PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 12: MAGNETISM AND THE MOTOR EFFECT

SCORE	PERCENTAGE
/111	%

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Q1.

Figure 11 shows the shape of the magnetic field near a bar magnet.

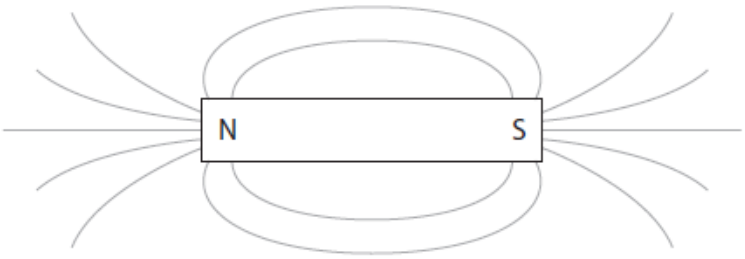


Figure 11

(i) Draw arrows on the field lines in Figure 11 to show the direction of the magnetic field.

(1)

(ii) Place a letter X on Figure 11 at a place where the magnetic field is strongest.

(1)

(iii) Describe **two** differences between the magnetic field shown in Figure 11 and a uniform magnetic field.

(2)

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(Total for question = 4 marks)

Q2.

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

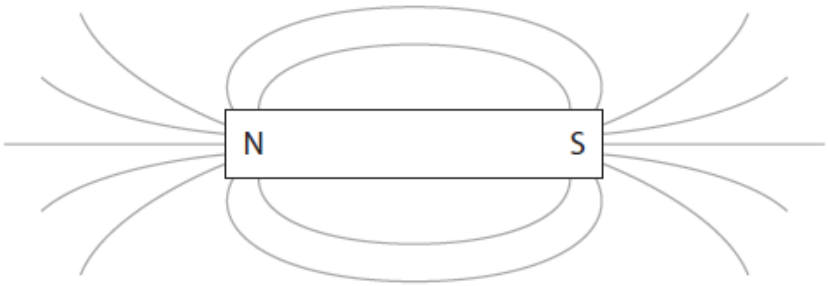


Figure 4

(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)

Q3.

A student sets up the apparatus shown in Figure 9.

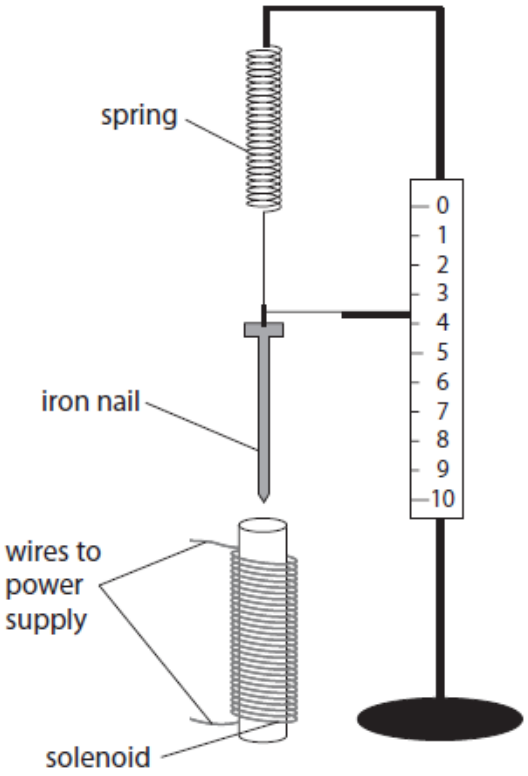


Figure 9

(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)

Q4.

A student sets up the apparatus shown in Figure 9.

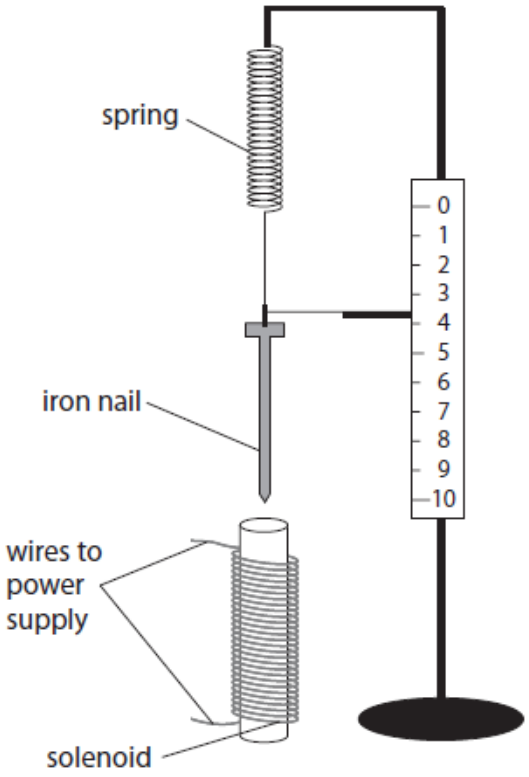


Figure 9

(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)

Q5.

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)

.....

.....

(Total for question = 4 marks)

Q6.

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)

Q7.

A straight piece of wire is 0.713 m long.

It is placed at right angles to a uniform magnetic field of 0.47 T.

The force on the wire is 0.089 N.

Calculate the current in the wire.

Use an equation from the formula sheet. Give your answer to an appropriate number of significant figures.

(2)

current = ... A

(Total for question = 2 marks)

Q8.

A student investigates moments of forces.

Figure 14 shows the apparatus used.

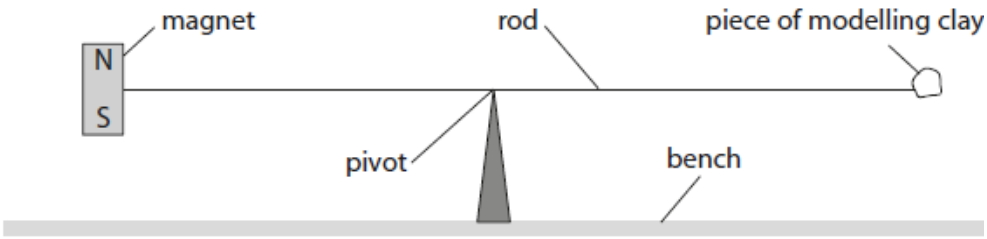


Figure 14

The pivot is under the centre of the rod.

