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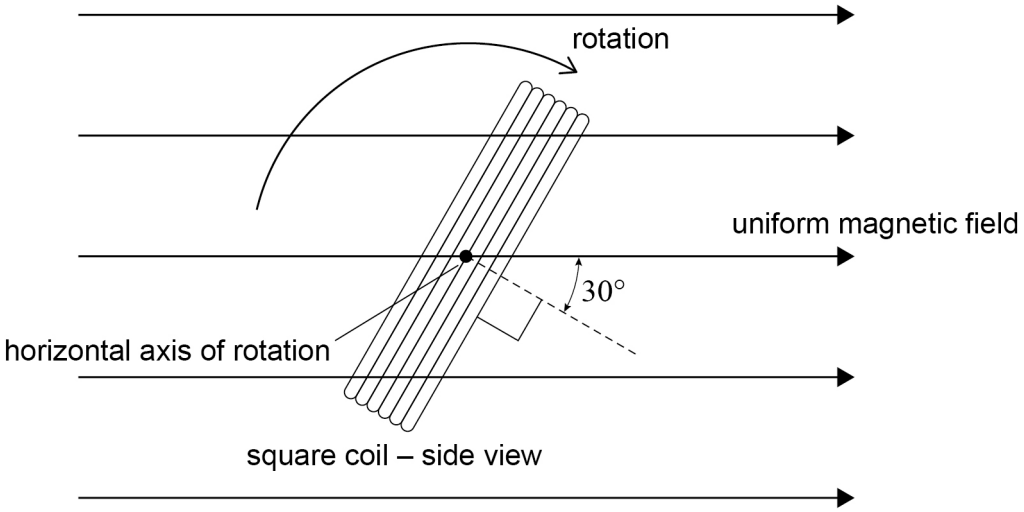
0 5 A square coil of wire is rotating at a constant angular speed about a horizontal axis. **Figure 4** shows the coil at one instant when the normal to the plane of the coil is at $30°$ to a magnetic field.

Figure 4



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.

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0 5 . 1 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.

[2 marks]

number of turns = _____

0 5 . 2 Calculate the flux linkage of the coil at the instant shown in **Figure 4**.

[1 mark]

flux linkage = _____ Wb turns

Question 5 continues on the next page

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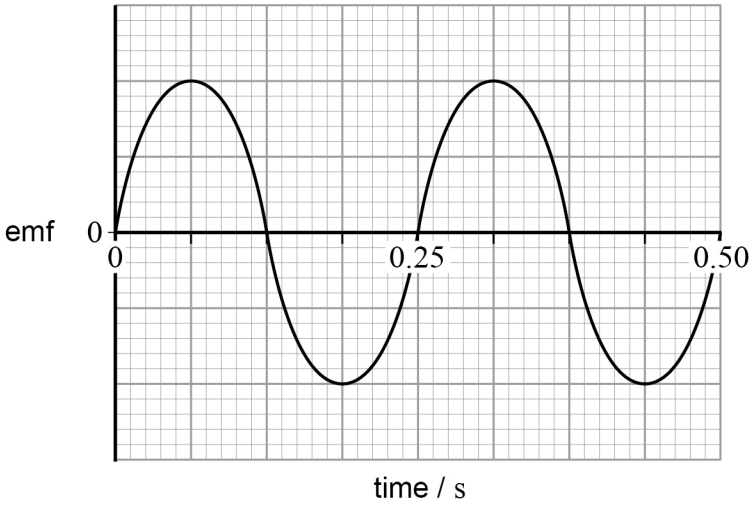
0 5 . 3 The coil forms part of an electrical generator. **Figure 5** shows the emf generated by the coil.

Figure 5



Calculate the peak value of the emf generated.

