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School code

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School name

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Given name/s

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Attach your
barcode ID label here

Book

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of

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books used

External assessment 2024

Question and response book

Physics

Paper 2

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- QCAA-approved calculator permitted.
- QCAA formula and data book provided.
- Planning paper will not be marked.

Section 1 (47 marks)

- 8 short response questions

DO NOT WRITE ON THIS PAGE
THIS PAGE WILL NOT BE MARKED

Section 1

Instructions

- Marks will not be deducted for correct answers that use different units or a different number of significant figures/decimal places than those indicated in the question.
 - If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
-

QUESTION 1 (4 marks)

A coil of wire with 100 turns and a radius of 1.4 cm is placed perpendicular to a magnetic field of strength 0.510 T. The magnetic field strength is then changed to 0.030 T in 0.020 s.

Calculate the magnitude of electromotive force (emf) induced in the coil. Show your working.

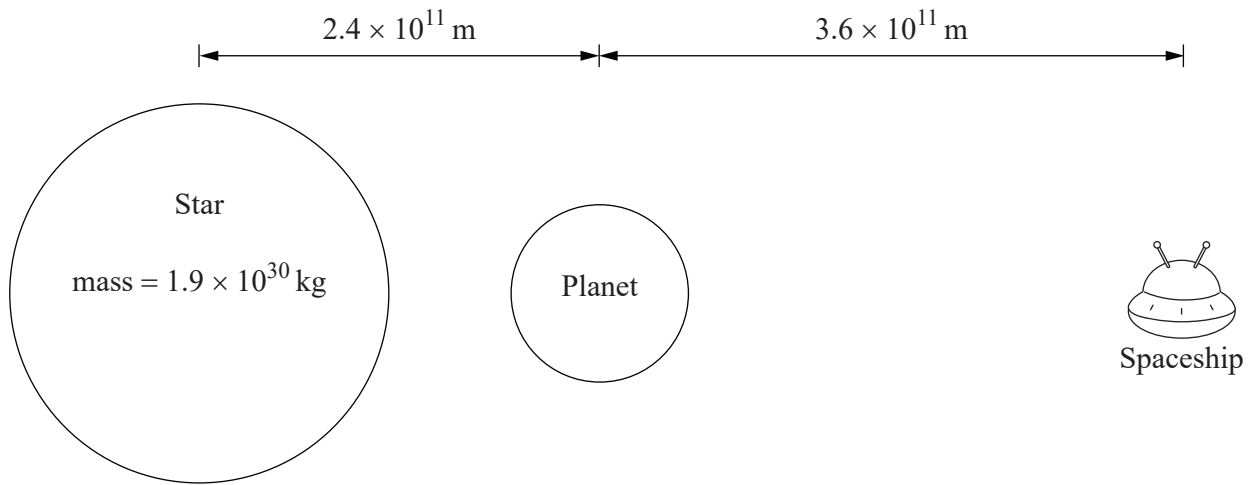
Magnitude of emf = _____ V

Do not write outside this box.

QUESTION 2 (6 marks)

In a distant solar system, a star, planet and spaceship are aligned as shown.

Not to scale



- a) Calculate the strength of the star's gravitational field experienced by the spaceship.
Show your working.

[3 marks]

Gravitational field strength = _____ m s^{-2}

Do not write outside this box.

- b) An observer on the planet measures the spaceship to be travelling directly towards the star at a speed of $1.9 \times 10^8 \text{ m s}^{-1}$. Calculate the distance between the spaceship and the star from the perspective of an astronaut on the spaceship. Show your working. *[3 marks]*

