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EDEXCEL COMBINED SCIENCE PHYSICS: QUESTIONS BY TOPIC

Magnetism and the Motor Effect (12)

Combined Science Physics (Foundation) Topic 12

7 questions · 64 marks · Mark schemes included

Pearson Edexcel Combined Science (9-1) Physics 1SC0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
1. Q2	Paper 2 June 2018	9	4
2. Q3	Paper 2 November 2020	9	7
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QUESTIONS

7 questions · 64 marks · lowest tariff first



9-MARK QUESTIONS

6 questions in this booklet



- 2 (a) Figure 1 shows the magnetic field produced by a current in a long, straight wire.

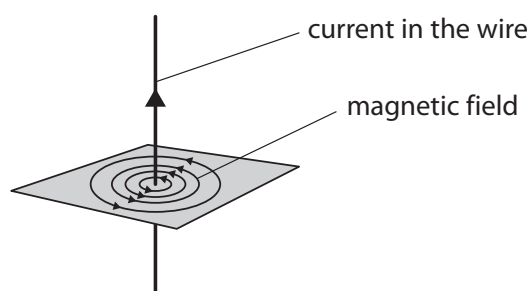


Figure 1

Which row of the table is correct when the strength of the magnetic field is greatest?

(1)

	distance from the wire	current
☐ A	small	small
☐ B	small	large
☐ C	large	small
☐ D	large	large

- (b) Which of these materials would be the most suitable for making a temporary magnet?

(1)

- ☐ A copper
- ☐ B iron
- ☐ C plastic
- ☐ D steel

(c) Figure 2 shows a magnet holding some paper clips.

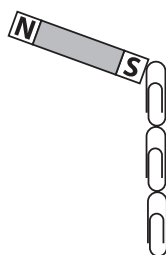


Figure 2

Describe how a student could show that the paper clips are induced magnets.

(2)

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(d) Describe how you could show that the Earth has a magnetic field.

(2)

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(e) A student uses a compass to investigate the magnetic field near a bar magnet.

The student places the compass near the bar magnet as shown in Figure 3.



Figure 3

(i) Mark the north pole of the bar magnet with an 'N' in Figure 3.

(1)

(ii) State two ways in which the investigation could be developed to show the shape of the magnetic field around the bar magnet.

You may add to Figure 3 to help with your answer.

(2)

1

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2

.....

(Total for Question 2 = 9 marks)

- 3 (a) Figure 6 shows a part of a machine used to separate steel cans from aluminium cans.

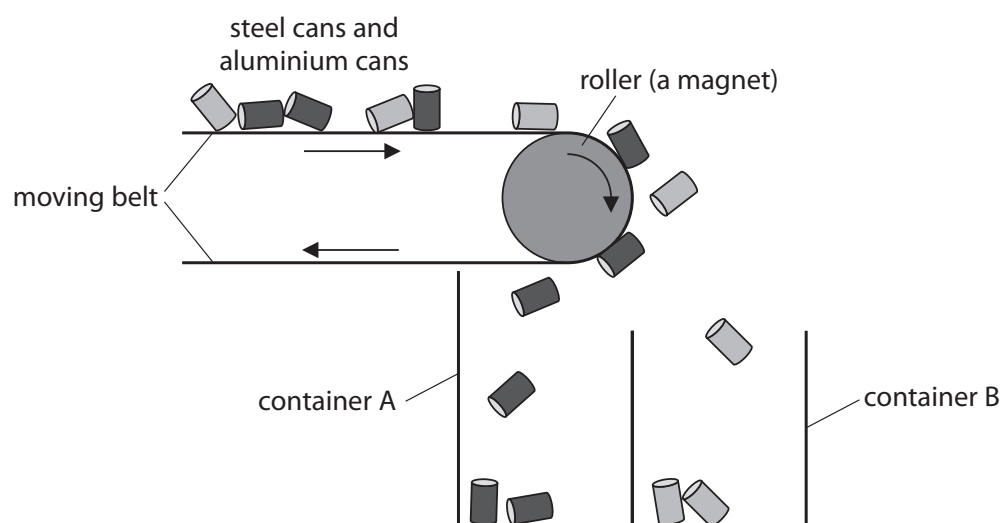


Figure 6

The cans are carried along a moving belt.

The belt goes around a roller.

The roller is a magnet.

Each can falls into one of the containers.

Explain how this machine separates the steel cans from the aluminium cans.

(2)

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(b) A student investigates magnetism using two toys as shown in Figure 7.

