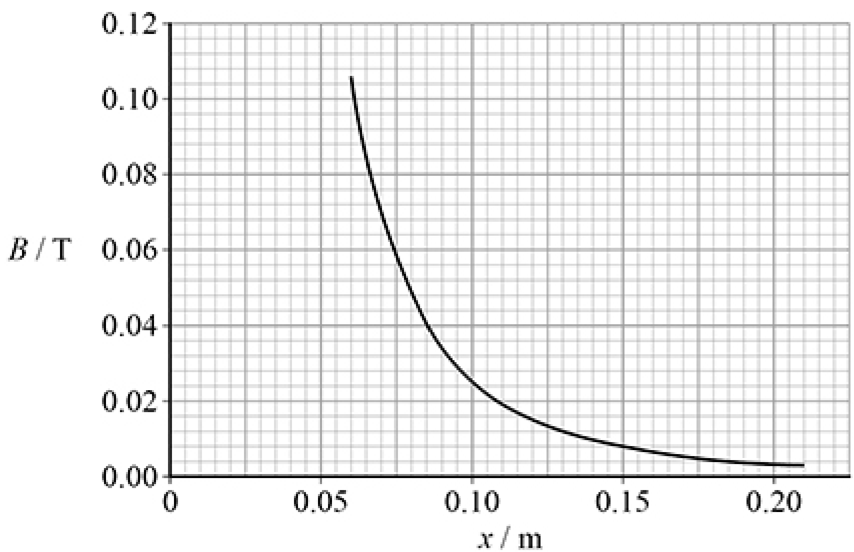
1. **Figure 1** shows a search coil positioned on the axis of an electromagnet, with the plane of the search coil perpendicular to the axis. A magnetic field is produced by a constant current in the electromagnet.
Assume that the magnetic flux density inside the search coil is uniform.

Figure 1



The distance between the search coil and the end of the electromagnet is x. **Figure 2** shows how the magnetic flux density B of the field varies with x.

Figure 2



The search coil has 200 turns and a cross-sectional area of 3.5×10^{-5} m^2.

(a) The search coil is placed at x = 0.070 m.

Show that the magnetic flux linkage through the search coil is about 5 × 10^{-4} Wb.

(2)

The search coil is now moved at a constant speed of 0.80 m s^{-1} along the axis so that x is increasing. An emf is induced across the terminals of the search coil.

(b) Explain what happens to the value of the emf as the search coil moves.

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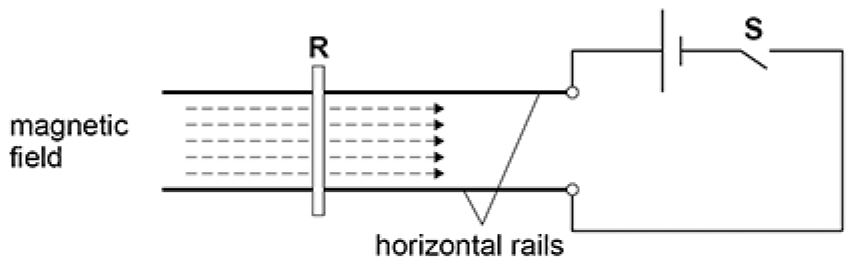
(2)

(c) The search coil passes through the position where x = 0.10 m.

Deduce whether the emf can exceed 5 mV for values of x greater than 0.10 m.

(4)
(Total 8 marks)

2. A short copper rod **R** is placed on a pair of thick horizontal parallel copper rails. A horizontal magnetic field exists in the direction shown by the dashed arrows. The diagram shows the apparatus when viewed from directly above.



When switch **S** is closed, **R** will tend to

A lift upwards away from the rails. ⬭

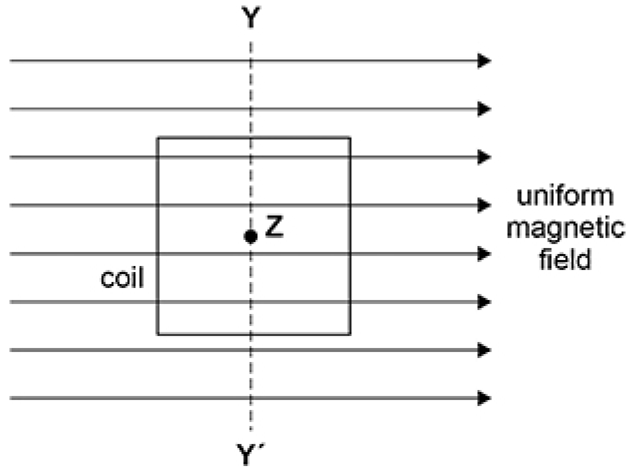
B move to the left. ⬭

C move to the right. ⬭

D be pressed downwards onto the rails. ⬭

(Total 1 mark)

3. The diagram shows a square coil with its plane parallel to a uniform magnetic field.



The coil always remains within the magnetic field.
There are four possible changes to the position of the coil:

- moving it to the left
- moving it towards **Y**
- rotating it about the axis **YY´**
- rotating it about an axis **Z** that is at its centre and perpendicular to the plane of the coil.

How many of these changes will result in an induced emf in the coil while the change occurs?

A one ⬭

B two ⬭

C three ⬭

D four ⬭

(Total 1 mark)

4. Mains electricity is rated 230 V in the UK.

Which is correct?

A The mean voltage is 163 V. ⬭

B The peak voltage is 230 V. ⬭

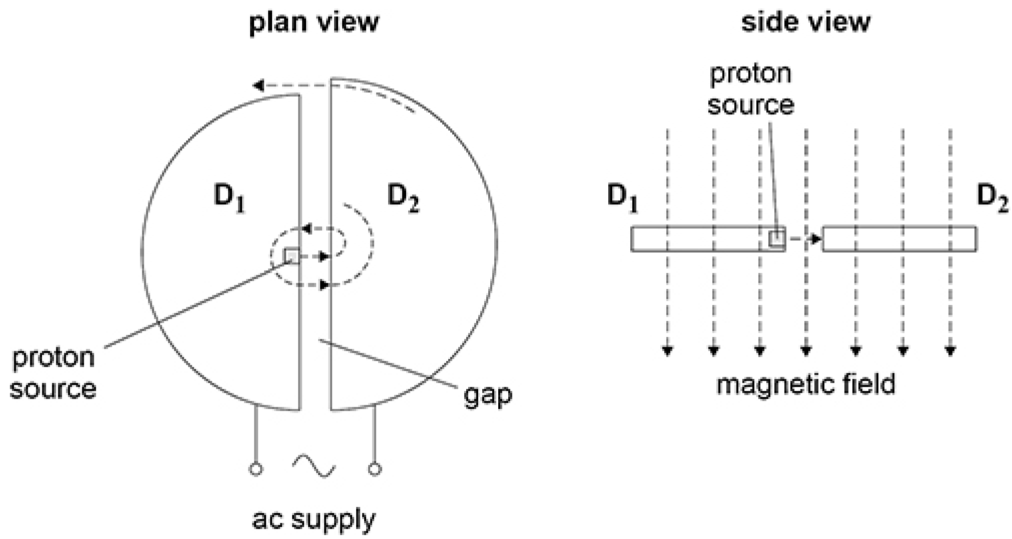
C The root mean square voltage is 325 V. ⬭

D The peak-to-peak voltage is 650 V. ⬭

(Total 1 mark)

5. The figure below shows a cyclotron. A proton is released from rest and is accelerated each time it reaches the gap between two horizontal 'dees' D_1 and D_2. Between these accelerations the proton moves at constant speed. A vertical magnetic field of flux density B acts over the dees so that the proton follows a semicircular path in each dee.

The dees are connected to an alternating potential difference (pd).
This pd is adjusted so that the proton is always accelerated by the peak electric field as it crosses the gap between the dees.



(a) Explain why the proton travels in a semicircular path in a dee.

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(2)

(b) The peak pd of the alternating supply is 10.0 kV. The proton leaves the cyclotron with kinetic energy of 14 MeV.

Determine the number of times the proton moves across the gap before it leaves the cyclotron.

number of times = ________________

(1)

The radius of the outermost semicircular path of the proton is R and the proton leaves with a maximum kinetic energy E_k.

(c) Show that E_k is given by

$$E_k = \frac{e^2 B^2 R^2}{2m_p}$$

(3)

(d) A hospital decides to purchase a cyclotron in order to manufacture its own radioactive isotopes using high-speed protons.
The required minimum kinetic energy of the emerging protons is 11 MeV.
The cost of a cyclotron is approximately proportional to $E_k^{1.5}$.
The cost of a 10 MeV cyclotron is about £2.3 million.
The table below gives information for three cyclotrons **X**, **Y** and **Z**.

Cyclotron	***B*** **/ T**	***R*** **/ m**
X	1.3	0.38
Y	1.1	0.50
Z	0.5	0.60

Deduce which cyclotron **X**, **Y** or **Z** will satisfy the energy requirement for the lowest cost.
Go on to determine the approximate cost of this cyclotron.

cyclotron = ________________

cost = ________________

(4)

(Total 10 marks)

6. In a resistor of resistance R, a steady current I dissipates a power P.

In a resistor of resistance $\frac{R}{2}$ there is an alternating current of root mean square value $3I$.

What is the mean power dissipated in the resistor of resistance $\frac{R}{2}$?

