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Draw a cross through the box (☒) if you have NOT written in this booklet

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NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Physics 2026

91173 Demonstrate understanding of electricity and electromagnetism

Credits: Six

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of electricity and electromagnetism.	Demonstrate in-depth understanding of electricity and electromagnetism.	Demonstrate comprehensive understanding of electricity and electromagnetism.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Make sure that you have Resource Sheet L2–PHYSR.

Show ALL working.

In your answers use clear numerical working, words, and / or diagrams as required.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in the margins (////). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

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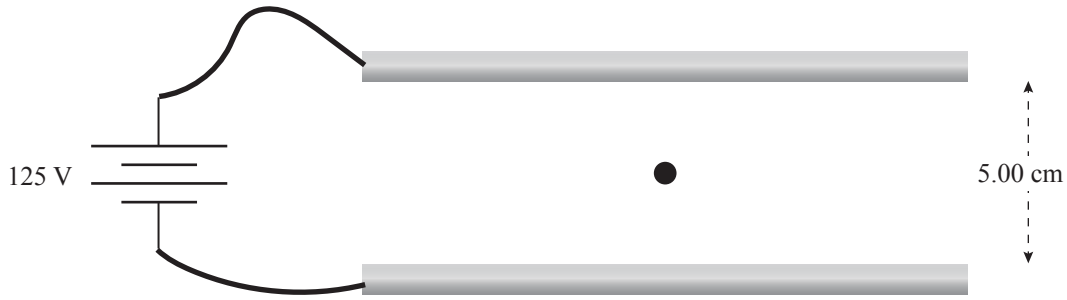
QUESTION ONE: ELECTRIC FIELDS

The diagram below shows two parallel metal plates connected to a 125 V supply. The plates are 5.00 cm apart.



(a) An electron is placed in the electric field between the plates.

Draw an arrow on the diagram above to show the direction of the electrostatic force acting on the electron.

If you need to redraw your response, use the diagram on page 9.

(b) Calculate the size of the electrostatic force exerted on the electron.

(c) Two different plate arrangements are set up as below. In Diagram 1, the plates have 1 V between them and are x m apart. In Diagram 2, the plates have 2 V between them and are $\frac{x}{2}$ m apart.

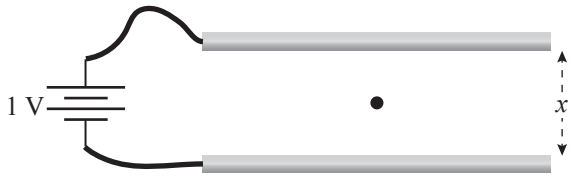


Diagram 1

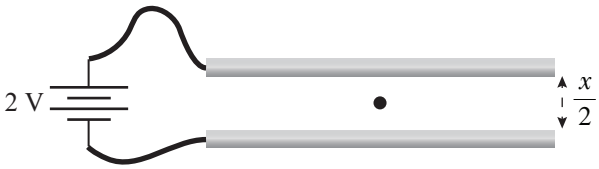


Diagram 2

Explain the difference in force on the electron between Diagram 1 and Diagram 2.

(d) The voltage is now set to 140 V, and the distance between the plates is 5.00 cm.



Charge on alpha particle: 3.20×10^{-19} C

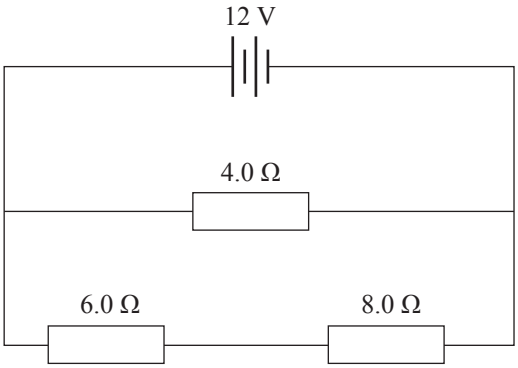
Mass of alpha particle: 6.64×10^{-27} kg

An alpha particle is released from rest at the positive plate.

Calculate the speed of the alpha particle as it reaches the negative plate.

QUESTION TWO: CIRCUITS

A circuit is set up as shown below.

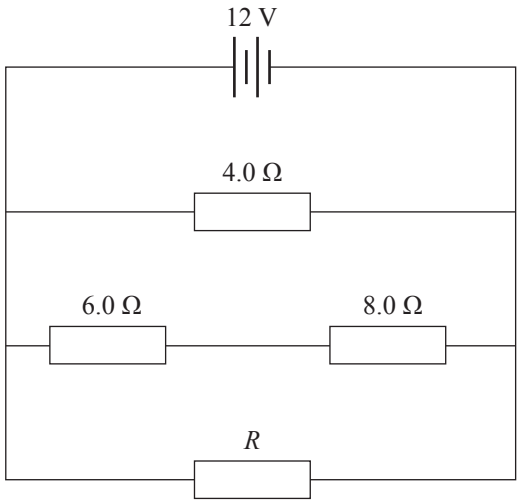


(a) Show that the current in the 4.0 Ω resistor is 3.0 A.