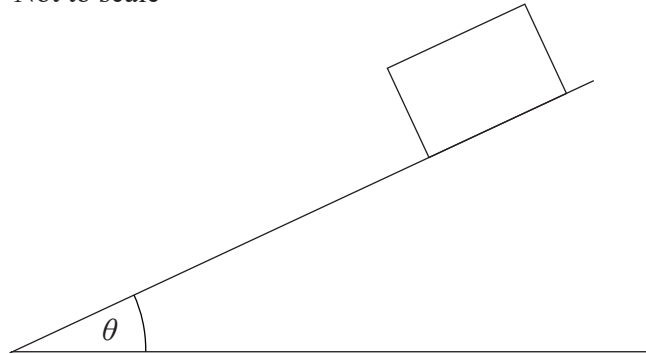
Distance = _____ m

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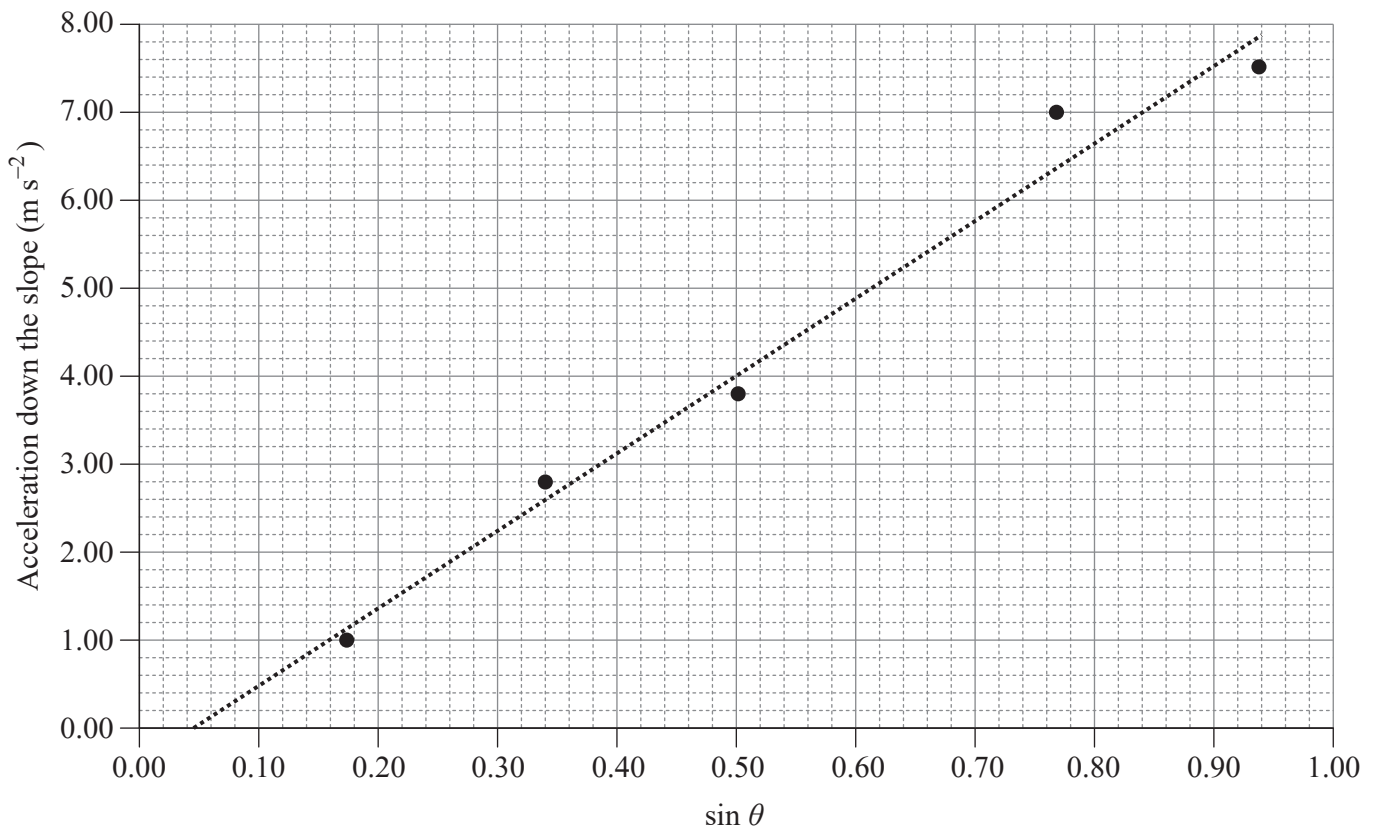
QUESTION 3 (8 marks)

A student conducted an experiment to address the following research question: What is the relationship between the angle of inclination and the acceleration from rest down a 2.4 m slope of a 0.050 kg object?

Not to scale



Data from the experiment was processed to produce the following graph.



Do not write outside this box.

- a) Determine the magnitude of the frictional force acting on the object when the angle of inclination is 45° . Use the graph and show your working.

[5 marks]

Magnitude of frictional force = _____ N

- b) Calculate the final velocity of the object when the angle of inclination is 45° . Show your working.

[3 marks]

Final velocity = _____ m s^{-1}

Do not write outside this box.

QUESTION 4 (4 marks)

Explain how a satellite can be accelerating yet maintain a constant speed in a circular orbit around a planet.

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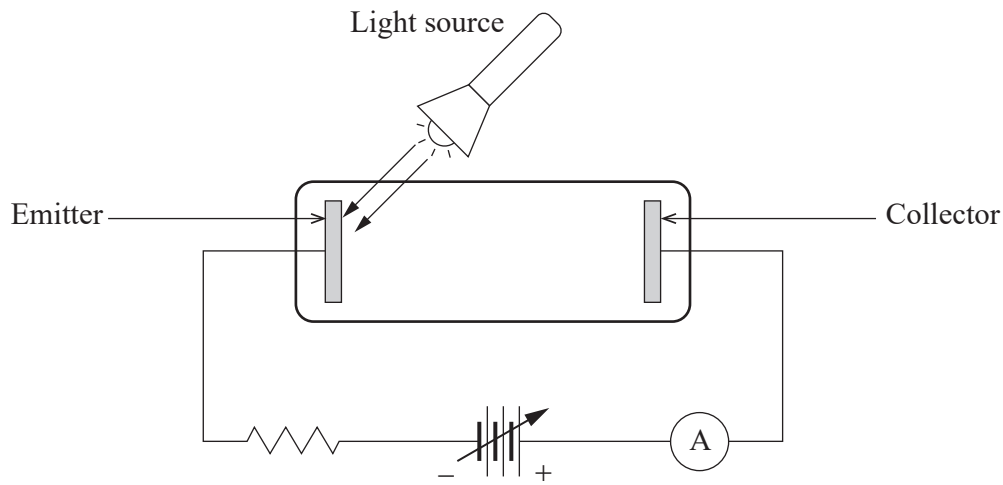
QUESTION 5 (3 marks)

Explain the significance of the threshold frequency when incident light with a range of frequencies shines on a metal.

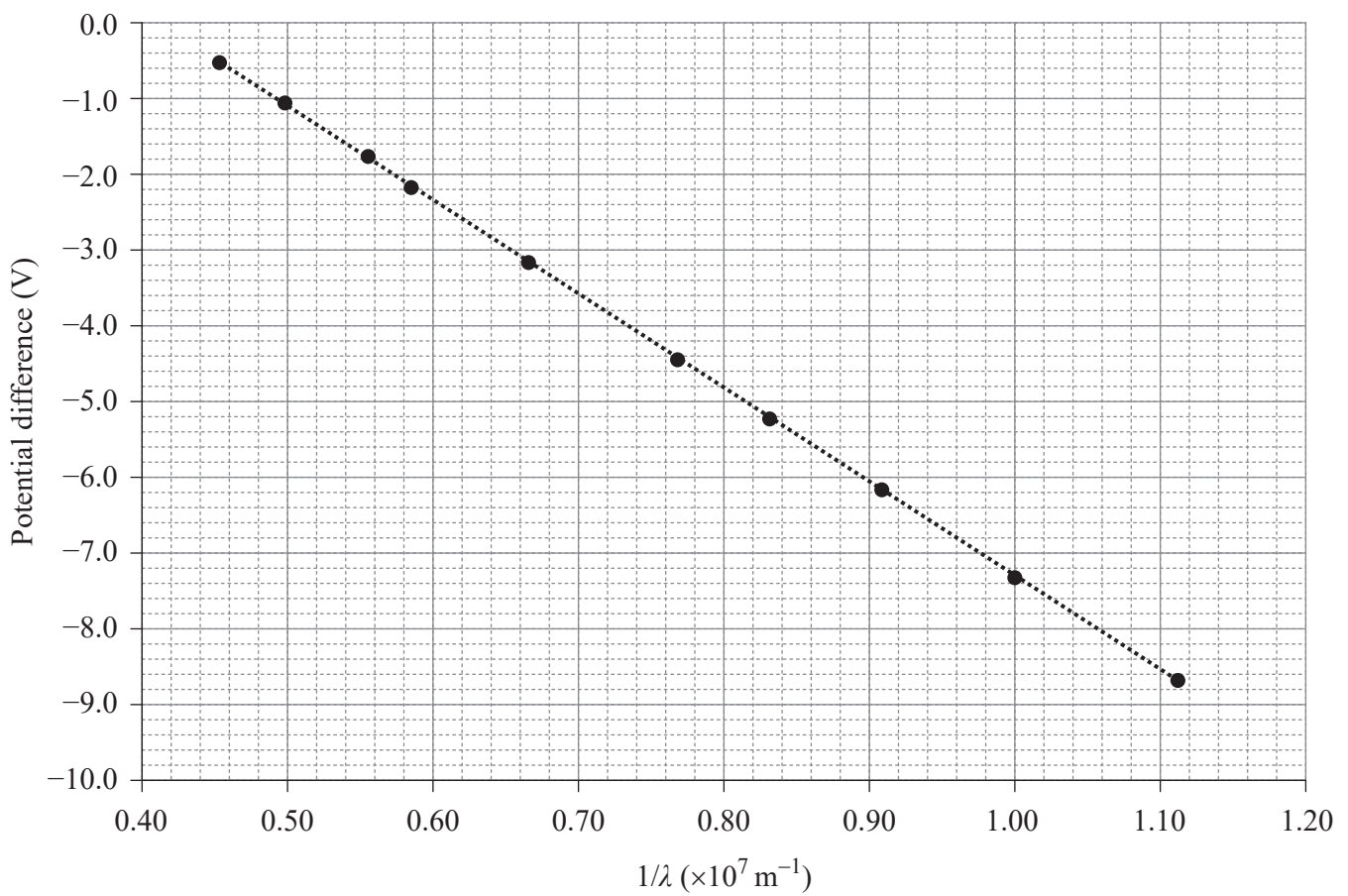
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QUESTION 6 (11 marks)

A photoelectric experiment was set up with a variable voltage between the collector and emitter, a resistor and an ammeter. There was no current detected when the light was off.



The potential difference required to reduce the current to 0 A was measured for different wavelengths of light.



Do not write outside this box.

- a) Determine the potential difference required to reduce the current to 0 A when light with a wavelength of 125 nm is shone on the emitter. Show your working and refer to the graph. [2 marks]

Potential difference = _____ V

- b) Use the graph to determine the work function of the emitter in eV. Show your working. [6 marks]

Work function = _____ eV

Do not write outside this box.

- c) The experiment was changed so that the variable voltage was removed and the light, with a frequency above the threshold frequency, was shining on the emitter.

Predict the effect of increasing intensity from the light source on the current in the circuit. Explain your reasoning.

[3 marks]

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QUESTION 7 (4 marks)

a) Contrast baryons and mesons in terms of composition.

[2 marks]

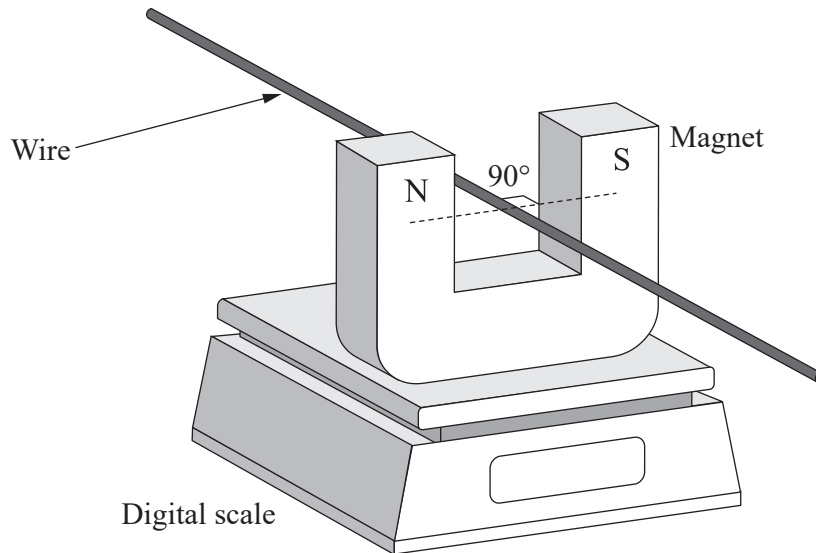
b) Contrast quarks and leptons in terms of the possible fundamental forces they experience.

[2 marks]

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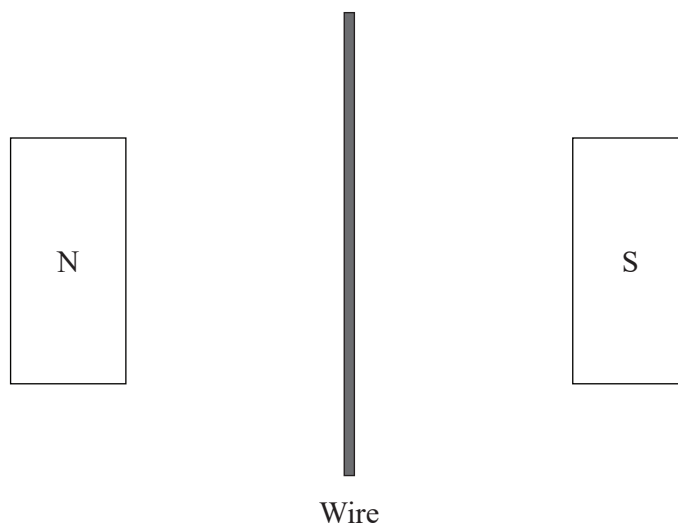
QUESTION 8 (7 marks)

A U-shaped magnet was placed on a digital scale. A current-carrying wire was connected to a variable power supply and passed through the space between the poles of the magnet. The length of wire within the magnetic field was 0.08 m, and the wire did not touch the magnet.



- a) Sketch the magnetic field between the north and south poles of the magnet when there is no current in the wire.