A $9P$

B $\frac{9}{2}P$

C $\frac{9}{4}P$

D $\frac{3}{2}P$

(Total 1 mark)

7. The primary winding of a transformer has 200 turns and the secondary winding has 1600 turns. A root mean square (rms) alternating voltage of 25 V is applied to the primary winding causing a primary rms current of 4.0 A. The transformer is 90% efficient.

What are the rms values of the secondary voltage and the secondary current?

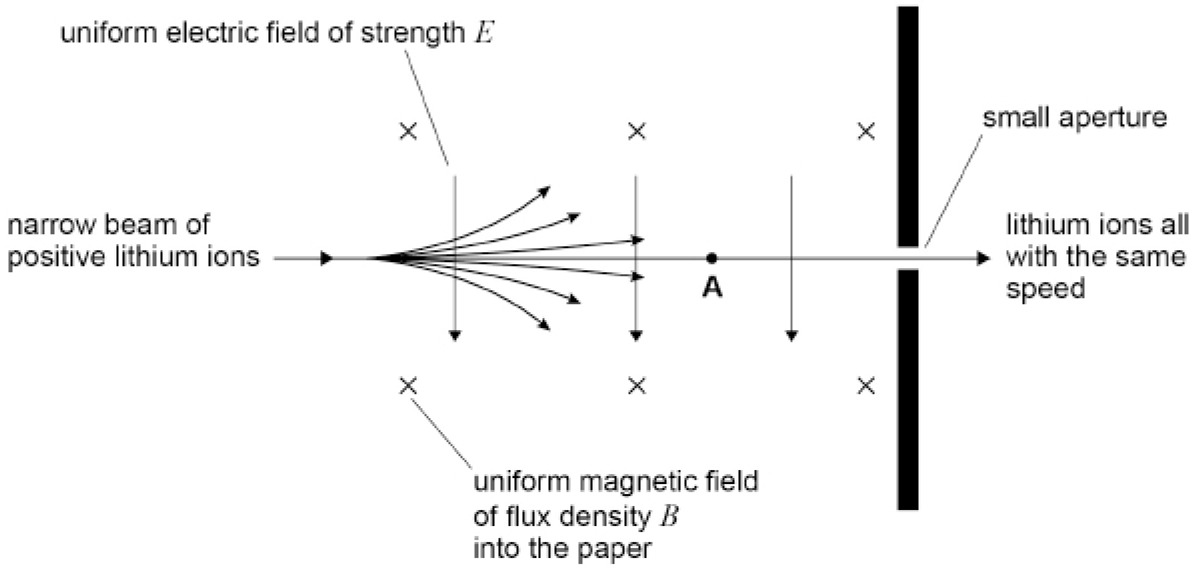
	Secondary voltage / V	Secondary current / A
A	200	0.50
B	200	0.45
C	180	0.50
D	3.1	29.0

(Total 1 mark)

8. Mass spectrometers are used to measure the masses of ions.

Figure 1 shows one part of a mass spectrometer.

Figure 1



A narrow beam consists of positive lithium ions travelling at different speeds.
The beam enters a region where there is an electric field and a magnetic field.
The directions of the uniform electric field of strength E and the uniform magnetic field of flux density B are shown on **Figure 1**.

Most ions are deflected from their original path.
Lithium ions that travel at one particular speed are not deflected, and pass through the small aperture.

(a) The positive lithium ion **A** in **Figure 1** moves at a speed v.

Draw **two** labelled arrows on **Figure 1** to show the directions of the electric force F_E and the magnetic force F_M acting on **A**.

(1)

(b) Lithium ions travelling at 1.5×10^5 m s^{-1} pass through the small aperture.

Calculate E.

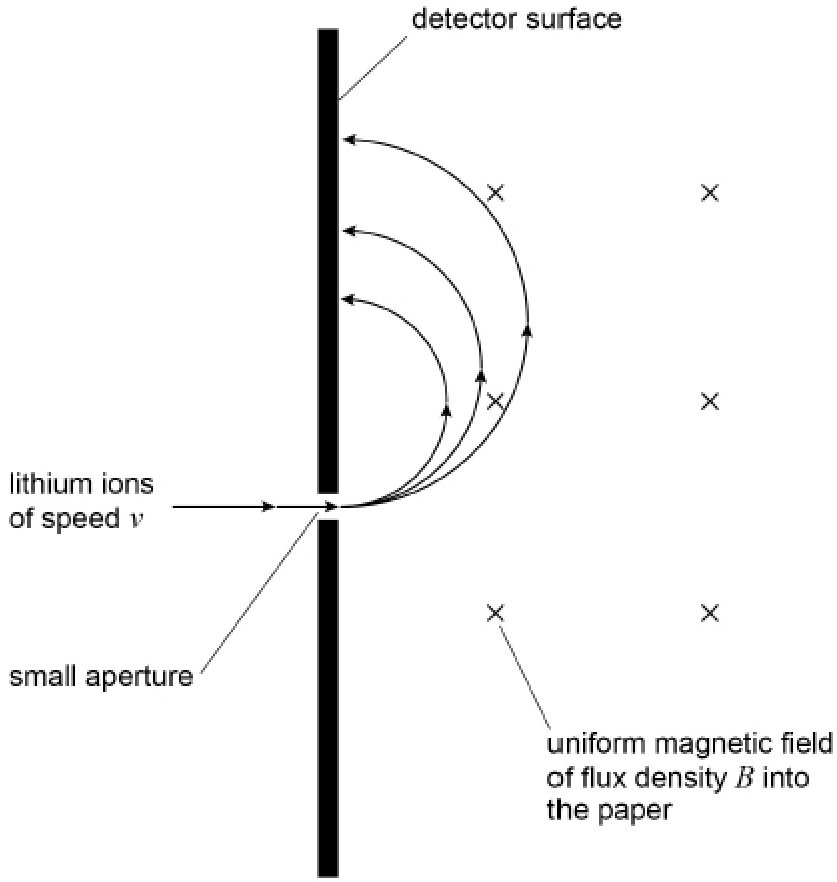
$B = 0.12$ T

E = _______________ V m^{-1}

(2)

(c) Ions that pass through the small aperture enter a second uniform magnetic field of flux density B.
Ions of different mass are separated because they follow different paths as shown in **Figure 2**.

Figure 2



Ions of mass m and charge q travelling at speed v follow a circular path in the uniform magnetic field.

Show that the radius r of the circular path is given by

$$r = \frac{mv}{Bq}$$

(1)

(d) The ions of different mass are deflected and strike the detector surface at different distances from the small aperture as shown in **Figure 2**.

A singly-charged lithium ion ($^{6}_{3}Li^{+}$) passes through the small aperture.

Calculate the distance between the small aperture and the point where this ion strikes the detector surface.

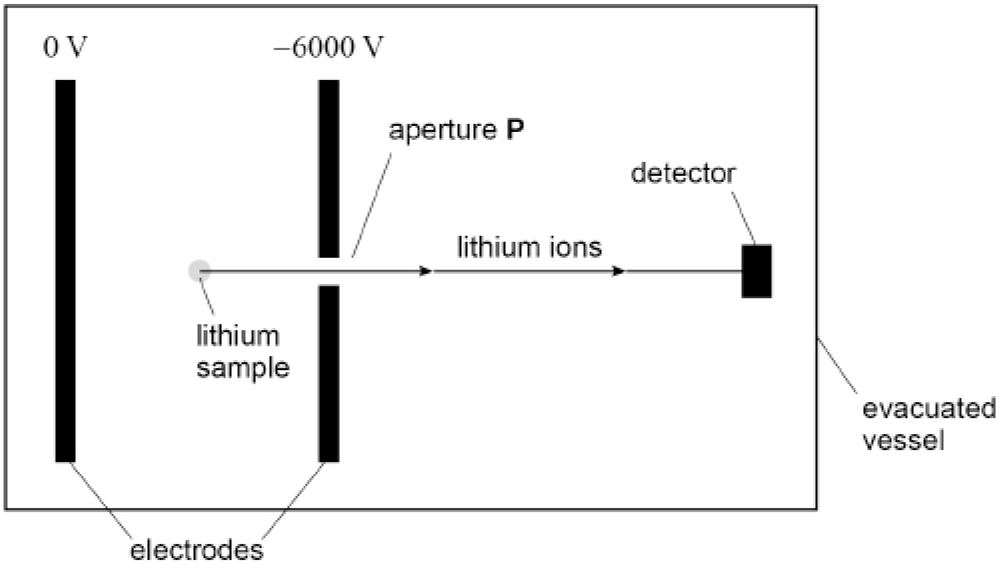
$v = 1.5 \times 10^{5}$ m s^{-1}
$B = 0.12$ T
mass of $^{6}_{3}Li^{+}$ ion = 1.0×10^{-26} kg

distance = _______________ m

(2)

(e) **Figure 3** shows a different type of mass spectrometer working with lithium ions.

Figure 3



A stationary ${}^{7}_{3}\mathrm{Li}^{+}$ ion in the lithium sample is at the mid-point between the parallel electrodes. The ${}^{7}_{3}\mathrm{Li}^{+}$ ion accelerates towards aperture **P**.

Determine the speed of the ion when it emerges through aperture **P**.

mass of ${}^{7}_{3}\mathrm{Li}^{+}$ ion = 1.2×10^{-26} kg

speed = ________________ m s^{-1}

(3)

(f) $^{6}_{3}Li^{+}$ and $^{7}_{3}Li^{+}$ ions are produced in the sample simultaneously and travel a distance L from aperture **P** to the detector.
For each type of ion, the time interval between production and detection is measured.

Discuss how the masses of the ions can be deduced from the measurement of these time intervals.

