PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 12: MAGNETISM AND THE MOTOR EFFECT (PAPER 2)

SCORE	PERCENTAGE
/134	%

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Q1.

A student investigates magnetism using two toys as shown in Figure 7.

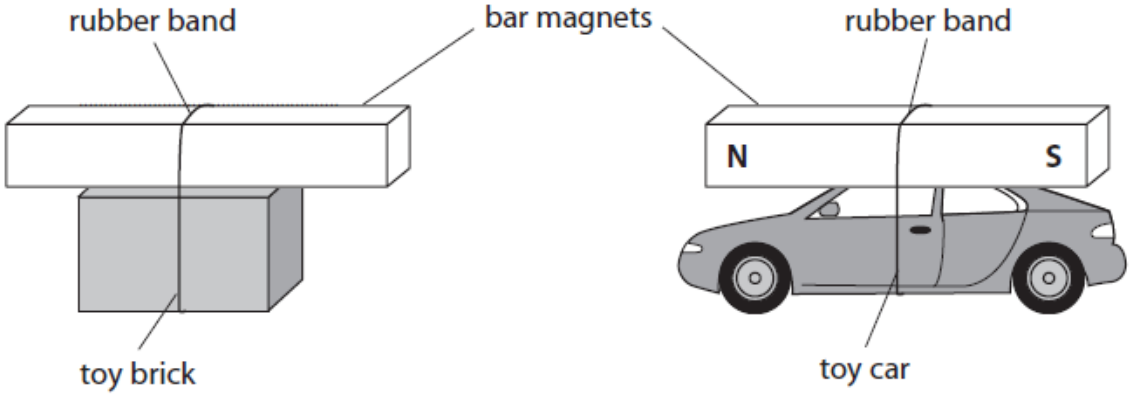


Figure 7

(i) There is a magnet attached to the top of each toy.

The student moves the toy brick towards the toy car.

The magnet on the toy brick repels the magnet on the toy car.

On Figure 7, label the north pole and the south pole on the magnet attached to the toy brick.

(1)

(ii) Explain why the toy car starts to move only when the toy brick gets near to the toy car.

(2)

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(iii) The student thinks that two magnets on top of each other will produce a magnetic field that is stronger than the magnetic field from a single magnet.

The student has a metre rule and more magnets available.

Describe how the student could develop this investigation to test this theory.

(4)

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(Total for question = 7 marks)

(**Q03b 1SC0/2PF, Nov 2020**)

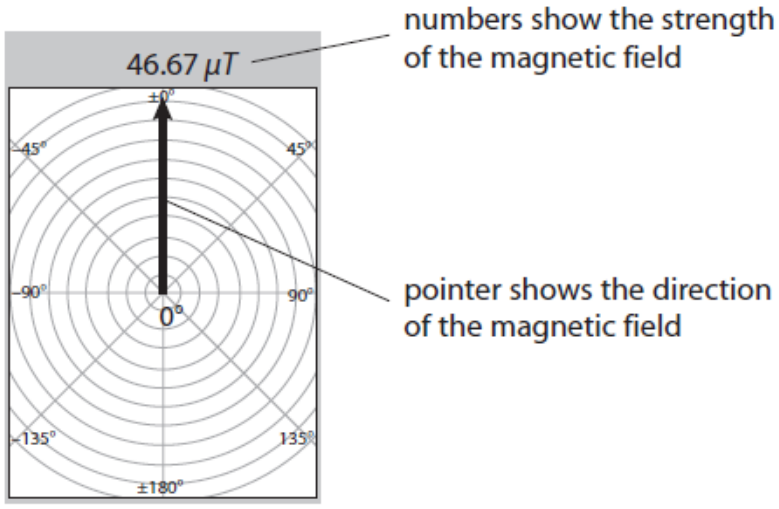
Q2.

A student's mobile phone has an app to measure a magnetic field.

The student places the phone on a table and rotates the phone until it is pointing north.

There are no magnets near to the phone.

Figure 3 shows the display on the screen of the phone.



(Source: adapted from MGS Lite app for iPhone)

Figure 3

(i) State why the strength of the magnetic field shown is not zero.

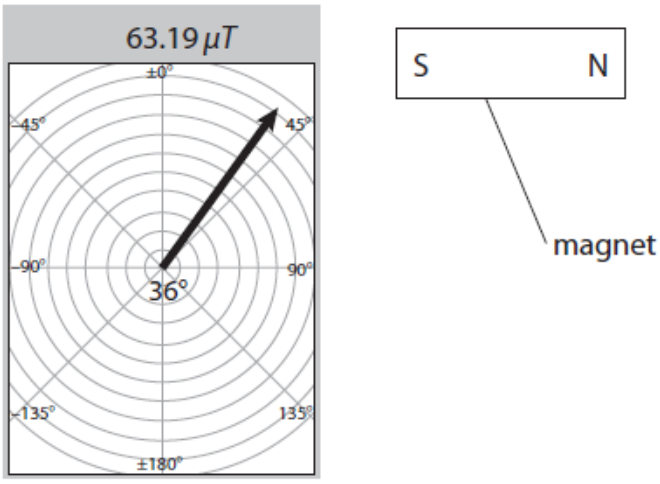
(1)

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The student places a magnet near to the phone on the table.

Figure 4 shows the magnet and the new display on the screen.



(Source: adapted from MGS Lite app for iPhone)

Figure 4

(ii) State **two** changes in the magnetic field measured by the phone from Figure 3 to Figure 4.

(2)

1 .....

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2 .....

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(iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

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(Total for question = 6 marks)

(**QU02b 1SC0/2PF, June 2022**)

Q3.

Figure 4 shows the shape of the magnetic field near a bar magnet.

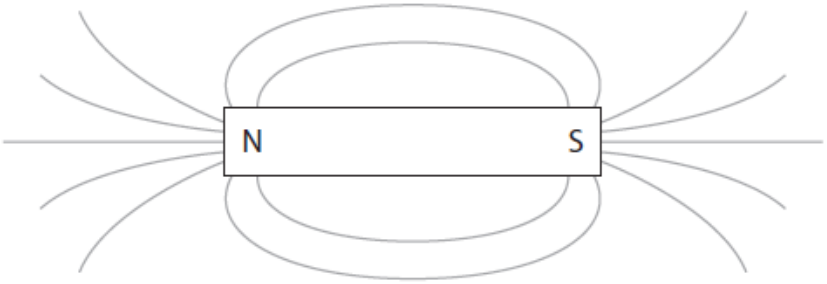


Figure 4

(i) Draw arrows on the field lines in Figure 4 to show the direction of the magnetic field.

(1)

(ii) Place a letter X on Figure 4 at a place where the magnetic field is strongest.

(1)

(iii) Describe **two** differences between the magnetic field shown in Figure 4 and a uniform magnetic field.

(2)

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(Total for question = 4 marks)

(**QU03a 1SC0/2PH, June 2022**)

Q4.

One use of a magnet is in a plotting compass.

(i) Explain how a plotting compass can be used to show that the Earth has a magnetic field.

(2)

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(ii) State the name of a device that uses a permanent magnet.

(1)

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(Total for question = 3 marks)

(**QU03d 1SC0/2PF, June 2025**)

Q5.

A student sets up the apparatus shown in Figure 9.

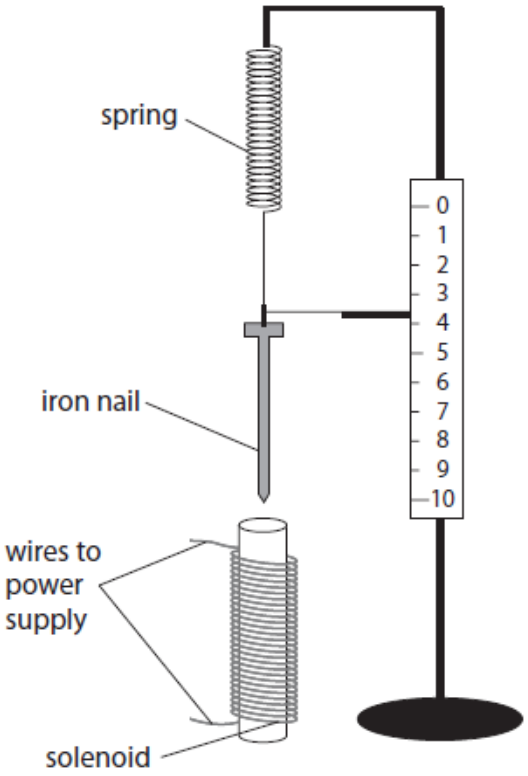


Figure 9

(i) When the current in the solenoid is switched on, the solenoid attracts the iron nail.