A magnet is fixed to one end of the rod.

A piece of modelling clay is fixed to the other end of the rod.

The system is in equilibrium.

(a) The student fixes a coil to the bench under the magnet as shown in Figure 15.

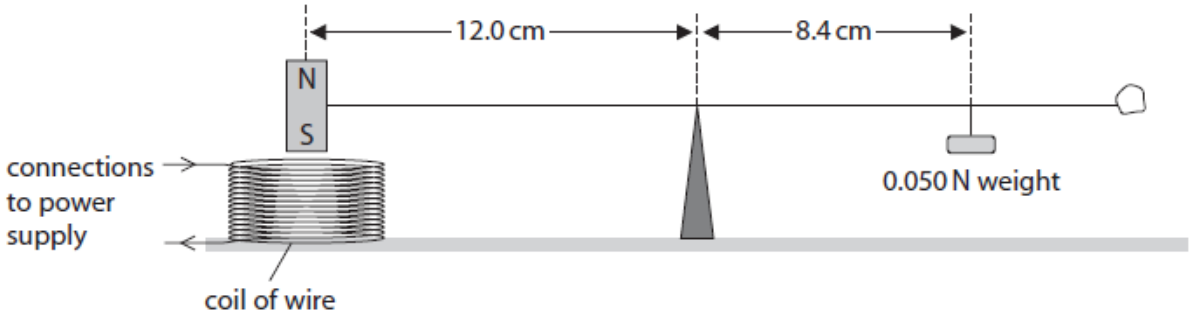


Figure 15

The coil of wire is connected to a d.c. power supply so that there is a current in the coil.

To bring the system back into equilibrium, the student hangs a 0.050 N weight on the rod, 8.4 cm away from the pivot, as shown in Figure 15.

Calculate the size of the force between the magnet and the coil.

(3)

force = ... N

(b) Describe how the student could develop the investigation to determine if the size of the force between the magnet and the coil is directly proportional to the size of the current in the coil.

(4)

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(Total for question = 7 marks)

Q9.

Figure 13 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.

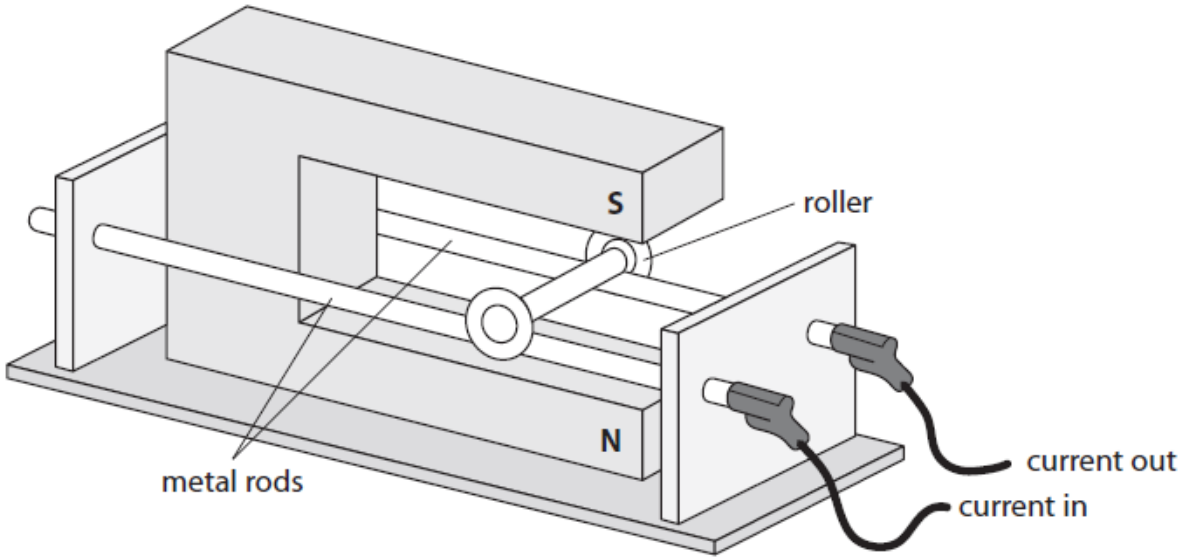


Figure 13

(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 13 to show the direction of the force acting on the roller.

(1)

(Total for question = 6 marks)

Q10.

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.

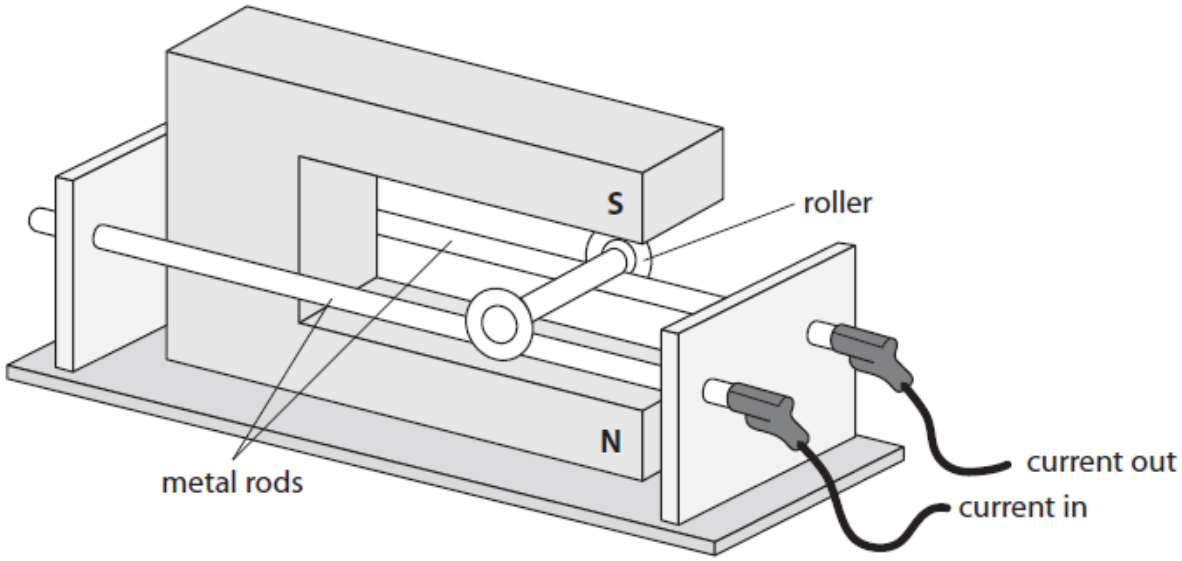


Figure 8

(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)

Q11.