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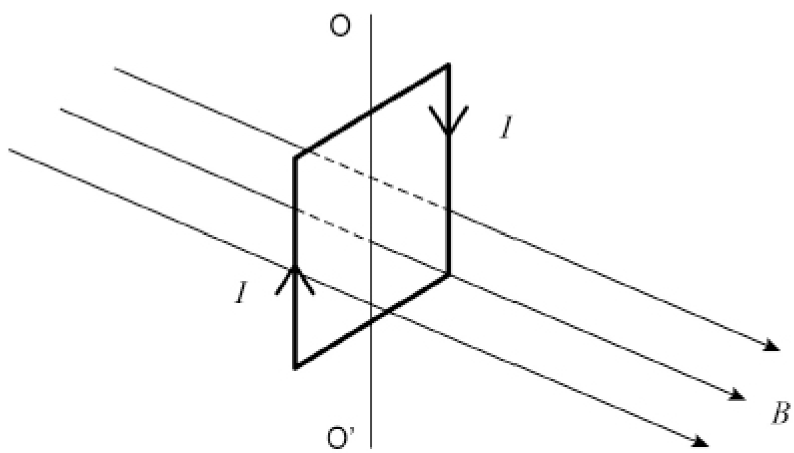
(2)
(Total 11 marks)

9. 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.

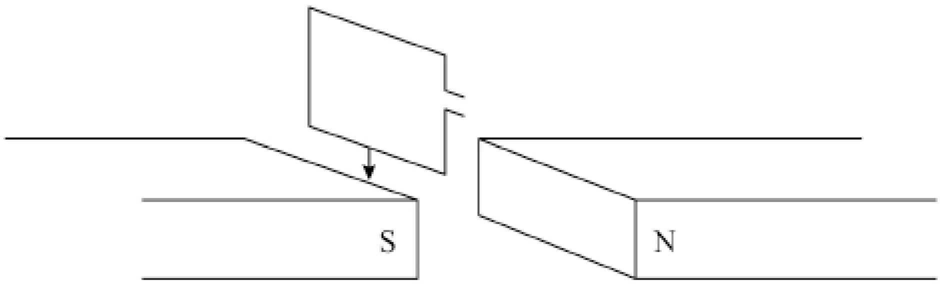


Which statement is correct?

A	The forces on the vertical sides of the coil are equal in magnitude and 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.	⬭

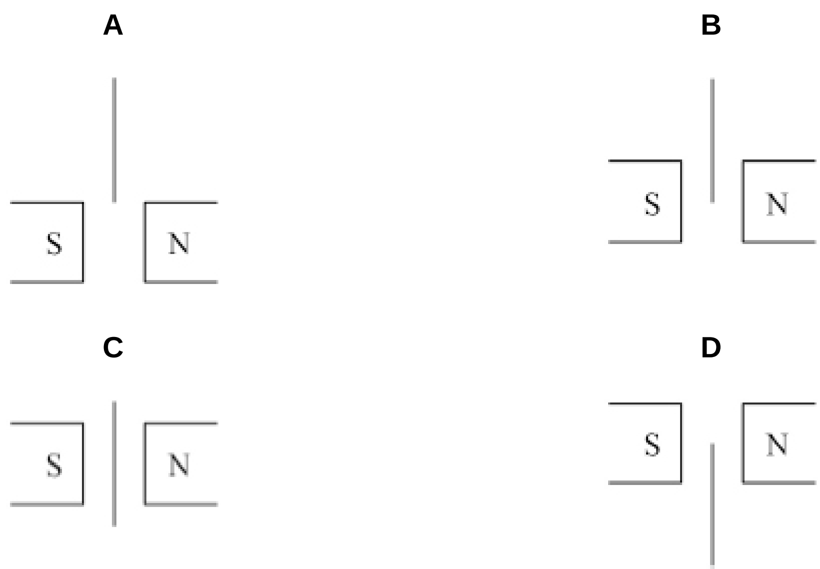
(Total 1 mark)

10. 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 ⬭

(Total 1 mark)

11. 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

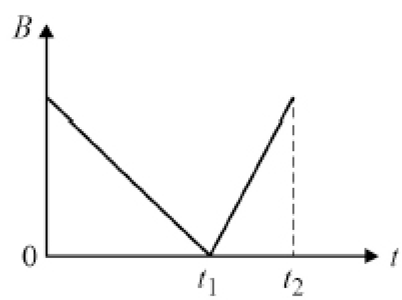
B $\frac{\pi}{3}$ rad

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

D π rad

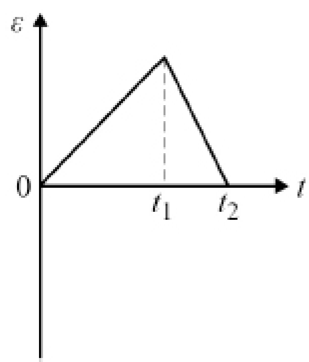
(Total 1 mark)

12. The diagram shows the variation with time t of the magnetic flux density B of the field linking a coil.

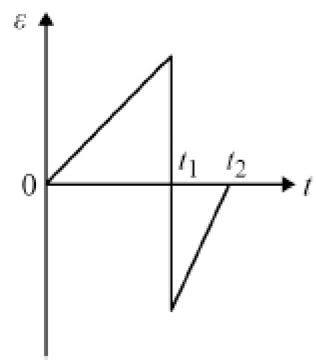


Which graph shows the variation of induced emf ε in the coil during this time interval?

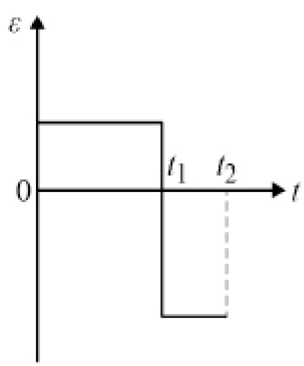
A



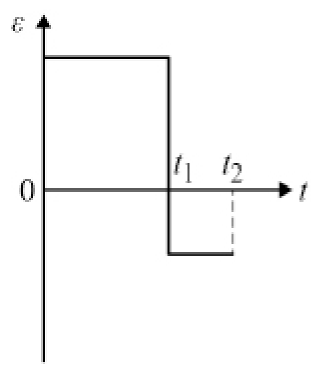
B



C



D



A ○

B ○

C ○

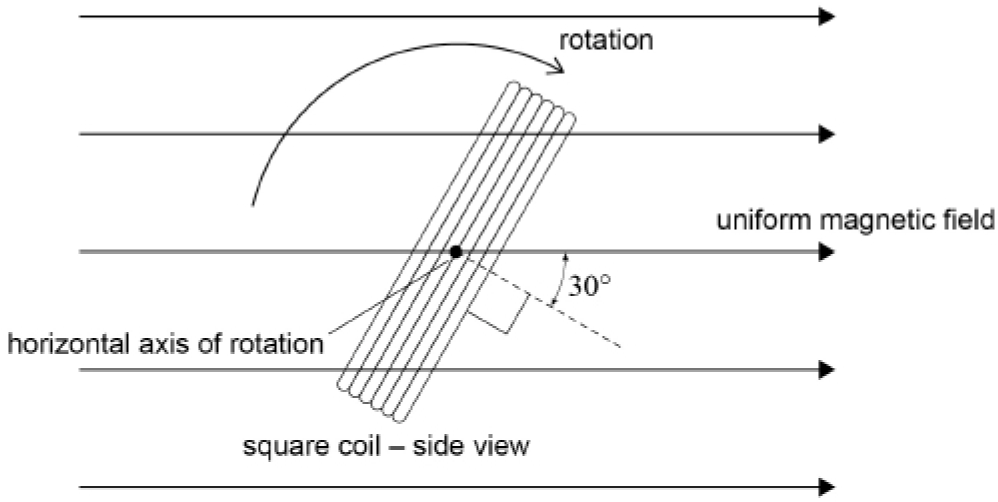
D ○

(Total 1 mark)

13. A square coil of wire is rotating at a constant angular speed about a horizontal axis.

Figure 1 shows the coil at one instant when the normal to the plane of the coil is at 30° to a magnetic field.

Figure 1



The area of the coil is 5.0×10^{-4} m^2 and the flux density of the uniform magnetic field is 2.5×10^{-2} T.

(a) The maximum flux linkage of the coil during its rotation is 1.5×10^{-3} Wb turns.

Calculate the number of turns in the coil.

number of turns = ____________________

(2)

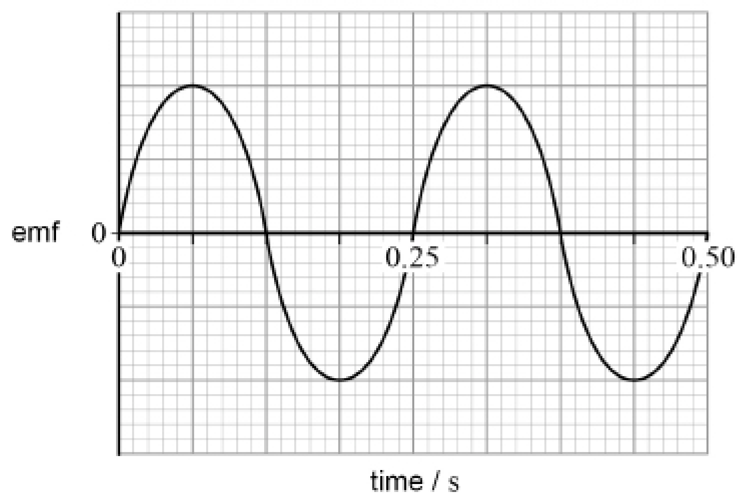
(b) Calculate the flux linkage of the coil at the instant shown in **Figure 1**.

flux linkage = ____________________ Wb turns

(2)

(c) The coil forms part of an electrical generator. **Figure 2** shows the emf generated by the coil.