Describe how the student could use this apparatus to investigate how the size of the current in the solenoid affects the force of attraction between the solenoid and the iron nail.

(4)

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(ii) The spring constant of a different spring is 24 N/m.

The spring is extended from its unstretched length by 12 cm.

Calculate the energy transferred in extending the spring by 12 cm.

Use an equation selected from the list of equations at the end of this paper.

(2)

energy transferred = ... J

(Total for question = 6 marks)

(**Q09 1SC0/2PH, June 2018**)

Q6.

Figure 1 shows a magnet, P, hanging from a support.

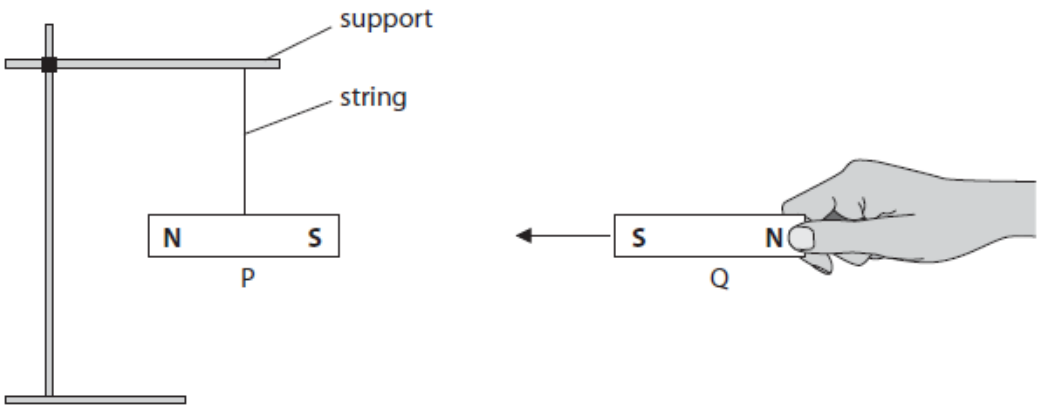


Figure 1

Explain what happens to magnet P when another magnet, Q, is brought towards it as shown.

(2)

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(Total for question = 2 marks)

(**Q01b 1SC0/2PF/S2, SAM**)

Q7.

Two long, thin magnets are held with their N-poles facing each other.
The force, *F*, between the magnets can be calculated using the equation

$$F = \frac{K}{d^2}$$

where

K is a constant value
d is the distance between the magnets.

(i) The magnets are 4.0 cm apart.

The force between the magnets is 1.2 N.

Calculate the value of *K*.

State the unit.

(3)

K = ...unit.....

(ii) The magnets are held the same distance apart but with the N-pole of one magnet now facing the S-pole of the other magnet.

The value of *K* does not change.

State how the force would compare with the force in part (i).

(1)

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(Total for question = 4 marks)

(**Q03b 1SC0/2PH, Nov 2021**)

Q8.

Figure 8 shows two metal rods carrying a current.

A metal roller touches both rods and completes the circuit.
The roller is in the magnetic field produced by a magnet.

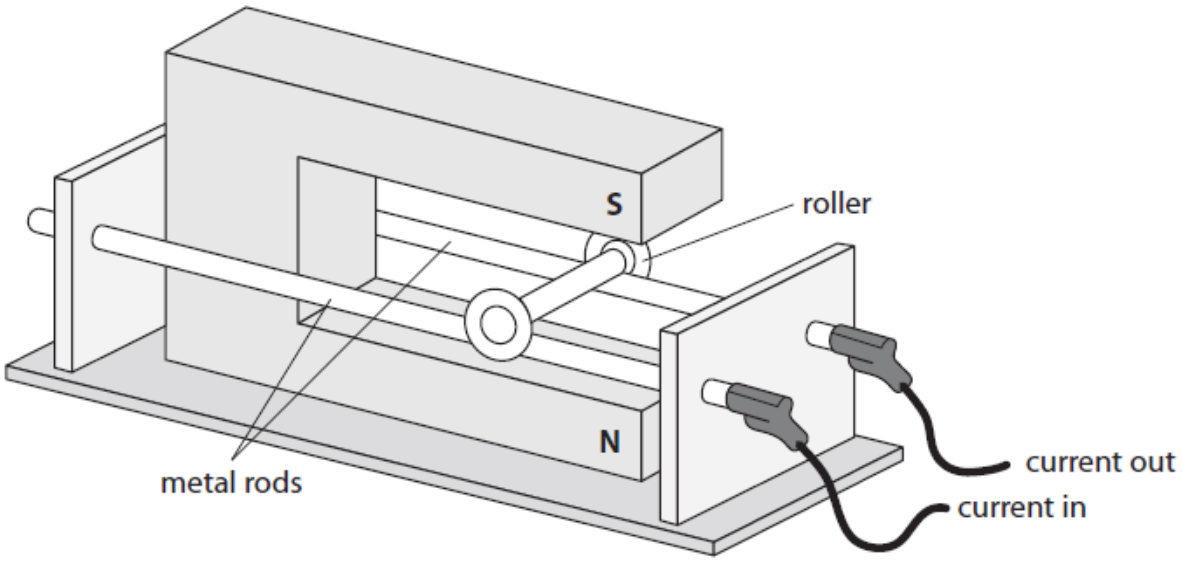


Figure 8

(i) The magnetic flux density of the magnetic field at the roller is 1.2 T.

The current in the roller is 2.5 A.

The length of the roller carrying the current is 0.060 m.

Calculate the force on the roller.

Use the equation

$$F = B \times I \times l$$

(2)

force on the roller = ... N

(ii) Describe how Fleming's left-hand rule can be used to determine the direction of the force acting on the roller.

You may draw a diagram to help your answer.

(3)

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(iii) Draw an arrow on Figure 8 to show the direction of the force acting on the roller.

(1)

(Total for question = 6 marks)

(**Q03c 1SC0/2PH, Nov 2020**)

Q9.

The magnetic flux density, B, is a measure of the strength of the magnetic field of a magnet.

B varies with the distance, d, from a magnetic pole of a magnet as given by the equation

$$B \times d^2 = K$$

where K is a constant for the magnet.

At a distance of 3 mm from the pole of a magnet, B = 650 μT.

Calculate the value of B at a distance of 6 mm from the pole of the magnet.

(3)

B at 6 mm = ... μT

(Total for question = 3 marks)

(**QU04c 1SC0/2PH, June 2025**)

Q10.

A wire is placed at right angles to the Earth's magnetic field.

The wire is 0.600 m long and carries a current of 93.1 mA.

The force on the wire is 1.11×10^{-5} N.

Calculate the magnetic flux density of the Earth's magnetic field.

Use the equation

$$F = B \times I \times l$$

(2)

magnetic flux density = ... T

(Total for question = 2 marks)

(**QU03d 1SC0/2PH, June 2022**)

Q11.

A student has

− a power pack

− a long piece of wire

− a stiff card

− iron filings

Describe how the student could use this equipment to show the shape of the magnetic field produced by a current in the wire.

You may draw a diagram to help with your answer.

(4)

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(Total for question = 4 marks)

(**Q02b 1SC0/2PF, June 2019**)

Q12.

Figure 4 shows a toy that has a plastic cylinder, a plastic base and two similar magnets. Each of the two magnets is in the shape of a ring.

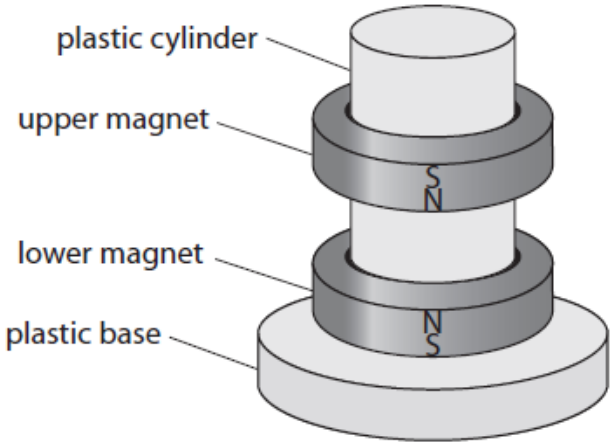


Figure 4

The upper magnet seems to float in the air above the lower magnet.

Describe the forces acting on the upper magnet.

