PEARSON EDEXCEL IGCSE PHYSICS · 4PH1

PHYSICS



EXAM QUESTION PACK

SECTION 6: MAGNETISM AND ELECTROMAGNETISM (PACK 1)

SCORE	PERCENTAGE
/180	%

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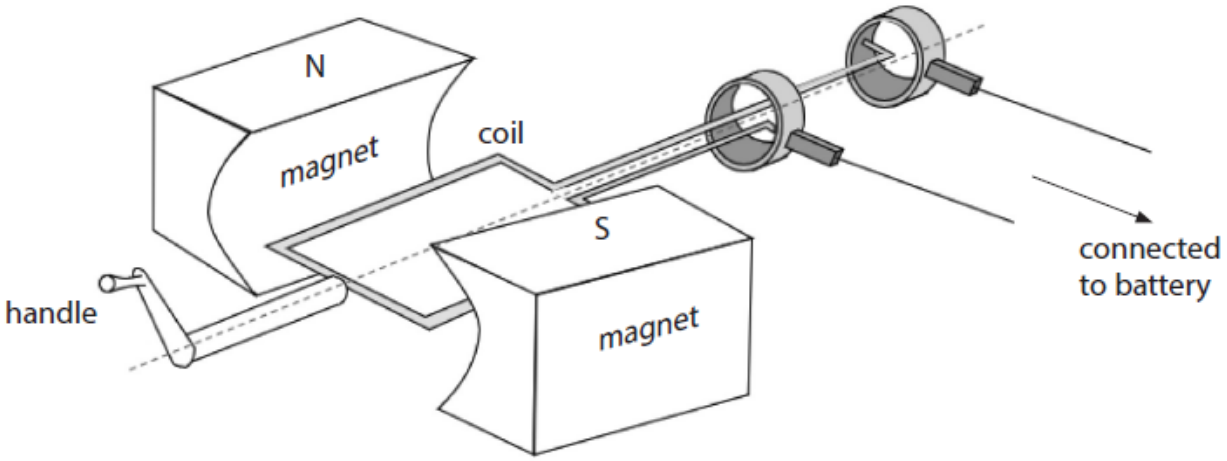
Q1.

This question is about a radio powered by a person turning a handle.

The radio has a battery which stores energy when the handle is turned.

(a) The diagram shows the part of the radio called a generator.

The generator produces a voltage which does electrical work on the battery.



Explain how the generator produces a voltage.

(3)

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(b) The radio receives a radio wave of frequency 93 MHz.

(i) State the formula linking speed, frequency and wavelength of a wave.

(1)

(ii) Calculate the wavelength of the radio wave.

[speed of radio waves = 3.0×10^8 m/s]

(3)

wavelength = ... m

(c) The signal received by the radio is converted into an alternating current (a.c.) signal.

(i) Describe how the loudspeaker in the radio converts this a.c. signal into a sound wave.

(4)

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(ii) State a modification that would increase the force on the loudspeaker coil.

(1)

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(Total for question = 12 marks)

Q2.

Diagram 1 shows a simple loudspeaker.

The coil is connected to an alternating current (a.c.) supply.

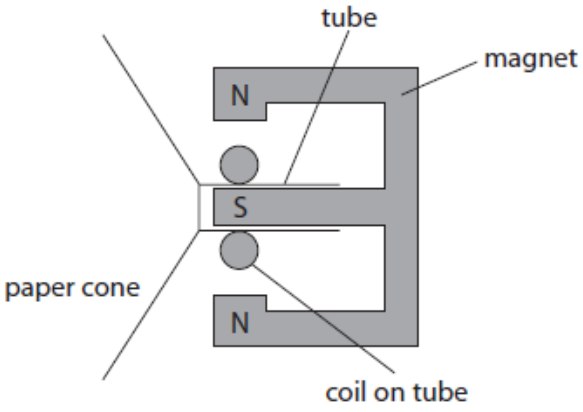


Diagram 1

(a) Describe how the loudspeaker produces sound.

(4)

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(b) Diagram 2 shows two loudspeakers connected in series with a variable resistor.

The variable resistor is set to 5.0 Ω.

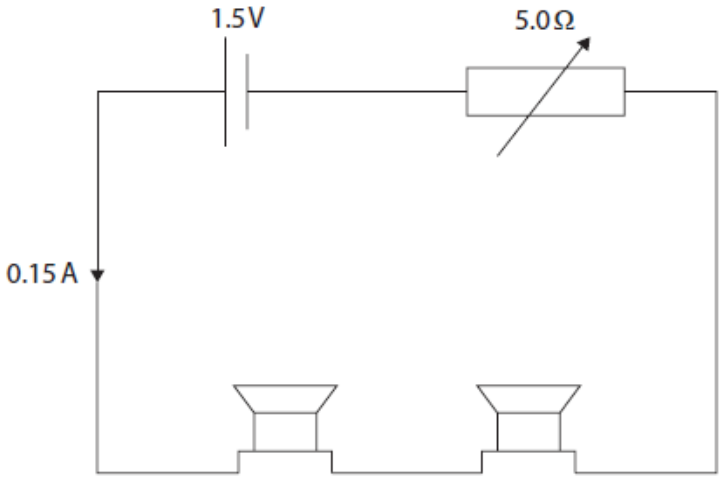


Diagram 2

(i) The total voltage across the two loudspeakers is 0.75 V and the current in the circuit is 0.15 A.

Show that the total power of the two loudspeakers is about 0.1 W.

[power = current × voltage]

(2)

(ii) A student varies the resistance of the variable resistor.

The table shows the power of the loudspeakers for different resistance values of the variable resistor.

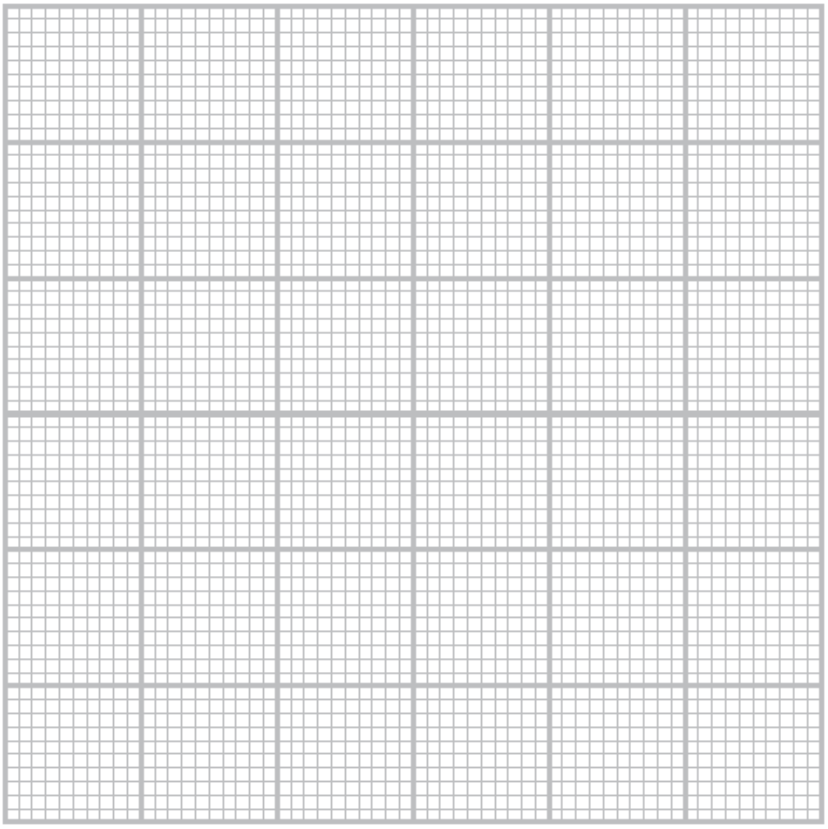
Resistance of variable resistor in Ω	Power of loudspeakers in W
0.0	0.000
2.5	0.100
5.0	0.113
7.5	0.108
10.0	0.100
12.5	0.092
15.0	0.084

Plot the student's results on the grid.

(3)

(iii) Draw a curve of best fit.

(2)



(c) Diagram 3 shows the loudspeakers connected in series to a cell.

Diagram 4 shows the loudspeakers connected in parallel to the same cell.