Figure 2



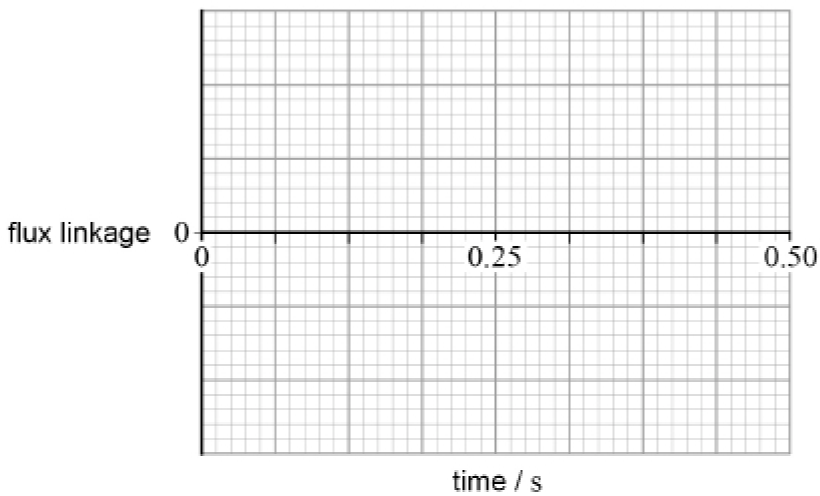
Calculate the peak value of the emf generated.

emf = ____________________ V

(2)

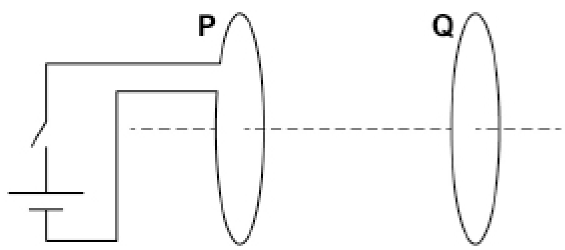
(d) Sketch on **Figure 3** the variation with time of flux linkage for the same time interval as **Figure 2**.

Figure 3



(1)
(Total 6 marks)

14. 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 ⬭

(Total 1 mark)

15. When an electron is moving at a speed v perpendicular to a uniform magnetic field of flux density B, it follows a path of radius R.

A second electron moves at a speed $\frac{v}{2}$ perpendicular to a uniform magnetic field of flux density $4B$.

What is the radius of the path of the second electron?

A $\frac{R}{8}$

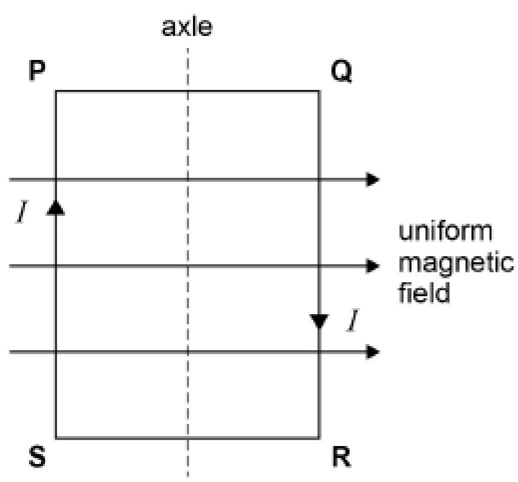
B $\frac{R}{4}$

C $2R$

D $8R$

(Total 1 mark)

16. The plane of coil **PQRS** is parallel to a uniform magnetic field.



When a current I is in the coil

A there are no magnetic forces acting on **SP** and **QR**.

B there are no magnetic forces acting on **PQ** and **RS**.

C an attractive magnetic force acts between **SP** and **QR**.

D an attractive magnetic force acts between **PQ** and **RS**.

(Total 1 mark)

17. A horizontal wire of length 0.50 m and weight 1.0 N is placed in a uniform horizontal magnetic field of flux density 1.5 T directed at 90° to the wire.

What is the current that just supports the wire?

A 0.33 A ○

B 0.75 A ○

C 1.3 A ○

D 3.0 A ○

(Total 1 mark)

18. (a) State Lenz's law.

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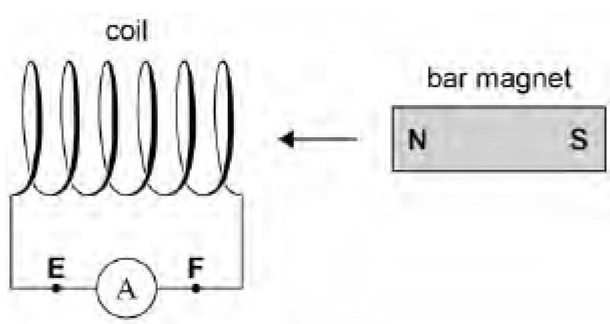
(1)

(b) Lenz's law can be demonstrated using a bar magnet and a coil of wire connected to a sensitive ammeter as shown in **Figure 1**.

Figure 1



The bar magnet is moved towards the coil and is then brought to a halt.

State how the reading on the ammeter changes during this process.

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(1)

(c) During the demonstration an induced current is detected by the ammeter. The induced current is in the direction **E** to **F**.
Explain how this demonstrates Lenz's law.

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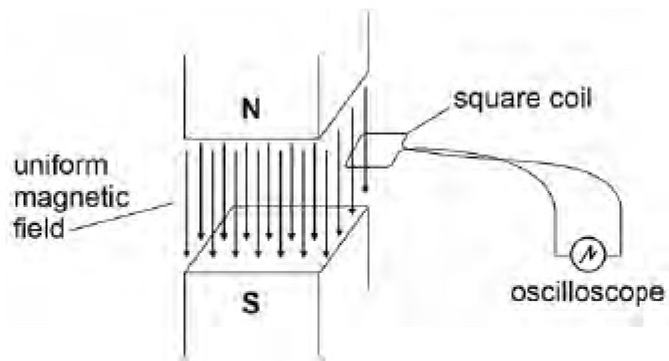
(2)

(d) **Figure 2** shows an arrangement for investigating induced emf.

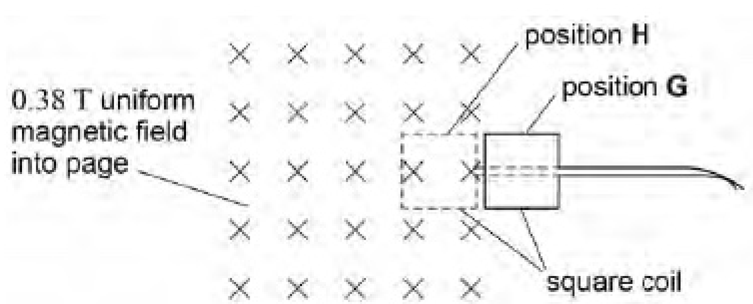
Figure 2



As shown, the uniform vertical magnetic field is confined to the gap between the poles of the magnet. The plane of the square coil is horizontal and is made of conducting wire. The coil consists of a single turn and is attached by flexible wire to an oscilloscope.

The oscilloscope gives a reading of 2.9×10^{-4} V when the coil is moved at uniform speed from position **G** outside the field to position **H** inside the field, as shown in **Figure 3**.

Figure 3



Length of side of square coil = 32 mm

Magnetic flux density of uniform magnetic field = 0.38 T

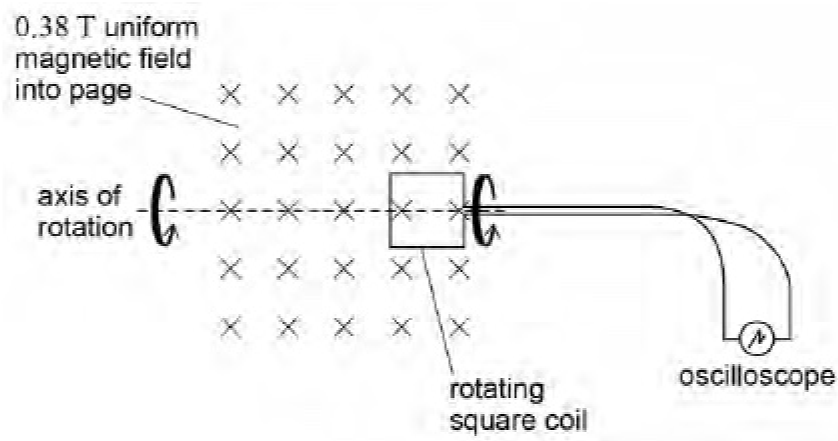
Calculate the time taken to move the coil from position **G** to position **H**.

time = ____________________ s

(2)

(e) The square coil is rotated through 360° at a constant angular speed about the horizontal axis shown in **Figure 4**.