Use the idea of magnetic fields in your answer.

(3)

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(Total for question = 3 marks)

(**QU03b 1SC0/2PH, June 2023**)

Q13.

Figure 4 shows a wire passing through a piece of card.
The wire carries an electric current.

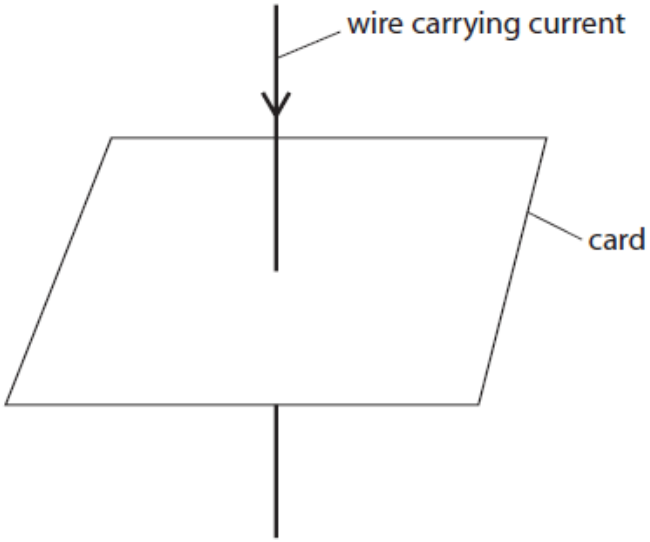


Figure 4

(i) Draw **one** magnetic field line on Figure 4, to show the shape of the magnetic field produced by the current.

(1)

(ii) Draw **one** arrow on the field line you have drawn to show the direction of the magnetic field.

(1)

(Total for question = 2 marks)

(**Q02b 1SC0/2PF, Nov 2021**)

Q14.

Figure 6 shows the magnetic field around a bar magnet.

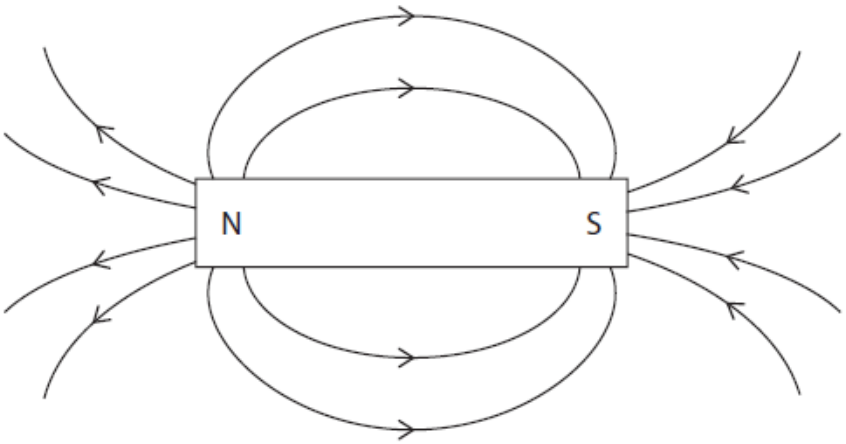


Figure 6

Iron filings are sprinkled onto the magnet.

(i) On Figure 6, draw an X where most of the iron filings will stick.

(1)

(ii) Explain why most of the iron filings will stick to the point you have labelled with an X.

(2)

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(Total for question = 3 marks)

(**QU03c 1SC0/2PF, June 2025**)

Q15.

Figure 5 shows two magnetic poles facing each other.

There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5 to show the uniform part of the magnetic field.
At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)



Figure 5

(Total for question = 2 marks)

(**QU03b 1SC0/2PF, June 2025**)

Q16.

Figure 3 shows some objects and words describing these objects.

Draw one line from each object to its description.

(2)

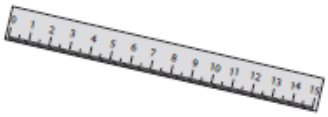
object	description
 nail in a current-carrying coil	non-magnetic
 plotting compass needle	permanent magnet
 wooden ruler	temporary magnet

Figure 3

(Total for question = 2 marks)

(**Q02a 1SC0/2PF, Nov 2021**)

Q17.

Figure 3 shows two magnetic poles facing each other.

The magnetic field between the poles is uniform.

On Figure 3, draw the magnetic field lines between the two poles and show the direction of this magnetic field.

(3)

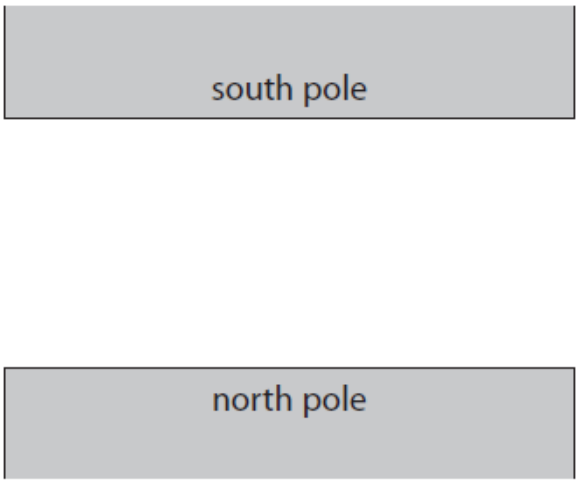


Figure 3

(Total for question = 3 marks)

(**Q02c 1SC0/2PF, June 2019**)

Q18.

Figure 3 shows two magnets with their N poles facing each other.



Figure 3

On Figure 3, draw the shape and direction of the magnetic field between the two magnets.

(Total for question = 2 marks)

(**QU03a 1SC0/2PH, June 2023**)

Q19.

Figure 7 shows a wire carrying a current.

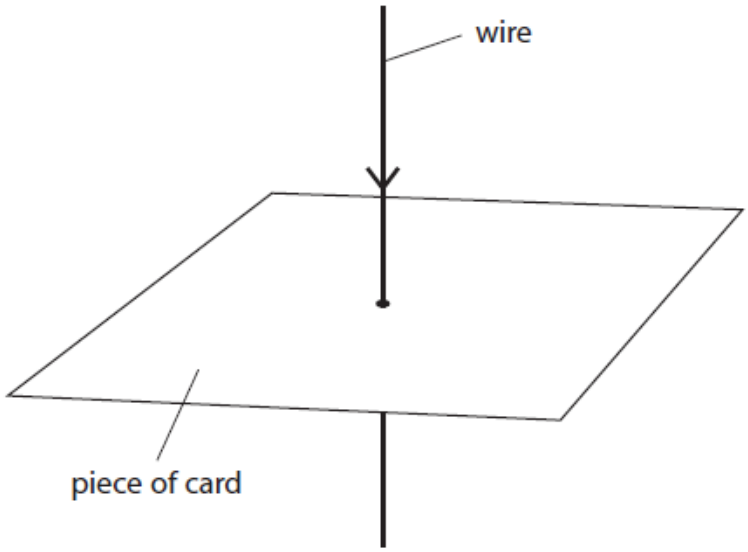


Figure 7

Draw, on the card in Figure 7, the magnetic field that is produced by the current.

(Total for question = 2 marks)

(**Q03b 1SC0/2PH, Nov 2020**)

Q20.

Figure 6 represents the Earth.

Figure 6 shows **two** magnetic compass needles placed near to the Earth's surface, at points Q and T.

Each magnetic compass needle can rotate about its central dot.

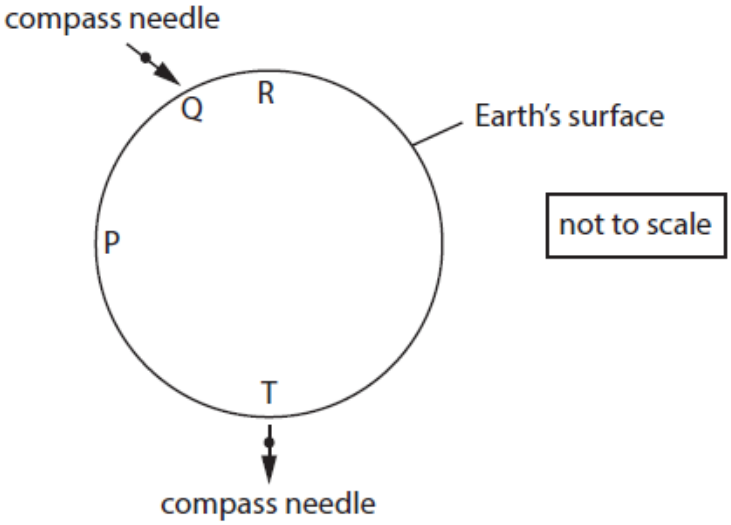


Figure 6

(i) A compass needle is placed at point P and another at point R, near to the Earth's surface.