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)

Q12.

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)

Q13.

Figure 12 shows a wire carrying a current.

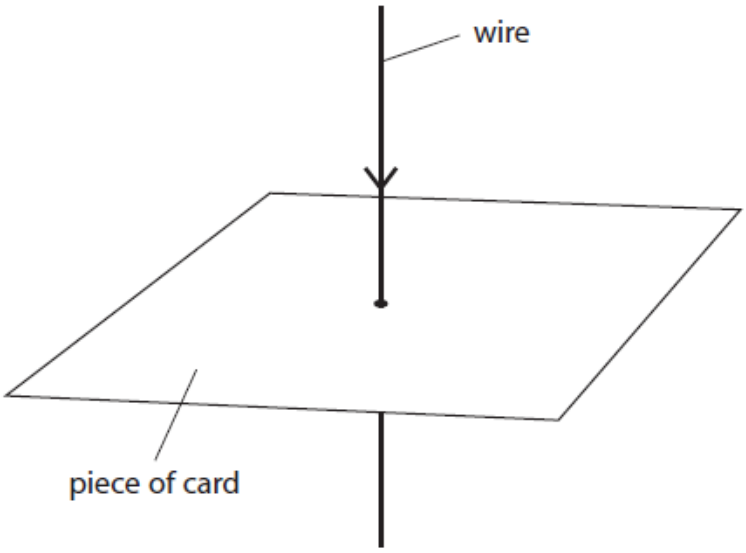


Figure 12

Draw, on the card in Figure 12, the magnetic field that is produced by the current.

(2)

(Total for question = 2 marks)

Q14.

Figure 7 shows a wire carrying a current.

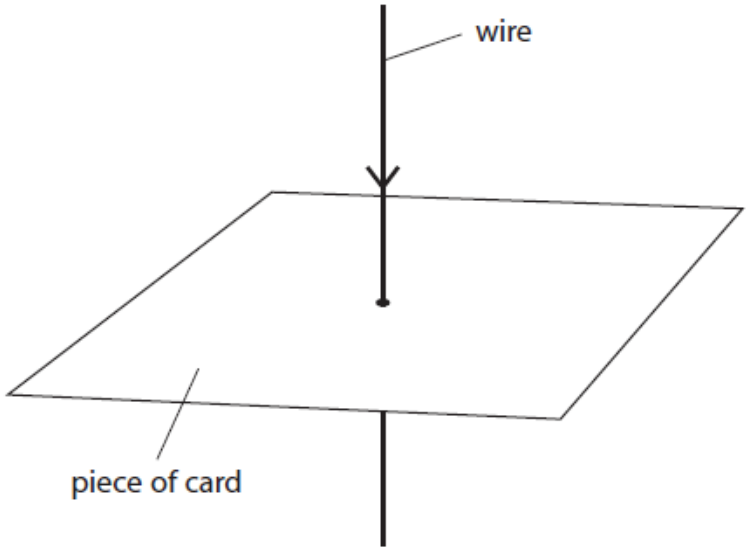


Figure 7

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

(Total for question = 2 marks)

Q15.

A power transmission wire hangs so that it is at right angles to the Earth's magnetic field.

Although this magnetic field is constant, the cable experiences a changing force.

Explain why the force experienced by the cable changes.

(4)

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(Total for question = 4 marks)

Q16.

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 11 shows a copper wire between two magnetic poles.

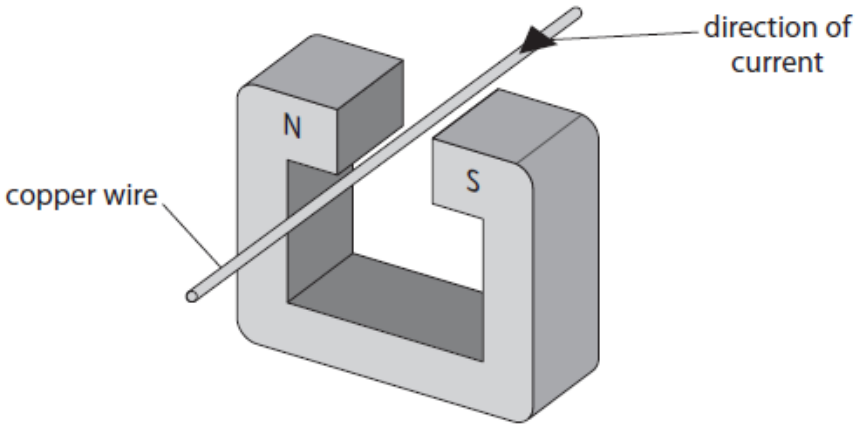


Figure 11

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 12 shows a different wire inside a uniform magnetic field.

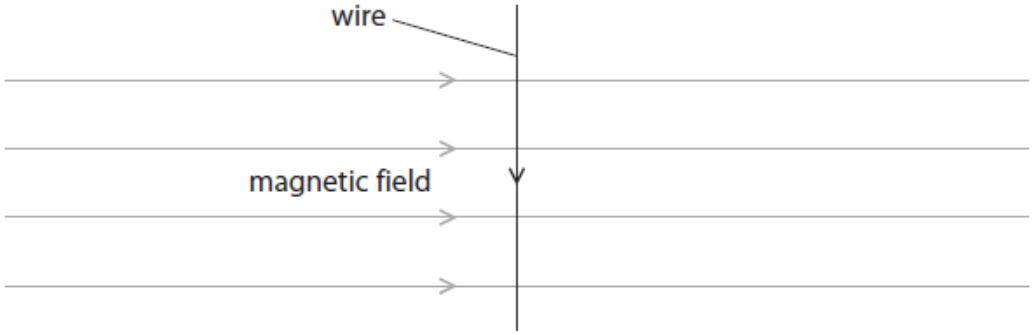


Figure 12

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 at the end of this paper.