Figure 4



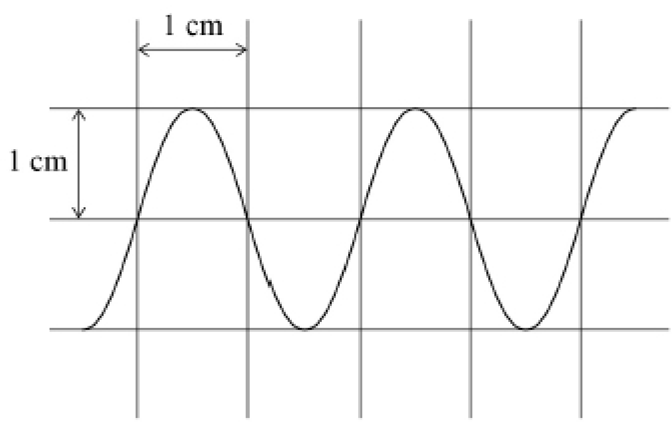
Calculate the angular speed of the coil when the maximum reading on the oscilloscope is 5.1 mV

angular speed = ____________________ rad s^{-1}

(2)

(Total 8 marks)

19. The figure shows an oscilloscope trace of a sinusoidal ac voltage.



The time base setting is 5 ms cm^{-1} and the Y-voltage gain is 10 V cm^{-1}.

Which row describes the ac voltage?

	rms voltage / V	Frequency / Hz	
A	14	50	⬭
B	14	100	⬭
C	7	50	⬭
D	7	100	⬭

(Total 1 mark)

20. A steady current I dissipates power P in a resistor of resistance R.
An alternating current through a resistor of resistance $2R$ has a peak value of I.

What is the power dissipated in the second resistor?

A $\frac{P}{\sqrt{2}}$ ⬭

B P ⬭

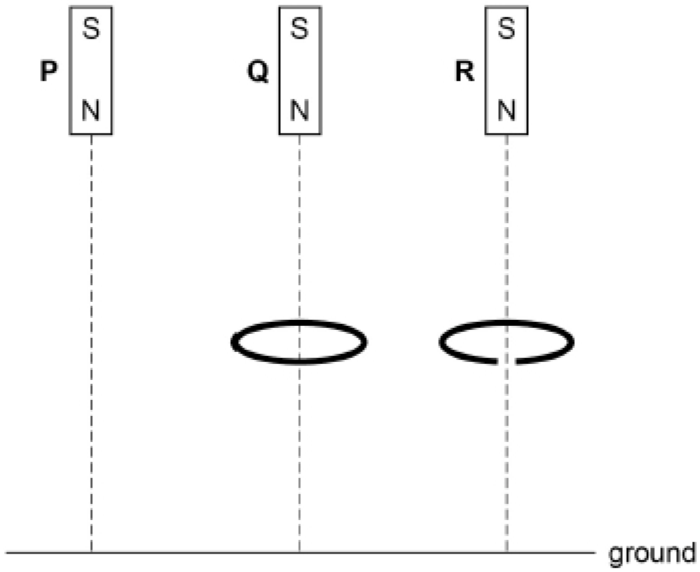
C $\sqrt{2}\,P$ ⬭

D $2P$ ⬭

(Total 1 mark)

21. Three identical magnets **P**, **Q** and **R** are released simultaneously from rest and fall to the ground from the same height.

P falls directly to the ground.
Q falls through the centre of a thick horizontal conducting ring.
R falls through a similar ring that has a gap cut into it.



In which order do the magnets reach the ground?

A **P** and **R** arrive together, followed by **Q**. ☐

B **P** and **Q** arrive together, followed by **R**. ☐

C **P** arrives first, followed by **Q** which is followed by **R**. ☐

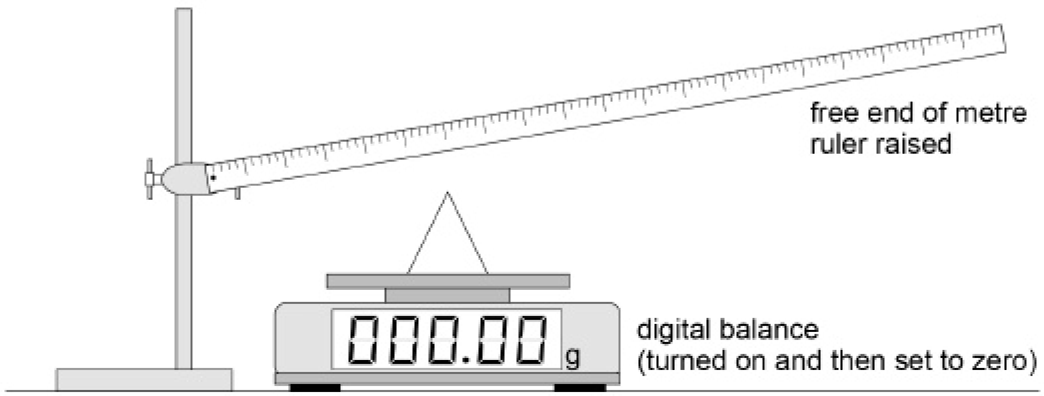
D All three magnets arrive simultaneously. ☐

(Total 1 mark)

22. This question is about using a digital balance to investigate the force on a wire placed in a magnetic field when there is an electric current in the wire.

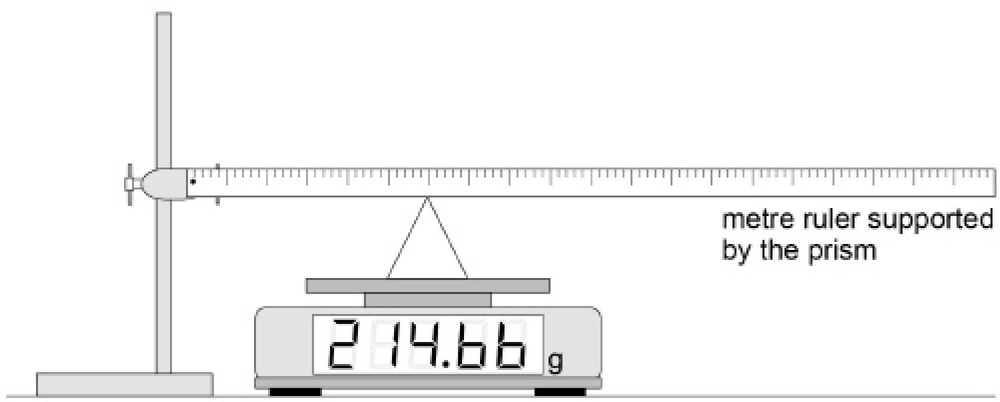
A student carries out the procedure shown in **Figure 1** and **Figure 2**.
A metre ruler is pivoted at the 1.0 cm mark and a prism is placed on a digital balance. The free end of the ruler is raised and the balance is turned on and then set to zero, as shown in **Figure 1**.

Figure 1



The ruler is then supported by the prism with the apex of the prism at the 30.0 cm mark as shown in **Figure 2**. The height of the pivot is adjusted so that the ruler is horizontal.

Figure 2



(a) Deduce the mass of the ruler.
State **one** assumption you make.

mass of ruler = ____________________ g

assumption ____

____

(3)

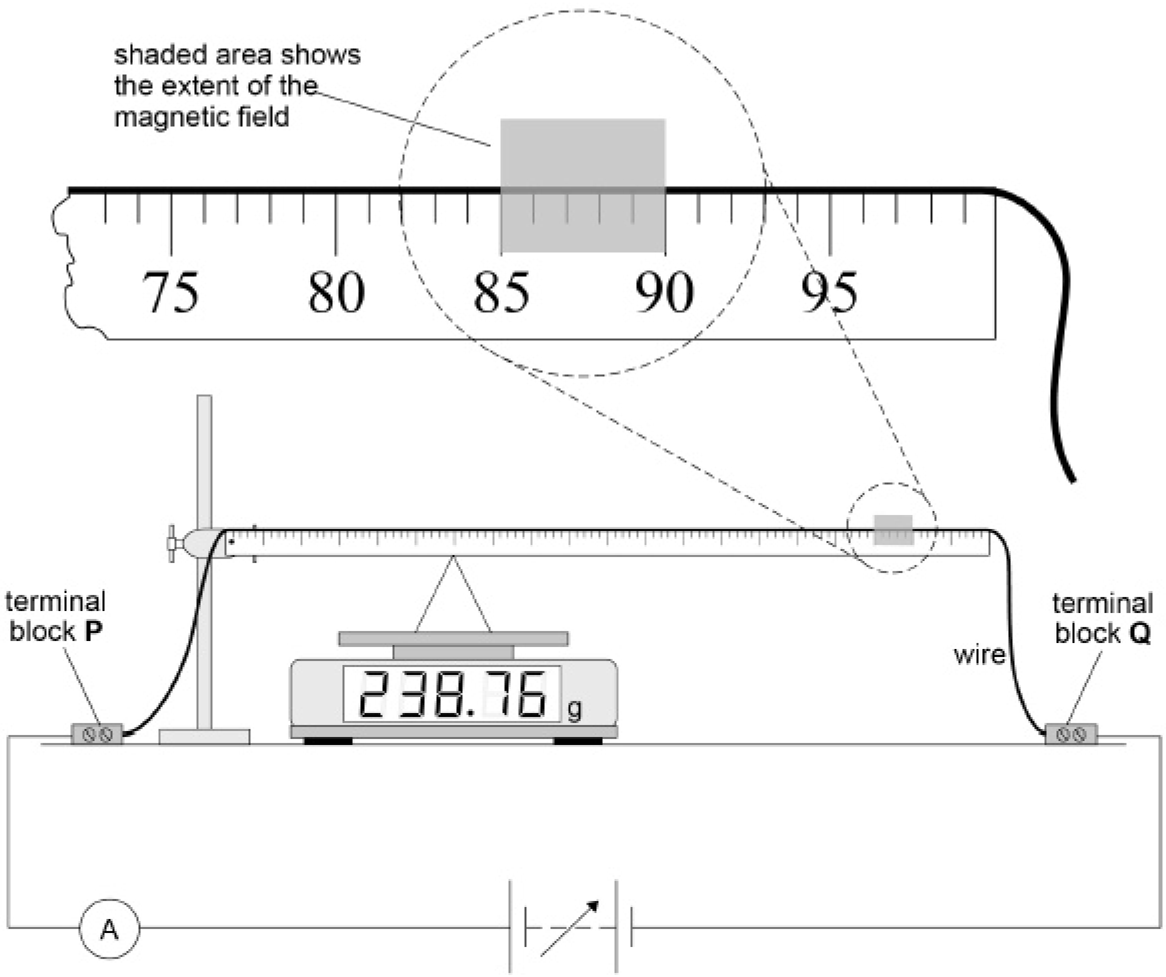
(b) The student attaches a uniform wire to the upper edge of the ruler, as shown in **Figure 3**.