On Figure 6, draw an arrow at point P and an arrow at point R to show the direction of the compass needle at each point.

(2)

(ii) Explain why the arrows point in the directions you have drawn in part (i).

You may draw on Figure 6 to help your answer.

(3)

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(Total for question = 5 marks)

(**QU03a 1SC0/2PH, June 2024**)

Q21.

Figure 6 shows a part of a machine used to separate steel cans from aluminium cans.

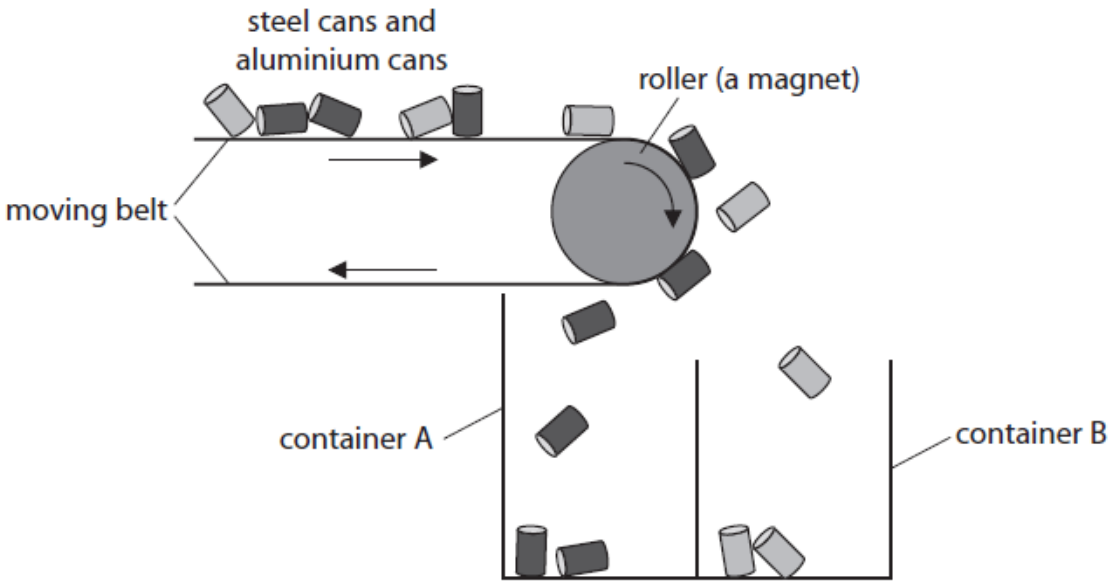


Figure 6

The cans are carried along a moving belt.

The belt goes around a roller.

The roller is a magnet.

Each can falls into one of the containers.

Explain how this machine separates the steel cans from the aluminium cans.

(2)

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(Total for question = 2 marks)

(**Q03a 1SC0/2PF, Nov 2020**)

Q22.

Answer the question with a cross in the box you think is correct (☒). If you change

your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

A student is given two permanent magnets and some paper clips, as shown in Figure 4.

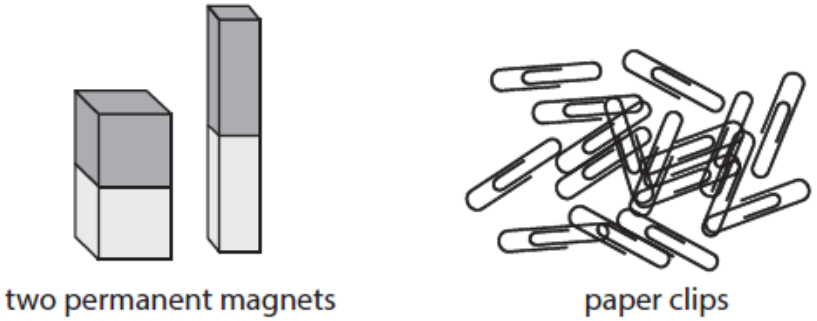


Figure 4

The paper clips are **not** magnets, but they are made from a magnetic material.

(i) Which of these is a magnetic material?

(1)

☒ **A** aluminium

☒ **B** iron

☒ **C** plastic

☒ **D** wood

(ii) Describe how the student could use the paper clips to find out which of the two permanent magnets is the stronger magnet.

(2)

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(Total for question = 3 marks)

(**QU02c 1SC0/2PF, June 2024**)

Q23.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 4 shows a copper wire between two magnetic poles.

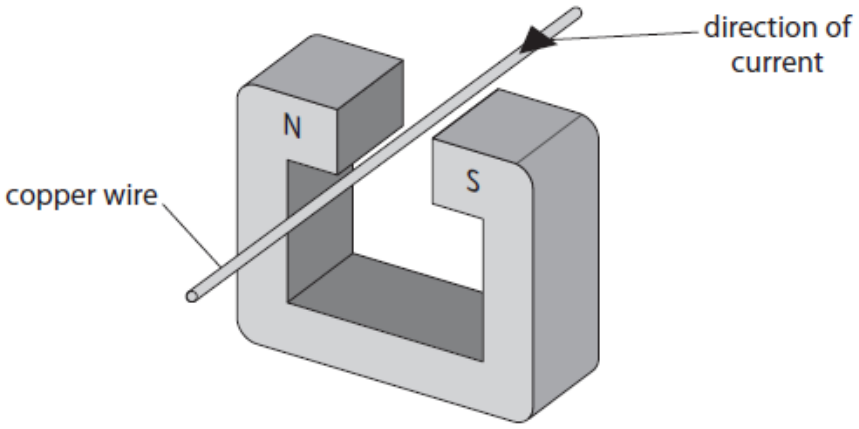


Figure 4

The current in the wire is in the direction shown by the arrow.

The wire experiences a force due to the magnetic field.

(i) The direction of the force due to the magnetic field is

(1)

☒ **A** down

☒ **B** up

☒ **C** towards the north pole of the magnet

☒ **D** towards the south pole of the magnet

(ii) The interaction between the magnetic fields produced by the magnet and the current in the wire produces forces on the magnet and the wire.

Compare these two forces.

(1)

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(iii) Figure 5 shows a different wire inside a uniform magnetic field.

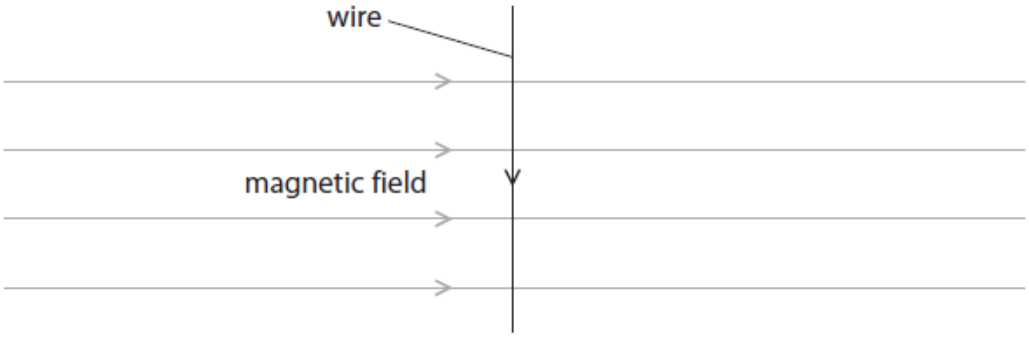


Figure 5

The magnetic flux density of the magnetic field is 0.72 N/A m.
The length of the wire inside the field is 30 mm.
The size of the force due to the magnetic field on the wire is 0.045 N.

Calculate the size of the current in the wire.

Use an equation selected from the list of equations from the relevant equation sheet.

(3)

current in the wire = ... A

(Total for question = 5 marks)

(**Q03b 1SC0/2PH, June 2019**)

Q24.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of these is a magnetic material?

(1)

☒ **A** aluminium

☒ **B** carbon

☒ **C** cobalt

☒ **D** copper

(Total for question = 1 mark)

(**Q02a 1SC0/2PF, June 2019**)

Q25.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Which of these is a magnetic material?

(1)

☒ **A** aluminium

☒ **B** plastic

☒ **C** steel

☒ **D** lead

(Total for question = 1 mark)

(**QU03a 1SC0/2PF, June 2025**)

Q26.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 6 shows the magnetic field of a magnet.