(3)

current in the wire = ... A

(Total for question = 5 marks)

Q17.

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.

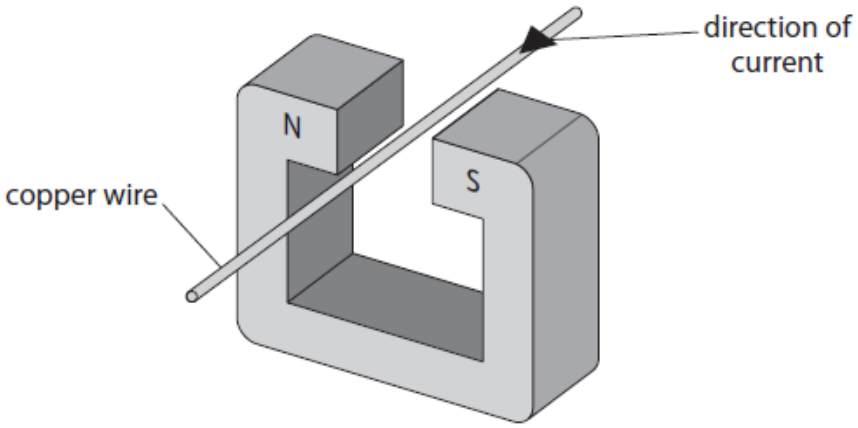


Figure 4

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)

.....

.....

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

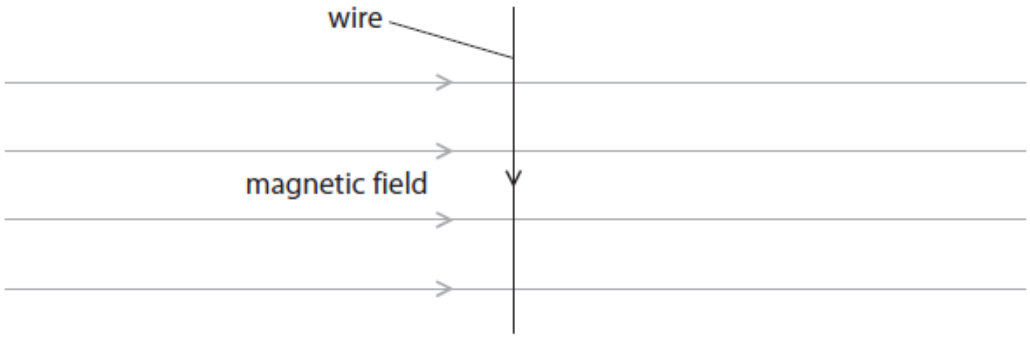


Figure 5

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)

Q18.

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 11 shows the magnetic field of a magnet.

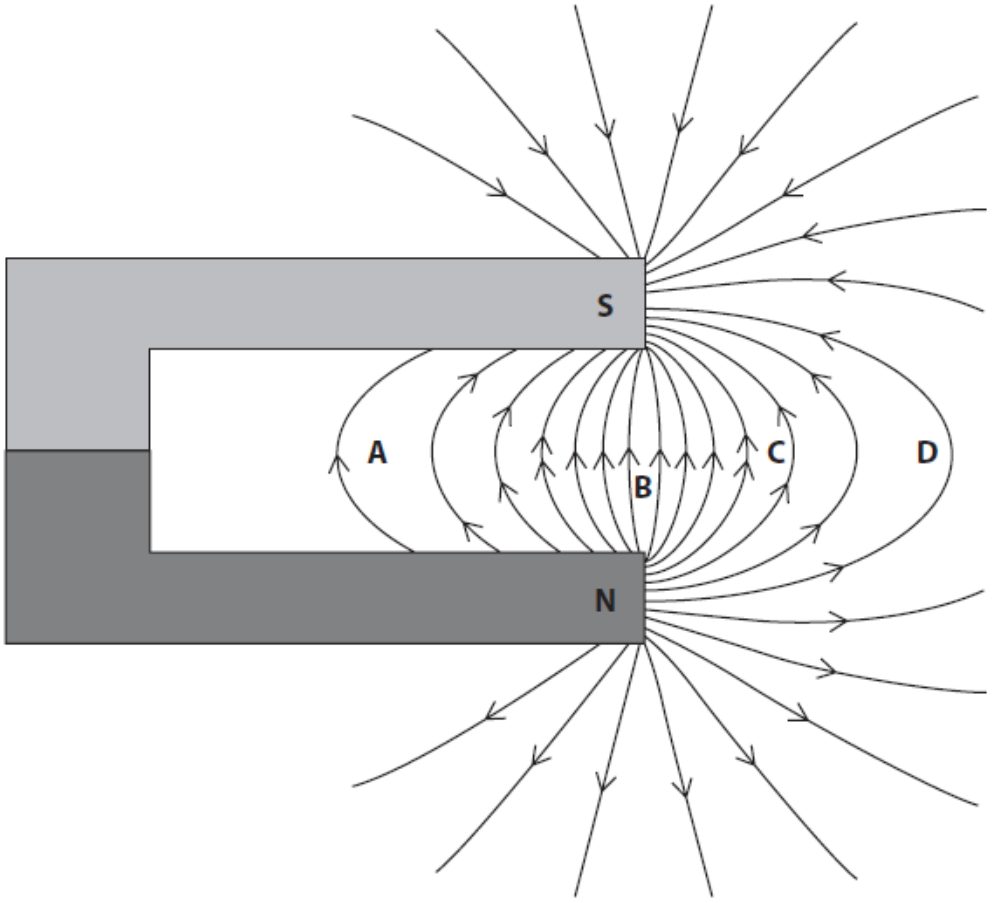


Figure 11

At which point is the magnetic field strongest?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q19.

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.