The ends of the wire are connected to terminal blocks **P** and **Q** which are fixed firmly to the bench. A power supply and an ammeter are connected between **P** and **Q**.

These modifications cause the balance reading to increase slightly.

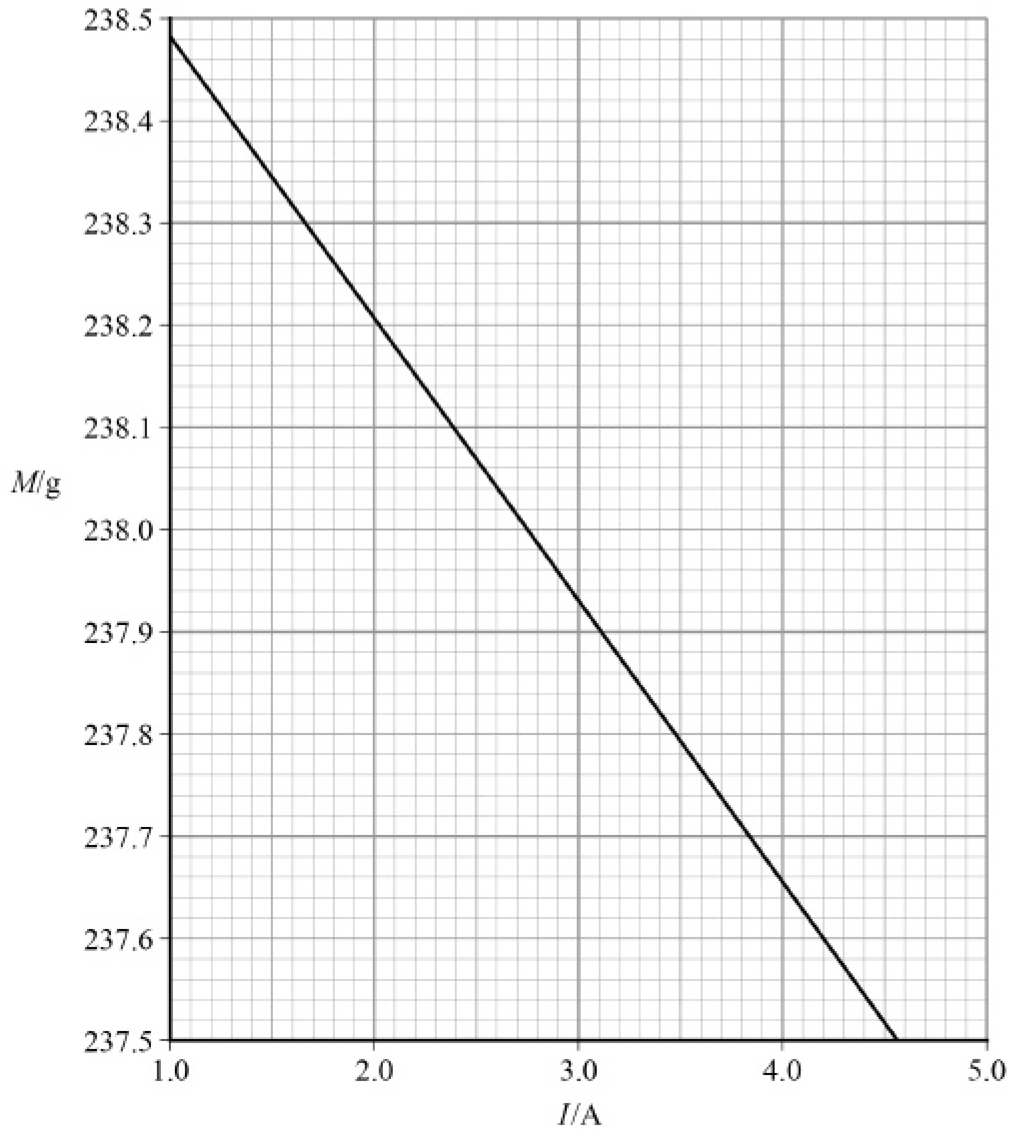
A horizontal uniform magnetic field is applied, perpendicular to the wire, between the 85 cm and 90 cm marks, as shown in the close-up diagram in **Figure 3**.

Figure 3



The balance reading M is recorded for increasing values of current I.
A graph of these data is shown in **Figure 4**.

Figure 4



State and explain the direction of the horizontal uniform magnetic field.

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(3)

(c) It can be shown that B, the magnitude of the magnetic flux density of the horizontal uniform magnetic field, is given by

$$B = \frac{\sigma}{3L}$$

where

σ = change in force acting on the prism per unit current in the wire
L = length of the region where the magnetic field cuts through the wire.

Determine B.

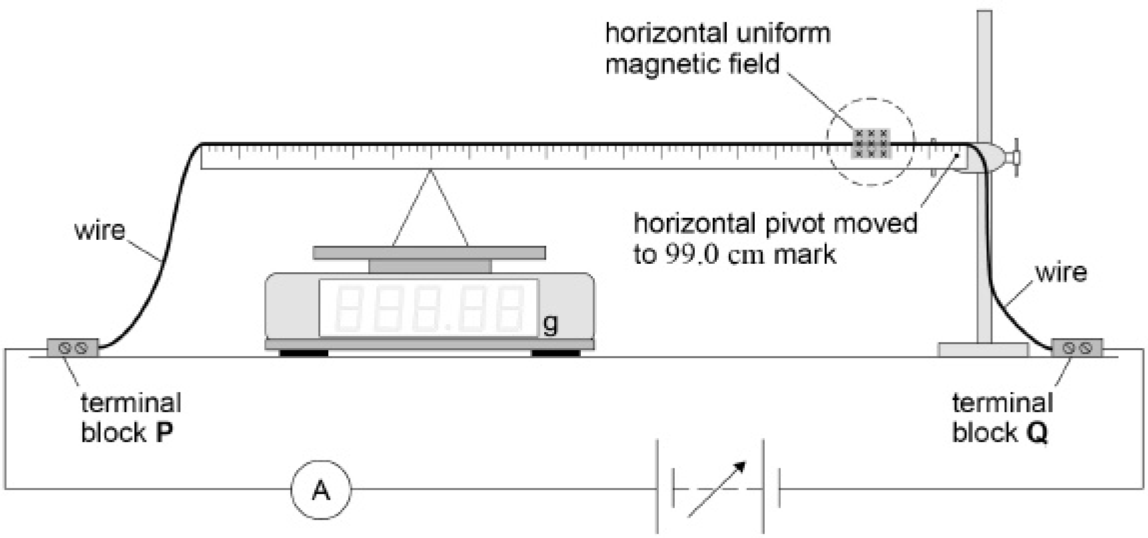
B = ____________________ T

(3)

(d) The experiment is repeated with the ruler pivoted at the 99.0 cm mark.
Nothing else is changed from **Figure 3**.

This arrangement is shown in **Figure 5**.

Figure 5



Tick (✓) **one** box in row 1 and **one** box in row 2 of the table to identify the effect, if any, on the magnitude of the forces acting on the apparatus as a certain current is passed through the wire.

Tick (✓) **one** box in row 3 and **one** box in row 4 of the table to identify the effect, if any, on the graph produced for this modified experiment compared with the graph in **Figure 4**.

