AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.7.1 PERMANENT AND INDUCED MAGNETISM, MAGNETIC FORCES AND FIELDS (PACK 1)

SCORE	PERCENTAGE
/113	%

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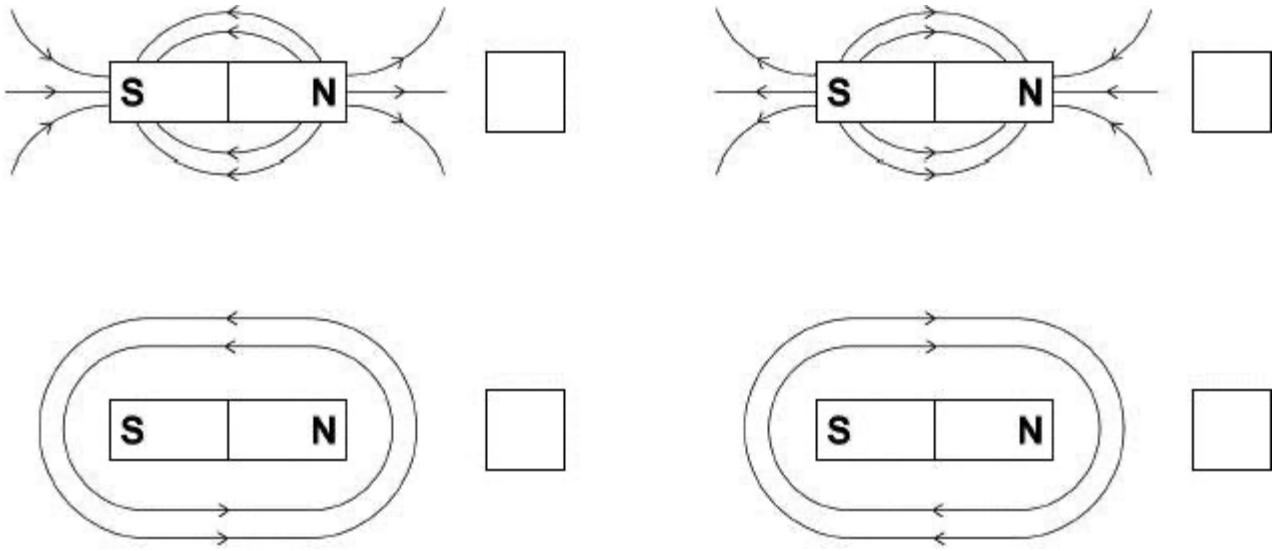
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Q1.

A magnet produces a magnetic field.

(a) Which diagram shows the magnetic field pattern around a bar magnet?

Tick **one** box.



(1)

(b) **Figure 1** shows three metal blocks.

The blocks are not labelled.

One block is a permanent magnet, one is iron and one is aluminium.

Figure 1



Describe how another permanent magnet can be used to identify the blocks.

_____

_____

_____

_____

_____

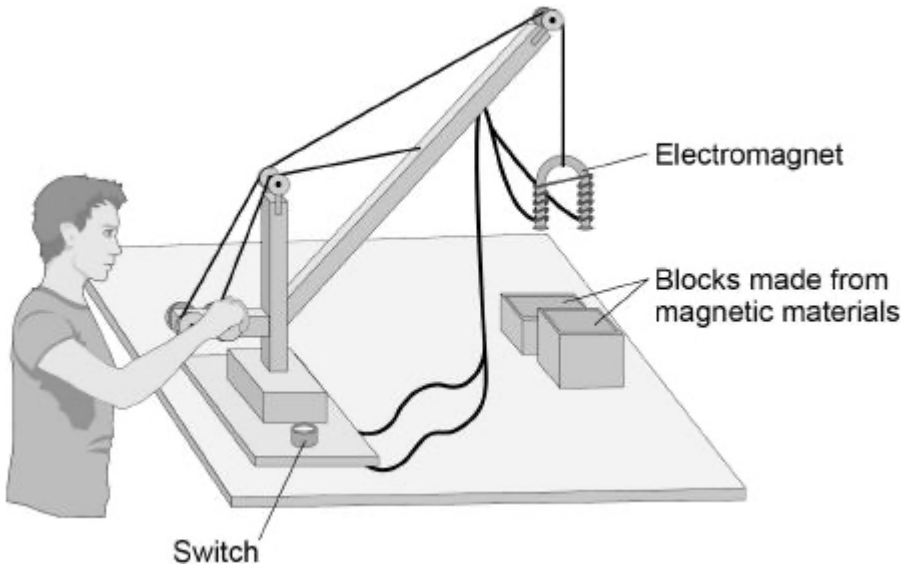
_____

(3)

(c) **Figure 2** shows a toy crane.