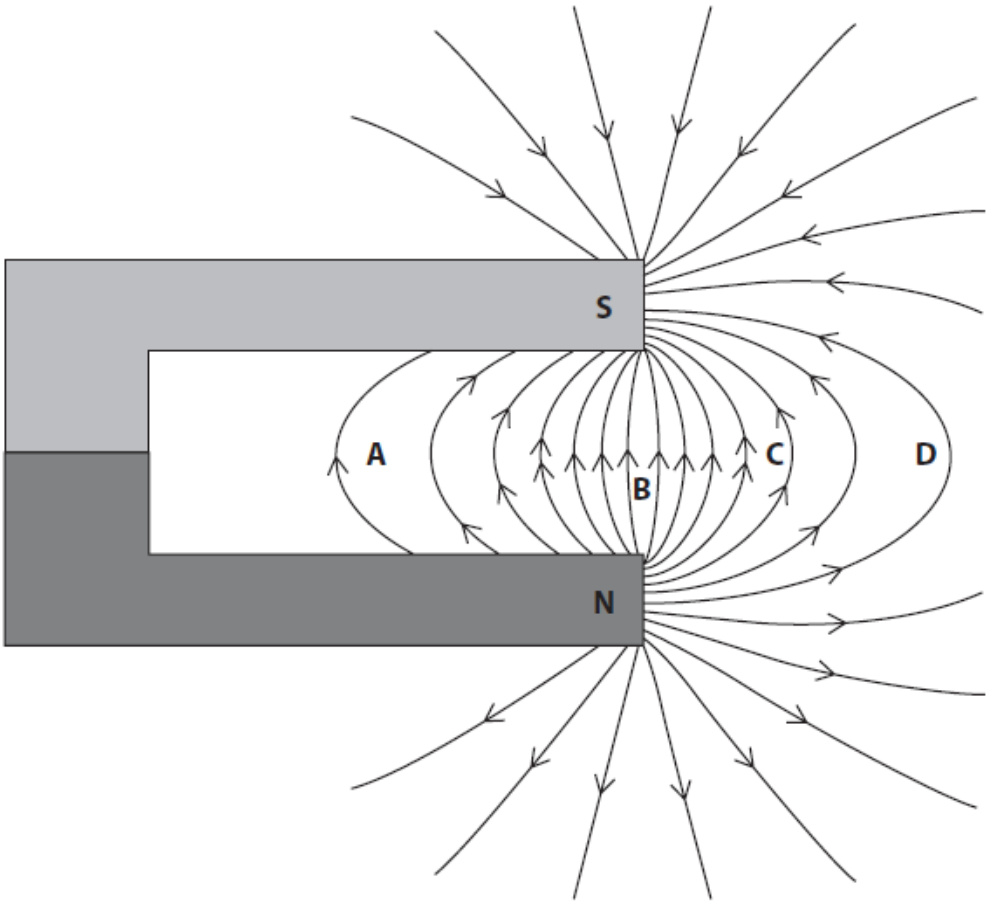


Figure 6

At which point is the magnetic field strongest?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

(**Q03a 1SC0/2PH, Nov 2020**)

Q27.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer

with a cross ☒.

A student uses a plotting compass to investigate the magnetic field around a wire.

Figure 3 shows the wire going straight through a card.

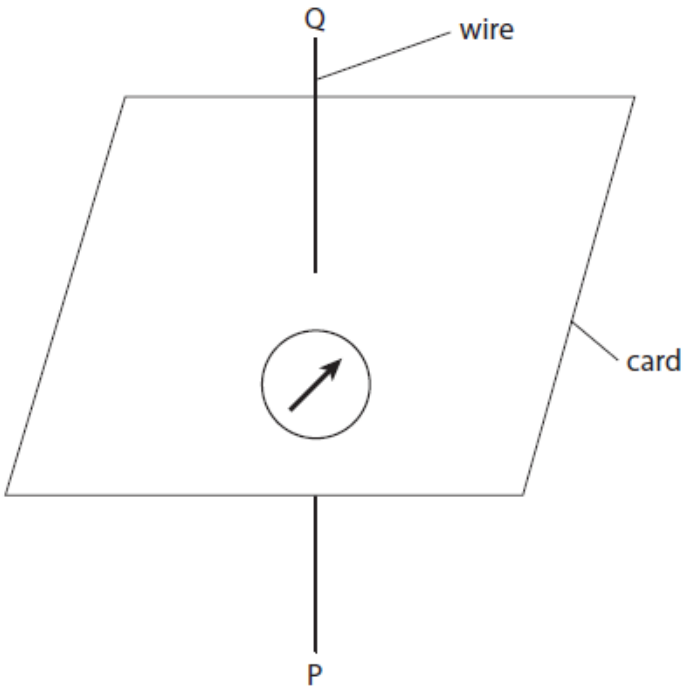


Figure 3

Figure 3 shows the compass needle when there is no current in the wire.

(i) Which of these shows a possible direction of the compass needle when there is a current in the wire going from P to Q?

(1)



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(ii) Describe how the student could develop the investigation to find the shape of the magnetic field produced by the current.

(3)

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(Total for question = 4 marks)

(**Q03a 1SC0/2PH, June 2019**)

Q28.

Three of the following are magnetic materials.

Which of these is **NOT** a magnetic material?

(1)

☒ **A** cobalt

☒ **B** copper

☒ **C** iron

☒ **D** nickel

(Total for question = 1 mark)

(**Q01a 1SC0/2PF/S2, SAM**)

Q29.

A teacher has a pile of steel nails, a magnet and some plastic strips that are all the same size.

The teacher places a plastic strip under the magnet and picks up some nails from the pile, as shown in Figure 6.

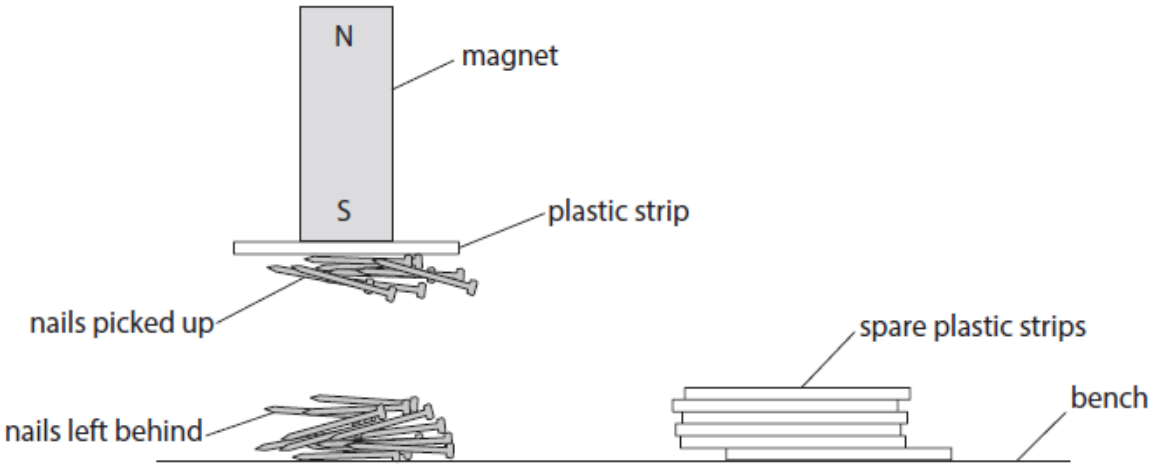


Figure 6

Some nails are not picked up and are left behind on the bench.

The teacher investigates how the number of nails that can be picked up changes when the number of plastic strips under the magnet is increased.

The results are shown in Figure 7.

	number of nails picked up				
number of plastic strips	1st trial	2nd trial	3rd trial	4th trial	mean
1	12	13	12	13	12.5
2	11	.....	12	12	12.0
3	10	12	11	12	11.25
4	7	9	8	12	9.0
5	6	6	8	7	6.75
6	3	5	4	6	4.5
7	1	2	3	2	2.0

Figure 7

(i) Complete Figure 7 to show the missing value.

(1)

(ii) Use the data in Figure 7 to complete the bar chart in Figure 8.