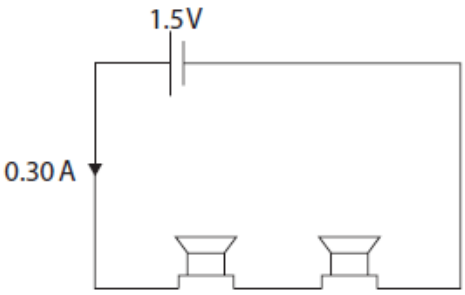


Diagram 3

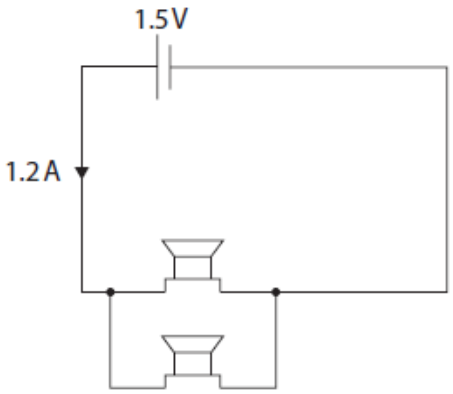


Diagram 4

Comment on how the total resistance of the loudspeakers in diagram 3 compares with the total resistance of the loudspeakers in diagram 4.

(4)

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(Total for question = 15 marks)

Q3.

(a) Photograph 1 shows part of an ammeter that can measure very small currents.



Photograph 1

A student moves a wire between the poles of a strong magnet and uses the ammeter to measure the induced current.

Determine the current reading shown by the ammeter in photograph 1.

(1)

current = ... mA

(b) (i) Predict a value for the current if the movement of the wire was repeated with the poles of the magnet reversed.

(1)

current = ... mA

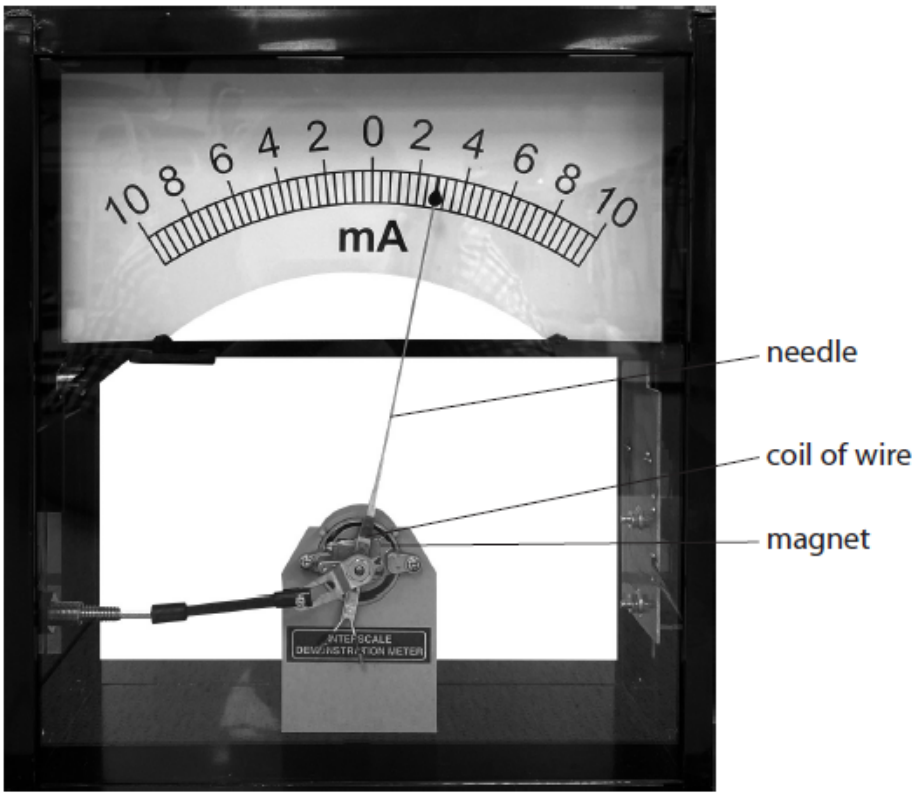
(ii) Predict a value for the current if the wire is moved faster between the poles of the magnet.

(1)

current = ... mA

(c) Photograph 2 shows the structure of the ammeter.

The ammeter has a needle attached to a coil of wire which can move freely around a magnet.
When there is a current in the coil, the needle moves.
The larger the current, the more the coil turns.



Photograph 2

Suggest how the design of the ammeter could be modified to increase its sensitivity.

(1)

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(d) Photograph 3 shows part of the ammeter after a student has adjusted the ammeter in error.

The needle on the ammeter does not point to zero when there is no current.



Photograph 3

(i) Which of these factors has been decreased by the student's adjustment?

(1)

☒ **A** accuracy

☒ **B** precision

☒ **C** reliability

☒ **D** resolution

(ii) Suggest how the student could correct the readings taken from this ammeter due to this error without adjusting the ammeter.

(1)

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(Total for question = 6 marks)

Q4.

This question is about bar magnets.

(a) Describe an investigation to show the shape and direction of the magnetic field for a bar magnet.

You may draw a diagram to help your answer.

(3)

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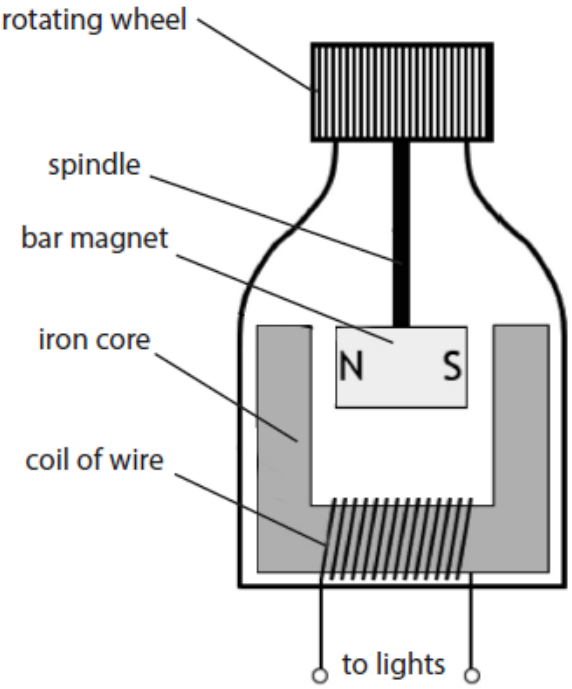
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(b) A bar magnet is used in a bicycle dynamo.

The diagram shows a cross-section of a bicycle dynamo.



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The dynamo has a rotating wheel that presses against the tyre of the bicycle.

The rotating wheel is connected to a bar magnet by a spindle.

When the rotating wheel spins, the bar magnet spins.

(i) The dynamo is connected to the lights on the bicycle.

Explain how the dynamo causes the lights to turn on when the bicycle is moving.

(4)

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(ii) Suggest a disadvantage of using the dynamo to power the bicycle lights.

(1)

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(Total for question = 8 marks)

Q5.

This question is about an electric fan.

(a) A battery supplies a voltage of 12 V and a current of 0.25 A to the fan.

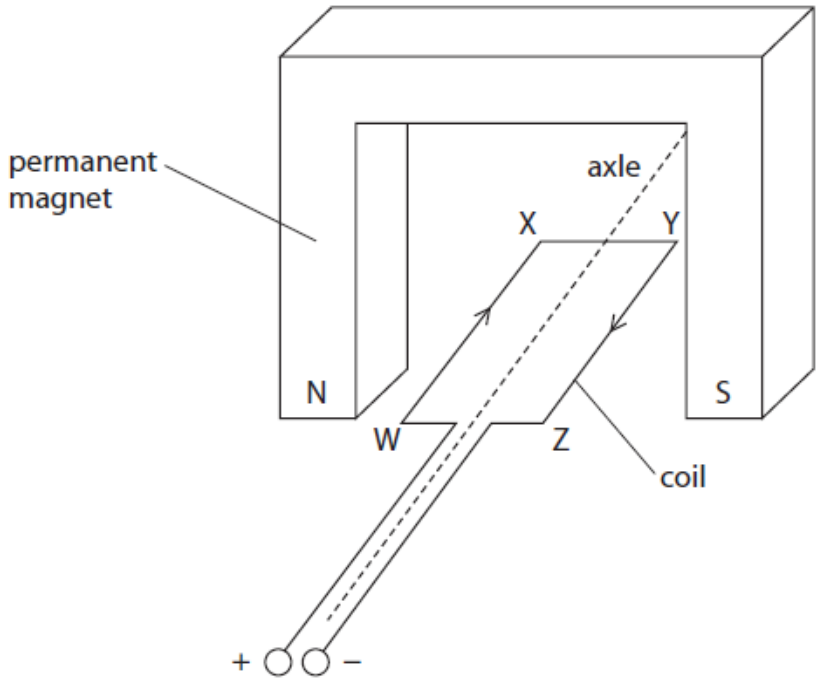
The fan is switched on for 12 seconds and the fan gains 25 J in its kinetic energy store.