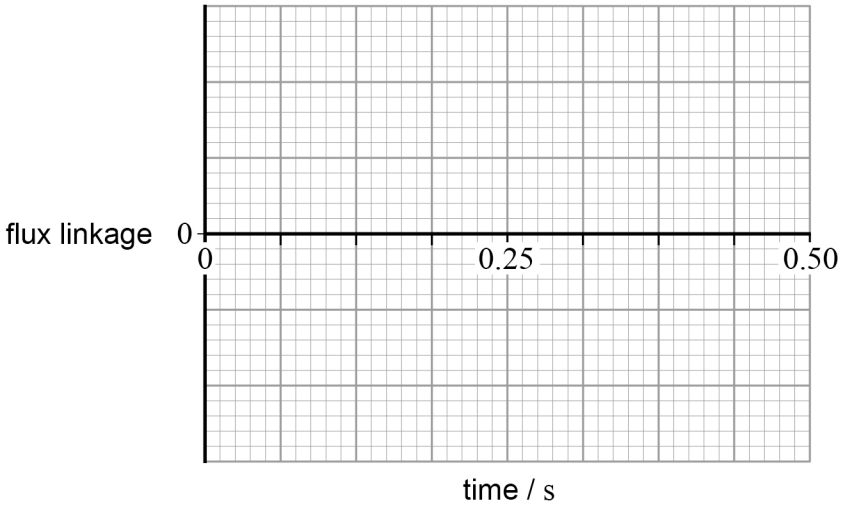
[2 marks]

emf = _____ V

0 5 . 4 Sketch on **Figure 6** the variation with time of flux linkage for the same time interval as **Figure 5**.

[1 mark]

Figure 6



6

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1 3 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?

[1 mark]

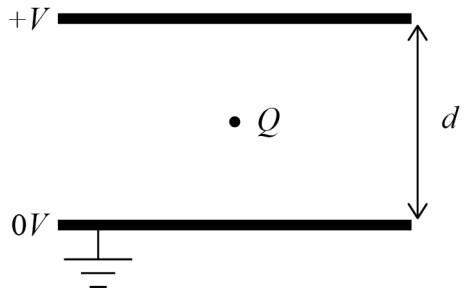
A $\frac{R}{8}$ ⬭

B $\frac{R}{4}$ ⬭

C $2R$ ⬭

D $8R$ ⬭

1 4 A small object of mass m has a charge Q. The object remains stationary in an evacuated space between two horizontal plates. The plates are separated by a distance d and the potential difference between the plates is V.



What is V?

[1 mark]

A $\frac{mQg}{d}$ ⬭

B $\frac{mdg}{Q}$ ⬭

C $\frac{mQ}{d}$ ⬭

D $\frac{md}{Q}$ ⬭

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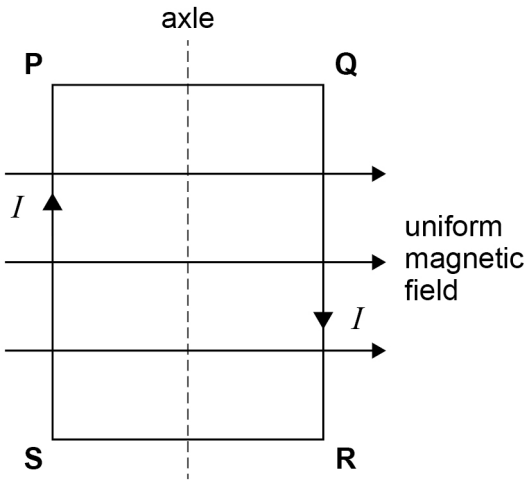
2 3 The plane of coil **PQRS** is parallel to a uniform magnetic field.



When a current I is in the coil

[1 mark]

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**. ⬭

2 4 A horizontal wire of length $0.50\ \text{m}$ and weight $1.0\ \text{N}$ is placed in a uniform horizontal magnetic field of flux density $1.5\ \text{T}$ directed at $90°$ to the wire.

What is the current that just supports the wire?