(1)

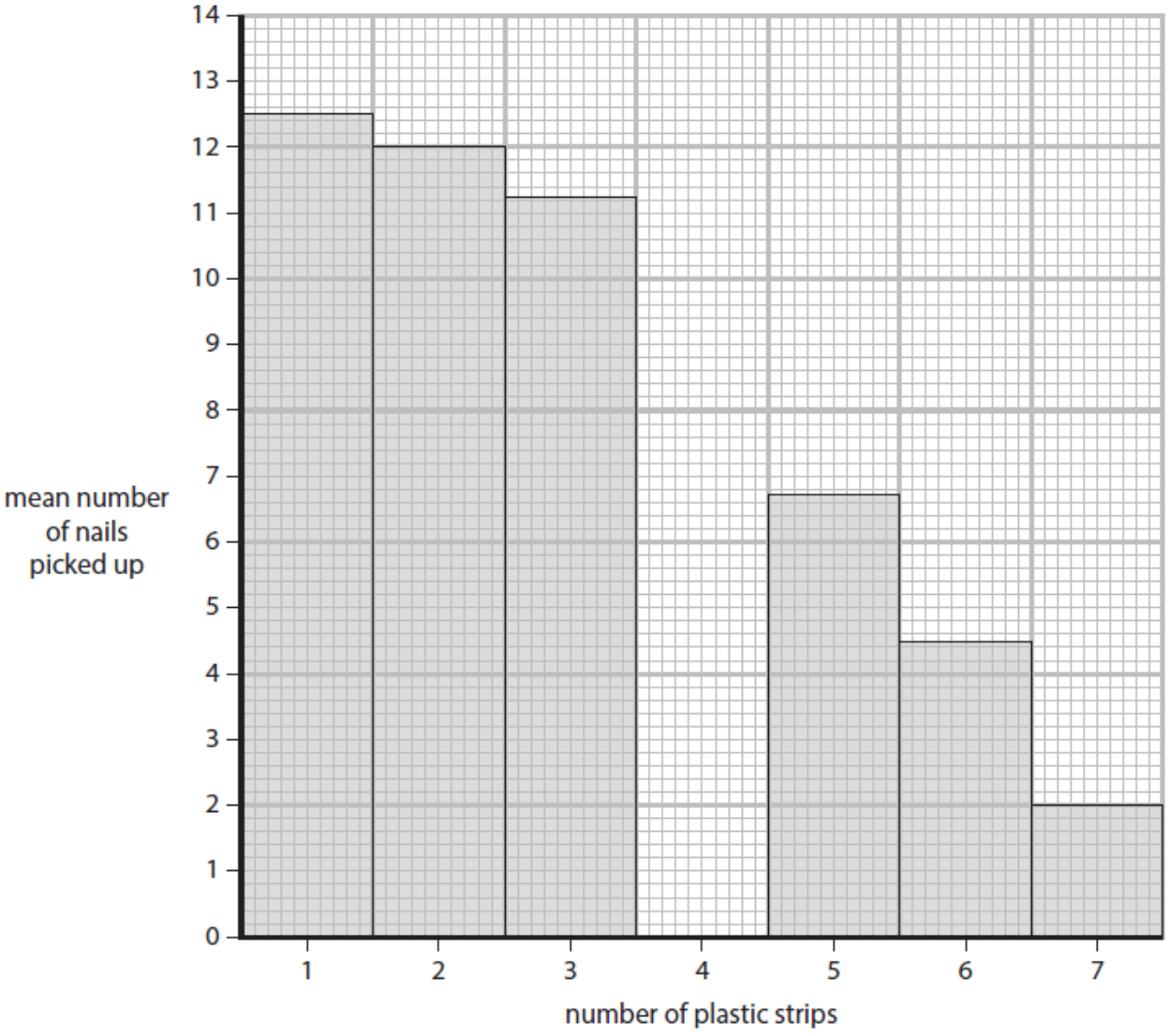


Figure 8

(iii) Use Figure 8 to describe the relationship between the number of plastic strips and the mean number of nails picked up.

(2)

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(iv) A student thinks that none of the nails used in the investigation become permanently magnetised.

Suggest how the student could test this hypothesis.

(2)

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(Total for question = 6 marks)

(**QU04b 1SC0/2PH, June 2025**)

Q30.

This question is about magnets and magnetism.

Figure 3 shows a magnet that has picked up three paper clips.

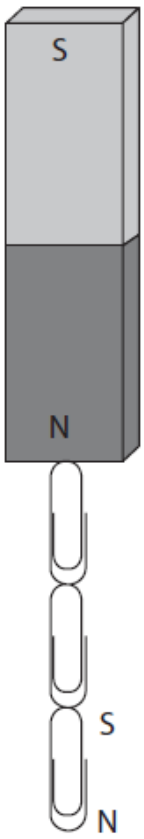


Figure 3

(i) The poles of the lowest paper clip are labelled.

Label the poles of the other two paper clips in Figure 3.

(2)

(ii) Complete the sentence, by choosing a word from the box, to describe the type of magnetism that these paper clips have.

(1)

alternated	earthed	induced	transformed

These paper clips have ..... magnetism.

(iii) Suggest a material that these paper clips in Figure 3 could be made from.

(1)

.....

(iv) When the paper clips were pulled off the magnet they fell separately to the table.

Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

.....

.....

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.....

(Total for question = 6 marks)

(**QU02a 1SC0/2PF, June 2023**)

Q31.

A student uses plotting compasses to investigate the magnetic field between the poles of two bar magnets.

Figure 5 shows **one** of the plotting compasses and **one** of the bar magnets.



Figure 5

The student places the two magnets on a piece of paper with a pole of one magnet a few centimetres away from a pole of the other magnet.

The student places 20 plotting compasses on the paper near the magnets.

Figure 6 shows the direction in which each of the plotting compasses points.

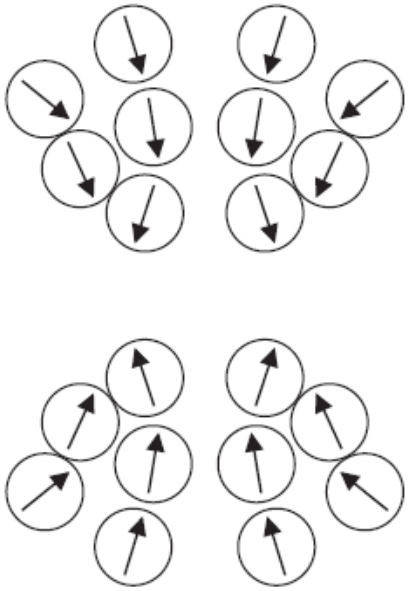


Figure 6

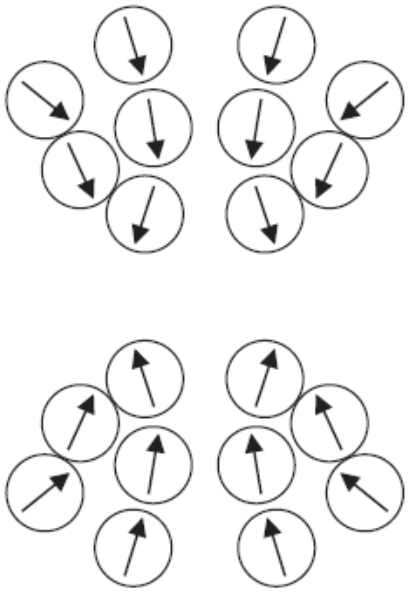


Figure 6

(i) Draw two rectangles on Figure 6 to show the positions of the two bar magnets.

Label the N-pole and the S-pole of each magnet.

(2)

(ii) The student wants to determine the shape of the magnetic field for a larger area around the magnets.

Describe how the student should continue the investigation using just one plotting compass.

(3)

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.....

.....

(Total for question = 5 marks)

(**Q03a 1SC0/2PH, Nov 2021**)

Q32.

Figure 4 shows the magnetic field produced by a current in a long, straight wire.

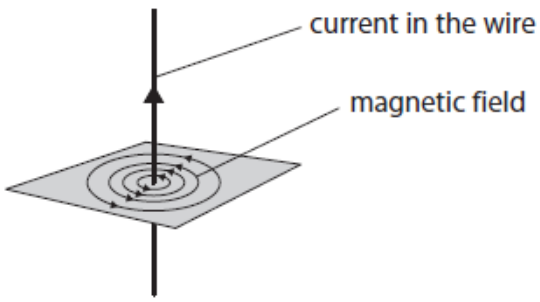


Figure 4

Which row of the table is correct when the strength of the magnetic field is greatest?

(1)

	distance from the wire	current
☒ A	small	small
☒ B	small	large
☒ C	large	small
☒ D	large	large

(Total for question = 1 mark)

(**Q04 1SC0/2PF, June 2018**)

Q33.