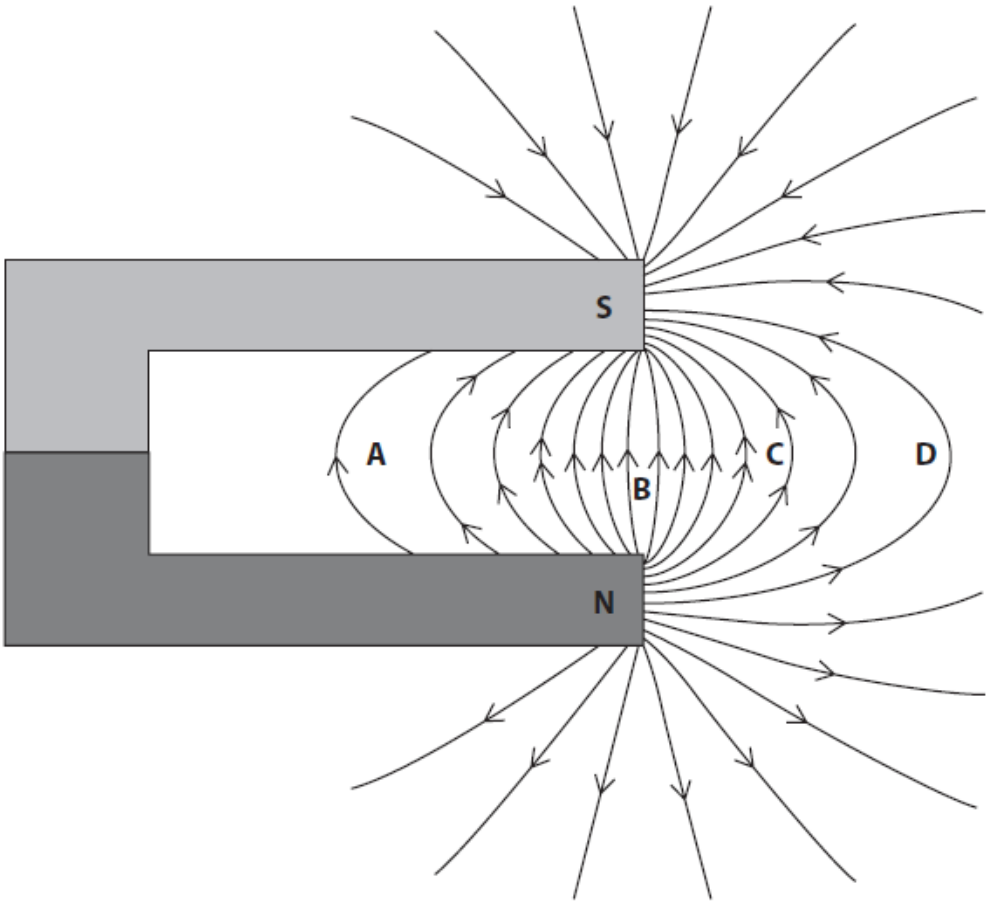


Figure 6

At which point is the magnetic field strongest?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q20.

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.

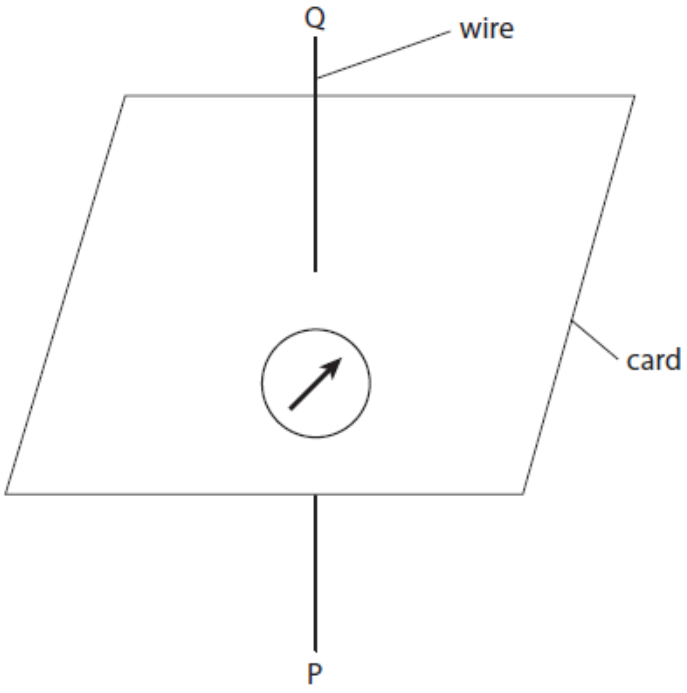


Figure 3

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)

Q21.

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 10 shows the wire going straight through a card.

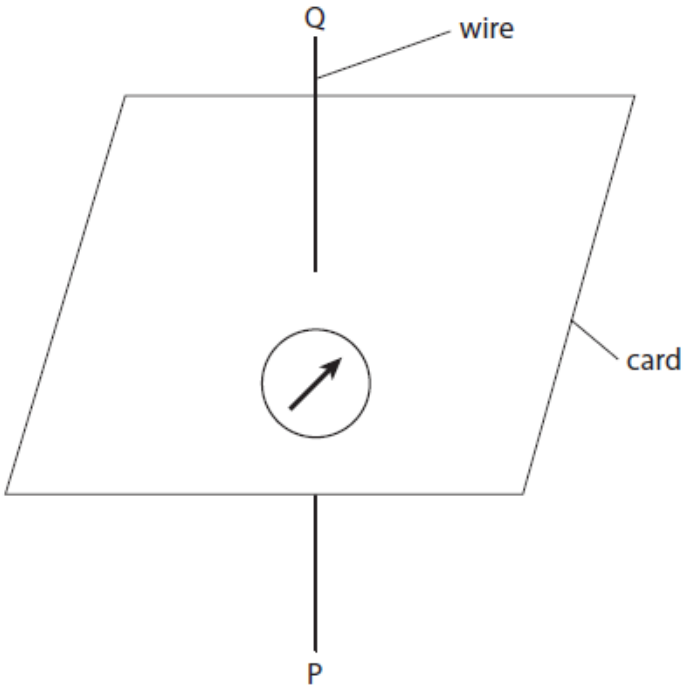


Figure 10

Figure 10 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.

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(Total for question = 4 marks)

Q22.