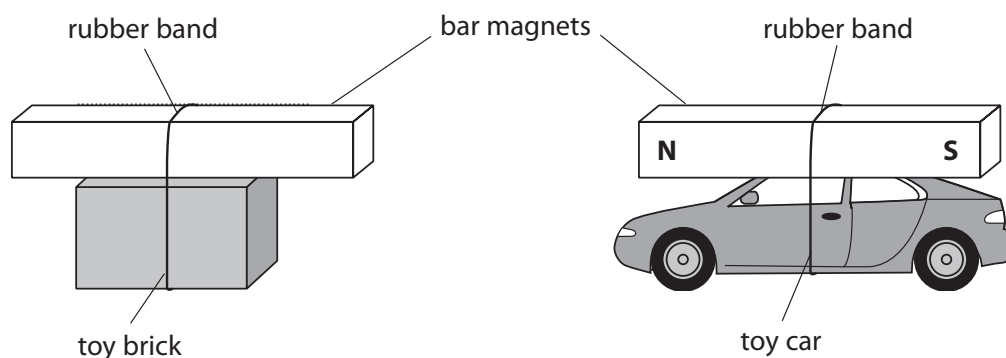


Figure 7

- (i) There is a magnet attached to the top of each toy.

The student moves the toy brick towards the toy car.

The magnet on the toy brick repels the magnet on the toy car.

On Figure 7, label the north pole and the south pole on the magnet attached to the toy brick.

(1)

- (ii) Explain why the toy car starts to move only when the toy brick gets near to the toy car.

(2)

.....

.....

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.....

(iii) The student thinks that two magnets on top of each other will produce a magnetic field that is stronger than the magnetic field from a single magnet.

The student has a metre rule and more magnets available.

Describe how the student could develop this investigation to test this theory.

(4)

(Total for Question 3 = 9 marks)



- 2 (a) A teacher prepares some equipment to demonstrate electromagnetism. Figure 2 shows the equipment.

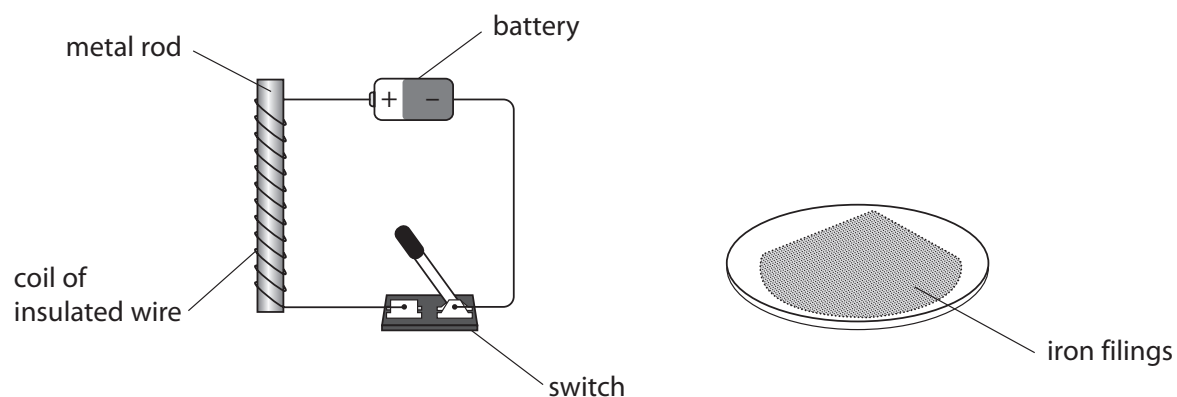


Figure 2

The teacher wants to show that iron filings

- are picked up by the metal rod when the switch is closed
- fall off the metal rod when the switch is opened again.

- (i) Suggest a suitable metal for the rod.

(1)

- (ii) Give **two** reasons for your choice.

(2)

1

.....

2

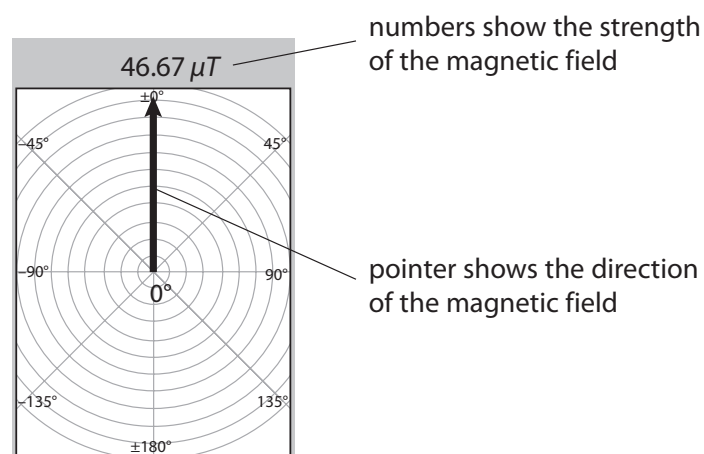
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(b) A student's mobile phone has an app to measure a magnetic field.

The student places the phone on a table and rotates the phone until it is pointing north.

There are no magnets near to the phone.

Figure 3 shows the display on the screen of the phone.



(Source: adapted from MGS Lite app for iPhone)

Figure 3

(i) State why the strength of the magnetic field shown is not zero.

