AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.7.1 PERMANENT AND INDUCED MAGNETISM, MAGNETIC FORCES AND FIELDS (PACK 2)

SCORE	PERCENTAGE
/110	%

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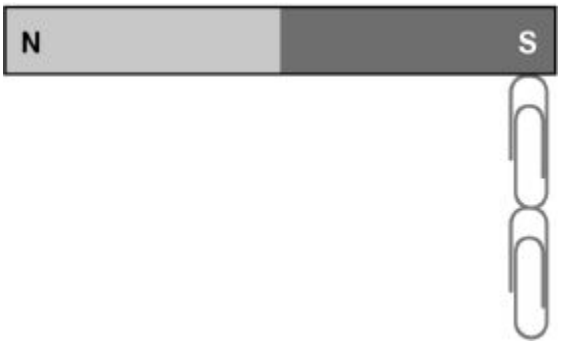
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Q1.

Figure 1 shows two paper clips hanging from a bar magnet.

Figure 1



The paper clips have become magnetised.

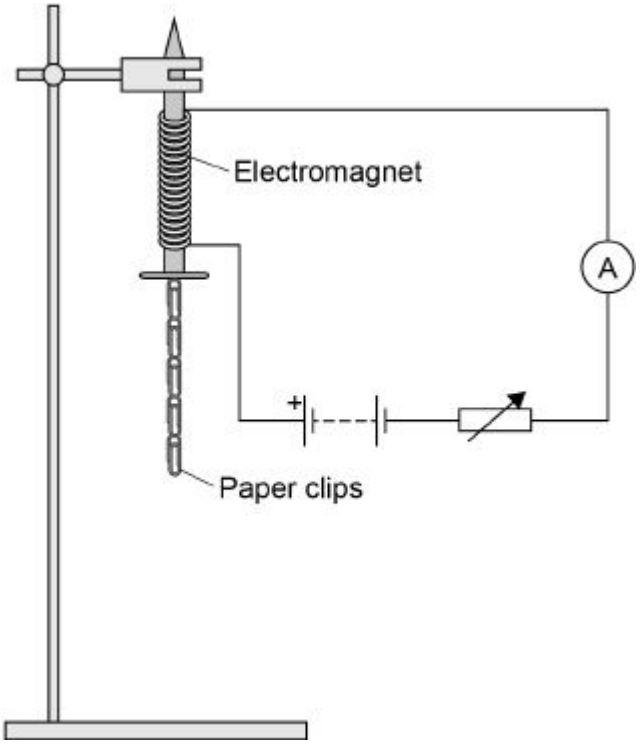
(a) Label the north and south poles of both paper clips.

(1)

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

Figure 2 shows the equipment used by the student. Throughout the investigation the student kept the current through the wire constant.

Figure 2



(b) The student measured the strength of the electromagnet by counting the number of paper clips the electromagnet could hold.

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Explain why it was important that the paper clips were all the same size.

_____

_____

_____

_____

(2)

The table below shows the student's results.

Number of turns of wire on the electromagnet	Number of paper clips held
10	3
20	6
30	9
40	12

(c) Describe the pattern shown in the table.

_____

_____

_____

_____

(2)

(d) The student then used 50 turns of wire on the electromagnet.

The electromagnet picked up 18 paper clips. This was more paper clips than the student had expected.

Which **one** is the most likely cause of this result?

Tick **one** box.

The paper clips used with 50 turns were larger than the others. ☐

There were less than 50 turns of wire on the electromagnet. ☐

Some of the paper clips were already magnetised. ☐

(1)

(e) The student repeated the measurement for 50 turns of wire three more times.

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This gave her the following set of results.

18 16 14 15

Explain what the student should now do with the **four** results for 50 turns of wire.

_____

_____

_____

_____

_____

_____

(3)

(f) The student wrote the hypothesis:

'Increasing the current through the wire will make the electromagnet stronger.'

Describe how the student should change the investigation to test this hypothesis.

_____

_____

_____

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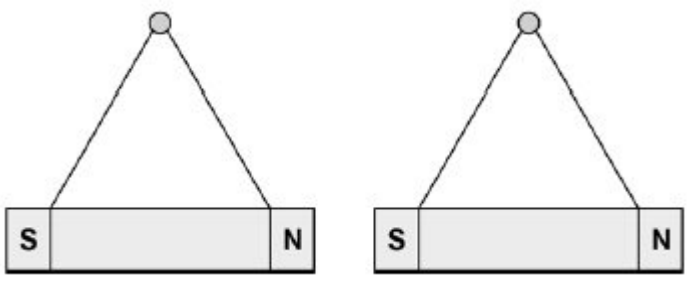
(3)

(Total 12 marks)

Q2.

Figure 1 shows two bar magnets suspended close to each other.

Figure 1



(a) Explain what is meant by the following statement.

'A non-contact force acts on each magnet'.

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(2)

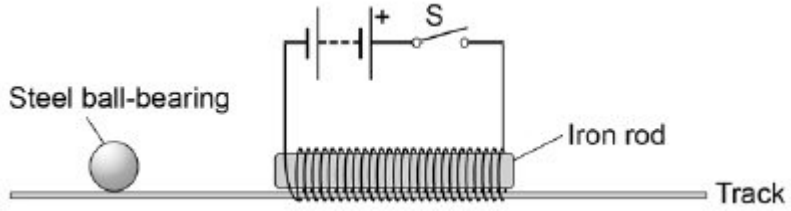
(b) Describe how to plot the magnetic field pattern of a bar magnet.

(3)

A student has set up the apparatus shown in **Figure 2**.

The iron rod is fixed to the track and cannot move.

Figure 2



(c) The student gives the steel ball bearing a gentle push in the direction of the iron rod.

At the same time the student closes the switch **S**.

Explain the effect on the motion of the ball bearing when the switch **S** is closed.

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_____

(4)

(Total 9 marks)

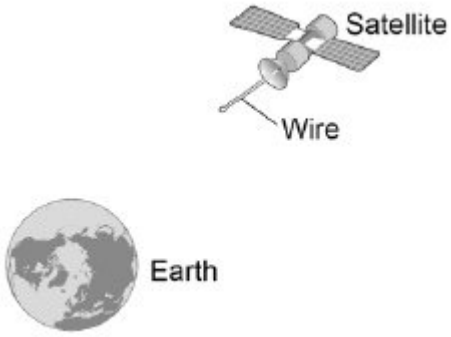
Q3.

Scientists have used a satellite system to investigate the idea of generating electricity in space.

As the system orbited the Earth a 20 km copper wire was reeled out.

Before the wire snapped a current of 1 amp was induced in the wire.

Figure 1



(a) What provides the force needed to keep a satellite in orbit around the Earth?

_____

(1)

(b) Explain how a current is induced in the wire.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

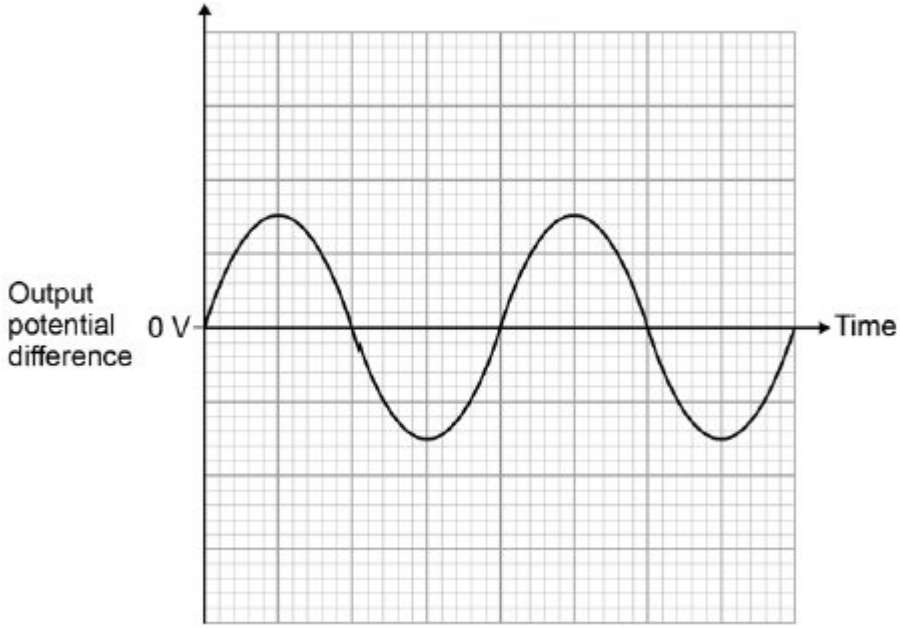
An alternator is connected to a data logger.

The data logger is connected to a computer.

Figure 2 shows how the output potential difference of the alternator varies with time.

Figure 2

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(c) The coil inside the alternator now rotates at twice the frequency.

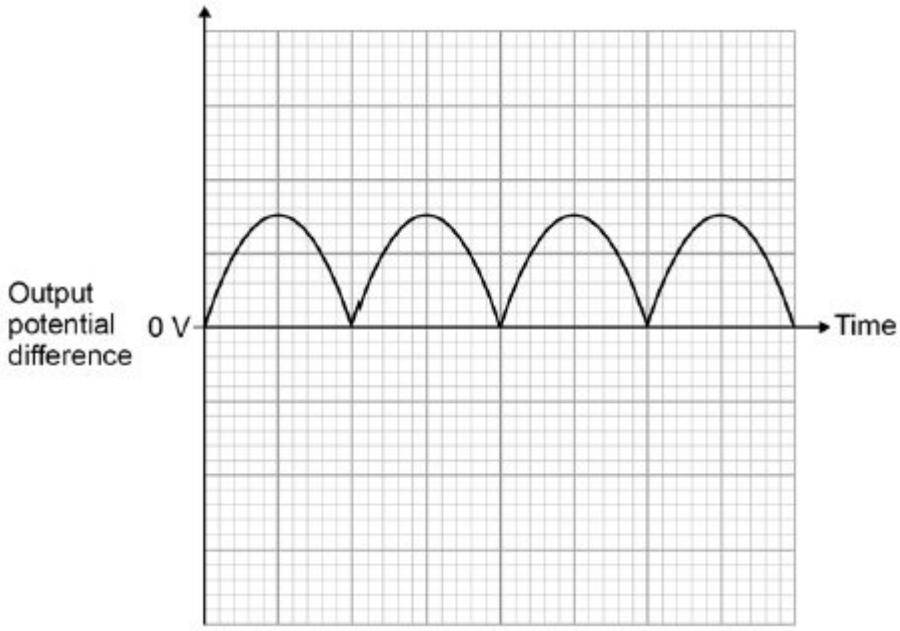
Draw on **Figure 2** to show how the output potential difference varies with time at this new frequency.

(2)

Another type of generator is now connected to the data logger and computer.

Figure 3 shows how the output potential difference varies with time for this generator.

Figure 3



(d) What name is given to this second type of generator?

_____

(1)

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(e) Look at **Figure 2** and **Figure 3**.

Give one difference between the outputs from the two types of generator.

_____

_____

_____

(1)

(f) The charger used to charge the battery inside a laptop computer contains a small transformer.

The charger plugs into the mains electricity supply.

mains electricity supply = 230 V

number of turns on the primary coil of the transformer = 690

number of turns on the secondary coil of the transformer = 57

Calculate the potential difference applied by the charger across the battery inside the computer.

_____

_____

_____

_____

_____

_____

Potential difference = _____ V

(3)

(Total 11 marks)

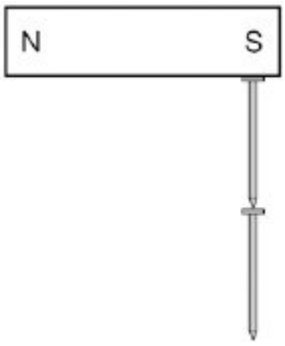
Q4.

Figure 1 shows two iron nails hanging from a bar magnet.

The iron nails which were unmagnetised are now magnetised.

Figure 1

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(a) Complete the sentence.

Use a word from the box.

forced	induced	permanent

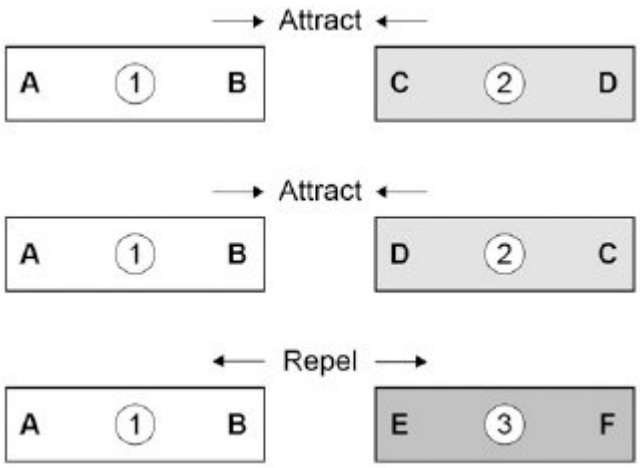
The iron nails have become _____ magnets.

(1)

(b) Each of the three metal bars in **Figure 2** is either a bar magnet or a piece of unmagnetised iron.

The forces that act between the bars when different ends are placed close together are shown by the arrows.

Figure 2



Which **one** of the metal bars is a piece of unmagnetised iron?

Tick **one** box.

Bar 1 ☐

Bar 2 ☐

Bar 3 ☐

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Give the reason for your answer.

_____

_____

(2)

(c) A student investigated the strength of different fridge magnets by putting small sheets of paper between each magnet and the fridge door.

The student measured the maximum number of sheets of paper that each magnet was able to hold in place.

Why was it important that each small sheet of paper had the same thickness?

_____

_____

_____

(1)

(d) Before starting the investigation the student wrote the following hypothesis:

'The bigger the area of a fridge magnet the stronger the magnet will be.'

The student's results are given in the table below.

Fridge magnet	Area of magnet in mm^2	Number of sheets of paper held
A	40	20
B	110	16
C	250	6
D	340	8
E	1350	4

Give **one** reason why the results from the investigation **do not** support the student's hypothesis.

_____

_____

(1)

(Total 5 marks)

Q5.

Waves may be either longitudinal or transverse.

(a) Describe the difference between a longitudinal and a transverse wave.

_____

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_____

_____

_____

(2)

(b) Describe **one** piece of evidence that shows when a sound wave travels through the air it is the wave and not the air itself that travels.

_____

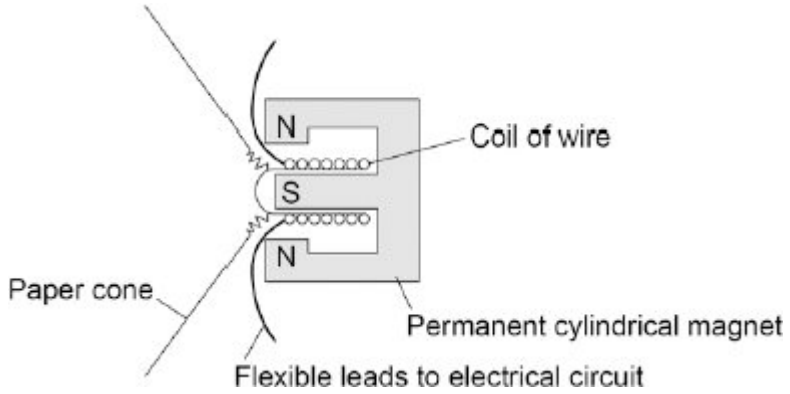
_____

_____

(1)

(c) The figure below shows the parts of a moving-coil loudspeaker.

A coil of wire is positioned in the gap between the north and south poles of the cylindrical magnet.



Explain how the loudspeaker converts current in an electrical circuit to a sound wave.

_____

_____

_____

_____

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_____

(6)

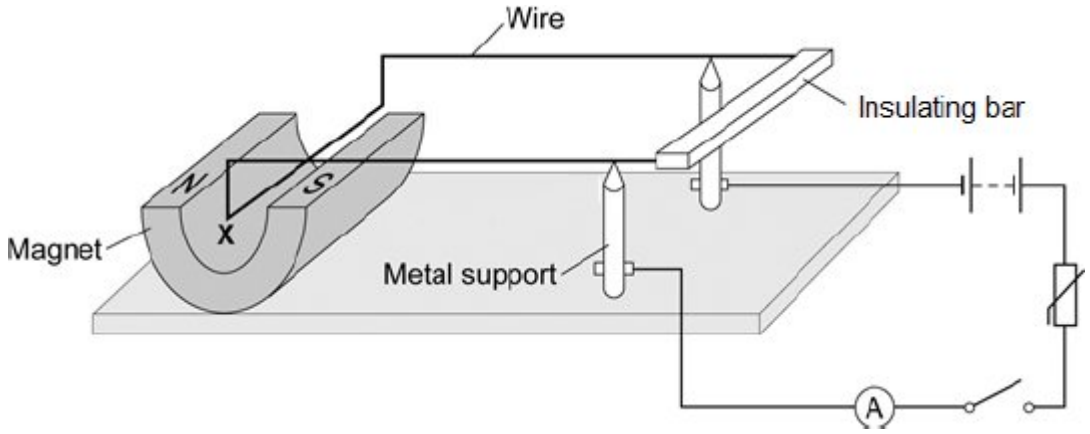
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(Total 9 marks)

Q6.

Figure 1 shows a piece of apparatus called a current balance.

Figure 1



When the switch is closed, the part of the wire labelled **X** experiences a force and moves downwards.

(a) What is the name of the effect that causes the wire **X** to move downwards?

_____

(1)

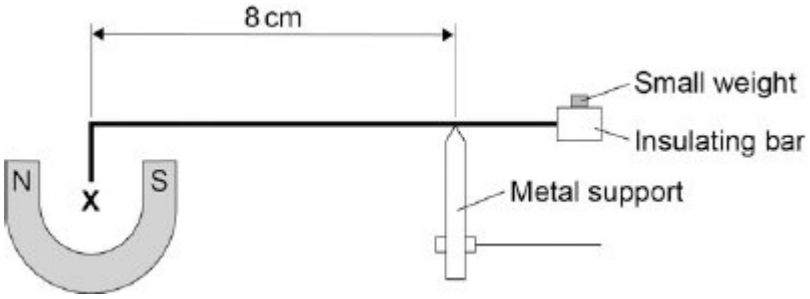
(b) Suggest one change you could make to the apparatus in **Figure 1** that would increase the size of the force that wire **X** experiences.

_____

(1)

(c) **Figure 2** shows how a small weight placed on the insulating bar makes the wire **X** go back and balance in its original position.

Figure 2



The wire **X** is 5 cm long and carries a current of 1.5 A.

The small weight causes a clockwise moment of 4.8×10^{-4} Nm.

Calculate the magnetic flux density where the wire **X** is positioned

Give the unit.

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_____

_____

_____

_____

_____

_____

_____

Magnetic flux density = _____ Unit _____

(6)

(Total 8 marks)

Q7.

(a) Electromagnets are often used at recycling centres to separate some types of metals from other materials.

Give **one** reason why an electromagnet would be used rather than a permanent magnet.

_____

_____

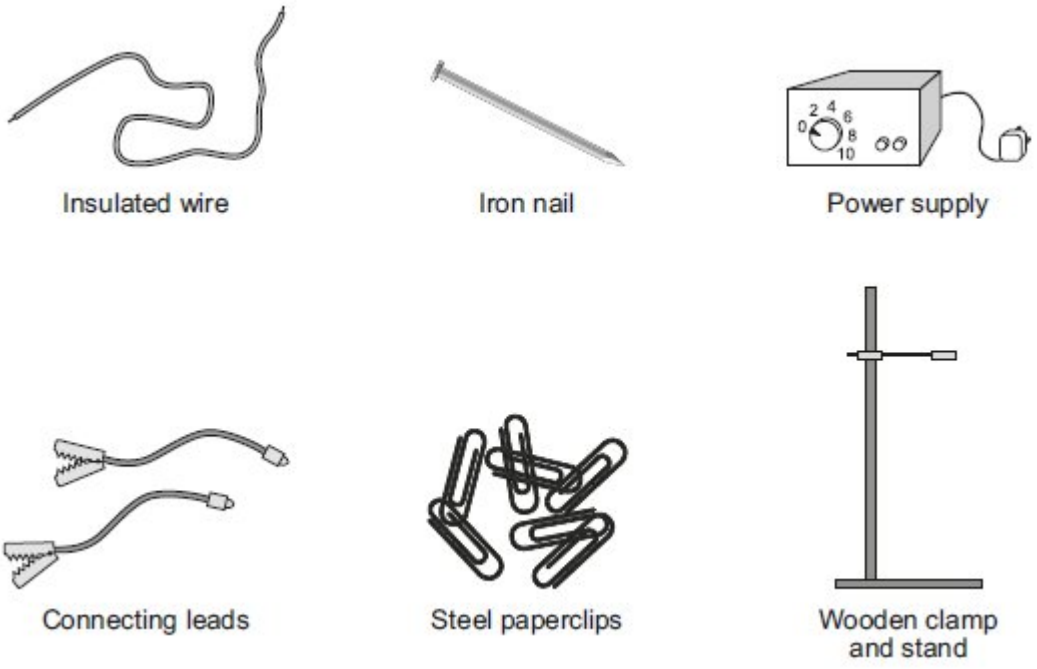
(1)

(b) **In this question you will gain marks for using good English, organising information clearly and using scientific words correctly.**

Some students want to build an electromagnet.

The students have the equipment shown below.

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Describe how the students could build an electromagnet. Include in your answer how the students should vary and test the strength of their electromagnet.