A student investigates the relationship between the magnetic flux density and the electromagnetic force on a current-carrying wire.

The student has the equipment shown in Figure 19.

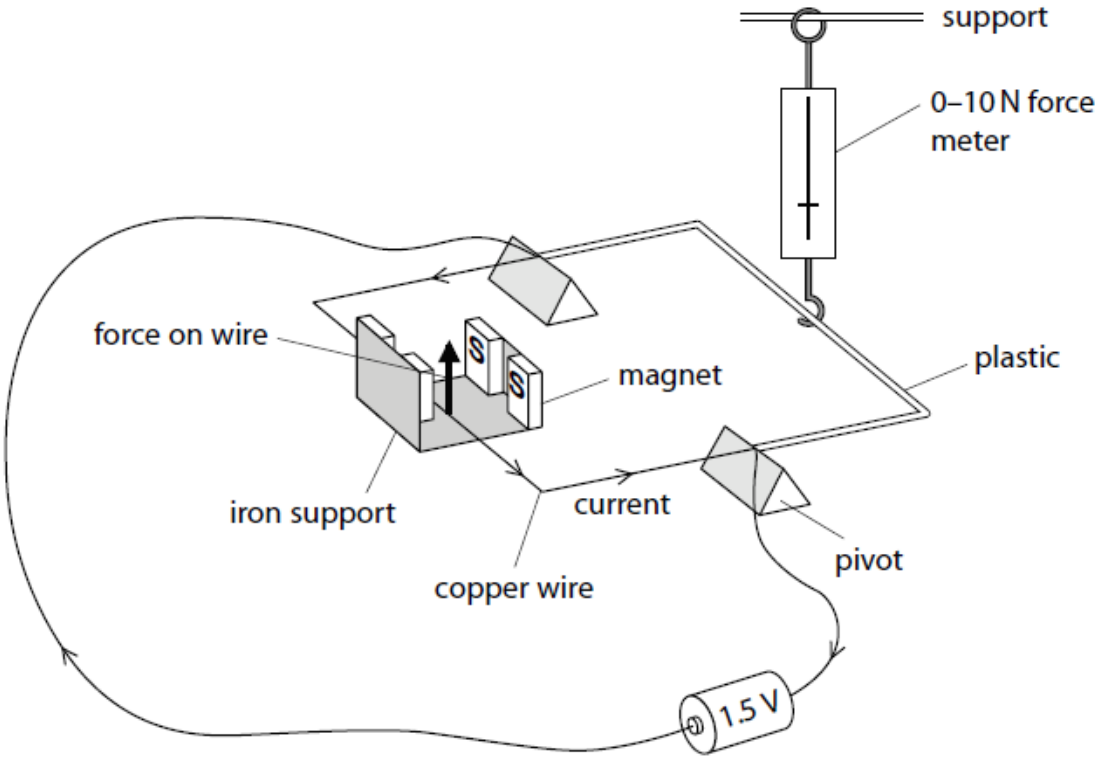


Figure 19

The student varies the number of magnets and measures the force on the wire using the force meter.

The results are shown in Figure 20.

number of pairs of magnets	reading on force meter (N)
1	0.0
2	0.0
3	0.1

Figure 20

The student decides that his equipment is not sufficiently sensitive.

Give **three** ways the student should develop his investigation to improve the quality of his results.

(3)

1 .....

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2 .....

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3 .....

.....

(Total for question = 3 marks)

Q23.

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

Figure 12 shows **one** of the plotting compasses and **one** of the bar magnets.



Figure 12

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 13 shows the direction in which each of the plotting compasses points.

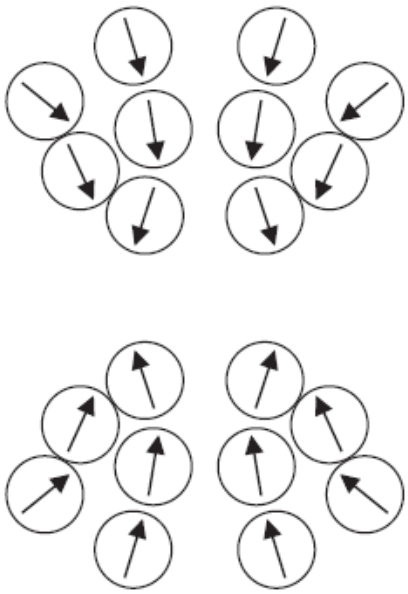


Figure 13

(i) Draw two rectangles on Figure 13 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)

Q24.

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.

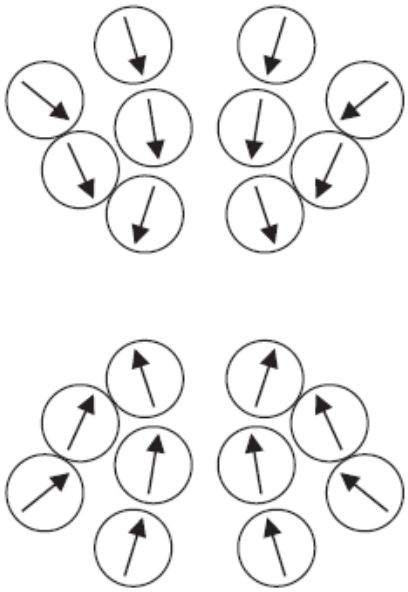


Figure 6

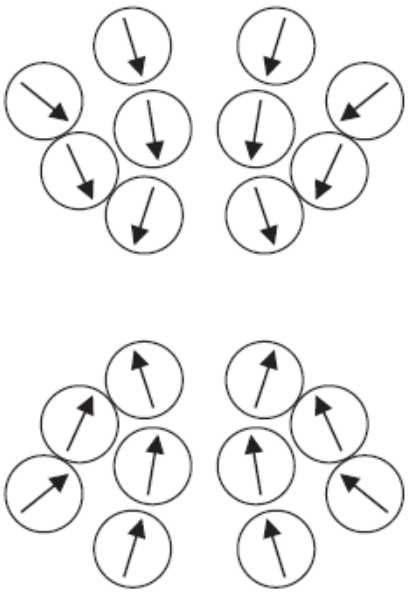


Figure 6

(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)

Q25.