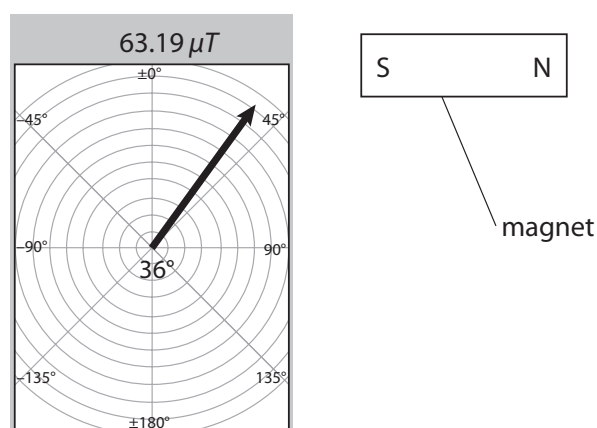
(1)

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.....

The student places a magnet near to the phone on the table.

Figure 4 shows the magnet and the new display on the screen.



(Source: adapted from MGS Lite app for iPhone)

Figure 4

- (ii) State **two** changes in the magnetic field measured by the phone from Figure 3 to Figure 4.

(2)

- 1
- 2

- (iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

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-
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-

(Total for Question 2 = 9 marks)

2 This question is about magnets and magnetism.

(a) Figure 3 shows a magnet that has picked up three paper clips.

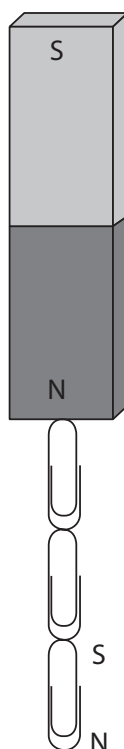


Figure 3

(i) The poles of the lowest paper clip are labelled.

Label the poles of the other two paper clips in Figure 3.

(2)

(ii) Complete the sentence, by choosing a word from the box, to describe the type of magnetism that these paper clips have.

(1)

alternated	earthed	induced	transformed
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These paper clips have magnetism.

(iii) Suggest a material that these paper clips in Figure 3 could be made from.

(1)

.....



- (iv) When the paper clips were pulled off the magnet they fell separately to the table.

Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

- (b) Figure 4 shows the magnetic field around a wire carrying a current.

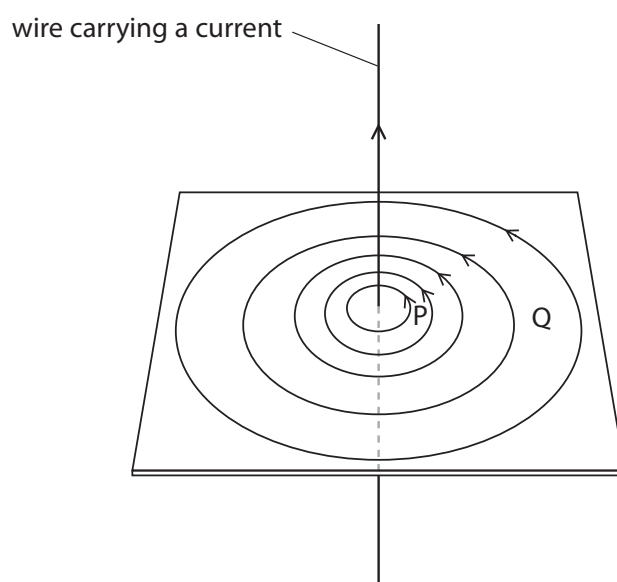


Figure 4

- (i) State how you can tell from Figure 4 that the strength of the field is greater at P than at Q.

(1)

- (ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 5.

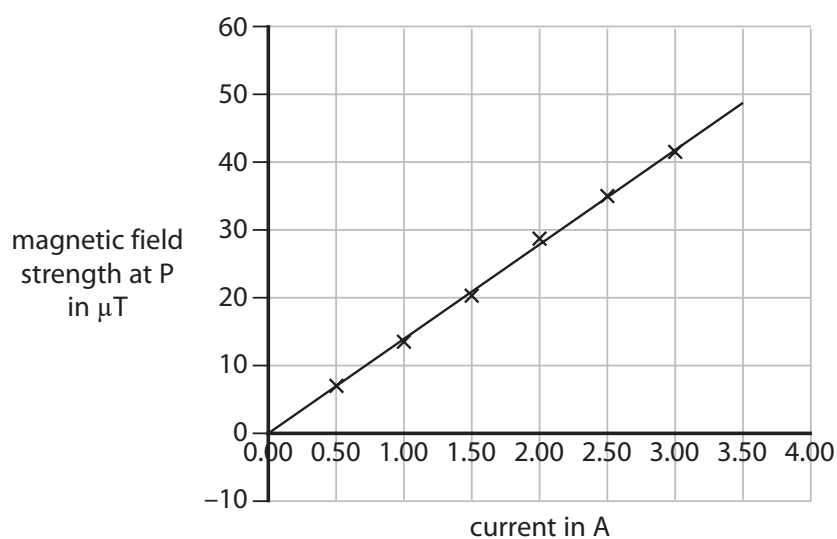


Figure 5

Describe the relationship between magnetic field strength and current.