Figure 5 shows a magnet holding some paper clips.

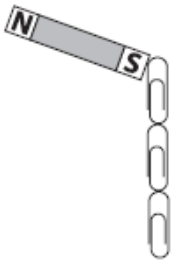


Figure 5

Describe how a student could show that the paper clips are induced magnets.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q06 1SC0/2PF, June 2018**)

Q34.

A student measures the strength of the magnetic field at several distances from the wire in Figure 4.
Figure 5 shows most of the student's results.

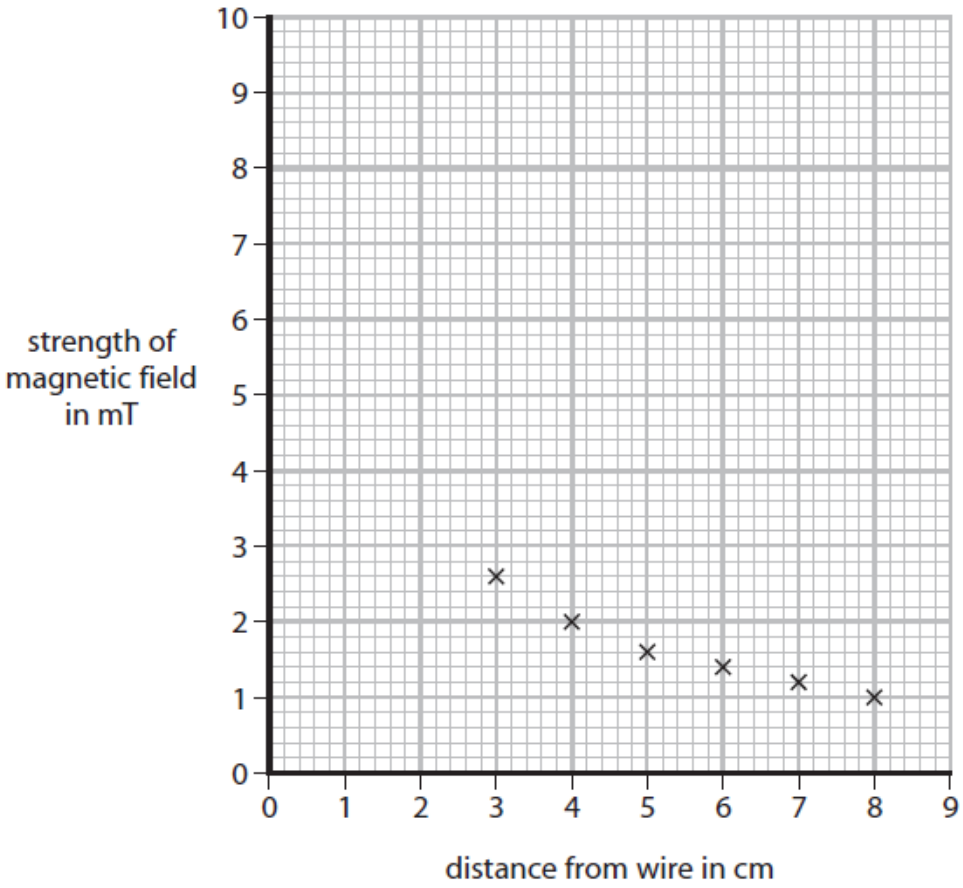


Figure 5

Figure 6 shows two extra sets of results.
mT is a unit of strength of a magnetic field.

distance from wire in cm	strength of magnetic field in mT
1.0	8.1
2.0	3.9

Figure 6

(i) Plot the two extra points on Figure 5.

(2)

(ii) Draw a best fit curve on the graph in Figure 5.

(1)

(iii) Use the graph in Figure 5 to calculate the change in strength of magnetic field when the

distance from the wire changes from 4 cm to 8 cm.

(2)

change in strength of magnetic field = ... mT

(iv) The distance from the wire affects the strength of the magnetic field.

State **one** other factor that affects the strength of the magnetic field.

(1)

.....

(Total for question = 6 marks)

(**Q02c 1SC0/2PF, Nov 2021**)

Q35.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Figure 5 shows two nails, X and Y, hanging from a magnet.

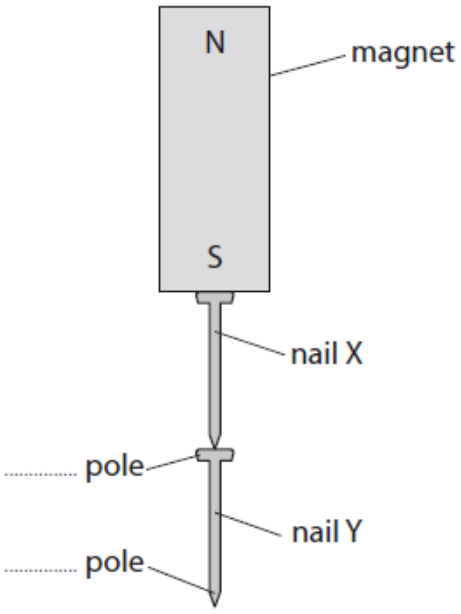


Figure 5

(i) Complete the labels in Figure 5 to show the N and S poles of nail Y.

(1)

(ii) Nail X is removed from the magnet and nail Y falls off nail X.

This shows that the magnet caused both nails to be

(1)

☒ **A** permanent magnets

☒ **B** temporarily charged

☒ **C** permanently charged

☒ **D** induced magnets

(Total for question = 2 marks)

(**QU04a 1SC0/2PH, June 2025**)

Q36.

A student uses iron filings to show the pattern of a magnetic field around a bar magnet.

Figure 2 shows the pattern the student produced.

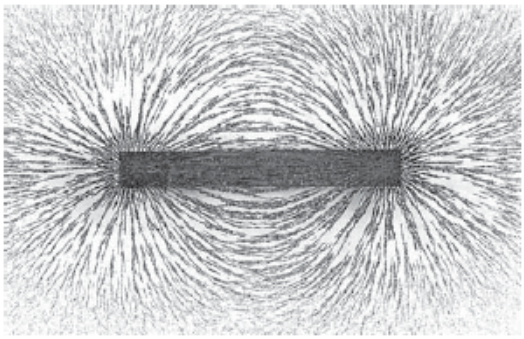


Figure 2

(i) Describe how you can tell from Figure 2 where the magnetic field is strongest.

(2)

.....

.....

.....

.....

(ii) The bar magnet is placed on a sheet of paper. Describe how the student could plot the shape and show the direction of the magnetic field around the magnet.

(3)

.....

.....

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.....

.....

.....

(Total for question = 5 marks)

(**Q01c 1SC0/2PF/S2, SAM**)

Q37.

Describe how you could show that the Earth has a magnetic field.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q07 1SC0/2PF, June 2018**)

Q38.

Figure 5 shows the directions of some plotting compass needles placed at different points near the Earth's surface.

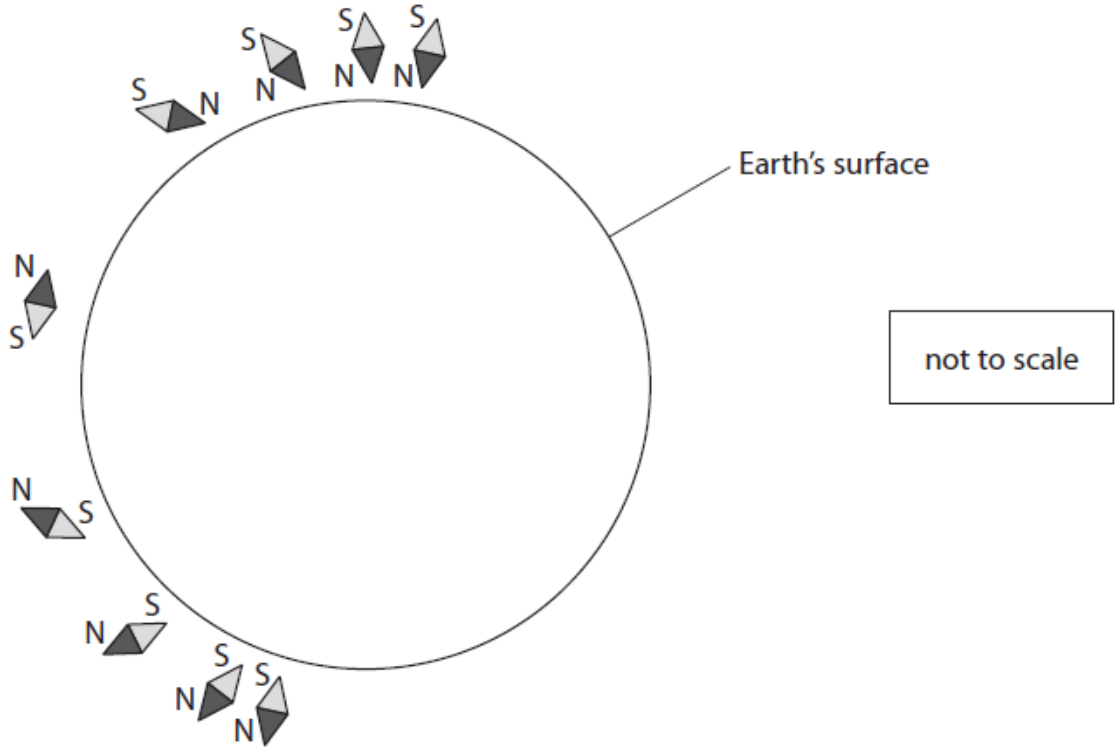


Figure 5

(i) Sketch, on Figure 5, the Earth's magnetic field outside and inside the Earth.