Calculate the efficiency of this energy transfer.

(4)

efficiency = ... %

(b) The diagram shows part of the electric motor inside the fan.



(i) Explain why the coil starts to rotate when there is a current in the coil.

(4)

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(ii) Which side of the coil moves vertically upwards?

(1)

☒ **A** WX

☒ **B** XY

☒ **C** YZ

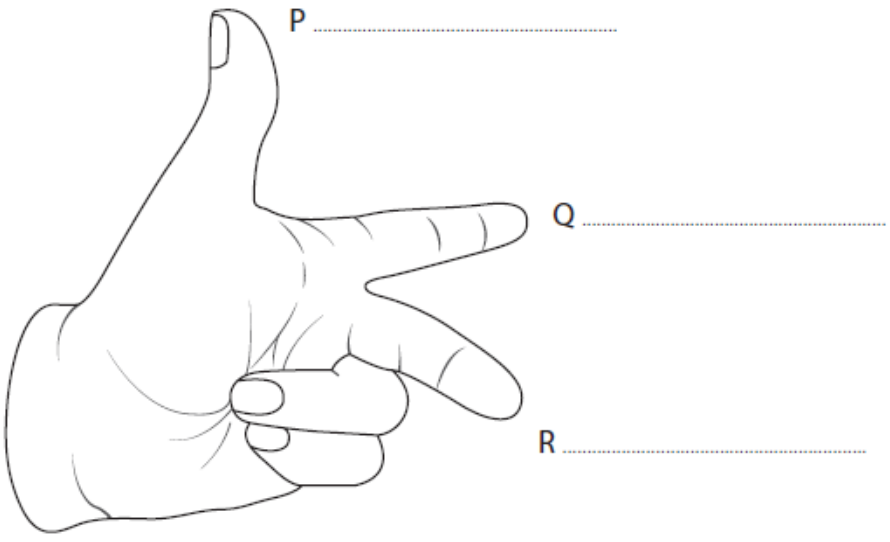
☒ **D** ZW

(Total for question = 9 marks)

Q6.

This is a question about how a loudspeaker works.

(a) Diagram 1 shows a student's left hand.



Edited from shutterstock 198052058

Diagram 1

Label diagram 1 to show what P, Q and R represent in the left-hand rule.

(3)

(b) Diagram 2 shows part of the permanent magnet taken from a loudspeaker.

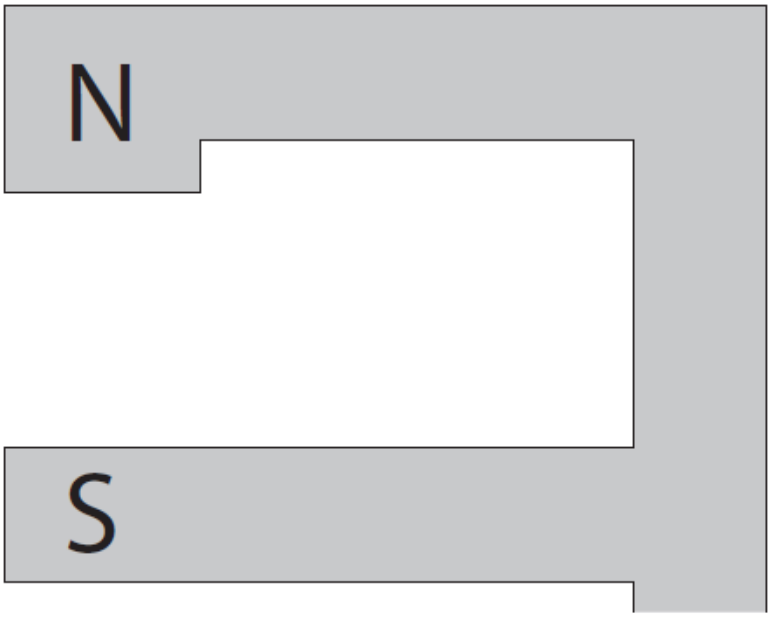


Diagram 2

There is a uniform magnetic field between the north pole and the south pole of the permanent magnet.

On diagram 2, draw three field lines to show this uniform magnetic field.

(2)

(c) The loudspeaker is connected to an alternating current supply.

(i) Describe the difference between alternating current (a.c.) and direct current (d.c.).

(2)

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(ii) Diagram 3 shows a cross-section of the loudspeaker with a current in the coil.

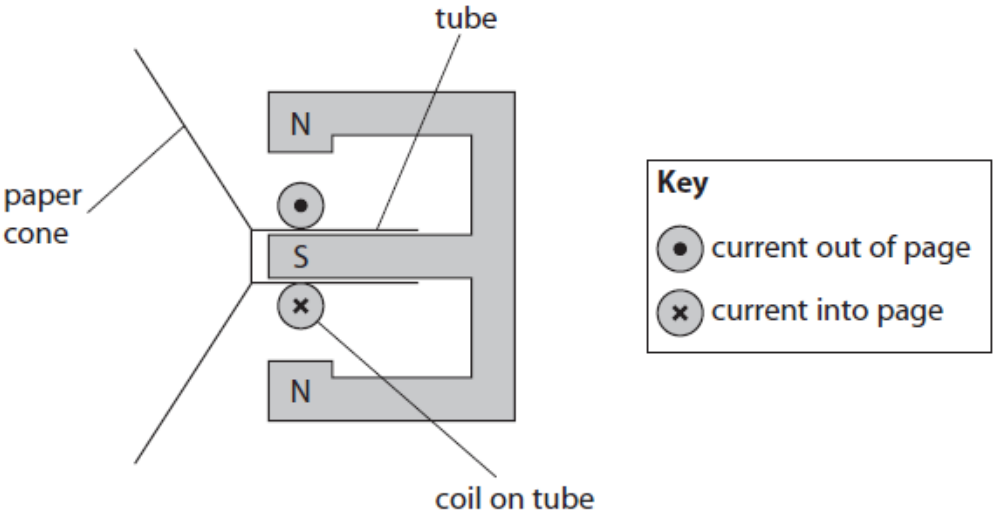


Diagram 3

The coil is attached to the tube.

The tube is attached to the paper cone.

State the direction of motion of the paper cone when the current is in the direction shown in diagram 3.

(1)

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(iii) Explain why the loudspeaker does not work when the coil is connected to a battery.

(2)

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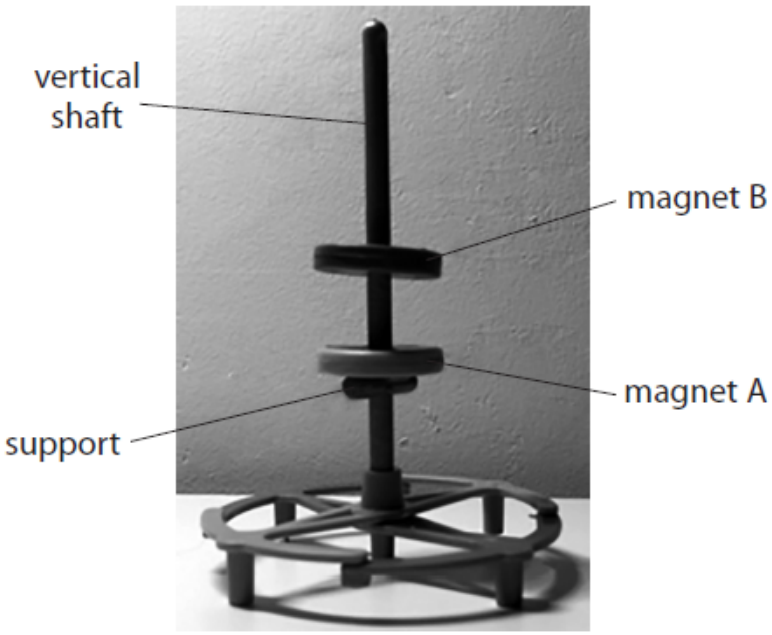
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(Total for question = 10 marks)

Q7.

Photograph 1 shows a child's toy.

The toy has two magnets on a vertical shaft.



Photograph 1

(a) Magnet A rests on a support near the bottom of the vertical shaft.

A student places magnet B at the top of the vertical shaft and releases it from rest.

Magnet B is repelled by magnet A causing it to come to rest again at the position shown.