[1 mark]

A $0.33\ \text{A}$ ⬭

B $0.75\ \text{A}$ ⬭

C $1.3\ \text{A}$ ⬭

D $3.0\ \text{A}$ ⬭

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2 5 Which is **not** an assumption about gas particles in the kinetic theory model for a gas?

[1 mark]

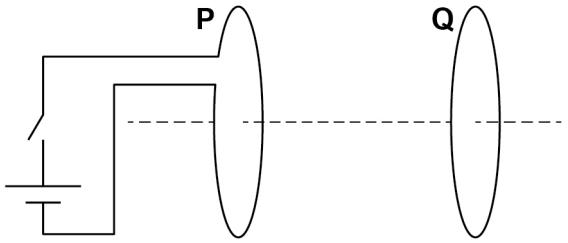
A They collide elastically with the container walls. ⬭

B They have negligible size compared to the distance between the container walls. ⬭

C They travel between the container walls in negligibly short times. ⬭

D They collide with the container walls in negligibly short times. ⬭

2 6 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**?

[1 mark]

	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	⬭

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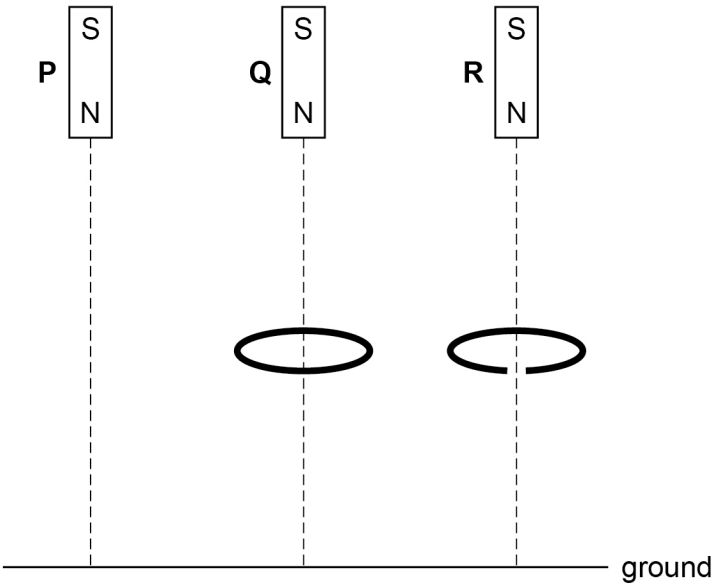
2 7 Three identical magnets **P**, **Q** and **R** are released simultaneously from rest and fall to the ground from the same height.

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?

[1 mark]

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. ⬭

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2 8 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?

[1 mark]

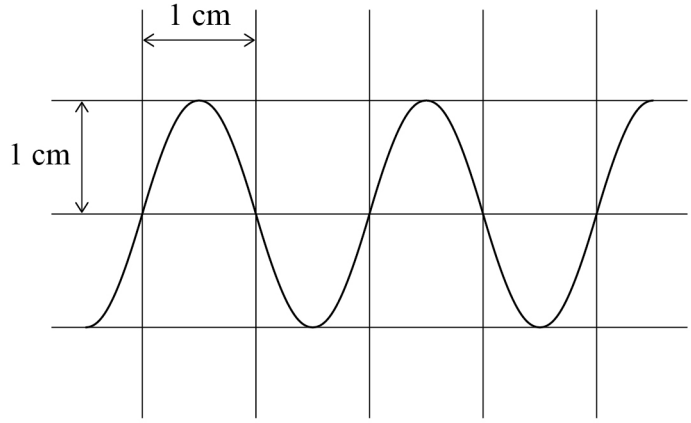
A $\frac{P}{\sqrt{2}}$ ⬭

B P ⬭

C $\sqrt{2}\,P$ ⬭

D $2P$ ⬭

2 9 The figure shows an oscilloscope trace of a sinusoidal ac voltage.



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

Which row describes the ac voltage?

[1 mark]

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