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Figure 2



The toy crane uses an electromagnet to pick up and move the blocks.

Explain how this electromagnet is able to pick up and move the blocks.

(6)
(Total 10 marks)

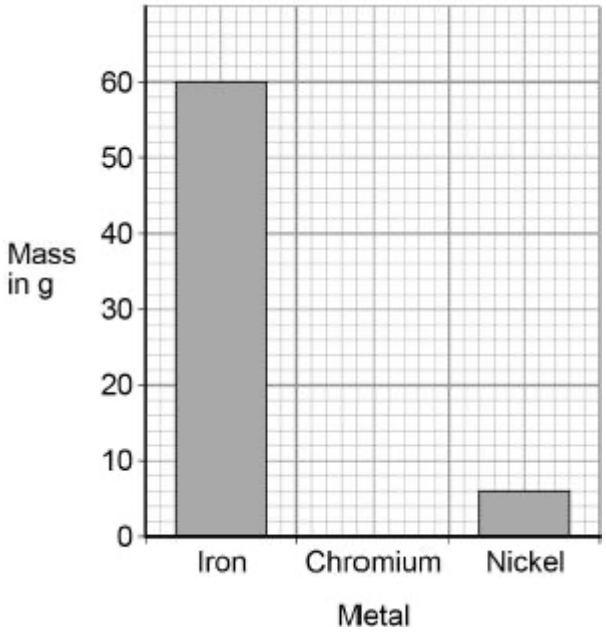
Q2.

One alloy contains iron, chromium and nickel.

Figure 1 shows the mass of iron and the mass of nickel in 80 g of this alloy.

Figure 1

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(a) Determine the mass of iron and nickel in 80 g of the alloy.

Use **Figure 1**.

Mass of iron = _____ g

Mass of nickel = _____ g

(1)

(b) Calculate the mass of chromium in 80 g of the alloy.

Draw a bar on **Figure 1** to show the mass of chromium in 80 g of the alloy.

_____

_____

Mass of chromium = _____ g

(2)

(c) What mass of iron is present in **0.80 kg** of the alloy?

Give your answer in grams.

_____

_____

Mass of iron = _____ g

(1)

(d) What is an alloy?

_____

_____

(1)

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(e) Give **one** reason why alloys are used instead of pure metals.

_____

_____

(1)

(f) Iron and nickel are both magnetic metals.

Which is also a magnetic metal?

Tick **one** box.

Cobalt ☐

Copper ☐

Sodium ☐

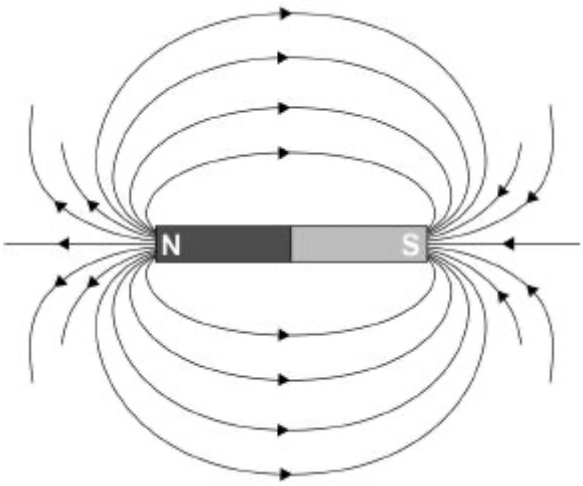
Zinc ☐

(1)

A student plotted the magnetic field pattern around a bar magnet.

Figure 2 shows the magnetic field pattern.

Figure 2



(g) Complete the sentence.

Choose the answer from the box.

induced	**permanent**	**temporary**

Bar magnets produce their own magnetic fields.

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Bar magnets are described as _____ magnets.

(1)

(h) Which statement about the magnetic field around a bar magnet is correct?

Tick **one** box.