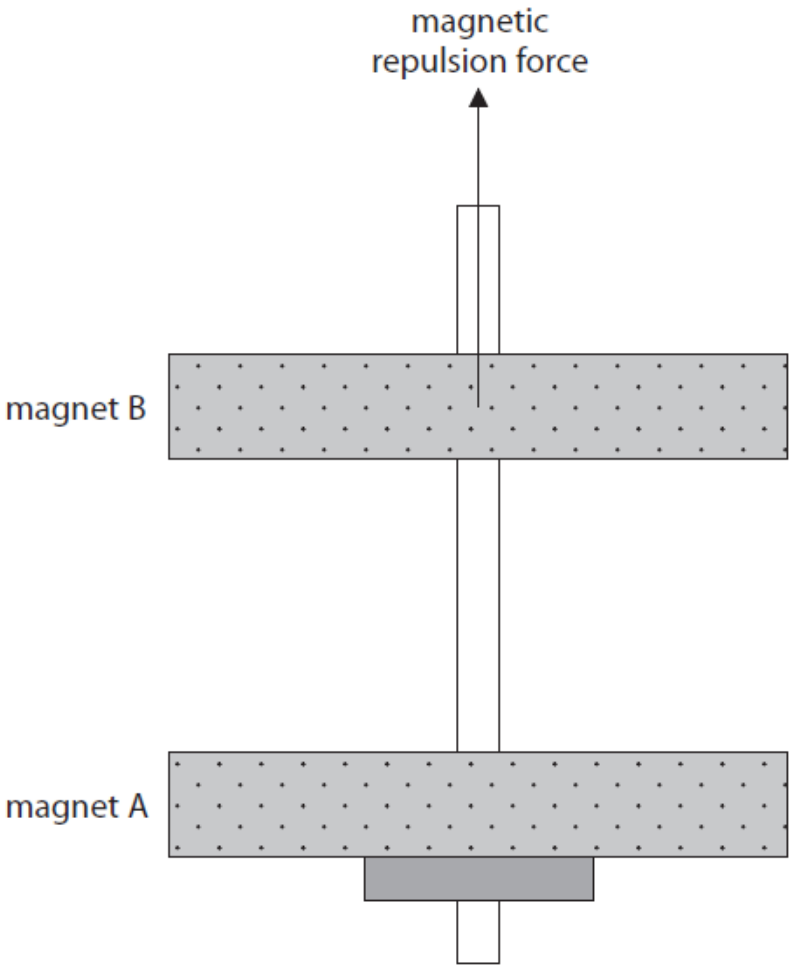
The table shows some energy stores in magnet B.

Put ticks (✓) in the correct boxes to show whether the amount of energy in each store of magnet B increases, decreases or stays the same when compared to its value at the top of the vertical shaft.

(3)

Energy store in magnet B	Increases	Decreases	Stays the same
gravitational			
magnetic			
kinetic			

(b) This is a diagram of the toy shown in photograph 1.



One of the forces acting on magnet B is shown.

Draw another labelled arrow on the diagram to show the other force acting on magnet B.

(2)

(c) The student adds a 10 g mass on top of magnet B when it is stationary above

magnet A and observes that the distance between the magnets decreases.

He carries out an investigation to see how the distance changes as more masses are added.

In your answer, you should refer to

- the measuring equipment required
- the independent and dependent variables
- a way to check the reliability of the data

You may draw a diagram to help your answer.

(5)

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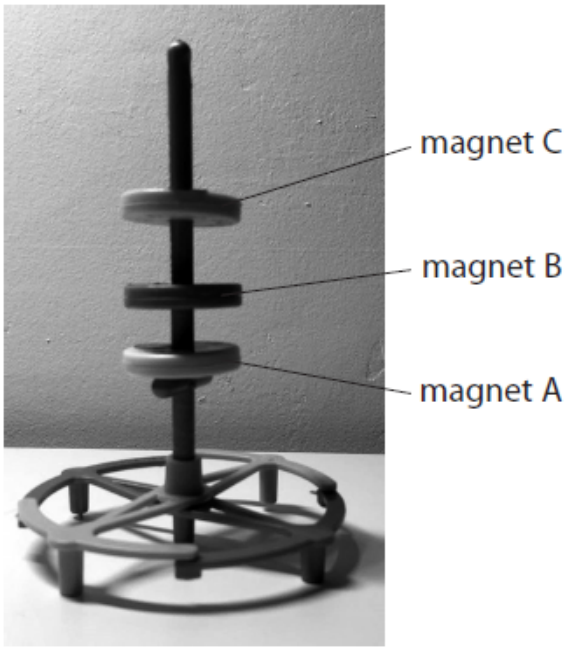
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(d) The student removes the masses from magnet B.

He then adds magnet C on to the vertical shaft.



Photograph 2

Photograph 2 shows that when magnet C is added, magnet B moves further down the shaft until it is at rest again.

Explain why the distance between magnet A and magnet B has decreased.

(3)

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(Total for question = 13 marks)

Q8.

This question is about magnetic fields.

(a) Describe an experiment to investigate the magnetic field pattern around a permanent bar magnet.

You may draw a diagram to help your answer.

(3)

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(b) The diagram shows two bar magnets.

Complete the diagram to show the magnetic field pattern.

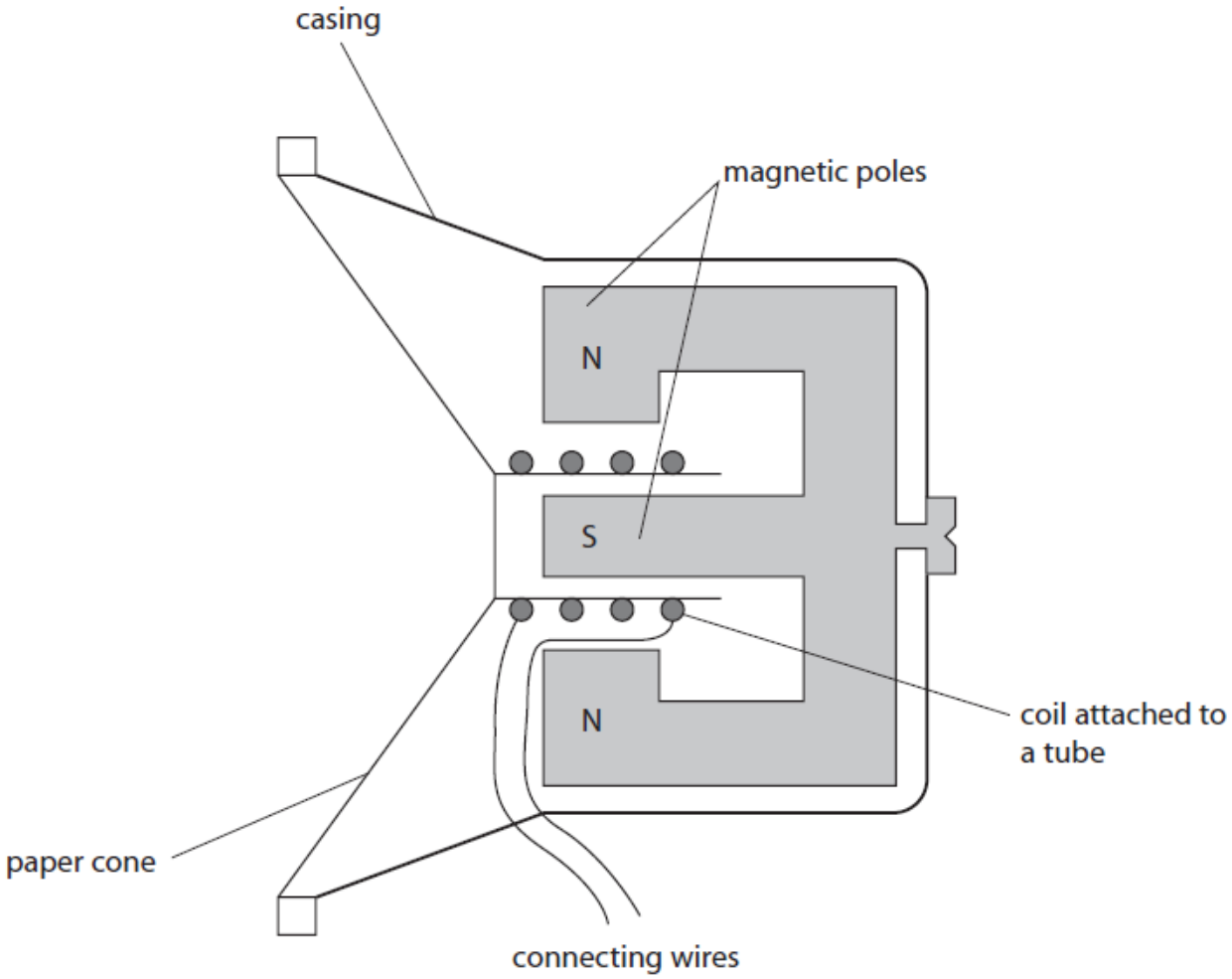
(3)



(Total for question = 6 marks)

Q9.