(2)

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(Total for Question 2 = 9 marks)

- 2 (a) Figure 2 shows the shape of the magnetic field lines around a bar magnet.

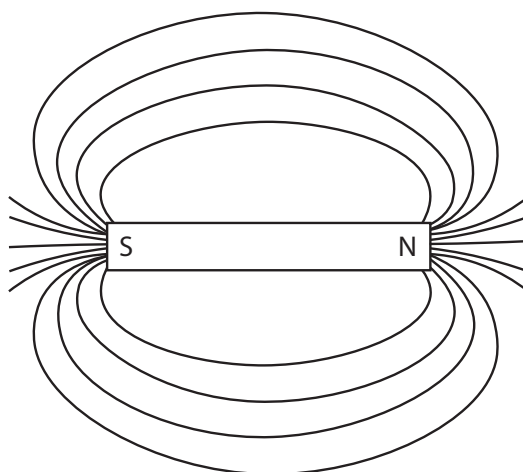


Figure 2

- (i) Draw **one** arrow on a magnetic field line in Figure 2 to show the direction of that magnetic field line. (1)
- (ii) Draw an **X** on Figure 2 to show where the magnetic field is strongest. (1)
- (iii) Give a reason why Figure 2 shows the magnetic field is strongest at point **X**. (1)

.....

.....

- (b) A student places two magnets on a smooth bench.

The student holds the magnets close to each other, as shown in Figure 3.



Figure 3

- (i) Draw some magnetic field lines on Figure 3 to show the shape of the magnetic field **between** the two magnets.

(2)

- (ii) The student is holding the two magnets on the smooth bench.

State what would happen if the student let go of one of the magnets.

(1)

- (c) A student is given two permanent magnets and some paper clips, as shown in Figure 4.

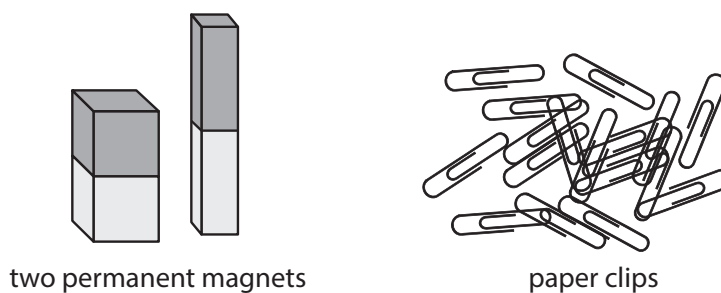


Figure 4

The paper clips are **not** magnets, but they are made from a magnetic material.

- (i) Which of these is a magnetic material?

(1)

- ☐ **A** aluminium
- ☐ **B** iron
- ☐ **C** plastic
- ☐ **D** wood

- (ii) Describe how the student could use the paper clips to find out which of the two permanent magnets is the stronger magnet.

(2)

(Total for Question 2 = 9 marks)



3 (a) Which of these is a magnetic material?

(1)

- ☐ A aluminium
- ☐ B plastic
- ☐ C steel
- ☐ D lead

(b) Figure 5 shows two magnetic poles facing each other.

There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5, to show the uniform part of the magnetic field.
At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)

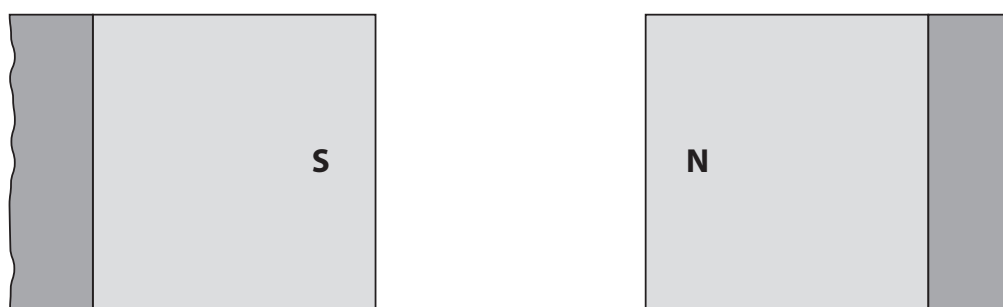


Figure 5

(c) Figure 6 shows the magnetic field around a bar magnet.

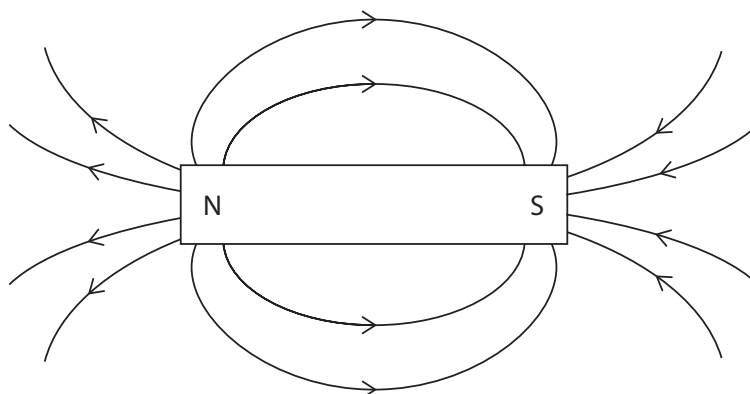


Figure 6

Iron filings are sprinkled onto the magnet.

(i) On Figure 6, draw an X where most of the iron filings will stick.

(1)

(ii) Explain why most of the iron filings will stick to the point you have labelled with an X.

(2)

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.....

(d) One use of a magnet is in a plotting compass.

(i) Explain how a plotting compass can be used to show that the Earth has a magnetic field.

(2)

(ii) State the name of a device that uses a permanent magnet.

(1)

(Total for Question 3 = 9 marks)



10-MARK QUESTIONS

1 question in this booklet



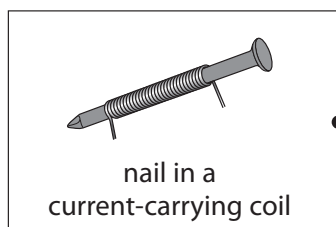
- 2 (a) Figure 3 shows some objects and words describing these objects.

Draw one line from each object to its description.

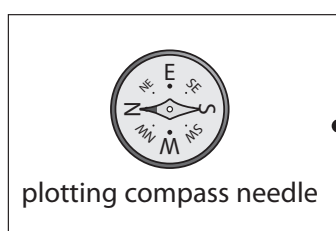
(2)

object

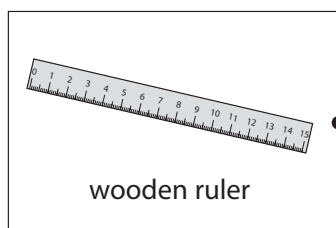
description



• non-magnetic



• permanent
magnet



• temporary
magnet

Figure 3

- (b) Figure 4 shows a wire passing through a piece of card.
The wire carries an electric current.

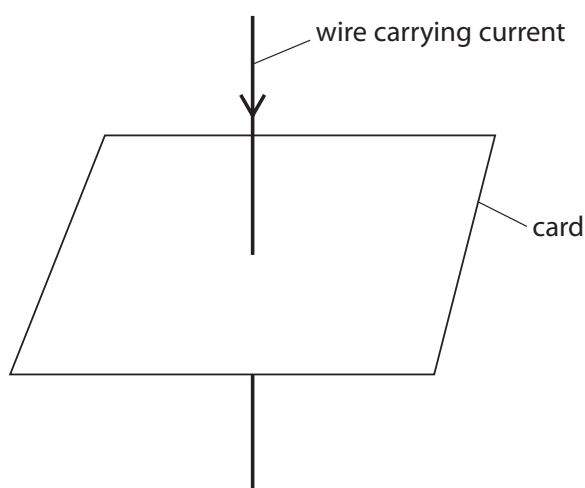


Figure 4

- (i) Draw **one** magnetic field line on Figure 4, to show the shape of the magnetic field produced by the current.
- (ii) Draw **one** arrow on the field line you have drawn to show the direction of the magnetic field.

(1)

(1)

(c) A student measures the strength of the magnetic field at several distances from the wire in Figure 4.
Figure 5 shows most of the student’s results.

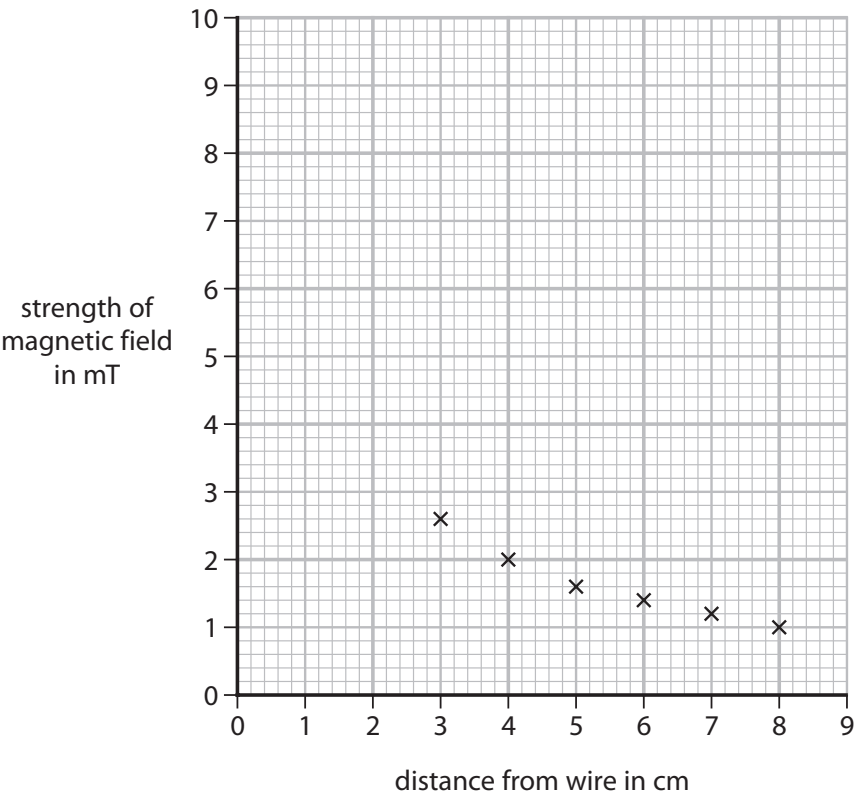


Figure 5

Figure 6 shows two extra sets of results.
mT is a unit of strength of a magnetic field.

distance from wire in cm	strength of magnetic field in mT
1.0	8.1
2.0	3.9

Figure 6

- (i) Plot the two extra points on Figure 5.

(2)
- (ii) Draw a best fit curve on the graph in Figure 5.

(1)

- (iii) Use the graph in Figure 5 to calculate the change in strength of magnetic field when the distance from the wire changes from 4 cm to 8 cm.

(2)

change in strength of magnetic field = ... mT

- (iv) The distance from the wire affects the strength of the magnetic field.

State **one** other factor that affects the strength of the magnetic field.

(1)

(Total for Question 2 = 10 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question Number:	Answer	Mark
2(a)	B small large The only correct answer is B A is not correct because the current is small C is not correct because the distance from the wire is large D is not correct because the distance from the wire is large	(1) AO 1 1

Question Number:	Answer	Mark
2(b)	B iron The only correct answer is B A is not correct as copper is non-magnetic C is not correct as plastic is non-magnetic D is incorrect, as steel is only suitable for a permanent magnet	(1) AO 1 1

Question Number:	Answer	Additional guidance	Mark
2(c)	a description to include: remove the magnet (from the paper clips)(1) paperclips no longer attracted to each other (1)	accept no longer magnetic	(2) AO 3 1a AO 3 1b

Question Number:	Answer	Additional guidance	Mark
2(d)	a description to include: use a compass (1) always points in the same direction / will point north (1)	accept reasonable alternatives such as suspended magnet needles on cork in water	(2) AO 3 2a

Question Number:	Answer	Additional guidance	Mark
2(e)(i)		N must be at the end of the bar, not at the end of the compass needle	(1) AO 3 3a

Question Number:	Answer	Additional guidance	Mark
2(e)(ii)	any two developments from: use a compass in various positions / more compasses (1) plot more points/mark direction of compass(point)/ join the dots (1) sprinkle/add iron filings (1) give more than one (magnetic field) line (1)	marks can be taken from text or diagram allow 'around' 'on', 'near' the magnet etc series of dots / several compasses end to end	(2) AO 3 3a

(Total for Question 2 = 9 marks)

Question number	Answer	Additional guidance	Mark
3a	an explanation linking any two of steel is magnetic (material) (1) aluminium is non-magnetic (material) (1) steel falls into container A / aluminium falls into container B (1)	steel attracted / sticks to / carried round by magnet/roller) is not attracted / does not stick (to magnet roller) steel cans are carried further round than aluminium and fall into A steel hangs on for longer / aluminium falls quicker	(2)

Question number	Answer	Additional guidance	Mark
3 (bi)	S N	allow s or south north	(1)

Question number	Answer	Additional guidance	Mark
3 (bii)	an explanation linking two from (strength of magnetic) field /force (1) (depends on) distance from the magnet (1)	(magnets) attract / repel force / field is weaker when further away (from magnet) or reverse argument lines of force are further apart	(2)

Question number	Answer	Additional guidance	Mark
3 (biii)	a description to include four from move brick towards the car (1) until car (just) starts to move (1) measure distance of brick from car/magnet (1) repeat with 2 magnets (1) compare distances (for one magnet and for two magnets) (1) detail about procedure (1) conclusion or prediction (1)	change distance between car and brick measure how close car gets to the brick how to attach second magnet(s) how to measure distance where to measure take several readings and find average if distance is bigger then it works	(4)

Total marks for Question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
2 (a)(i)	(soft) iron (1)	allow (in this context) nickel (alloys) cobalt steel	(1) AO1

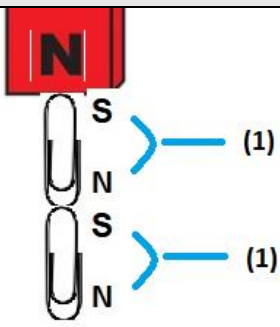
Question number	Answer	Additional guidance	Mark
2 (a)(ii)	would be magnetised (when switch is closed) (1) would be demagnetised when switch is open (1)	(is) magnetic (is) electromagnetic induced magnetism magnetism can be switched off accept for either mark not permanent magnet or temporary magnet	(2) AO1