(b) Calculate the total resistance of the circuit.

(c) Calculate the energy used by the 8.0 Ω resistor in 3 minutes.

(d) A fourth resistor with a resistance of R is added, as below.



Explain what effect adding the resistor R has on:

(i) the total resistance of the circuit

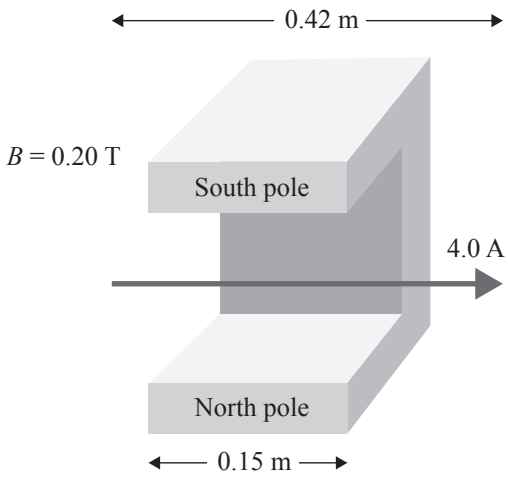
(ii) the current through the 4.0 Ω resistor.

QUESTION THREE: MAGNETISM

A wire of length 0.42 m carries a current of 4.0 A.

The wire is placed at right angles to a magnetic field of strength 0.20 T, as shown below.

The magnetic field between the poles is 0.15 m wide.



If you need to redraw your response, use the diagram on page 9.

(a) Draw an arrow on the diagram above to show the magnetic field direction between the poles.

(b) (i) Calculate the magnetic force acting on the wire.

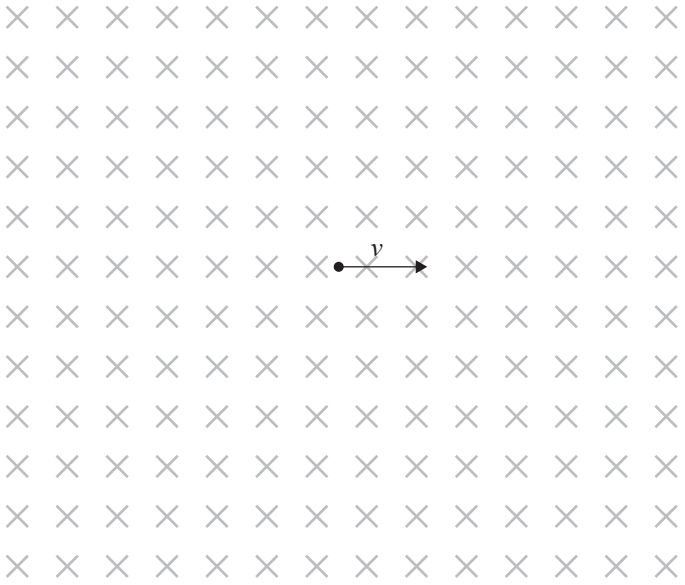
(ii) State the direction of the force on the wire.

Select your response from:

Left (←) Right (→) Into the page Out of the page Up (↑) Down (↓) No force

Direction is: _____

(c) An alpha particle is moving in the magnetic field at speed v, as below.



Charge on alpha particle: 3.20×10^{-19} C
Magnetic field strength: 0.20 T

(i) If the force on the particle is 5.3×10^{-19} N, calculate the speed of the alpha particle.

(ii) Assuming the alpha particle remains in the field, draw its path on the diagram above.

If you need to redraw your response, use the diagram on page 10.

(iii) Explain why the alpha particle would follow this path.

(d) A coil labelled ABCD is cutting through a magnetic field with speed v, as shown in the diagrams below.

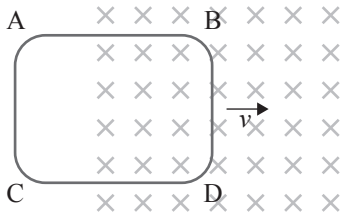


Diagram 1

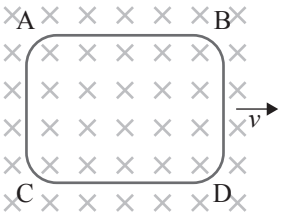


Diagram 2

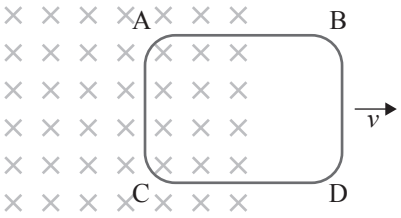


Diagram 3

(i) Complete the table below to show which of the three diagrams above have a current flowing.