The diagram shows a loudspeaker.



The connecting wires connect the coil to a power supply.

Explain how the loudspeaker uses an electric current to produce sound waves.

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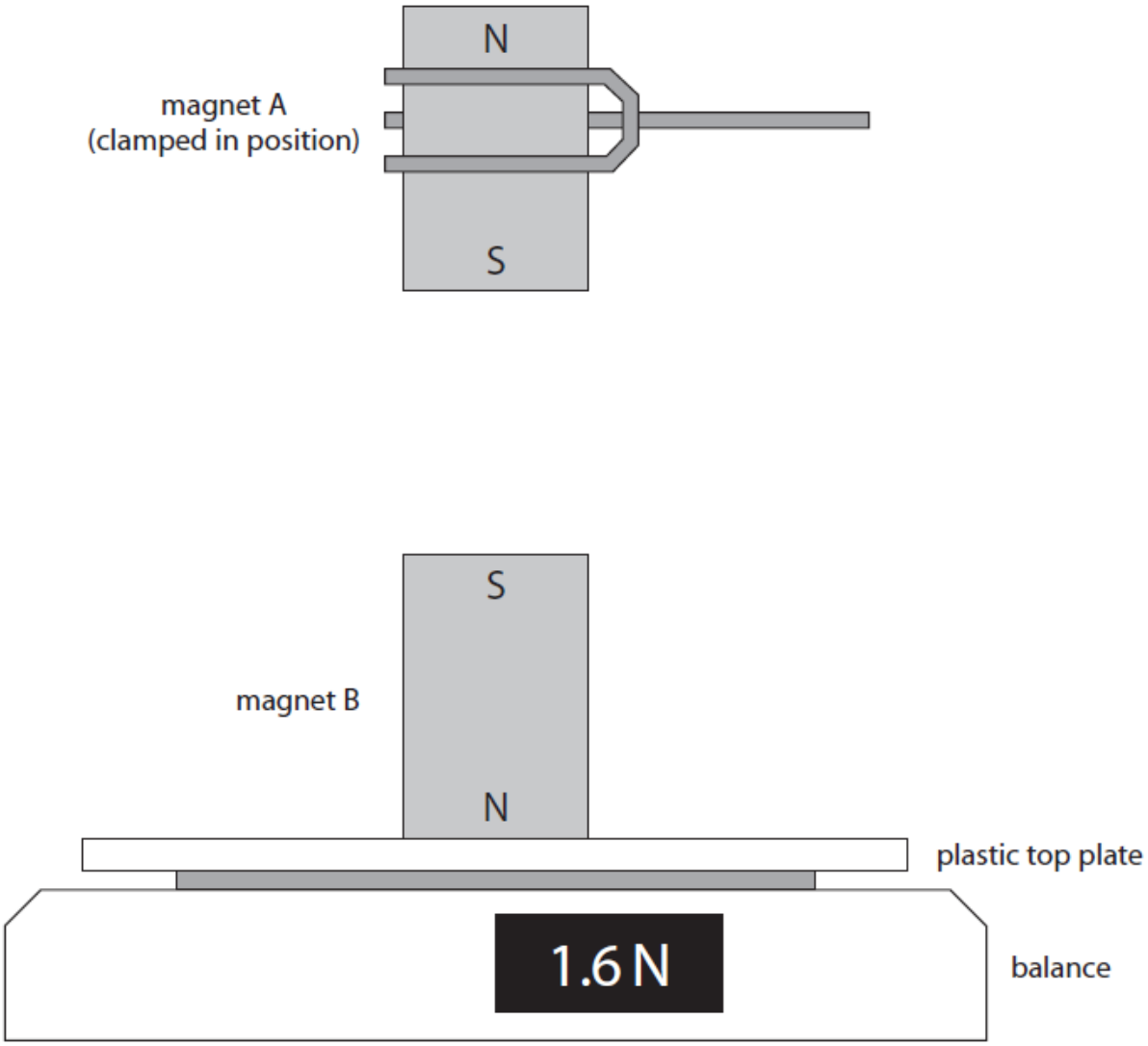
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(Total for question = 5 marks)

Q10.

A student uses this apparatus to measure the force of repulsion between magnet A and magnet B.



Magnet A is clamped in a fixed position.

Magnet B is resting on a balance.

(a) Give a reason why the two magnets shown in the diagram will repel each other.

(1)

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(b) Give a reason why the top plate of the balance is not affected by the magnetic fields of the magnets.

(1)

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(c) Complete the diagram by drawing the shape and direction of the magnetic field pattern between the magnets.

(2)

(d) In the position shown, the balance reading is 1.6 N.

(i) Explain how the balance reading will change if magnet A is brought closer to magnet B.

(2)

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(ii) Explain how the balance reading will change if the poles of magnet A are reversed but the distance between the magnets remains constant.

(2)

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(Total for question = 8 marks)

Q11.

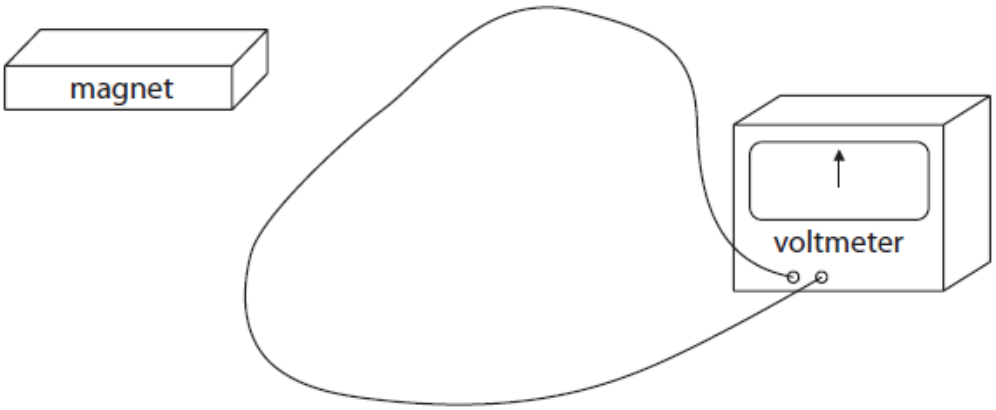
(a) The diagram shows a bar magnet.

Draw four magnetic field lines around the bar magnet.

(3)



(b) The diagram shows a loop of wire connected to the terminals of a voltmeter.



Explain why the voltmeter reading changes from zero when the magnet is moved near the loop of wire.

(2)

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(Total for question = 5 marks)

Q12.

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

(a) Name the apparatus that the student could use to find the direction of the field lines.

(1)