(2)

(ii) State which part of the Earth generates its magnetic field.

(1)

.....

.....

(Total for question = 3 marks)

(**QU03c 1SC0/2PH, June 2022**)

Q39.

This question is about magnets and magnetism.

Figure 4 shows the magnetic field around a wire carrying a current.

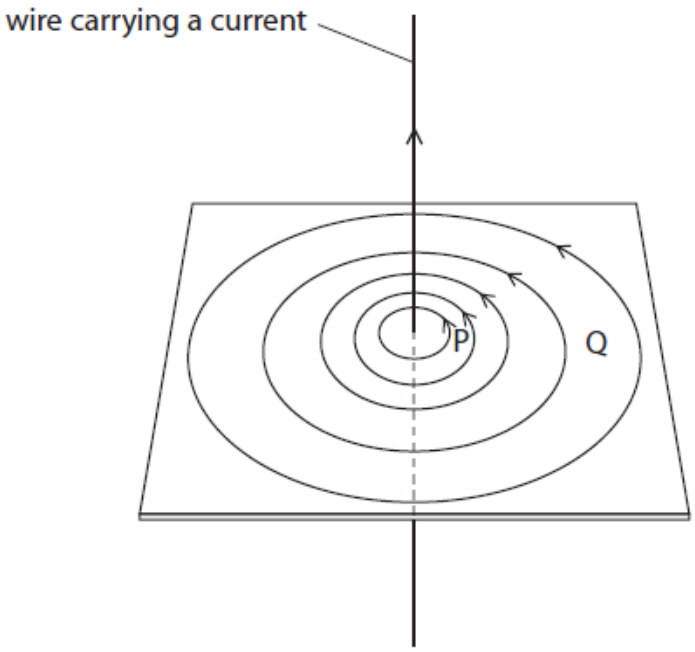


Figure 4

(i) State how you can tell from Figure 4 that the strength of the field is greater at P than at Q.

(1)

.....

.....

(ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 5.

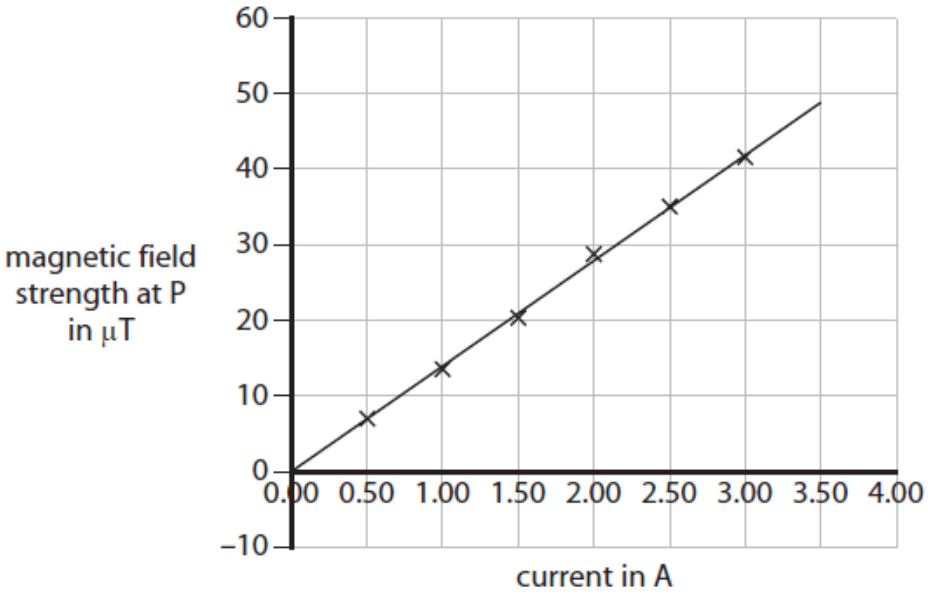


Figure 5

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Describe the relationship between magnetic field strength and current.

(2)

.....

.....

.....

.....

(Total for question = 3 marks)

(**QU02b 1SC0/2PF, June 2023**)

Q40.

Figure 7 shows a wire placed between the poles of a U-shaped magnet.

The wire is connected to a resistor and a battery.

The wire carries a current in the direction shown.

The wire is perpendicular to the magnetic field of the magnet.

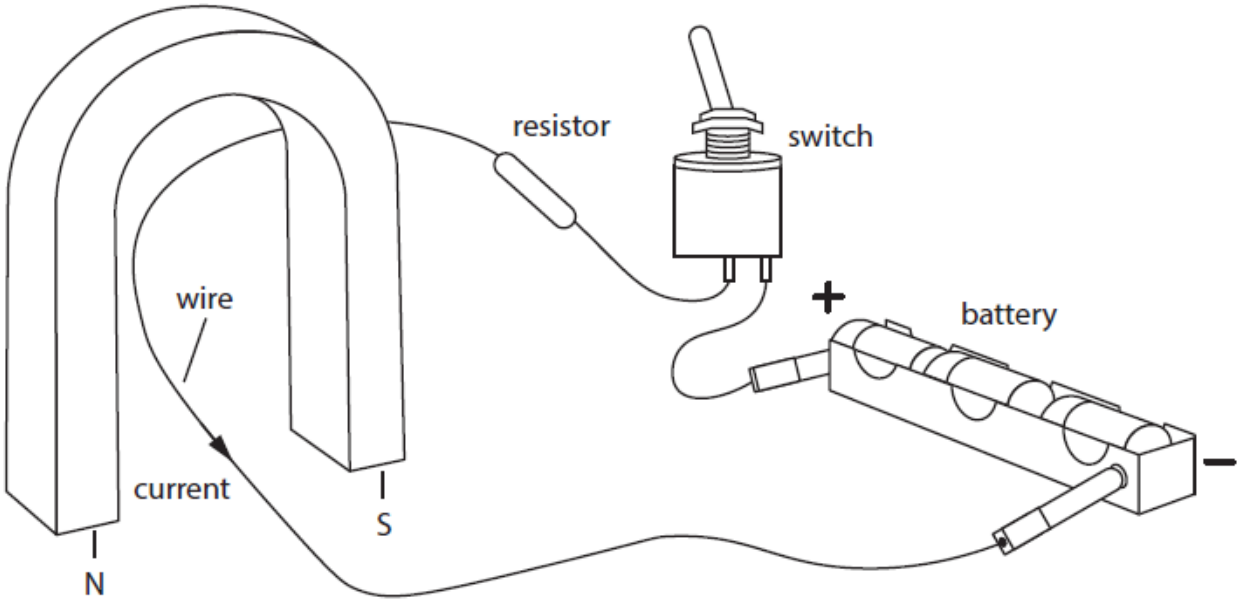


Figure 7

(i) Draw an arrow on Figure 7 to show the direction of the force, F, acting on the wire.

Label this arrow 'F'.

(1)

(ii) State **one** practical way of reversing the direction of force F.

(1)

.....

.....

(iii) In Figure 7

- current in the wire = 3.2 A
- length of wire in the magnetic field = 0.042 m
- magnitude of the force on the wire = 0.078 N

Calculate the magnitude of the magnetic flux density between the two poles of the magnet.

(2)

magnetic flux density = ... T

(Total for question = 4 marks)

(**QU03b 1SC0/2PH, June 2024**)