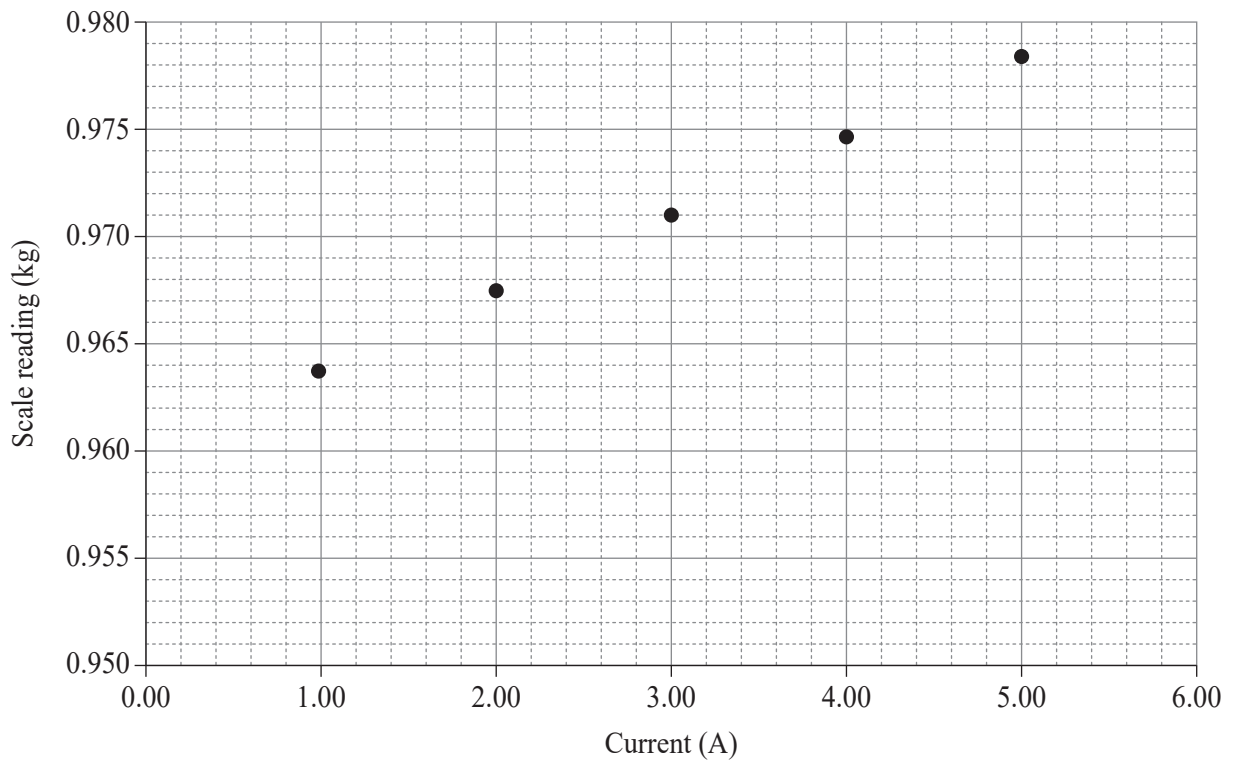
[1 mark]



Note: If you make a mistake in the diagram, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this question and response book.

Do not write outside this box.

The power supply was switched on. Readings from the digital scale were recorded while the current in the wire was varied to produce the graph shown.



b) Identify the mass of the magnet.

[1 mark]

Mass = _____ kg

Do not write outside this box.

c) Determine the strength of the magnetic field produced by the magnet.
Show your working.

[5 marks]

Magnetic field strength = _____ T

END OF PAPER

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Do not write outside this box.

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Lined area for student responses, consisting of 20 horizontal lines.

Do not write outside this box.

ADDITIONAL PAGE FOR STUDENT RESPONSES

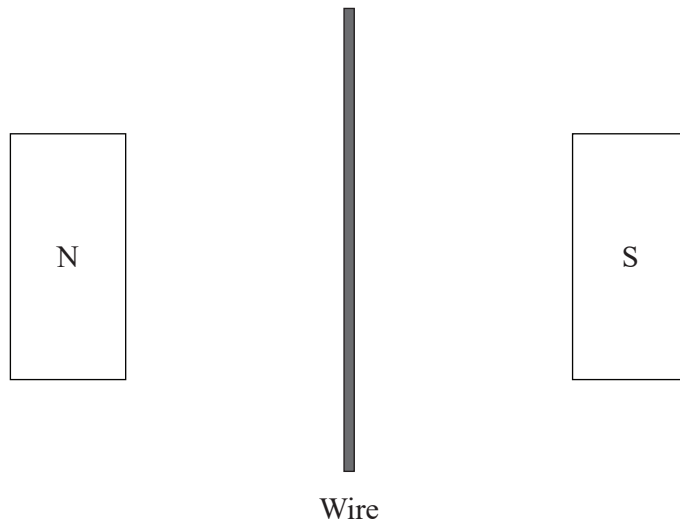
Write the question number you are responding to.

Horizontal lines for writing student responses.

Do not write outside this box.

ADDITIONAL RESPONSE SPACE FOR QUESTION 8a)

If you want this diagram to be marked, draw a single diagonal line through your original response.



Do not write outside this box.



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