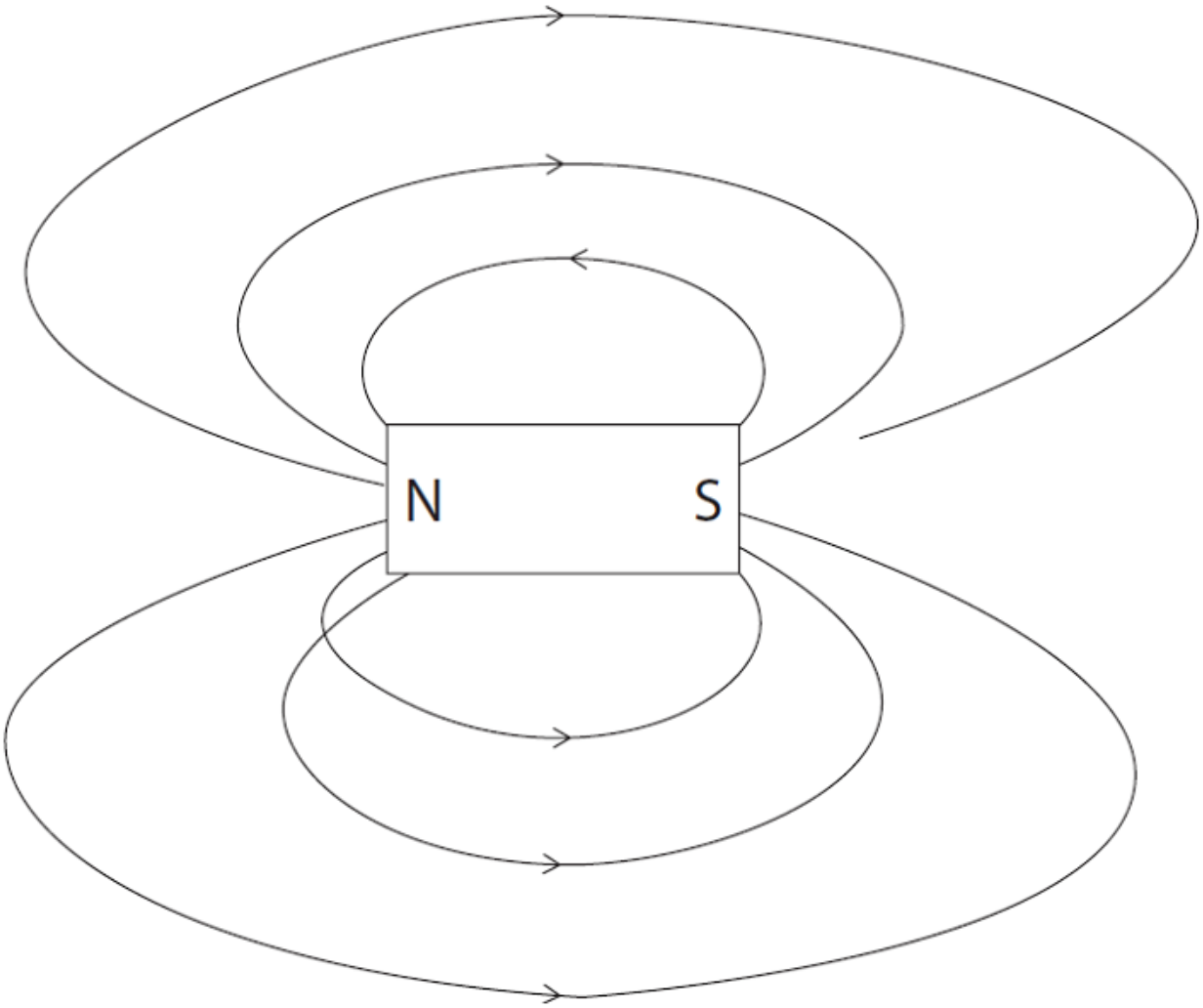
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(b) The student draws a diagram of the magnetic field pattern of the magnet.

The student makes three mistakes.

Draw a circle around each mistake on the diagram.

(3)



(c) The magnet is made of a magnetically hard material.

Describe what is meant by the term **magnetically hard**.

(2)

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(Total for question = 6 marks)

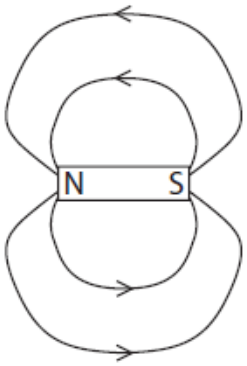
Q13.

The region of space around a magnet is known as a magnetic field.

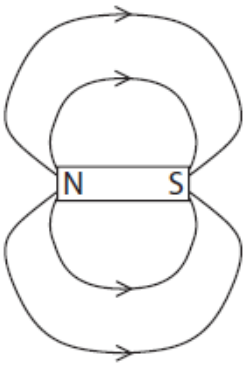
(a) Which of these diagrams correctly represents the magnetic field around a bar magnet?

(1)

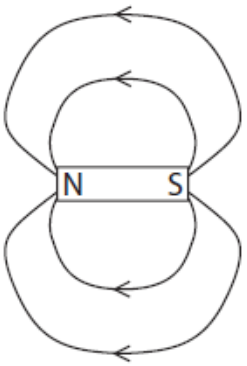
☒ **A**



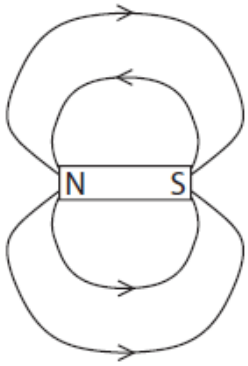
☒ **B**



☒ **C**



☒ **D**



(b) The diagram shows two bar magnets placed close together.



(i) Which of these describes what happens to the two magnets?

(1)

☒ **A** nothing happens

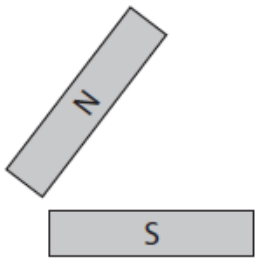
☒ **B** they attract

☒ **C** they repel

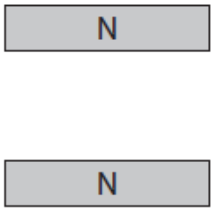
☒ **D** they spin

(ii) Which of these magnet arrangements gives a uniform field between the poles?

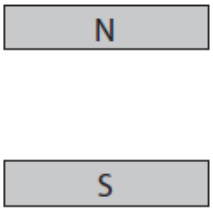
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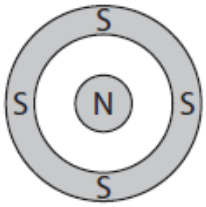
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(c) State the name of a material that would be suitable for use as a permanent magnet.

(1)

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(d) Describe an investigation that could be used to determine the shape of the magnetic field around a bar magnet.

(3)

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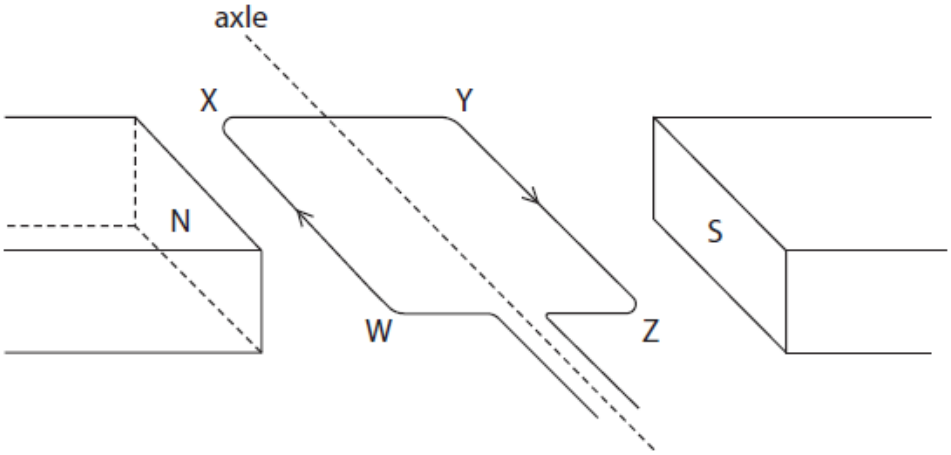
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(Total for question = 7 marks)

Q14.

The diagram shows a coil of wire, WXYZ, positioned between the opposite poles of a magnet.

The arrows show the direction of the current in the coil.



(a) Draw arrows on the diagram to show the direction of the forces that act on the coil due to the magnet.

(2)

(b) Explain the motion of the coil of wire.

Refer to magnetic fields in your answer.

(4)

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(c) Explain how the motion of the coil will change if the current is increased.

(2)

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(Total for question = 8 marks)

Q15.

The passage describes some of the properties of magnets and magnetic fields.

Use words from the box to complete the passage.

aluminium	copper	hard	negative	
north	positive	soft	south	steel

Each word may be used once, more than once or not at all.

(5)

The north pole of one magnet will repel the ..... pole of another magnet.

There is attraction between ..... and magnets.

Materials that are difficult to magnetise are called ..... magnetic materials.

The direction of the magnetic field lines for a magnet is from ..... to south.

Iron is a ..... magnetic material.

(Total for question = 5 marks)

Q16.

Very strong magnets can be made using the element neodymium.

(a) Diagram 1 shows parts of two neodymium magnets, X and Y, when they are held close together.

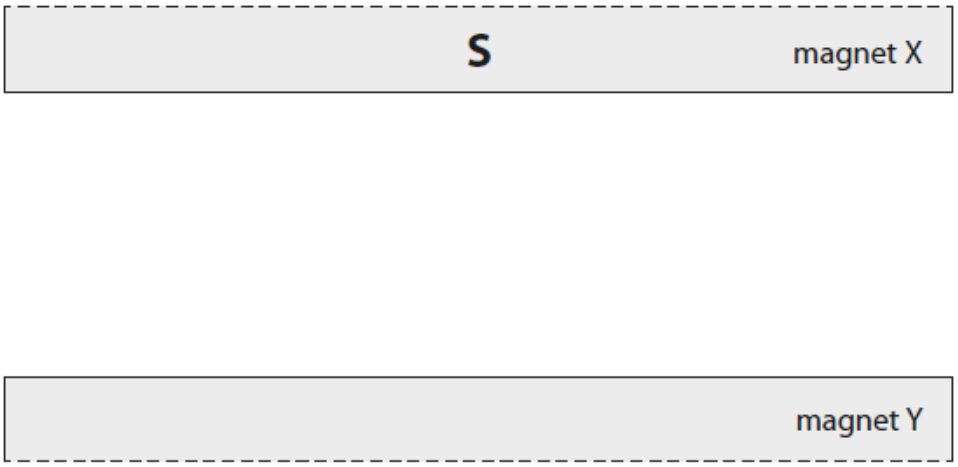


Diagram 1

A uniform magnetic field is produced in the space between the magnets.

Diagram 1 shows the south pole of magnet X.

Complete diagram 1 by drawing the uniform magnetic field and labelling the pole on magnet Y.

(3)

(b) Diagram 2 shows another neodymium magnet being used to lift an iron ball from a table.

The iron ball is shown at the instant it leaves the surface of the table.

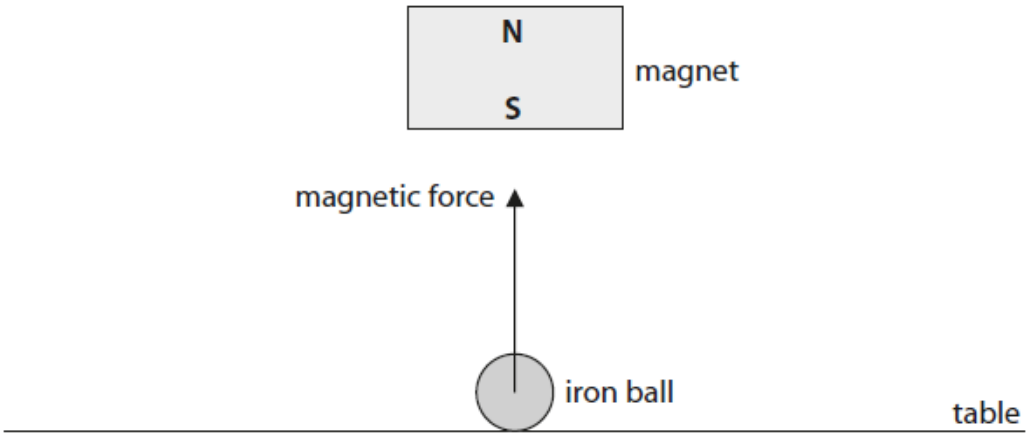


Diagram 2

(i) Explain why the iron ball experiences an upward magnetic force.

(2)

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(ii) The iron ball experiences an upward resultant force at the instant shown in diagram 2.

Draw a labelled arrow on diagram 2 to show the weight of the iron ball.

(1)

(iii) State the formula linking weight, mass and gravitational field strength.

(1)

(iv) At the instant shown in diagram 2, the resultant force acting on the iron ball is 124 mN and the magnetic force is 165 mN.

Calculate the mass of the iron ball.

(4)

mass of iron ball = ... kg

(v) Explain why the resultant force acting on the iron ball increases as the iron ball moves towards the magnet.

(2)

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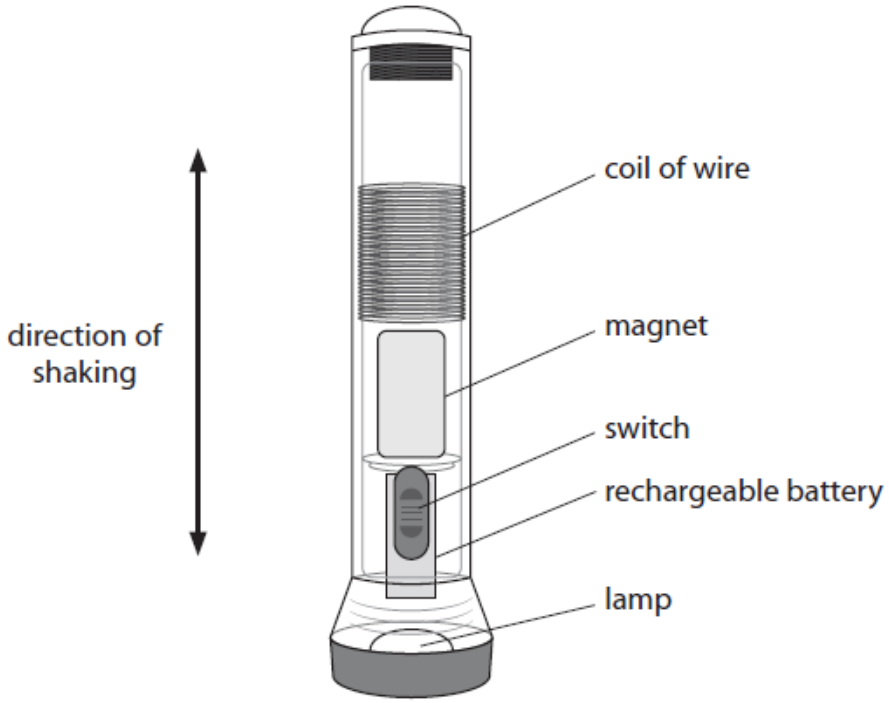
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(Total for question = 13 marks)

Q17.

The diagram shows a torch that uses a rechargeable battery.

The battery is recharged by shaking the torch up and down.



(Source: adapted from © www.shutterstock.com/1328720216)

(a) Shaking the torch causes the magnet to move up and down inside the coil of wire.

Explain why the movement of the magnet causes a current in the coil.

(3)

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(b) Using a stronger magnet could increase the current in the coil of wire.

State two other factors that could increase the current in the coil.

(2)

1 .....

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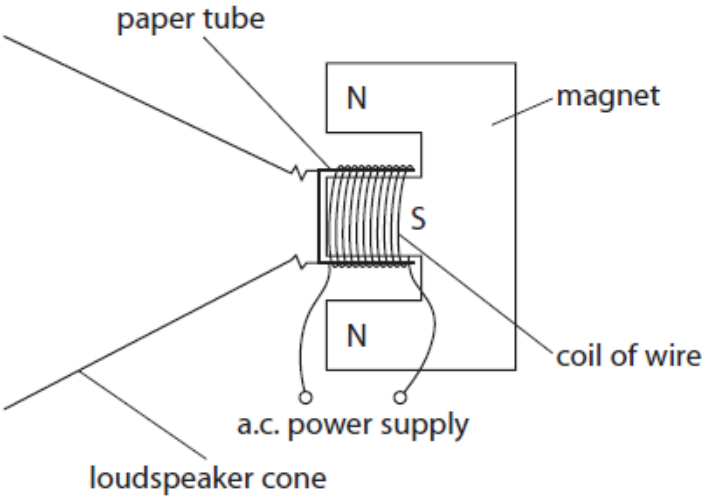
2 .....

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(Total for question = 5 marks)

Q18.

The diagram shows the construction of a simple loudspeaker.



A coil of wire is wrapped around a paper tube attached to the loudspeaker cone.

When there is an alternating current (a.c.) in the coil, the cone moves.

Explain how the loudspeaker produces a sound wave.

(5)

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(Total for question = 5 marks)

Q19.

(a) Describe how two magnets can be arranged to produce a uniform magnetic field.

You may draw a diagram to support your answer.

(2)

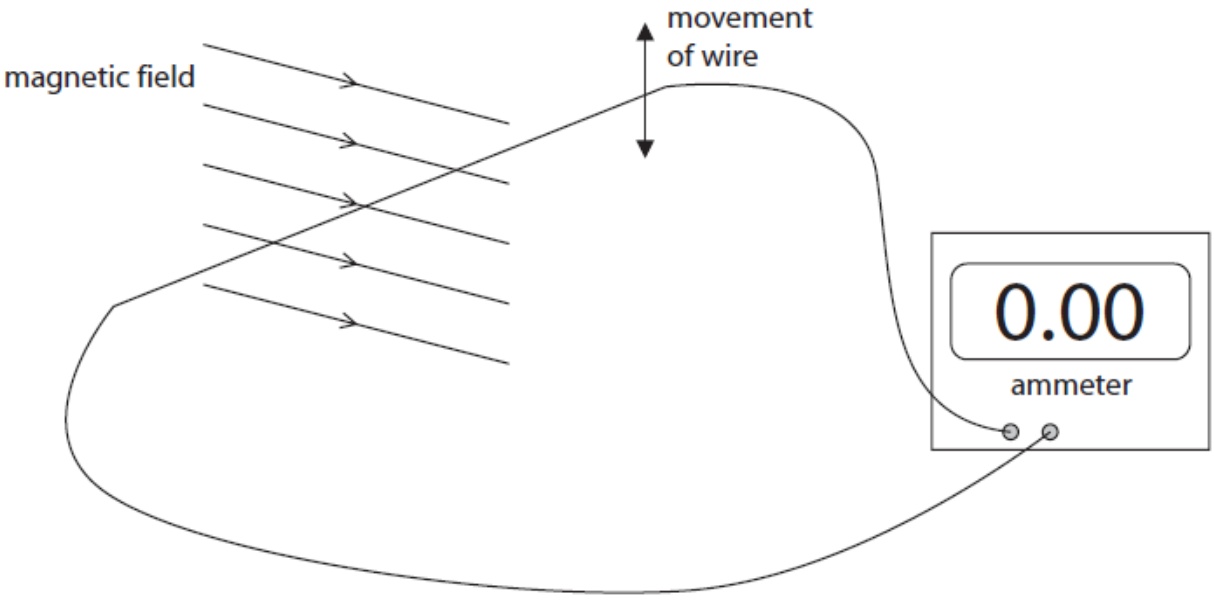
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(b) The diagram shows a wire in a uniform magnetic field.