		Reduced	**No effect**	**Increased**
1	Force acting on the current-carrying wire due to the horizontal uniform magnetic field			
2	Force acting on the prism due to the pivoted ruler			
3	Gradient of the graph			
4	Vertical intercept of the graph			

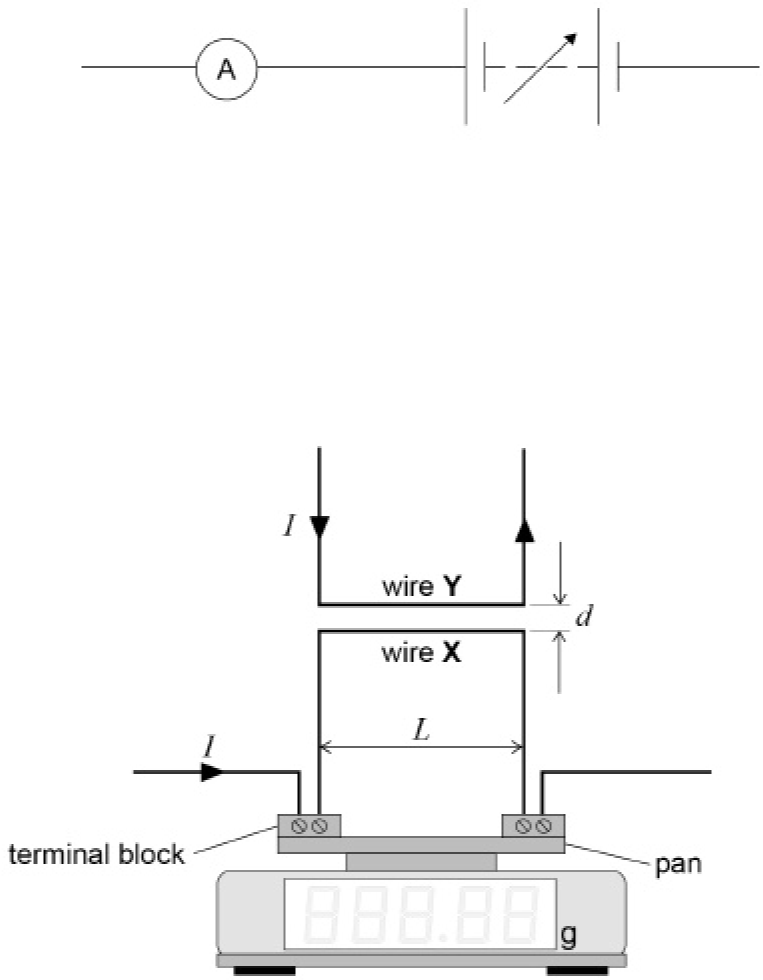
(3)

(e) **Figure 6** shows the balance being used to measure the forces between two wires. The connections joining these wires to the power supply are not shown.

The pan of the balance moves a negligible amount during use and it supports a straight conducting wire **X** of horizontal length L.
Terminal blocks are used to connect **X** into the circuit. The weight of these does not affect the balance reading.
A second conducting wire **Y** is firmly supported a distance d above **X**.

Show, by adding detail to **Figure 6**, the wire connections that complete the circuit.
The currents in **X** and **Y** must have the same magnitude and be in the directions indicated.

Figure 6



(2)

(f) The vertical force F on wire **X** due to the magnetic field produced by wire **Y** is given by

$$F = \frac{kI^2L}{d}$$

where

k is a constant
d is the perpendicular distance between **X** and **Y**
I is the current in the wires

and

L is the horizontal length of wire **X**.

A student wants to measure k using the arrangement in **Figure 6**.

The student is told that the following restrictions must apply:

- L is fixed
- I must not exceed 5.0 A
- the result for k must be obtained using a **graphical method**
- the experimental procedure must involve **only one** independent variable.

Explain what the student could do to find k.

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(5)

(Total 19 marks)

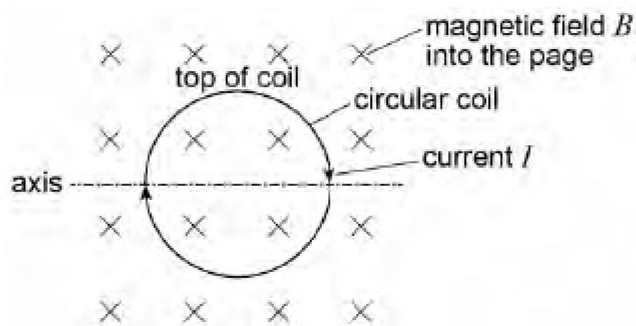
23. A transformer has an efficiency of 80%
It has 7000 turns on its primary coil and 175 turns on its secondary coil. When the primary of the transformer is connected to a 240 V ac supply, the secondary current is 8.0 A

What are the primary current and secondary voltage?

	Primary current / mA	Secondary voltage / V	
A	250	6.0	⬭
B	160	6.0	⬭
C	250	9600	⬭
D	160	9600	⬭

(Total 1 mark)

24. The diagram shows a clockwise current I in a circular coil placed in a uniform magnetic field B with the plane of the coil perpendicular to the magnetic field.



What is the effect on the coil of the interaction between the current and the magnetic field?

A It rotates about the axis with the top moving out of the page. ⬭

B It rotates about the axis with the top moving into the page. ⬭

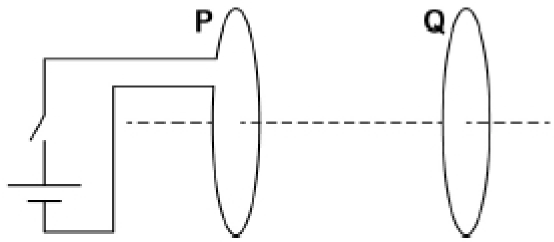
C It causes an increase in the diameter of the coil. ⬭

D It causes a decrease in the diameter of the coil. ⬭

(Total 1 mark)

25. A coil **P** is connected to a cell and a switch.

A second closed coil **Q** is parallel to **P** and is arranged on the same axis.



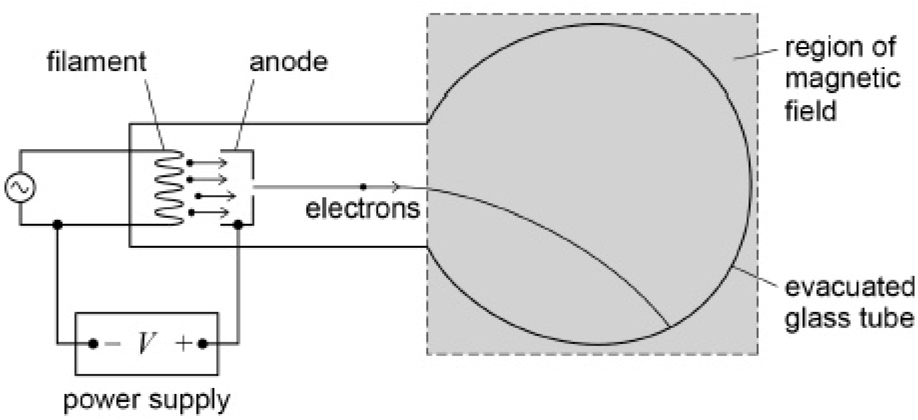
When the switch is closed, coil **Q** experiences a force.

Which row describes the force on **Q**?

	Force	Direction of force	
A	increases to constant value	to left	⬭
B	increases to constant value	to right	⬭
C	increases then decreases	to left	⬭
D	increases then decreases	to right	⬭

(Total 1 mark)

26. The diagram shows apparatus which can be used to determine the specific charge of an electron.



Electrons are emitted from the filament and accelerated by a potential difference between the filament and anode to produce a beam. The beam is deflected into a circular path by applying a magnetic field perpendicular to the plane of the diagram.

(a) Describe the process that releases the electrons emitted at the filament.

(3)

(b) The table shows the data collected when determining the specific charge of the electron by the method shown in the diagram.

potential difference V that accelerates the electrons	320 V
radius r of circular path of the electrons in the magnetic field	4.0 cm
flux density B of the applied magnetic field	1.5 mT

Show that the specific charge of the electron is given by the expression $\frac{2V}{B^2r^2}$

(2)

(c) Using data from the table, calculate a value for the specific charge of the electron.
Give your answer to an appropriate number of significant figures.

specific charge of the electron = ____________________ C kg^{-1}

(2)

(d) At the time when Thomson measured the specific charge of the particles in cathode rays, the largest specific charge known was that of the hydrogen ion.

State how Thomson's result for the specific charge of each particle within a cathode ray compared with that for the hydrogen ion and explain what he concluded about the nature of the particles.

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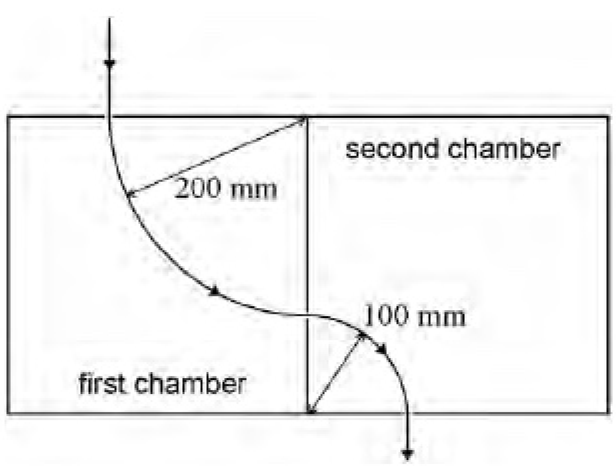
(2)
(Total 9 marks)

27. Different magnetic fields are present in the two chambers shown. A particle enters the first chamber at a velocity of 80 m s^{-1} and is deflected into a circular path of radius 200 mm
In the second chamber it follows a circular path of radius 100 mm



The particle leaves the second chamber at a speed of

A 20 m s^{-1} ⬭

B 40 m s^{-1} ⬭

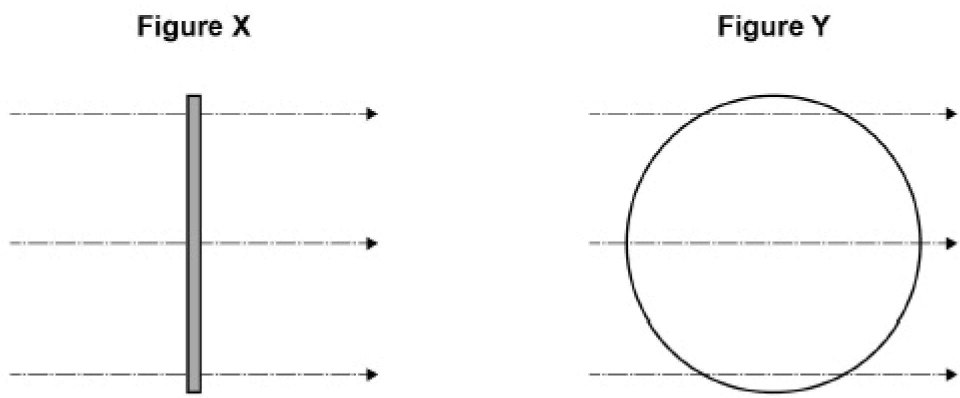
C 80 m s^{-1} ⬭

D 160 m s^{-1} ⬭

(Total 1 mark)

28. A coil with 20 circular turns each of diameter 60 mm is placed in a uniform magnetic field of flux density 90 mT.

Initially the plane of the coil is perpendicular to the magnetic field lines as shown in **Figure X**.



The coil is rotated about a vertical axis by 90° in a time of 0.20 s so that its plane becomes parallel to the field lines as shown in **Figure Y**.
Assume that the rate of change of flux linkage remains constant.

What is the emf induced in the coil?

A zero ⬭

B 1.3 mV ⬭

C 25 mV ⬭

D 100 mV ⬭

(Total 1 mark)

29. The mean power dissipated in a resistor is 47.5 μW when the root mean square (rms) voltage across the resistor is 150 mV.

What is the peak current in the resistor?

A 2.3×10^{-4} A

B 4.5×10^{-4} A

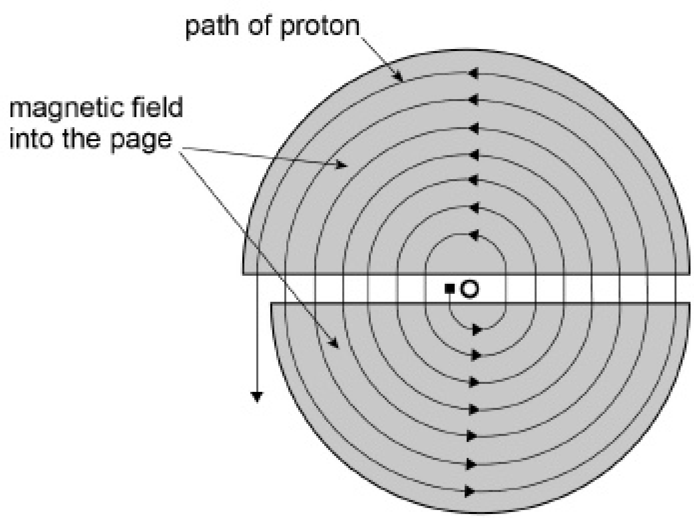
C 2.3×10^{3} A

D 4.5×10^{3} A

(Total 1 mark)

30. A cyclotron has two D-shaped regions where the magnetic flux density is constant.
The D-shaped regions are separated by a small gap.
An alternating electric field between the D-shaped regions accelerates charged particles. The magnetic field causes the charged particles to follow a circular path.

The diagram shows the path followed by a proton that starts from **O**.



(a) Explain why it is **not** possible for the magnetic field to alter the speed of a proton while it is in one of the D-shaped regions.

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(1)

(b) Derive an expression to show that the time taken by a proton to travel round one semi-circular path is independent of the radius of the path.

(3)

(c) The maximum radius of the path followed by the proton is 0.55 m and the magnetic flux density of the uniform field is 0.44 T.

Ignore any relativistic effects.

Calculate the maximum speed of a proton when it leaves the cyclotron.

maximum speed = ____________________ m s^{-1}

(2)

(Total 6 marks)

31. The National Grid is used to transfer electrical energy from power stations to consumers.

What conditions for the transmission voltage and the transmission current give the most efficient transfer of energy through the National Grid?

	Transmission voltage	**Transmission current**	
A	High	High	⬭
B	High	Low	⬭
C	Low	High	⬭
D	Low	Low	⬭

(Total 1 mark)

32. A mains transformer has a primary coil of 2500 turns and a secondary coil of 130 turns.
The primary coil is connected to a mains supply where V_{rms} is 230 V.
The secondary coil is connected to a lamp of resistance 6.0 Ω.
The transformer is 100% efficient.

What is the peak power dissipated in the lamp?

A 12 W ☐

B 24 W ☐

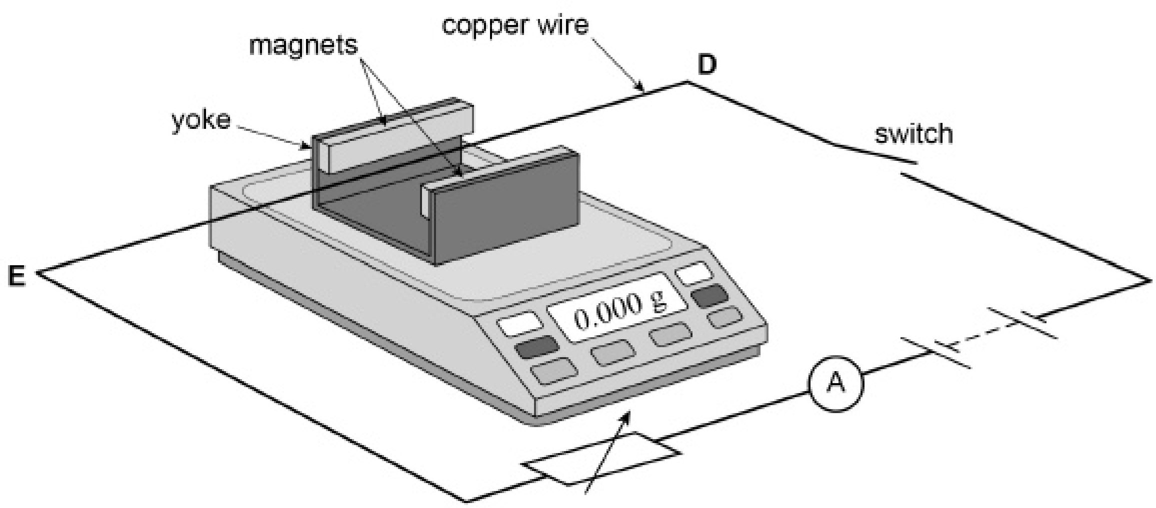
C 48 W ☐

D 96 W ☐

(Total 1 mark)

33. **Figure 1** shows two magnets, supported on a yoke, placed on an electronic balance.

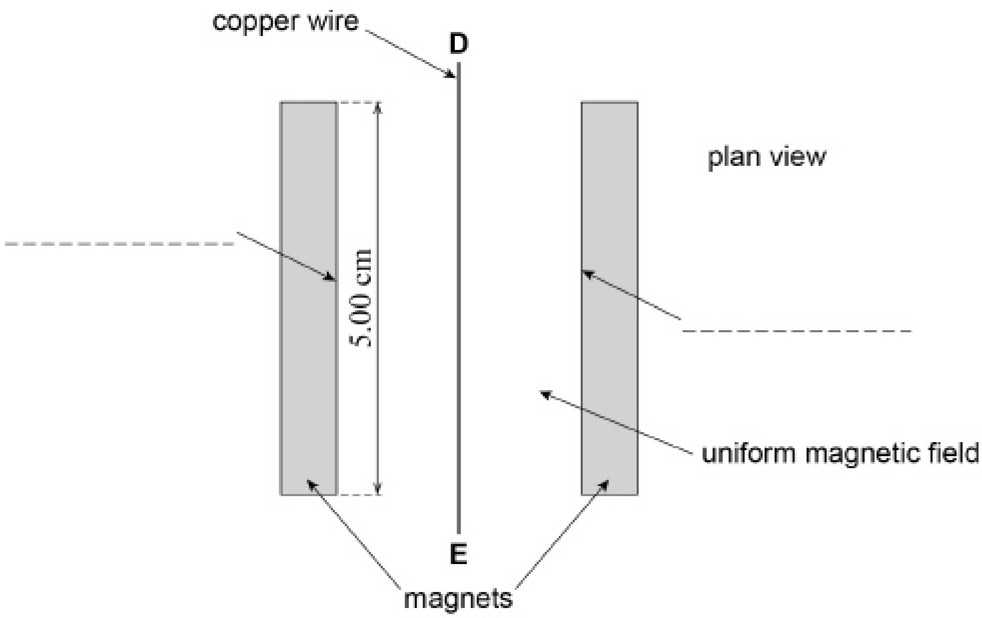
Figure 1



The magnets produce a uniform horizontal magnetic field in the region between them. A copper wire **DE** is connected in the circuit shown in **Figure 1** and is clamped horizontally at right angles to the magnetic field.

Figure 2 shows a simplified plan view of the copper wire and magnets.

Figure 2



When the apparatus is assembled with the switch open, the reading on the electronic balance is set to 0.000 g. This reading changes to a positive value when the switch is closed.

(a) Which of the following correctly describes the direction of the force acting on the wire **DE** due to the magnetic field when the switch is closed?

Tick (✓) the correct box.

towards the left magnet in **Figure 2**	☐
towards the right magnet in **Figure 2**	☐
vertically up	☐
vertically down	☐

(1)

(b) Label the poles of the magnets by putting **N** or **S** on each of the two dashed lines in **Figure 2**.

(1)

(c) Define the tesla.

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(1)

(d) The magnets are 5.00 cm long. When the current in the wire is 3.43 A the reading on the electronic balance is 0.620 g.

Assume the field is uniform and is zero beyond the length of the magnets.

Calculate the magnetic flux density between the magnets.

magnetic flux density = ____________________ T

(2)

(Total 5 marks)