Question number	Answer	Additional guidance	Mark
2 (b)(i)	the <u>Earth/world/planet</u> has a magnetic field / core(1)	<u>Earth/world/planet</u> has a north (and south) pole	(1) AO3

Question number	Answer	Additional guidance	Mark
2(b)(ii)	direction (of the field) has changed / rotated (1) (strength of the) field has increased (1)	(from 0 to) 36° from N to NE field is stronger (changed by) 16.52 (μT) numbers have increased (from 46.67 to 63.19)	(2) AO3

Question number	Answer	Additional guidance	Mark
2 (b)(iii)	a description including three from use of equipment to measure distance (1) ruler / tape measure obtain a measurement (1) measure / record strength of the field (at a certain point) change the conditions (1) move the phone / magnet (to a different location) process the results (1) e.g. • draw a diagram • make a table • compare results/values • see when (field) stays constant	measure the distance between phone and magnet rotate the phone/magnet	(3) A03

Total 9 marks

Question number	Answer	Additional guidance	Mark
2 (a) (i)		both poles needed for each mark (either side of paper clip, right or left) allow just S at the top of the pair and N at the bottom of the pair for 1 mark ignore the third paper clip after these two (given in question)	(2) AO1

Question number	Answer	Additional guidance	Mark
2 (a) (ii)	induced (1)		(1) AO1

Question number	Answer	Additional guidance	Mark
2 (a) (iii)	iron / steel / nickel / cobalt (1)	ignore 'metal' do not allow any other named metal	(1) AO1

Question number	Answer	Additional guidance	Mark
2(a) (iv)	description including two from use a (plotting) compass (1) (plotting compass) shows a change in direction / needle moves OR bring the paper clips together (1) seeing if they attract / repel (1) OR use of iron filings (around the paperclips) (1) see a pattern (1)	sees repulsion / repelling bring the paper clips near to a magnetic material ignore 'magnet' for this marking point do not accept 'attracts to a magnet' accept for two marks bring a magnet close to a paper clip to test for repulsion	(2) AO1

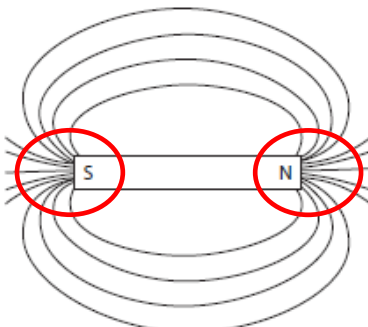
Question number	Answer	Additional guidance	Mark
2 (b) (i)	(magnetic field) {lines / circles / pattern} closer (together at P) (1)	(magnetic field) lines more concentrated (at P) (magnetic field) lines further apart / less concentrated at Q ignore idea that P is closer (to the wire than Q)	(1) AO1

Question number	Answer	Additional guidance	Mark
2 (b) (ii)	a description to include as current increases magnetic field strength increases (1) linear/ increases in even steps / doubling idea / proportional (1)	allow positive correlation 'directly proportional' scores 2 marks	(2) AO3

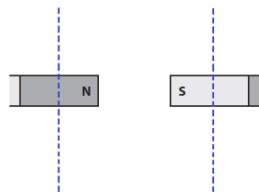
Total for Q2 = 9 marks



Question	Answer	Additional guidance	Mark
2(a)(i)	arrow(s) going from N to S on any field line (1)	any contradictory arrow loses the mark	(1) AO1.1

Question	Answer	Additional guidance	Mark
2(a)(ii)	X drawn close to N or S (1)	 any X drawn outside either ellipse loses the mark - judge by eye	(1) AO1.1

Question	Answer	Additional guidance	Mark
2(a)(iii)	one reason from: where the (field) lines are close(st) (to each other) (1) close to the pole(s) (1)	accept where there are most lines ignore close to the magnet	(1) AO1.1

Question	Answer	Additional guidance	Mark
2(b)(i)	at least 1 straight line between the N and S (1) at least 1 curved line between N and S (1)	 ignore lines that start or end outside the region identified do not accept any contradictory lines within the region ignore any arrows	(2) AO2.2

Question	Answer	Additional guidance	Mark
2(b)(ii)	(it would) move towards the other magnet (1)	idea of attraction/joining together	(1) AO3.3

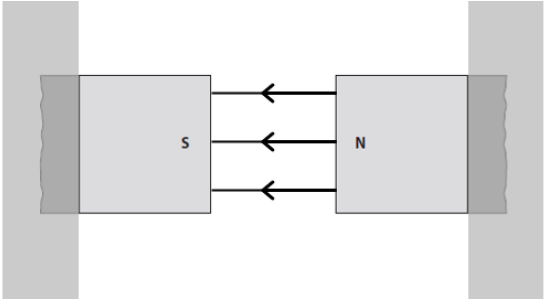
Question	Answer	Mark
2(c)(i)	B iron <i>A, C and D are not magnetic materials</i>	(1) AO1.1