(i) The wire is moved up and down repeatedly in the magnetic field.

Explain the effect that this movement has on the ammeter reading.

(3)

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(ii) Explain the effects on the ammeter reading of moving the wire with the same amplitude but

at a higher frequency.

(4)

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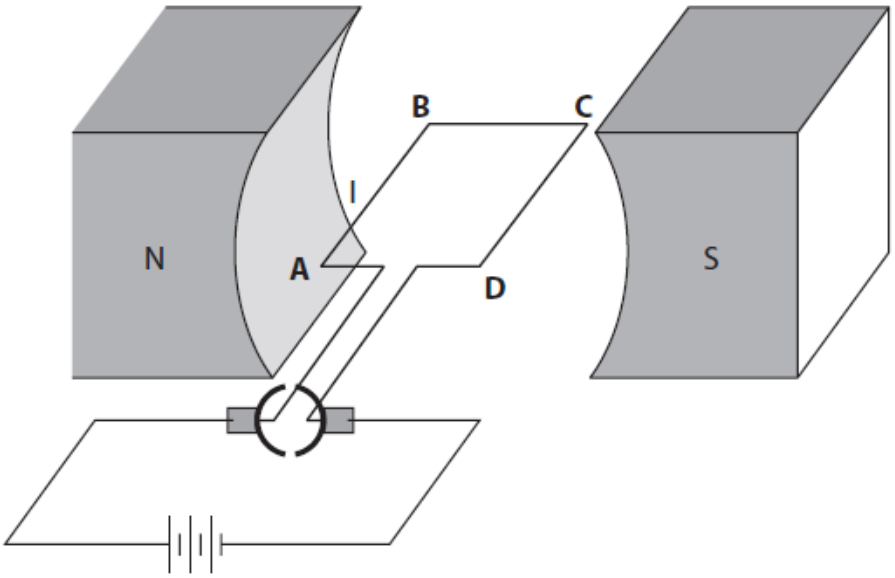
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(Total for question = 9 marks)

Q20.

The diagram shows part of an electric motor connected to a battery.

The coil is shown as **ABCD**.
The direction of the current, I, is from **A** to **B**.



(a) Draw an arrow showing the direction of the force on side **CD** of the coil.

(1)

(b) Give **one** change that can be made to the equipment that will make the motor spin in the opposite direction.

(1)

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(c) Give **two** changes that can be made to the equipment that will make the motor spin slower.

(2)

1 .....

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2 .....

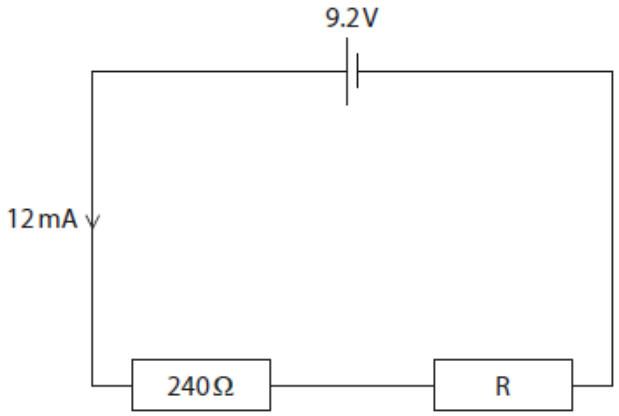
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(Total for question = 4 marks)

Q21.

This question is about voltage and current.

(a) The diagram shows two resistors connected to a battery.



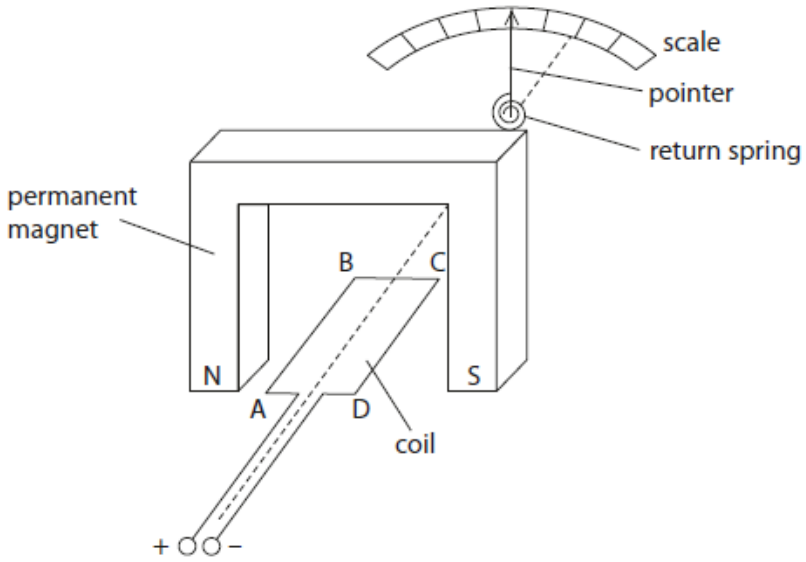
Calculate the voltage across resistor R.

(4)

voltage = ... V

(b) The diagram shows the parts of an ammeter.

The pointer is connected to the coil so they can move together.



(i) Explain what happens when there is a current in the coil.

(3)

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(ii) Draw an arrow on the diagram to show the force acting on side CD of the coil when there is a current in the coil.

(1)

(iii) Explain how the ammeter could be changed so that it could measure smaller currents.

(3)

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(Total for question = 11 marks)

Q22.

Diagram 1 shows a trolley seen from above.

A copper rod is attached to the front of the trolley.

The rod is connected to a voltmeter fixed to the trolley.

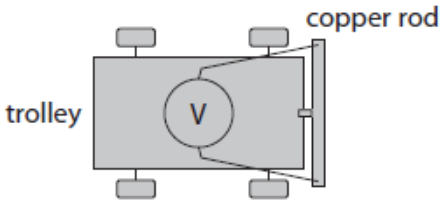


Diagram 1

(a) Diagram 2 shows the path of the trolley, backwards and forwards through a very strong magnetic field directed into the page.

The shaded area shows the magnetic field.

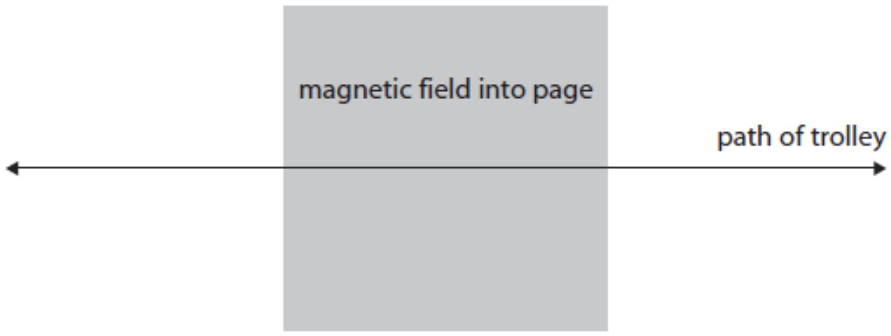


Diagram 2

(i) A voltage is induced in the copper rod as the trolley moves through the magnetic field.

Explain why the sign of the voltmeter reading changes as the trolley moves backwards and forwards.

(3)

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(ii) Give a reason why the magnitude of the induced voltage might change.

(1)

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(b) The voltmeter is replaced by a resistor.

A charge of 1.4×10^{-4} C flows in the resistor during a time of 0.78 s.

(i) Calculate the mean current in the resistor.

(3)

mean current = ... A

(ii) The thermal energy store of the resistor increases by 2.3×10^{-6} J as energy is transferred to it electrically.

Calculate the mean voltage across the resistor when a charge of 1.4×10^{-4} C transfers this energy.

(3)

mean voltage = ... V

(Total for question = 10 marks)