Figure 12 shows the directions of some plotting compass needles placed at different points near the Earth's surface.

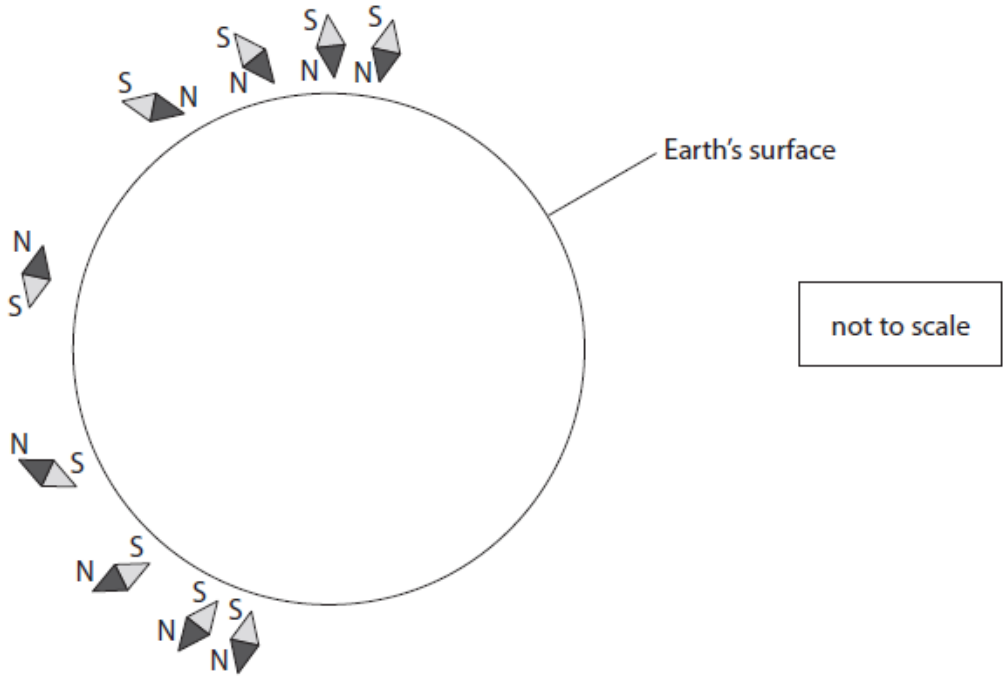


Figure 12

(i) Sketch, on Figure 12, 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)

Q26.

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

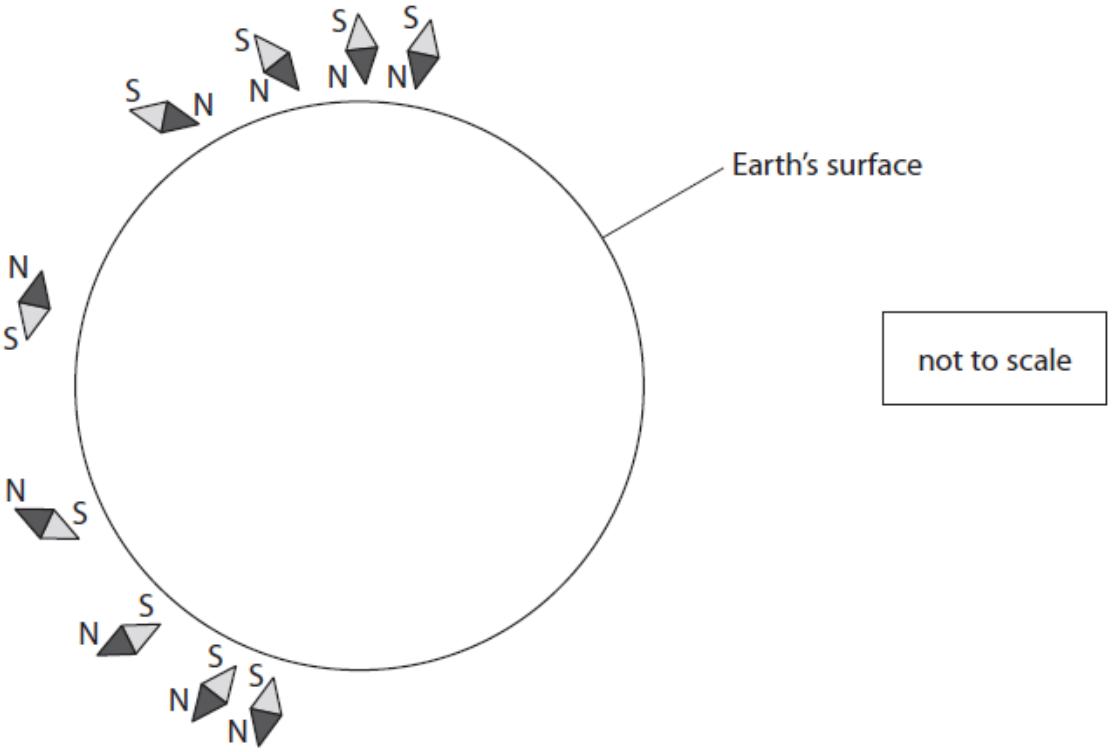


Figure 5

(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)

Q27.

State how a uniform magnetic field may be obtained in a school laboratory.

(1)

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(Total for question = 1 mark)

Q28.

State how a uniform magnetic field may be obtained in a school laboratory.

(1)

.....

.....

(Total for question = 1 mark)

Q29.

A student investigates moments of forces.

Figure 14 shows the apparatus used.

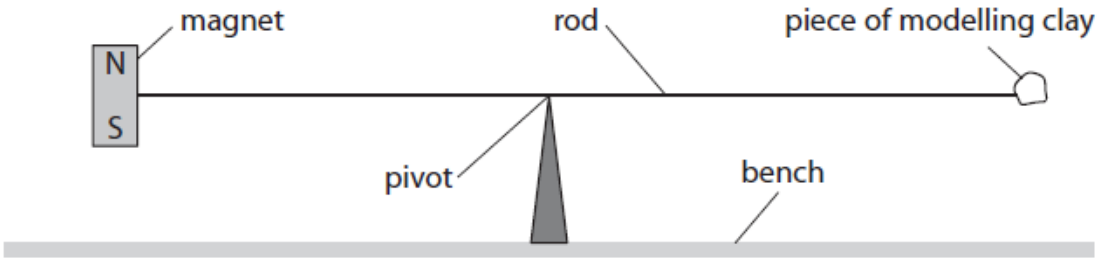


Figure 14

The pivot is under the centre of the rod.