Diagram number	Diagram 1	Diagram 2	Diagram 3
Write **Yes** if a current is flowing or **NO** if there is not a current			

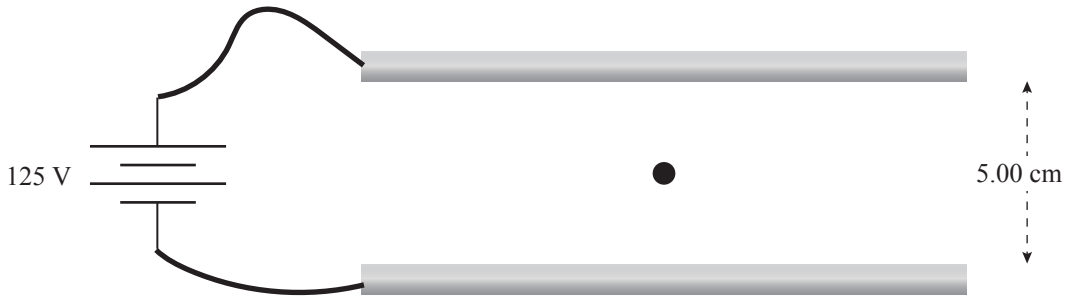
(ii) Draw an arrow on the labelled diagrams above that have a current flowing to show the direction of the conventional current.

If you need to redraw your response, use the diagram on page 10.

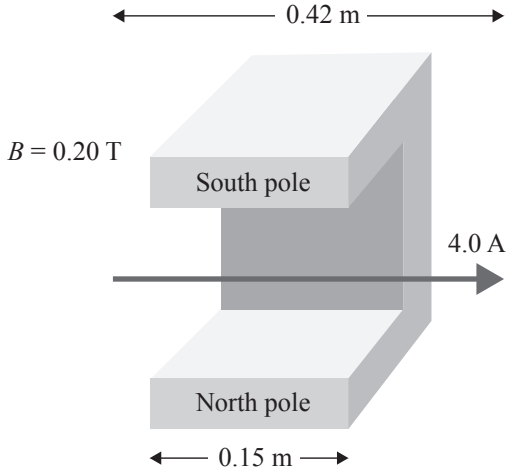
(iii) For one of the labelled diagrams you identified in part (i) as having a current, explain why there is a current flowing.

SPARE DIAGRAMS

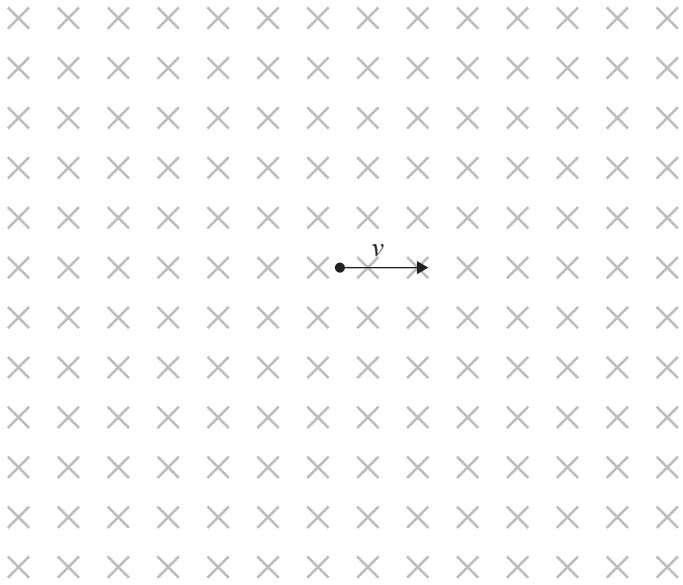
If you need to redraw your response to Question One (a), use the diagram below. Make sure it is clear which answer you want marked.



If you need to redraw your response to Question Three (a), use the diagram below. Make sure it is clear which answer you want marked.



If you need to redraw your response to Question Three (c)(ii), use the diagram below. Make sure it is clear which answer you want marked.



If you need to redraw your response to Question Three (d)(ii), use the space below. Make sure it is clear which answer you want marked.

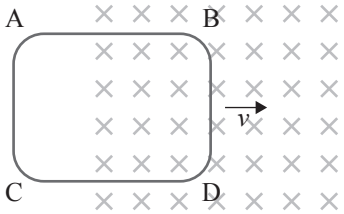


Diagram 1

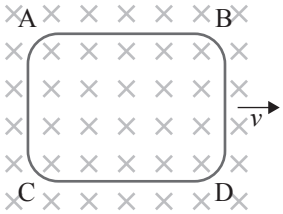


Diagram 2

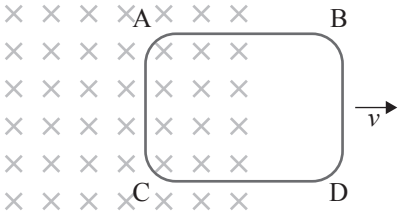


Diagram 3

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER