

Name: _____

Magnetism part 2 AQA Triple Physics

Class: _____

Date: _____

Time: **79 minutes**

Marks: **75 marks**

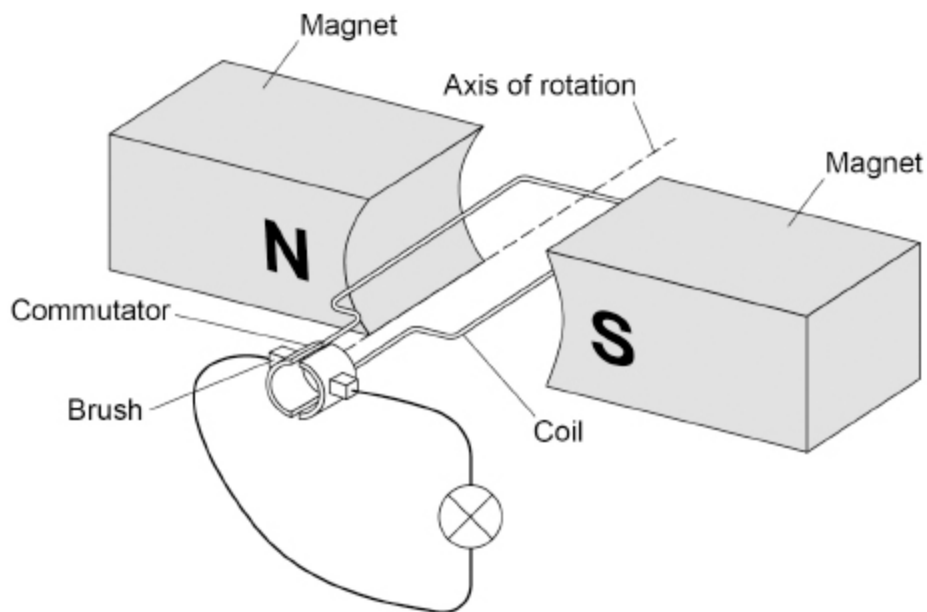
Comments:

1.

A dynamo is used to generate an electric current.

Figure 1 shows the inside parts of the dynamo connected to a lamp.

Figure 1



(a) The coil is rotated.

Explain why a direct current is induced in the coil.

(5)

- (b) Sketch a graph on **Figure 2** to show how the potential difference generated across the lamp varies for **two** complete revolutions of the dynamo coil.

Figure 2



(1)

- (c) The lamp is disconnected from the dynamo.

Explain why the dynamo becomes much easier to turn.

(3)

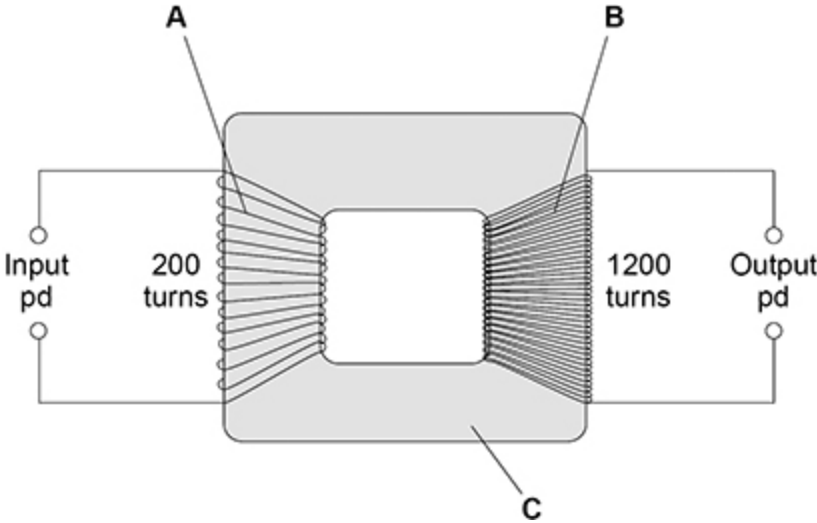
(Total 9 marks)

2.

The National Grid uses transformers to change potential difference (pd).

Figure 1 shows a transformer.

Figure 1



(a) Identify the parts of the transformer labelled in Figure 1.

- A _____
- B _____
- C _____

(2)

(b) There is an alternating input pd of 230 V.

Determine the output pd.

Use the Physics Equations Sheet.

Output pd = _____ V

(3)

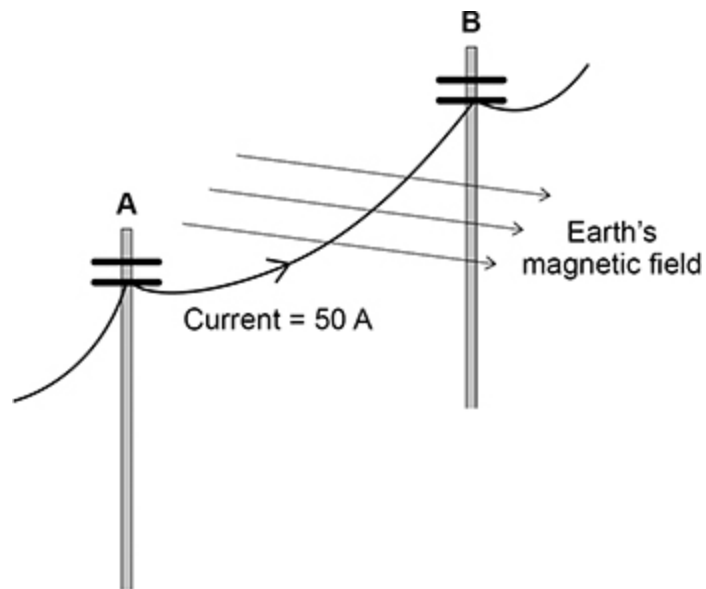
(c) The input pd causes an alternating current.

Explain why there is an alternating current in the output when the transformer is connected to a circuit.

(3)

Figure 2 shows a large cable supported by two wooden poles. The cable is connected to an electricity supply.

Figure 2



- (d) There is a force on the cable due to the Earth's magnetic field when the current is in the direction **A** to **B**.

What is the direction of this force?

Tick (✓) **one** box.

Down

Left

Right

Up

- (e) The cable experiences a force of 0.045 N due to the Earth's magnetic field.

magnetic flux density = 60 μT

current = 50 A

Calculate the length of the cable between **A** and **B**.

Use the Physics Equations Sheet.

Length = _____ m

(4)

(f) State **one** assumption you made in your calculation.

(1)





(Total 14 marks)

3.

When two magnets are close together they exert a force on each other.

(a) Complete table below to show if the magnets would attract or repel.

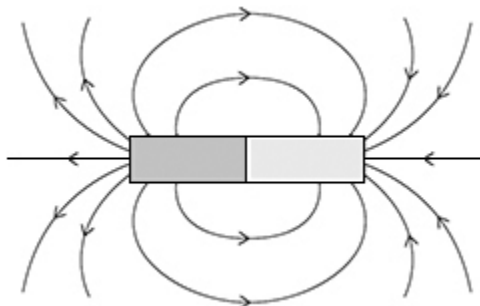
Tick (✓) **one** box in **each** row.

	Attract	Repel
		
		
		
		

(2)

(b) **Figure 1** shows the magnetic field around a bar magnet.

Figure 1



Which statements are true for the magnetic field shown in **Figure 1**?

Tick (✓) **two** boxes.

The magnetic field gets weaker further from the magnet.

The magnetic field is strongest at the poles.

The magnetic field is uniform away from the poles.

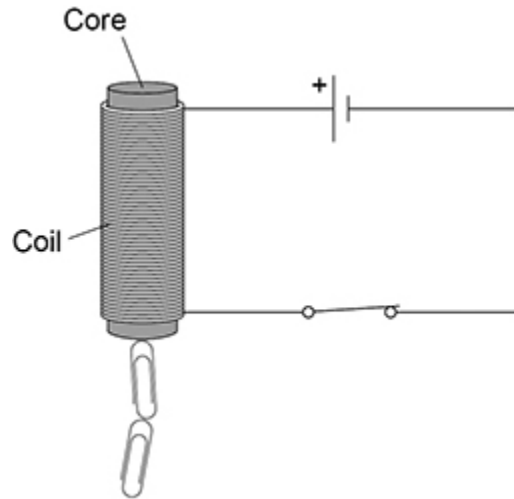
The magnetic field lines all meet at a single point.

The magnetic field lines point from south to north.

(2)

Figure 2 includes an electromagnet.

Figure 2



(c) Which metal is used to make the core of the electromagnet?

Tick (✓) **one** box.

- Aluminium
- Copper
- Iron
- Magnesium

(1)

(d) Complete the sentence.

Choose the answer from the box.

coil	metal core	paper clip
-------------	-------------------	-------------------

The switch is closed. There is a current in the _____.

(1)

(e) The number of turns on the coil is increased. The current remains the same.

How does this affect the strength of the magnetic field around the electromagnet?

Tick (✓) **one** box.

The magnetic field would be stronger.

The magnetic field would stay the same.

The magnetic field would be weaker.

(1)

(f) The metal core was removed. The current remains the same.

How does this affect the strength of the magnetic field around the electromagnet?

Tick (✓) **one** box.

The magnetic field would be stronger.

The magnetic field would stay the same.

The magnetic field would be weaker.

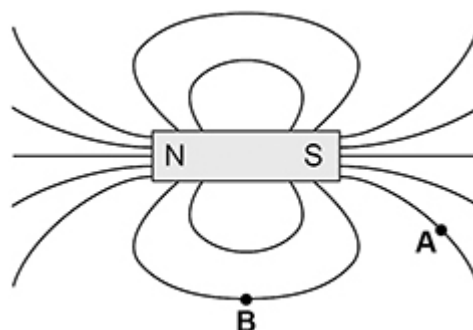
(1)

(Total 8 marks)

4.

Figure 1 shows the magnetic field pattern around a bar magnet.

Figure 1



(a) Draw an arrow at point **A** and point **B** to show the direction of the magnetic field at each point.

(1)

(b) A bar magnet produces its own magnetic field.

Complete the sentence.

Choose the answer from the box.

an electromagnet	an induced magnet	a permanent magnet
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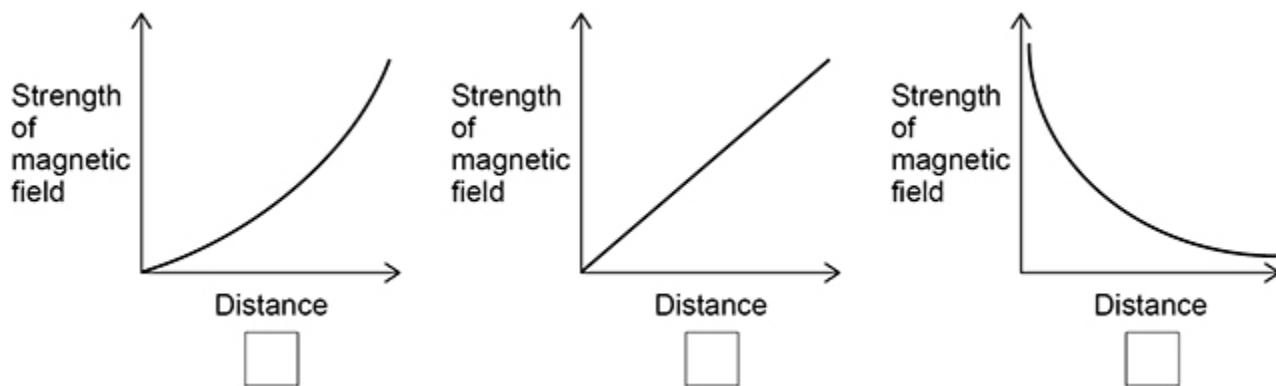
A bar magnet is an example of _____.

(1)

(c) Which graph shows how the strength of the magnetic field varies with distance from the bar magnet?

Give a reason for your answer.

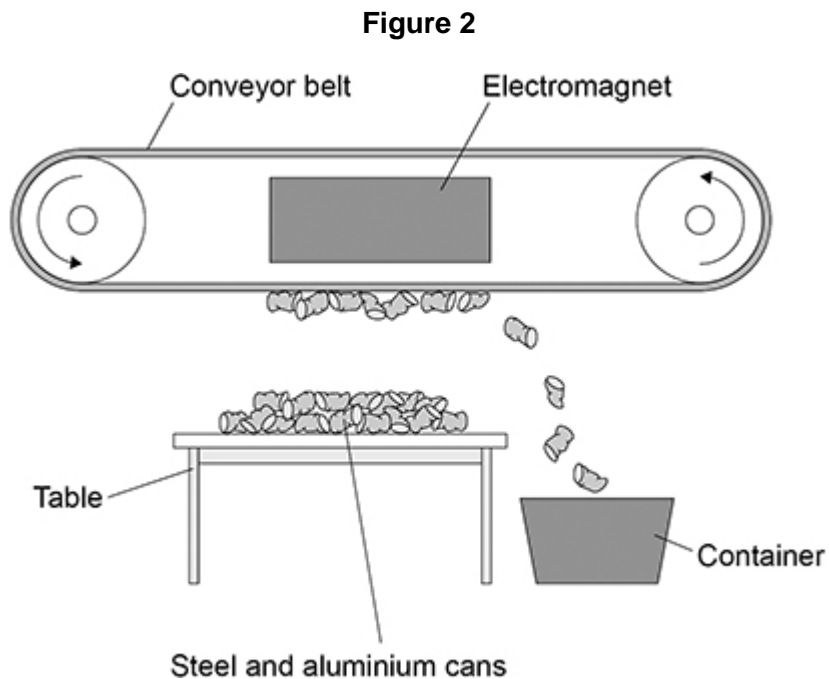
Tick (✓) **one** box.



Reason _____

(2)

Figure 2 shows an electromagnet being used to separate aluminium cans from steel cans.



- (d) Explain how the electromagnet and conveyor belt are used to separate the steel cans from the aluminium cans.

(2)

- (e) At the top of the table the strength of the magnetic field is only just enough to pick the cans up.

Describe **two** ways to increase the strength of magnetic field at the top of the table.

1 _____

2 _____

(2)

- (f) Write down the equation which links distance travelled (s), speed (v) and time (t).

(1)

- (g) The conveyor belt moves a can at a speed of 1.7 m/s.

Calculate the time taken to move the can 3.3 m at this speed.

Give your answer to 2 significant figures.

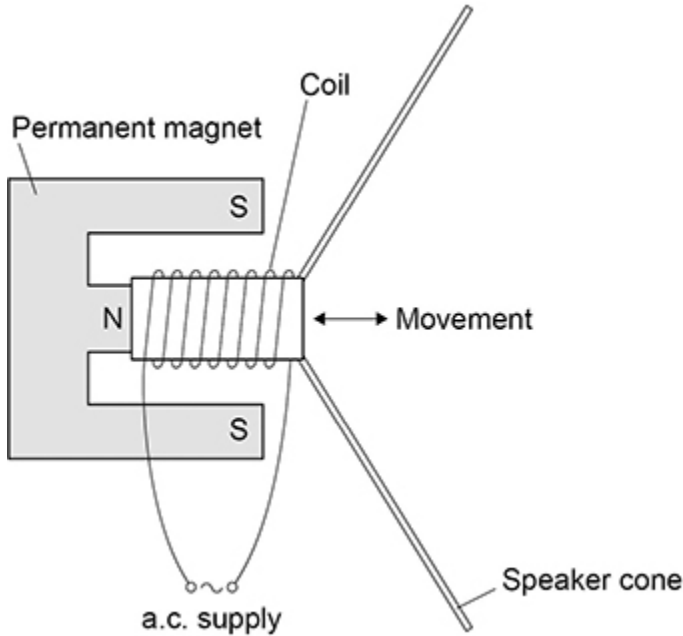
Time taken (2 significant figures) = _____ s

(4)

(Total 13 marks)

5. A student made a moving-coil loudspeaker.

The figure below shows a diagram of the loudspeaker.



(a) What is the name of the effect used by the moving-coil loudspeaker to produce sound waves?

(1)

(b) Explain how a moving-coil loudspeaker produces a sound wave.

(4)

- (c) A student investigated how the loudness of sound from the loudspeaker depends on:
- the number of turns on the coil
 - the frequency of the supply.

The table below shows the results.

Number of turns	Frequency of supply in Hz	Loudness of sound in arbitrary units
100	200	32
200	400	47
300	600	63

Explain why the results **cannot** be used to make a valid conclusion.

(2)
(Total 7 marks)

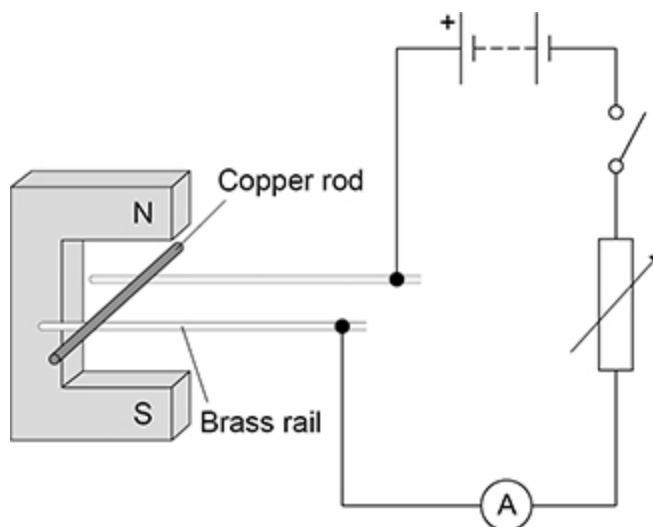
6.

A teacher demonstrated how a magnetic field can cause a copper rod to accelerate.

The teacher placed the copper rod on two brass rails in a magnetic field.

The copper rod was able to move.

The figure below shows the equipment used.



(a) The teacher closes the switch and the copper rod accelerates.

Explain how Fleming's left hand rule can be used to predict the direction in which the copper rod will move.

(5)

(b) Suggest **two** changes to the equipment that would increase the force on the copper rod.

1 _____

2 _____

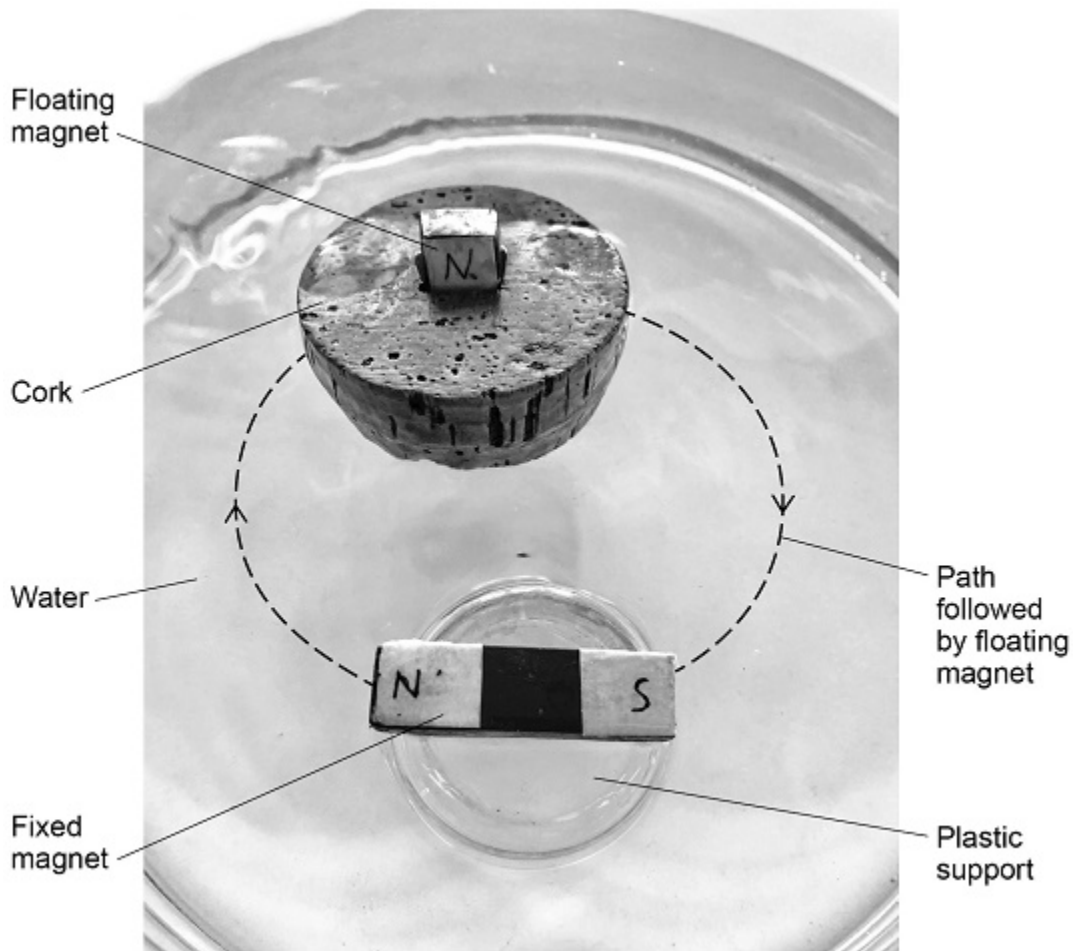
(2)

7.

A student placed a magnet on top of a plastic support in a bowl of water. This magnet was fixed in position and above the surface of the water.

The student put a second magnet into a piece of cork so that the magnet floated on the water. Only the north pole of the floating magnet was above the surface of the water.

The photograph below shows the arrangement of the magnets.



- (a) The floating magnet was placed near to the north pole of the fixed magnet. The floating magnet then moved along the path shown in the photograph.

Explain why.

(2)

(b) The student replaced the floating magnet with a piece of iron.

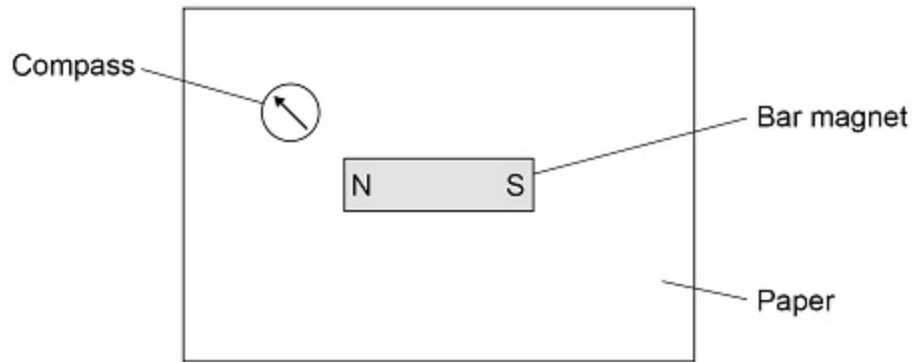
What happened to the piece of iron?

(1)

(c) Describe how to use a compass to plot the magnetic field pattern around a bar magnet.

Use **Figure 1** to help you.

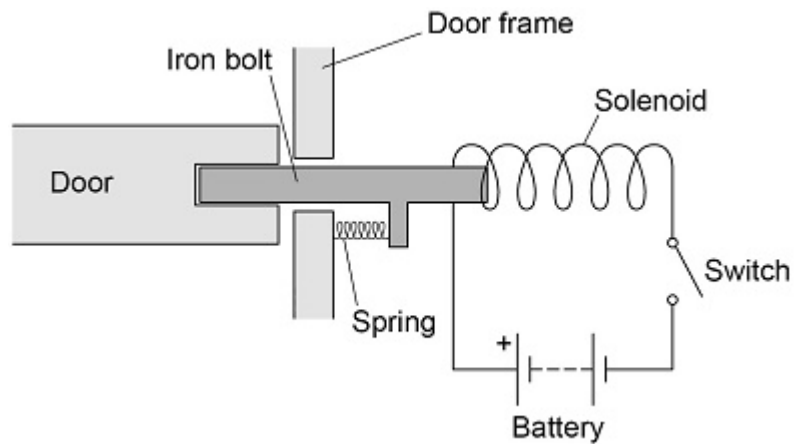
Figure 1



(4)

Figure 2 shows a diagram of an electromagnetic lock used to secure a door.

Figure 2



(d) **Figure 3** shows an incomplete sequence of how the door unlocks.

Figure 3



Write **one** letter in each box to show the correct sequence.

- A** The iron bolt moves.
- B** A magnetic field is created around the solenoid.
- C** There is a current in the circuit.

(2)

(e) The electromagnetic lock contains a spring.

When the door is unlocked the extension of the spring is 0.040 m.

spring constant = 200 N/m

Calculate the elastic potential energy of the spring when the door is unlocked.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

Elastic potential energy = _____ J

(2)

(Total 11 marks)

Mark schemes

1.

- (a) the coil moves through the (magnetic) field
or
the coil cuts (magnetic) field lines

1

a potential difference is induced (across the coil)

1

there is a complete circuit, so a current is induced (in the coil)

1

(because) each half-revolution, the two ends of the coil swap from one brush to the other

or

each half-revolution, (the two halves of) the commutator switch brushes / contacts

*(because) the half of the coil connected to each brush
always moves in the same direction*

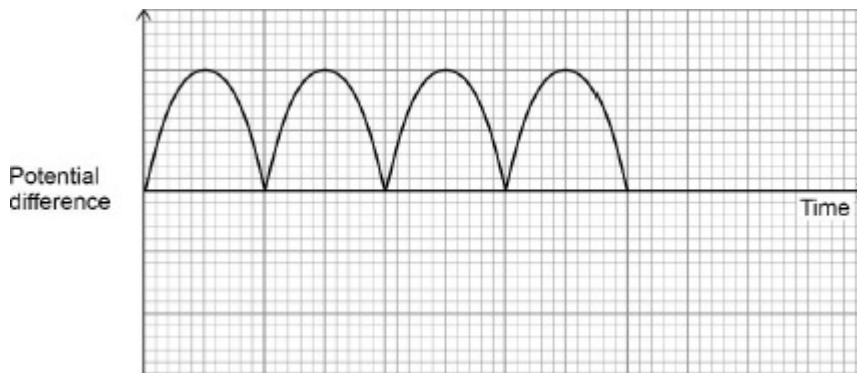
1

(so) the direction of the (induced) current / potential difference does not reverse every half rotation

*allow the direction of the (induced) current / potential
difference is the same every half rotation*

1

(b)



allow a correct graph showing a negative output potential difference only

1

- (c) (after disconnection) there is no (induced) current

1

(so) no magnetic field (produced around / by the coil)

1

to oppose the movement of the coil

allow no force opposes the movement of the coil

1

[9]

2.

- (a) A primary coil
and
B secondary coil

1

C iron core

1

(b) $\frac{230}{V_s} = \frac{200}{1200}$

1

$$V_s = \frac{1200 \times 230}{200}$$

1

$$V_s = 1380 \text{ (V)}$$

1

- (c) (the alternating current causes) a changing magnetic field around the primary (coil)

1

creates magnetic field that changes direction in the core

allow creates a changing magnetic field in the core

1

this induces an alternating potential difference across the secondary (coil (causing an alternating current)

1

- (d) down

1

- (e) $B = 60 \times 10^{-6} \text{ T}$

1

$$0.045 = 60 \times 10^{-6} \times 50 \times l$$

allow correct substitution of incorrectly / not converted value of B

1

$$l = \frac{0.045}{60 \times 10^{-6} \times 50}$$

allow correct rearrangement using an incorrectly / not converted value of B

1

$$l = 15 \text{ (m)}$$





allow a correct calculation using an incorrectly / not converted value of B

1

- (e) the wire / force is at right angles to the magnetic field
allow the current is constant
allow the cable is straight
allow the field is uniform
allow the force is constant

1
 [14]

3. (a) all ticks correct

	Attract	Repel
	✓	
	✓	
		✓
		✓

allow 1 mark for 3 correct ticks

2

- (b) the magnetic field gets weaker further from the magnet

1

the magnetic field is strongest at the poles

1

- (c) iron

1

- (d) coil

1

- (e) the magnetic field would be stronger

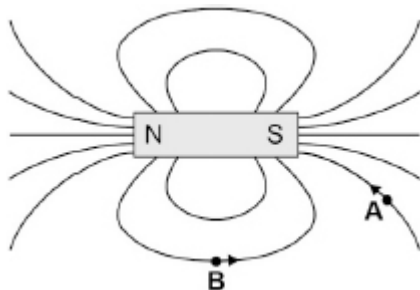
1

- (f) the magnetic field would be weaker

1

[8]

4. (a) both arrows correct

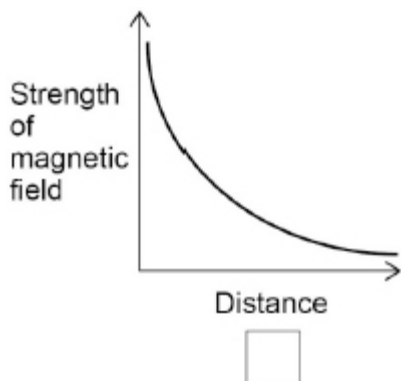


1

(b) a permanent magnet

1

(c) third box ticked



1

any **one** from

- (the only graph) that shows the magnetic field getting weaker (as distance increases)
- both other graphs show the magnetic field getting stronger (as the distance increases)

only scores if correct box is chosen

1

(d) steel cans are attracted to the electromagnet and are transferred to the container (by the conveyor belt)

1

aluminium cans are not attracted to the electromagnet and are left behind on the table

If no other mark scored: Steel cans are attracted (to the electromagnet) but aluminium cans are not – scores one mark

1

(e) raise the height of the table

allow longer legs on the table

allow put a (non-magnetic) box on top of the table

allow lower the electromagnet

1

use a larger potential difference / current

or

use a stronger electromagnet

allow more turns on the coil (of the electromagnet)

*do **not** accept insert a (soft) iron core*

1

(f) distance travelled = speed × time

or

$$s = v t$$

1

(g) $3.3 = 1.7 \times t$

1

$$t = \frac{3.3}{1.7}$$

1

$t = 1.941 \text{ (s)}$

1

$t = 1.9 \text{ (s)}$

allow a calculation using the given data incorrectly but correctly rounded to 2 sig figs

1

[13]

5.

(a) motor (effect)

1

(b) current creates a magnetic field (around the coil)

1

(which) interacts with the permanent magnet field

1

producing a (resultant) force causing the coil/cone to move

1

(when the) direction of the current reverses, the direction of the (resultant) force reverses (producing a sound wave)

allow coil/cone for force allow backwards for reverses

1

(c) the student changed two variables at the same time

allow only one variable should be changed at a time

1

(so) it is not possible to know the effect of each variable

1

[7]

6.

(a) hold thumb first finger and second finger (of left hand) at right angles to each other

allow first two fingers/index and middle for first and second finger throughout

1

second finger represents the current pointing out of the paper

1

first finger represents the field pointing downwards

1

thumb points in the direction of the force / thrust / acceleration

1

(therefore) the rod moves left to right

*allow correct description (eg away from the magnet)
dependent on scoring marking point 3 or 4*

1

(b) decrease the resistance of the variable resistor

allow increase the current/pd

1

use a stronger magnet

allow use a magnet with a greater flux density

1

(c) $F = 0.30 \times 1.7 \times 0.050$

1

$F = 0.0255 \text{ (N)}$

1

$m = 0.004(0 \text{ kg})$

1

$0.0255 = 0.0040 \times a$

this mark may be awarded if m is incorrectly / not converted and / or F is incorrectly calculated

1

$a = 0.0255 / 0.0040$

or

$a = 6.375$

this mark may be awarded if m is incorrectly / not converted and / or F is incorrectly calculated

1

$\Delta v = 6.375 \times 0.15 = 0.95625 \text{ (m/s)}$

*allow a correct calculation using an incorrectly / not converted m and / or an incorrectly calculated F
allow 0.96 **or** 0.956 (m/s)*

1

alternative method

$F = 0.30 \times 1.7 \times 0.050 \text{ (1)}$

$F = 0.0255 \text{ (N) (1)}$

$m = 0.004(0 \text{ kg}) \text{ (1)}$

$0.0255 = \frac{0.0040 \times \Delta v}{0.15} \text{ (1)}$

this mark may be awarded if m is incorrectly / not converted and / or F is incorrectly calculated

$\Delta v = \frac{0.0255 \times 0.15}{0.0040} \text{ (1)}$

this mark may be awarded if m is incorrectly / not converted and / or F is incorrectly calculated

$\Delta v = 0.95625 \text{ (m/s) (1)}$

*allow a correct calculation using an incorrectly / not converted m and / or an incorrectly calculated F
allow 0.96 **or** 0.956 (m/s)*

[13]

7.	<p>(a) (the north pole of the floating magnet is) repelled from the north pole (of the fixed magnet)</p> <p style="padding-left: 40px;">and attracted to the south pole (of the fixed magnet)</p> <p style="padding-left: 80px;"><i>allow following a magnetic field line for 1 mark if no other marks scored</i></p>	<p>1</p> <p>1</p>
	<p>(b) it was attracted (to the fixed magnet)</p> <p style="padding-left: 40px;"><i>allow it sticks / joins to the (fixed) magnet</i></p> <p style="padding-left: 40px;"><i>allow it becomes an induced magnet</i></p> <p style="padding-left: 40px;"><i>allow it becomes magnetised</i></p>	<p>1</p>
	<p>(c) Level 2: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.</p>	<p>3–4</p>
	<p>Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.</p>	<p>1–2</p>
	<p>No relevant content</p>	<p>0</p>
	<p>Indicative content:</p> <ul style="list-style-type: none"> • mark where the compass points on the paper • move the compass to the marked point • repeat until you go back to the magnet • join up the points • add an arrow pointing from the north pole to the south pole • repeat for positions (above and below the bar magnet) 	
	<p>(d) C B A</p> <p style="padding-left: 40px;"><i>allow 1 mark for one letter in the correct box</i></p>	<p>2</p>
	<p>(e) $E_e = 0.5 \times 200 \times 0.040^2$</p>	<p>1</p>
	<p>$E_e = 0.16 \text{ (J)}$</p>	<p>1</p>
		<p>[11]</p>