The magnetic field is the same strength all around the magnet. ☐

The magnetic field is strongest at the poles of the magnet. ☐

The magnetic field is strongest near the middle of the magnet. ☐

(1)

(i) This is the start of a method used to plot a magnetic field pattern around a bar magnet.

1. Place the magnet on a piece of paper.
2. Draw around the magnet.
3. Mark a dot by a pole of the magnet.
4. Place the compass on the dot.

Figure 3 shows the apparatus after steps 1−4.

Figure 3



Describe the rest of the method to plot the magnetic field pattern.

_____

_____

_____

_____

_____

_____

_____

_____

_____

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_____

(4)

(Total 13 marks)

Q3.

The diagram below shows a bar magnet.

(a) Complete the diagram to show the magnetic field lines around a bar magnet.



(2)

(b) Describe a method using a compass to plot the magnetic field lines around a bar magnet.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(c) Explain why a compass needle moves when placed near the bar magnet.

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_____

_____

_____

_____

_____

(2)

(d) Iron is a magnetic element.

Which of the following is also a magnetic **element**?

Tick **one** box.

Cobalt ☐

Copper ☐

Steel ☐

Zinc ☐

(1)

(e) Give **two** pieces of evidence that show the Earth's magnetic field is changing.

1. _____

_____

2. _____

_____

(2)

(f) Describe the most likely cause of the changes in the Earth's magnetic field.

_____

_____

_____

_____

(2)

(Total 13 marks)

Q4.

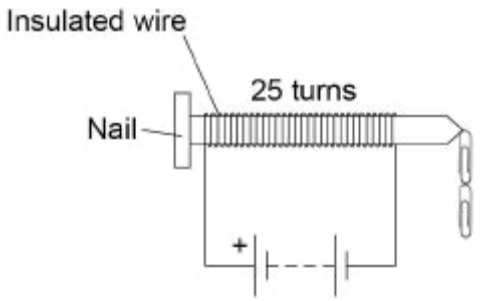
A student investigated how the number of turns of wire on an electromagnet affects how

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many paper clips the electromagnet can pick up.

Figure 1 shows the apparatus used.

Figure 1



This is the method used.

1. Wrap wire around an iron nail.
2. Count the number of turns of wire.
3. Connect the wire to a battery to make the electromagnet.
4. Switch on the electromagnet and place it near the paper clips.
5. Count the number of paper clips picked up.
6. Repeat steps 1−5 for different numbers of turns of wire.

The table below shows the results.

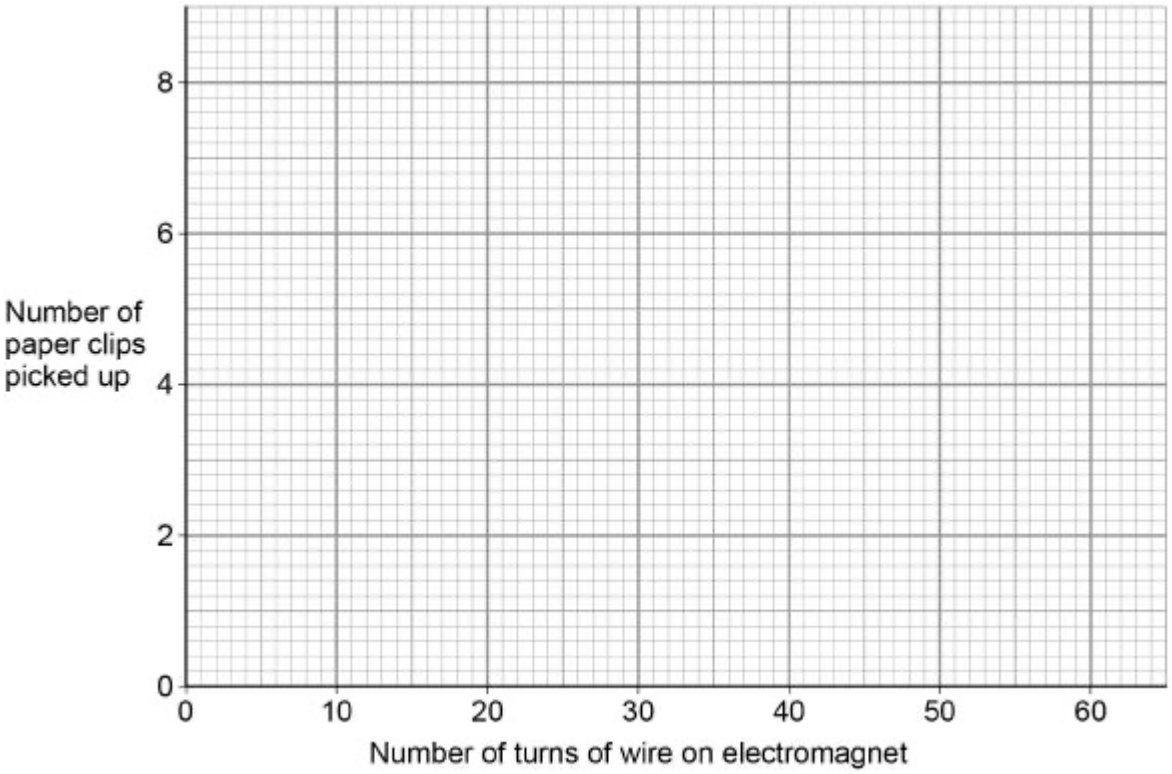
Number of turns of wire on electromagnet	**Number of paper clips picked up**
10	1
25	2
40	4
55	5
60	6