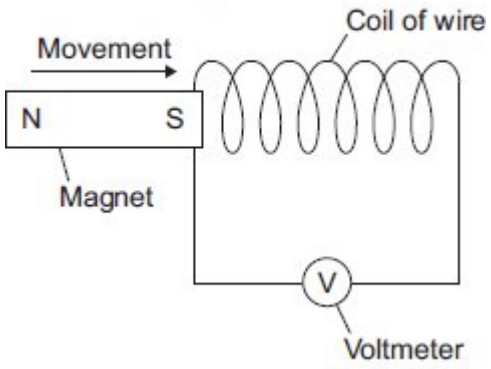
(6)

(Total 7 marks)

Q8.

Figure 1 shows a magnet moving into a coil of wire. This movement causes a reading on the voltmeter.

Figure 1



(a) Use the correct word from the box to complete the sentence.

generated	**induced**	**produced**

Moving the magnet into the coil of wire causes a reading on the voltmeter because a potential difference is _____ across the ends of the wire.

(1)

(b) A student investigated how the number of turns on the coil of wire affects the maximum voltmeter reading. The student changed the number of turns on the coil of

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wire, then moved the magnet into the coil. The student recorded the maximum voltmeter reading.

To obtain valid data, suggest **two** variables that the student should control in this investigation.

1. _____

_____

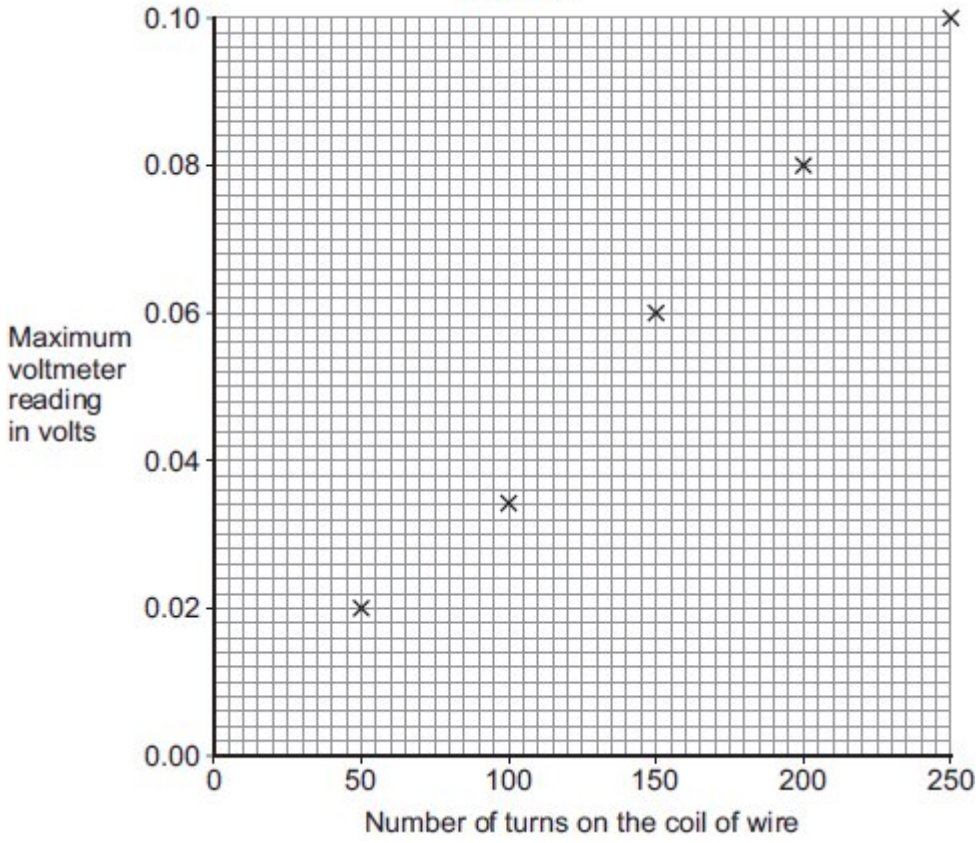
2. _____

_____

(2)

(c) The student's results are shown in **Figure 2**.

Figure 2



(i) One of the results is anomalous.
Suggest a reason for the anomalous result.

_____

(1)

(ii) Draw a line of best fit on **Figure 2**.

(1)

(d) A data-logger can automatically record and store data.

It may have been better for the student to have used a data-logger in his investigation rather than a voltmeter.

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Suggest **one** reason why.

_____

_____

(1)

(Total 6 marks)

Q9.

(a) **Diagram 1** shows a magnetic closure box when open and shut. It is a box that stays shut, when it is closed, due to the force between two small magnets.

These boxes are often used for jewellery.

Diagram 1

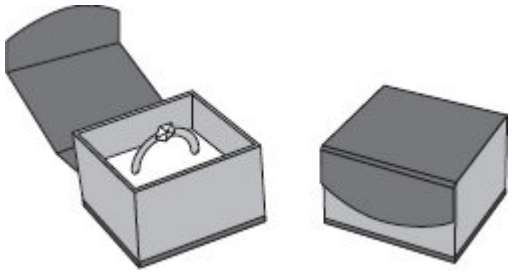
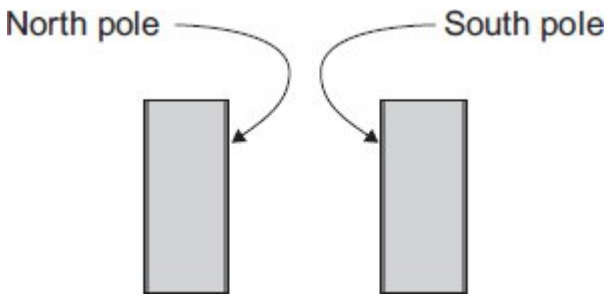


Diagram 2 shows the two magnets. The poles of the magnets are on the longer faces.

Diagram 2



(i) Draw, on **Diagram 2**, the magnetic field pattern between the two facing poles.

(2)

(ii) The magnets in the magnetic closure box must **not** have two North poles facing each other.

Explain why.

_____

_____

_____

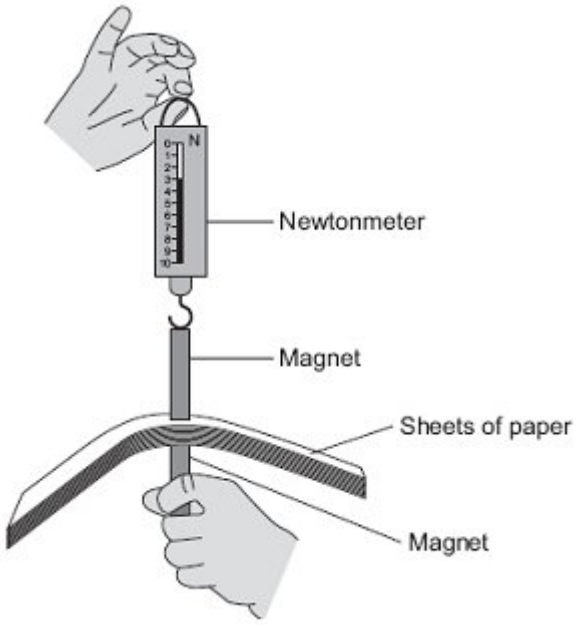
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(2)

(b) A student is investigating how the force of attraction between two bar magnets depends on their separation.

She uses the apparatus shown in **Diagram 3**.

Diagram 3



She uses the following procedure:

- ensures that the newtonmeter does not have a zero error
- holds one of the magnets
- puts sheets of paper on top of the magnet
- places the other magnet, with the newtonmeter magnetically attached, close to the first magnet
- pulls the magnets apart
- notes the reading on the newtonmeter as the magnets separate
- repeats with different numbers of sheets of paper between the magnets.

The results are shown in the table.

Number of sheets of paper between the magnets	10	20	30	40	50	60	70	80	120
Newtonmeter reading as the magnets separate	3.1	2.6	2.1	1.5	1.1	1.1	1.1	1.1	1.1

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(i) Describe the pattern of her results.

_____

_____

_____

_____

(2)

(ii) No matter how many sheets of paper the student puts between the magnets, the force shown on the newtonmeter never reaches zero.

Why?

_____

_____

(1)

(iii) The student is unable to experiment with fewer than 10 sheets of paper without glueing the magnet to the newtonmeter.

Suggest why.

_____

_____

_____

_____

(2)

(iv) Suggest **three** improvements to the procedure that would allow the student to gain more accurate results.

_____

_____

_____

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_____

_____

(3)

(v) The thickness of one sheet of paper is 0.1 mm.

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What is the separation of the magnets when the force required to separate them is 2.1 N?

_____

_____

_____

Separation of magnets = _____ mm

(3)

(Total 15 marks)

Q10.

(a) Name a material that could be used to make the outside case of the plug.

_____

Give a reason for your choice.

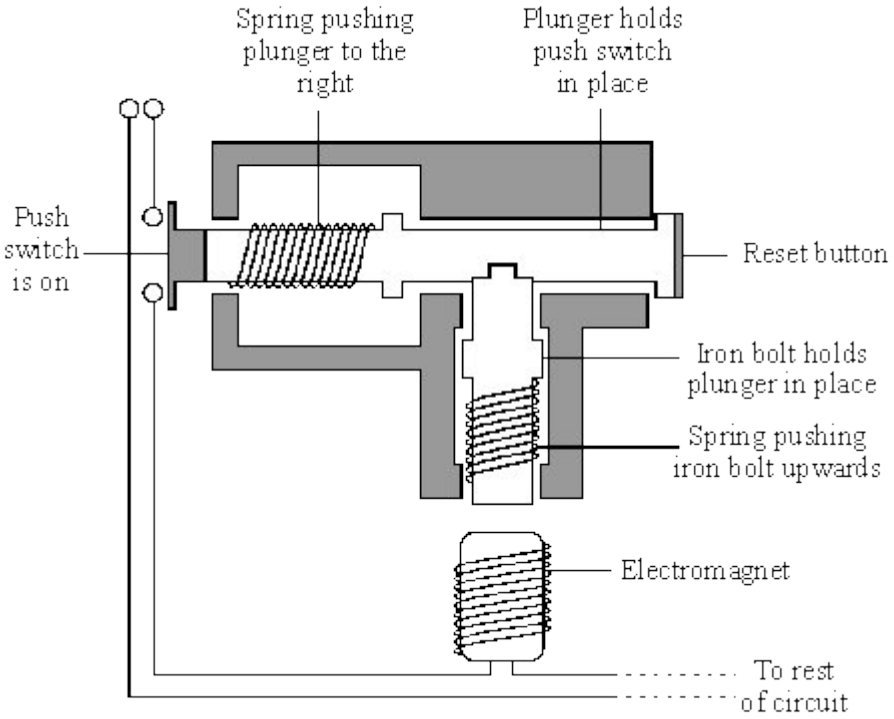
_____

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(2)

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Some electrical circuits are protected by a circuit breaker. These switch the circuit off if a fault causes a larger than normal current to flow. The diagram shows one type of circuit breaker. A normal current (15 A) is flowing.



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Explain what happens when a current larger than 15A flows. The answer has been started for you.

When the current goes above 15 A, the electromagnet becomes stronger and

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

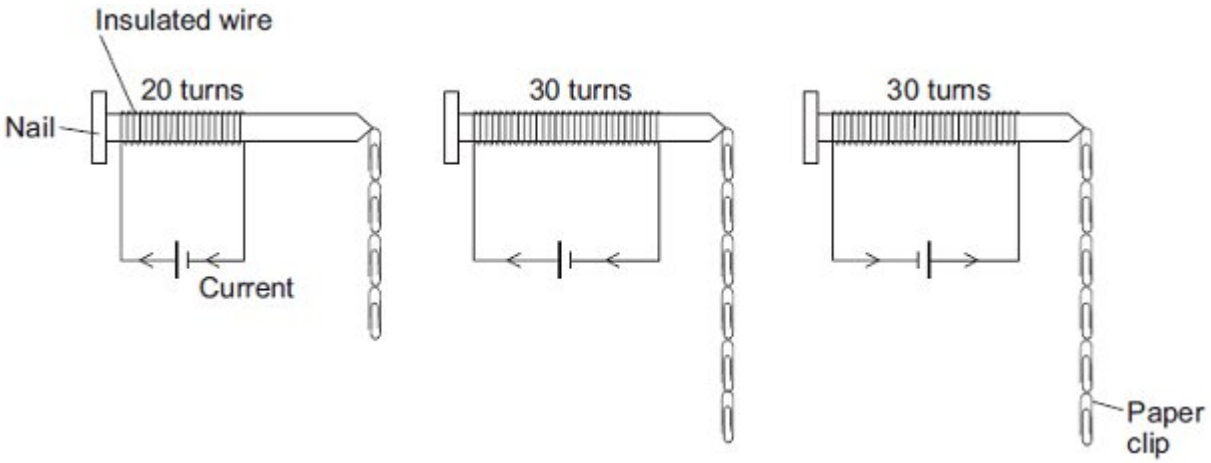
Q11.

A student is investigating the strength of electromagnets.

Figure 1 shows three electromagnets.

The student hung a line of paper clips from each electromagnet.

Figure 1



Electromagnet **A** Electromagnet **B** Electromagnet **C**

No more paper clips can be hung from the bottom of each line of paper clips.

(a) (i) Complete the conclusion that the student should make from this investigation.

Increasing the number of turns of wire wrapped around the nail will

_____ the strength of the electromagnet.

(1)

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(ii) Which **two** pairs of electromagnets should be compared to make this conclusion?

Pair 1: Electromagnets _____ and _____

Pair 2: Electromagnets _____ and _____

(1)

(iii) Suggest **two** variables that the student should control in this investigation.

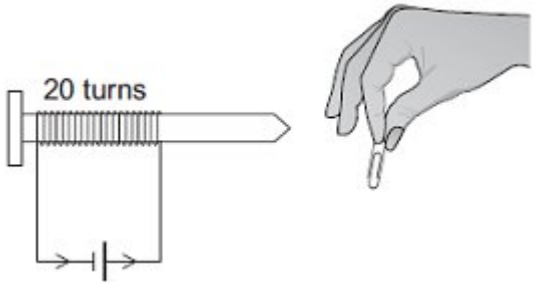
1. _____

2. _____

(2)

(b) The cell in electromagnet **A** is swapped around to make the current flow in the opposite direction. This is shown in **Figure 2**.

Figure 2



What is the maximum number of paper clips that can now be hung in a line from this electromagnet?

Draw a ring around the correct answer.

fewer than 4 **4** **more than 4**

Give **one** reason for your answer.

_____

_____

_____

(2)

(c) Electromagnet **A** is changed to have only 10 turns of wire wrapped around the nail.

Suggest the maximum number of paper clips that could be hung in a line from the end of this electromagnet.

Maximum number of paper clips = _____

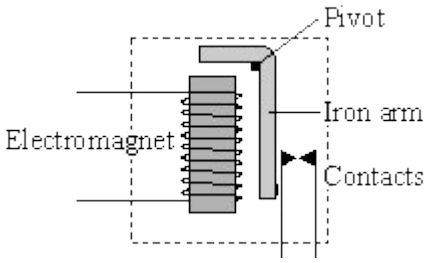
(1)

(Total 7 marks)

Q12.

The diagram shows a switch that is operated by an electromagnet.

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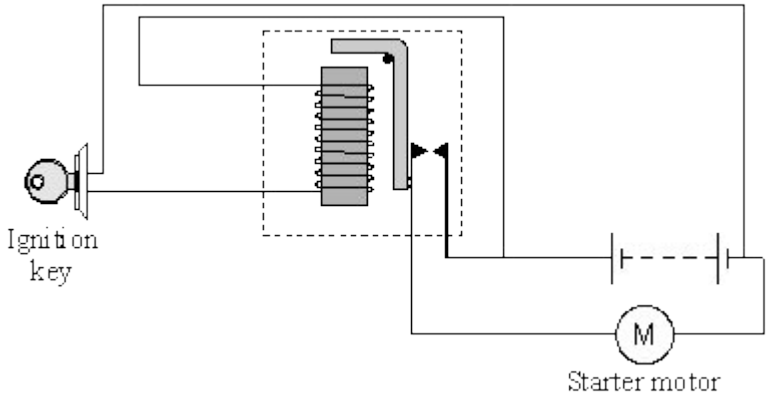


(i) What is this type of switch called?

_____

(1)

(ii) The switch is used in a car starter motor circuit.



Explain how turning the ignition key makes a current flow in the starter motor. The explanation has been started for you.