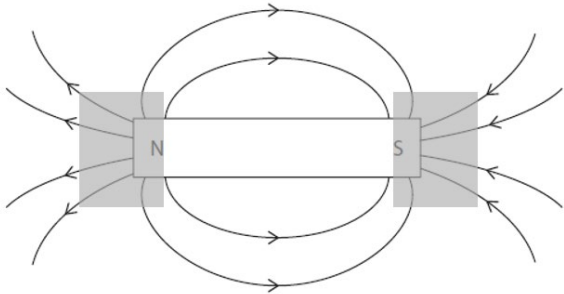
Question	Answer	Additional guidance	Mark
2(c)(ii)	A description to include: method (1) put magnet near paper clips outcome (1) (picks up/attracts) more paper clips OR (has the) longest chain OR (picks up/attracts from a) greater distance	method can be included with the outcome in one sentence for two marks e.g. see which magnet attracts the most paper clips	(2) AO1.2

(Total for question 2 = 9 marks)

Question	Answer	Additional guidance	Mark
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Question Number	Answer	Mark
3(a)	C steel A, B and D are incorrect because they are non-magnetic	(1) AO1.1

Question Number	Answer	Additional guidance	Mark
3(b)	 at least three straight lines between N and S poles (equally spaced) (1) all drawn arrows on lines are from N to S (1)	Ignore drawn lines which start inside the shaded regions judge by eye lines do not have to touch magnets ignore lines drawn above or below magnets / edge effects for this mark	(2) AO2.2

Question Number	Answer	Additional guidance	Mark
3(c) (i)	X drawn in either of the shaded regions (1) 		(1) AO1.1

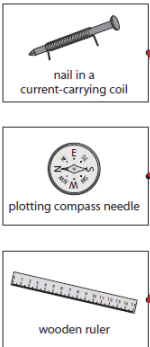
Question Number	Answer	Additional guidance	Mark
3(c) (ii)	the (magnetic) field is strongest (1) (because the field) lines are close(r) together (1)	accept strongest (magnetic) force allow more lines	(2) AO3.2a/2b

Question Number	Answer	Additional guidance	Mark
3(d)(i)	an explanation linking: (the compass needle) always points in the same direction (1) (because) the Earth's magnetic field exerts a force (on the needle) (1)	accept points north / south ignore aligns with Earth's magnetic field do not accept (always) points towards core accept attracted to (magnetic) pole	(2) AO2.2

Question Number	Answer	Additional guidance	Mark
3(d) (ii)	any one from: motor/generator/ loudspeaker/ microphone / (plotting) compass	accept any named device containing a permanent magnet e.g. door closer / fridge magnet / phone / any device with an electric motor / MRI ignore (bar) magnet	(1) A02.1

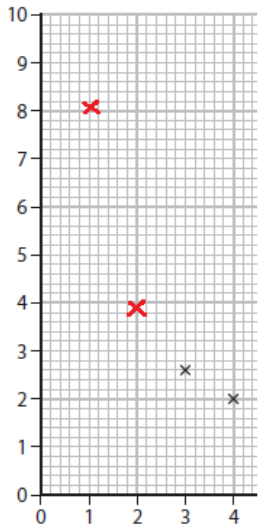
Total for Question 3 = 9 marks



Question number	Answer	Additional guidance	Mark
2a	object  description non-magnetic permanent magnet temporary magnet Diagram showing connections (red lines) between objects and descriptions: - Nail in a current-carrying coil connects to permanent magnet. - Plotting compass needle connects to temporary magnet. - Wooden ruler connects to non-magnetic.	three links correct (2) one link correct (1)	(2) AO1

Question number	Answer	Additional guidance	Mark
2 (b) i	circle shown around wire (1)	allow tolerance for translation of 3D to 2D ignore any multiplicity of those circles	(1) AO1

Question number	Answer	Additional guidance	Mark
2 (b) ii	arrow indicating a clockwise direction (for magnetic field line drawn for i) (1)		(1) AO1

Question number	Answer	Additional guidance	Mark
2(c)i	 One mark for each point plotted correctly, to within ± 1 small square		(2) AO2

Question number	Answer	Additional guidance	Mark
2(c)ii	smooth curve drawn fitting the plotted points (1)	judge by eye	(1) AO2

Question number	Answer	Additional guidance	Mark
2ciii	substitution using an attempt at calculation – any subtraction seen (1) e.g. $2(.0) - 1(.0)$ evaluation (1) (-) $1(.0)$ (mT)	 accept any number that rounds to 1.0 award full marks for correct answer without working	(2) AO3

Question number	Answer	Mark
2 (c) iv	(size of) current	(1) AO1

(Total for Question 2 = 9 marks)