(a) Plot the data from the table above on **Figure 2**.

Draw a line of best fit.

Figure 2

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(3)

(b) Describe the relationship between the number of paper clips picked up and the number of turns on the electromagnet.

_____

_____

(1)

(c) Suggest what would happen if the student used 5 turns of wire in the investigation.

Give a reason for your answer.

_____

_____

_____

_____

(2)

(d) Describe **one** way the student's investigation could have been improved.

Give a reason for the improvement.

Improvement _____

_____

Reason _____

_____

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(2)

(e) Which **two** factors would affect the strength of the magnetic field around the electromagnet?

Tick **two** boxes.

The colour of the insulation around the wire	☐
The direction of the current through the wire	☐
The distance from the electromagnet	☐
The size of the paper clips	☐
The size of the current through the wire	☐

(2)
(Total 10 marks)

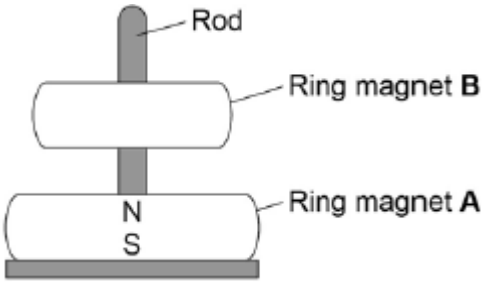
Q5.

A magnetic toy uses ring-shaped magnets.

Look at **Figure 1**.

The magnets can move up and down the rod. Ring magnet **B** appears to float.

Figure 1



(a) The magnetic poles are labelled on ring magnet **A**.

Label the magnetic poles on ring magnet **B**.

(1)

(b) What would happen if ring magnet **B** was turned upside down?

_____

_____

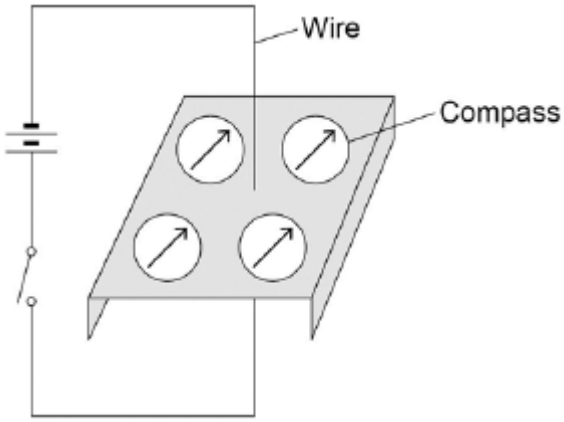
(1)

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(c) **Figure 2** shows four plotting compasses arranged around a wire.

The needle of a compass is a magnet.

Figure 2



In **Figure 2** the switch is open and there is no current in the wire.

Explain why the compass needles all point in the same direction.

_____

_____

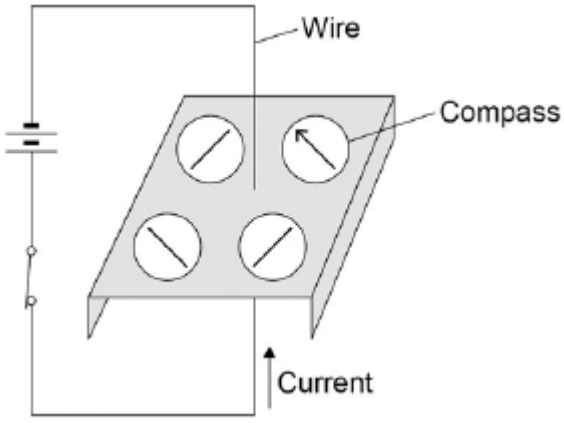
_____

_____

(2)

(d) **Figure 3** shows the switch closed.

Figure 3



There is now a current in the wire.

The compass needles change direction.

On **Figure 3** draw arrowheads on the three incomplete compass needles to show their direction.

(1)

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(e) What would happen to the direction of the compass needles if the current was reversed?

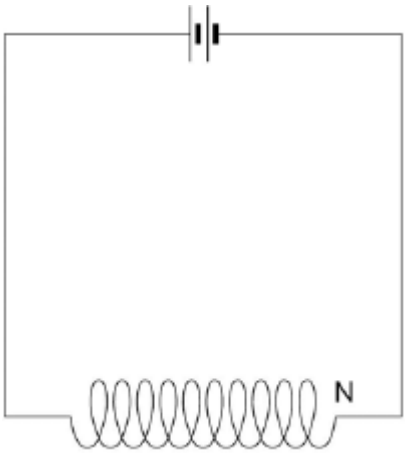
_____

_____

(1)

(f) **Figure 4** shows a coil of wire in a circuit.

Figure 4



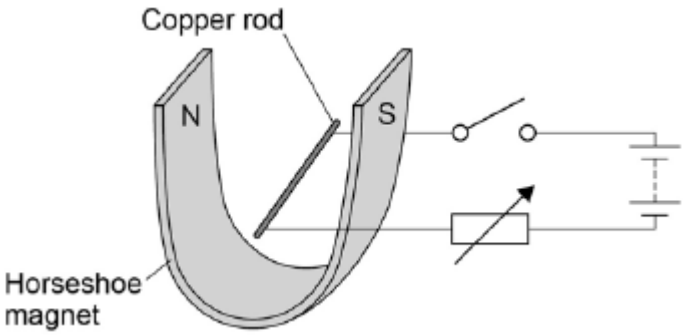
On **Figure 4** draw the magnetic field due to the current in the coil.

(3)

(Total 9 marks)

Q6.

A teacher used the equipment shown in the figure below to demonstrate the motor effect.



(a) Describe how Fleming's left-hand rule can be used to determine the direction in which the rod will move when the switch is closed, and state the direction.

_____

_____

_____

_____

_____

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_____

_____

_____

_____

(4)

(b) Increasing the current can increase the force acting on the copper rod.

Give **one** other way in which the size of the force acting on the copper rod could be increased.

_____

_____

(1)

(c) The copper rod in the figure above has a length of 7 cm and a mass of 4×10^{-4} kg.

When there is a current of 1.12 A the resultant force on the copper rod is 0 N.

Calculate the magnetic flux density.

Gravitational field strength = 9.8 N / kg

_____

_____

_____

_____

_____

_____

Magnetic flux density = _____ T

(5)

(Total 10 marks)

Q7.

The area around a magnet is called the magnetic field.

(a) The Earth has a magnetic field.

What causes the Earth's magnetic field?

Tick **one** box.

The movement of liquid iron in the Earth's outer core ☐

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The gravitational field of the Earth ☐

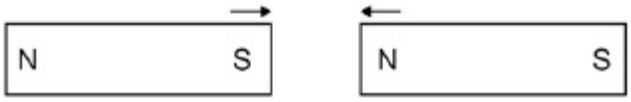
The permanent magnet in the Earth's core ☐

(1)

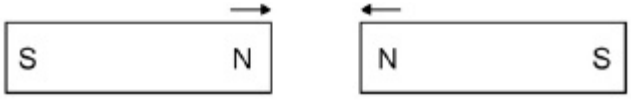
(b) Look at **Figure 1**.

Figure 1

Opposite poles brought together



Same poles brought together



What will happen in each case when the poles of two magnets are brought close together?

Opposite poles brought together _____

_____

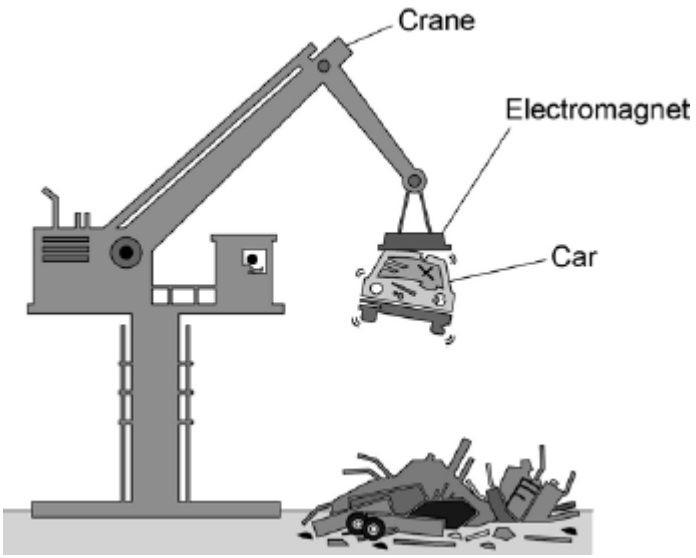
Same poles brought together _____

_____

(2)

(c) **Figure 2** shows an electromagnet being used to lift a car in a scrapyard.

Figure 2



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An electromagnet is a solenoid.

Explain why it is better to use an electromagnet rather than a permanent magnet in a scrapyard.

You should include a comparison of the properties of electromagnets and permanent magnets in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 7 marks)

Q8.

An electric current is a flow of electrical charge through a circuit.

(a) Complete the sentence.

Use a word from the box.

atoms	**electrons**	**ions**	**molecules**

Metals are good conductors of electricity because electrical charge is transferred

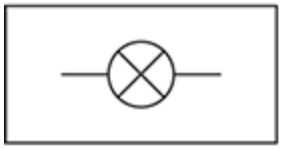
by delocalised _____

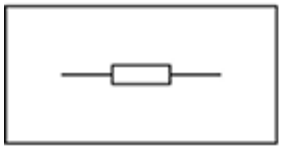
(1)

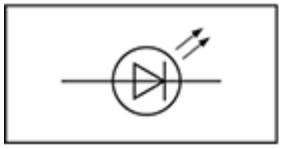
(b) Draw **one** line from each symbol to the name of the component.

Standard symbol	**Name of component**

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Battery

Lamp

LED

Resistor

Switch

(3)

(c) The table below shows information about some electrical appliances.

Electrical appliance	Power in watts
 Hairdryer	1500
 Kettle	2500
 Electric hob	3000
 Television	360

A student plugs all four of the appliances into one multi-way socket.

The mains electricity is 230 V.

The highest safe current in the socket is 30 A.

Explain why it is not safe to use all four appliances at the same time.

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In your answer you should:

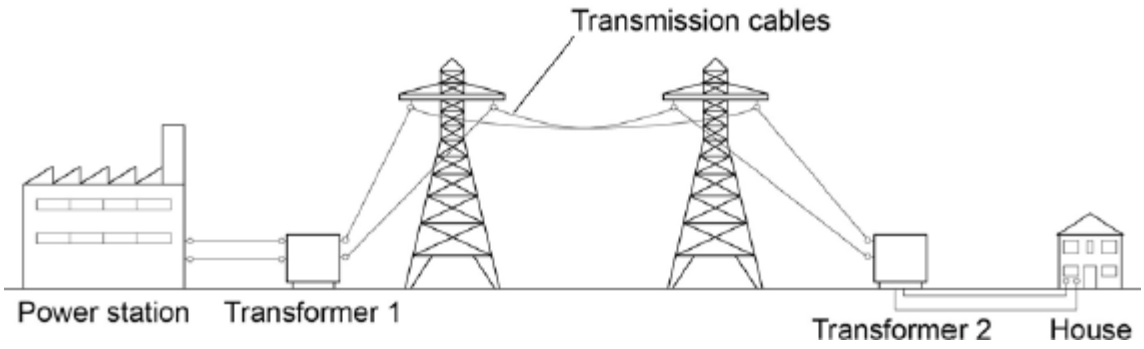
- calculate the total power needed
- use the equation

  current = power ÷ potential difference

to calculate the total current needed.

(4)

(d) The figure below shows how electrical power is transferred from power stations to consumers using the National Grid.