When the ignition key is turned _____

_____

_____

_____

_____

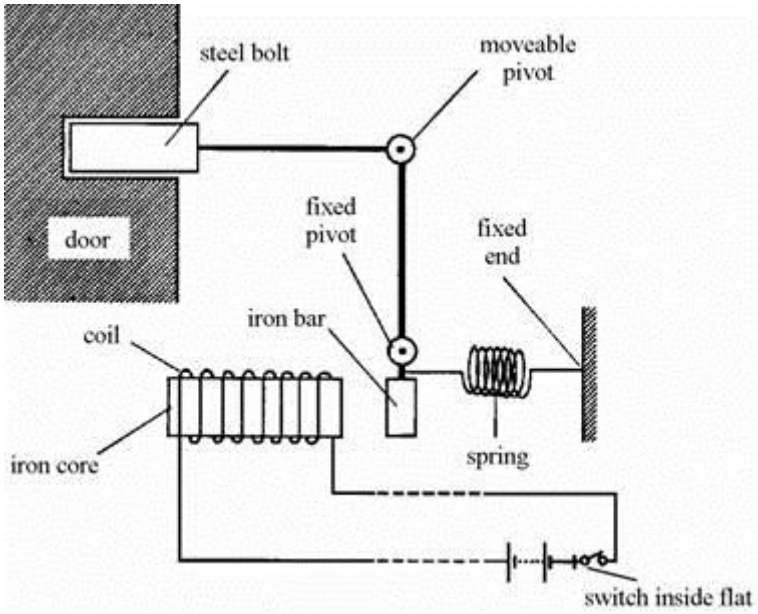
(3)

(Total 4 marks)

Q13.

The diagram below shows a door lock which can be opened from a flat inside a building.

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(a) Explain how the door is unlocked when the switch is closed.

_____

_____

_____

_____

(4)

(b) State **two** changes which would increase the strength of the electromagnet.

1. _____

2. _____

(2)

(c) Why is the spring needed in the lock?

_____

_____

(1)

(d) The connections to the coil were accidentally reversed. Would the lock still work?

_____

Explain your answer.

_____

_____

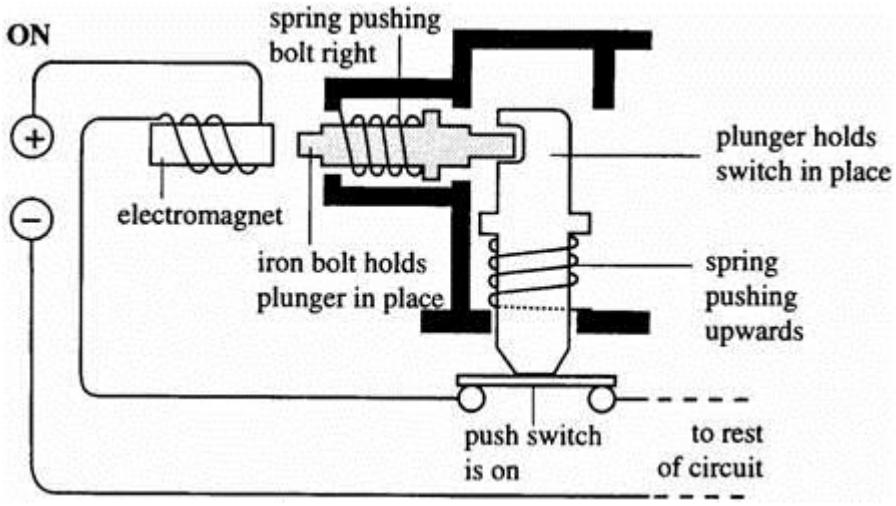
(2)

(Total 9 marks)

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Q14.

A fault in an electrical circuit can cause too great a current to flow.
Some circuits are switched off by a circuit breaker.



One type of circuit breaker is shown above. A normal current is flowing.
Explain, in full detail, what happens when a current which is bigger than normal flows.

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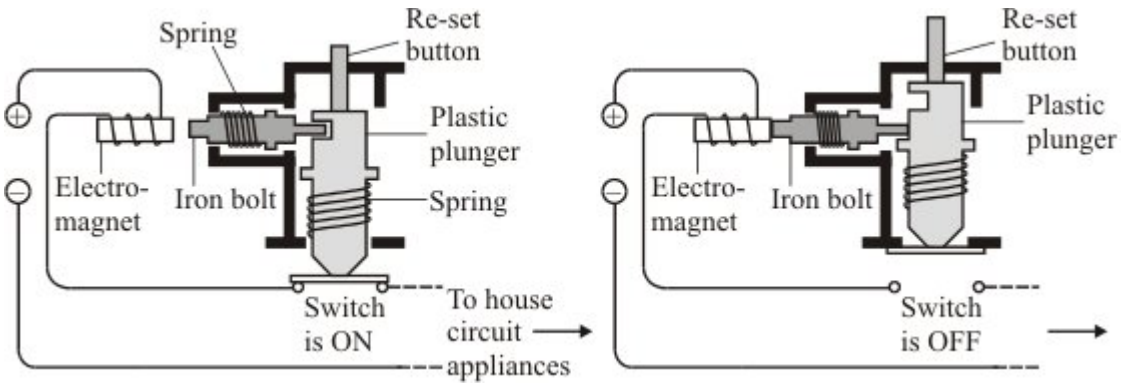
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(Total 4 marks)

Q15.

Circuit breakers help to make the electricity supply in homes safer.
A circuit breaker is an automatic safety switch. It cuts off the current if it gets too big.



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Describe, in as much detail as you can, how this circuit breaker works.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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(Total 6 marks)

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