A magnet is fixed to one end of the rod.

A piece of modelling clay is fixed to the other end of the rod.

The system is in equilibrium.

State the relationship between the moment of the weight of the magnet and the moment of the weight of the piece of modelling clay about the pivot.

(1)

.....

.....

(Total for question = 1 mark)

Q30.

A student has a bar magnet, a piece of iron the same size as the magnet, and some paper clips.

Describe how the student could use these items to demonstrate temporary induced magnetism.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q31.

A student has a bar magnet, a piece of iron the same size as the magnet, and some paper clips.

Describe how the student could use these items to demonstrate temporary induced magnetism.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q32.

Wooden trucks on a toy railway have permanent magnets that hold the train together.

The magnets are arranged so that an N-pole touches an S-pole between each truck, as shown in Figure 15.

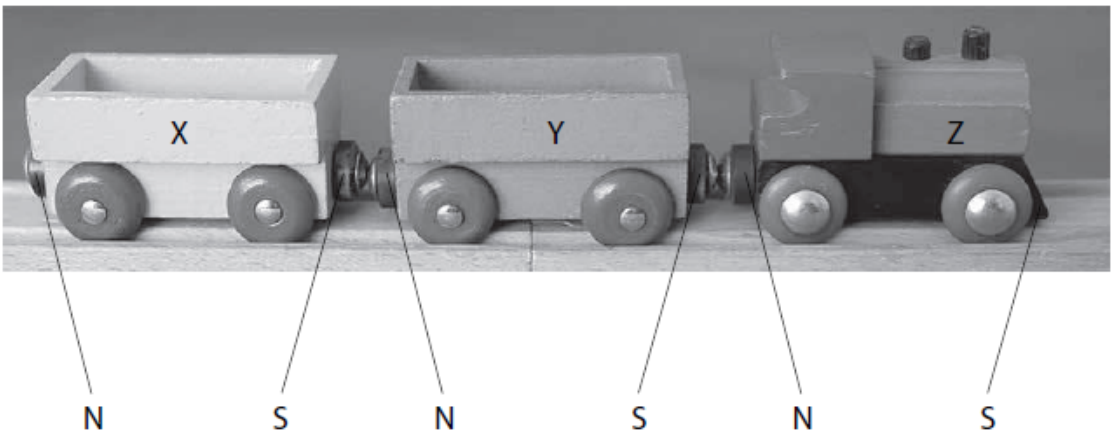


Figure 15

(a) Truck Y is removed from the train, turned through 180° and is then replaced between truck X and Z.

How does this affect the train?

(1)

☒ **A** Y attracts both X and Z as before

☒ **B** Y still attracts X but now repels Z

☒ **C** Y still attracts Z but now repels X

☒ **D** Y now repels both X and Z

(b) The structure of a truck, seen from above, is shown in Figure 16.

The permanent magnets cause a magnetic field both inside and outside the truck.

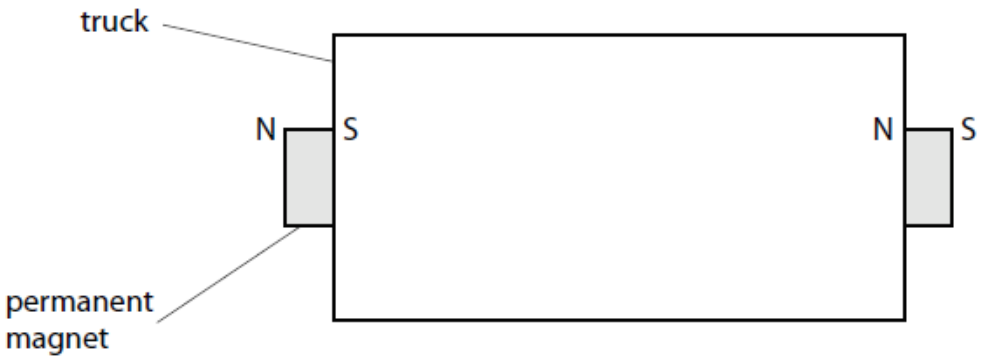
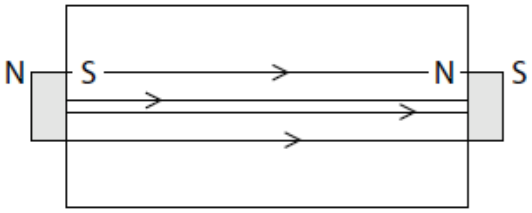


Figure 16

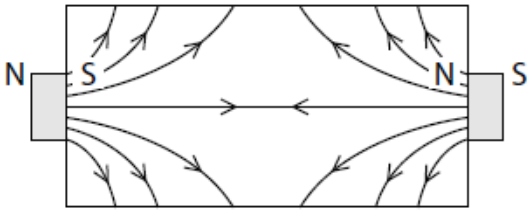
Which of these correctly shows the field inside the truck?

(1)

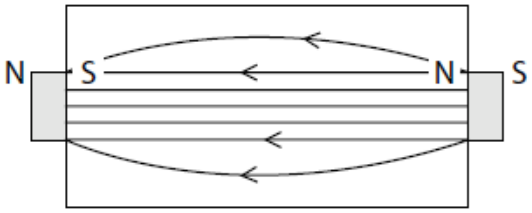
☐ **A**



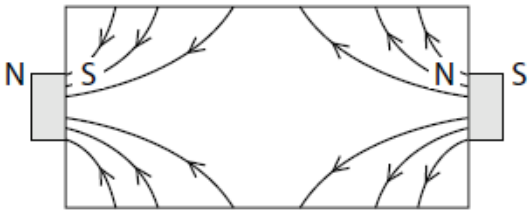
☐ **B**



☐ **C**



☐ **D**



(Total for question = 2 marks)