Transformer 1 is a step-up transformer.

Explain why step-up transformers are used in the National Grid.

(3)

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(e) What is the purpose of Transformer 2?

_____

_____

(1)

(f) In a power station 900 MJ of thermal energy were released by burning natural gas.

Write down the equation that links efficiency, useful input energy transfer and useful output energy transfer.

_____

(1)

(g) In a power station 900 MJ of thermal energy were released by burning natural gas.

Only 405 MJ was generated.

Calculate the efficiency of this energy transfer.

_____

_____

_____

Efficiency = _____

(2)

(Total 15 marks)

Q9.

Iron is a metal that has many uses.

(a) Iron is extracted from iron ore. Part of the process involves reduction of the ore with carbon monoxide.

Iron ore contains iron oxide (Fe_2O_3).

Write a balanced equation for the reaction of iron oxide with carbon monoxide.

_____

(3)

(b) Explain why this reaction is a redox reaction.

_____

_____

_____

(2)

Steel is an alloy of iron. Steel is used to make cars.

After its useful life a car is taken to a scrapyard for recycling.

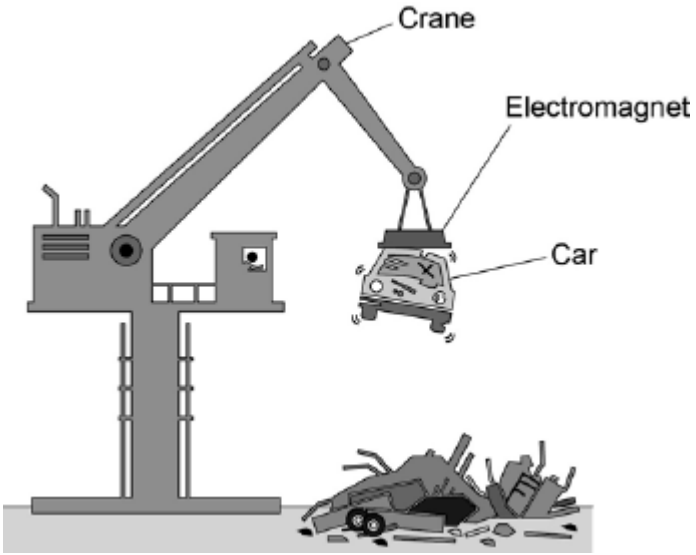
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(c) Suggest **four** benefits of recycling a car body.

(4)

(d) **Figure 1** shows an electromagnet being used to lift a car in a scrapyard.

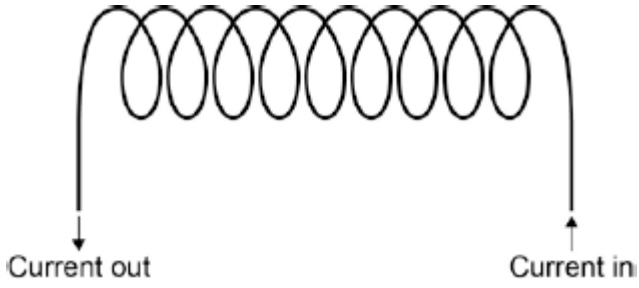
Figure 1



An electromagnet is made up of a solenoid.

Figure 2 shows a solenoid.

Figure 2



Draw the magnetic field of the solenoid on **Figure 2**.

(2)

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(e) In a scrapyard, an electromagnet is used to lift and release cars so they can be moved around.

Suggest **two** ways a solenoid could be made to lift and release cars in a scrapyard.

Explain why each suggestion would be useful in the scrapyard.

(4)

(Total 15 marks)

Q10.

This question is about magnetism.

(a) Which two materials are magnetic?

Tick **two** boxes.

- Carbon ☐
- Cobalt ☐
- Copper ☐
- Nickel ☐
- Sodium ☐

(2)

(b) Describe how you could find the magnetic field pattern of a permanent bar magnet.

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(3)

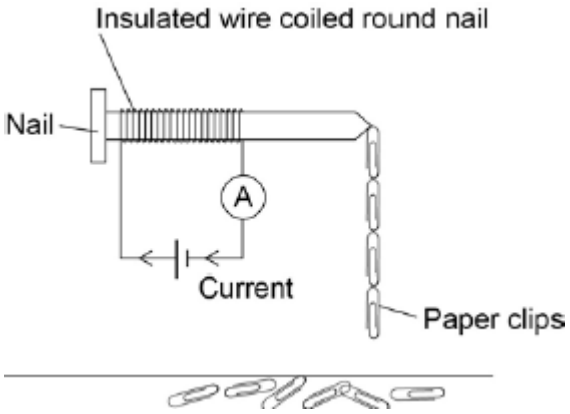
(c) A student investigates how the number of turns of wire on a solenoid affects the strength of the solenoid.

To test the strength of the solenoid she looks at how many paper clips the solenoid could lift.

Figure 1 shows how she sets up the equipment.

She keeps the current through the coil constant throughout the experiment.

Figure 1



The table below shows the student's results.

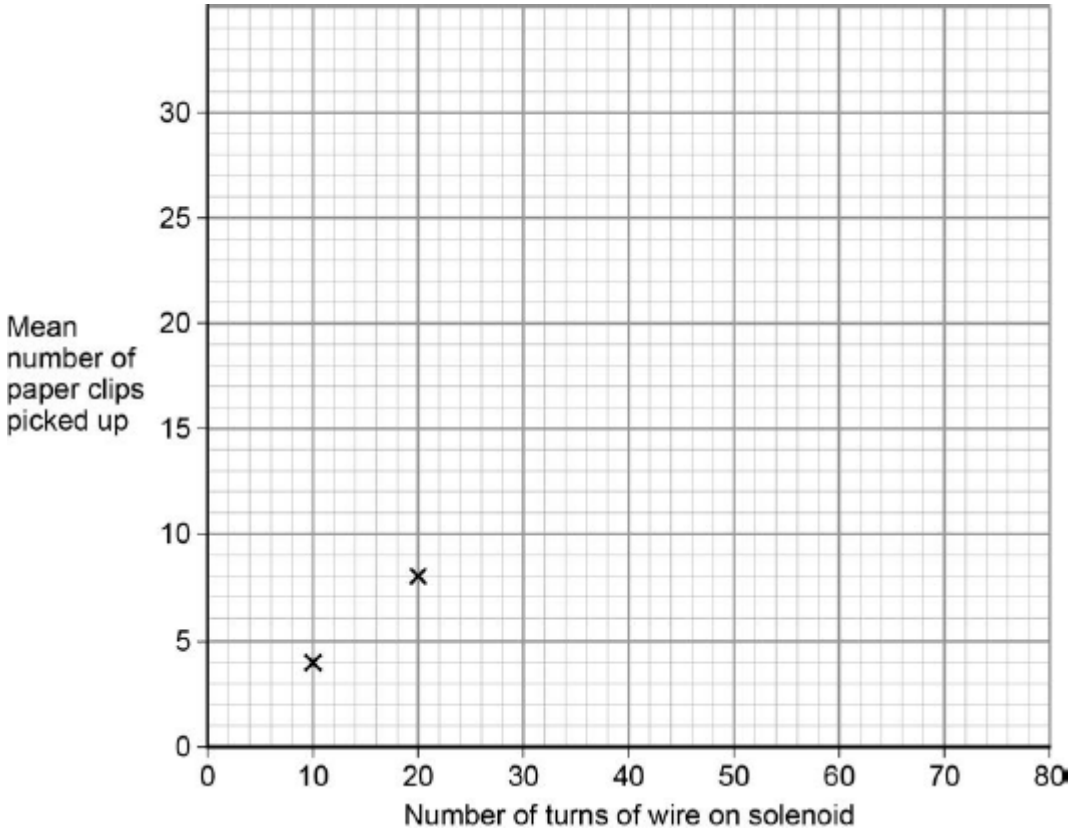
Number of turns of wire on solenoid	Number of paper clips picked up by solenoid			
	Test 1	Test 2	Test 3	Mean
0	0	0	0	0
10	4	3	4	4
20	8	8	9	8
30	11	11	13	12
40	15	13	16	15
50	21	24	19	21
60	25	24	26	25

Use the data from the table above to complete the graph in **Figure 2**.

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- The first two points have been plotted for you.
- Draw a line of best fit.

Figure 2



(3)

(d) Describe the pattern shown in the graph.

_____

_____

_____

_____

(2)

(e) Use your graph to predict how many paper clips the solenoid will pick up when 80 turns of wire are used.

Number of paper clips picked up = _____

(1)

(Total 11 marks)

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