AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.7.2.2

Fleming's left-hand rule (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**5**
Available paper years	**2019–2023**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 01 · Mark scheme June 2019 | 8464/P/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
04.1			1	AO1 6.7.2.2	A
04.2	reverse the direction of the current reverse the direction of the magnetic field		1 1	AO1 6.7.2.2	E
04.3	B = 0.360 (T) $0.072 = 0.360 \times I \times 0.050$ $I = \frac{0.072}{(0.360 \times 0.050)}$ I = 4.0 (A)	an answer of 4.0 (A) scores **4** marks allow a correct substitution using an incorrectly / not converted value of B allow a correct rearrangement using an incorrectly / not converted value of B allow a correct calculation using an incorrectly / not converted value of B	1 1 1 1	AO2 6.7.2.2	E

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 01 · Mark scheme

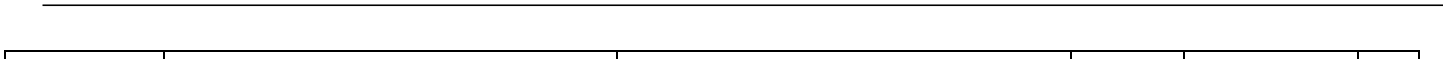
June 2019 | 8464/P/2H | Original Q4

04.4	there is a magnetic field (due to the permanent magnet) **and** current in a wire causes a magnetic field current is in opposite directions in each side of the coil so forces act in opposite directions on either side of the coil (the split ring ensures that) the current in the left / right side of the coil is always in the same direction	 allow (the split ring ensures that) the force in the left / right side of the coil is always in the same direction allow the current reverses each half rotation	1 1 1 1	AO1 6.7.2.3	E
Total			**11**		

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 01 · Mark scheme

June 2019 | 8464/P/2H | Original Q4



6.7.2.2 Fleming's left-hand rule (HT only)

Answer 02 · Mark scheme November 2020 | 8464/P/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	the downward force on the balance increased	allow when there is a current in the wire there is a magnetic field around the wire (which causes a magnetic force)	1	AO3 6.7.2.2 6.5.4.2.3
	therefore the wire must experience an equal and opposite force (which is upwards)		1	
07.2	calculate the difference between the two mass readings	allow 254.8 – 252.3 = 2.5	1	AO1 6.7.2.2
	convert to kg **and** multiply by gravitational field strength	allow (2.5 / 1000) × 9.8 = 0.02375 (N)	1	
07.3	gradient $= \frac{(0.0210 - 0.0)}{(0.70 - 0.02)}$		1	AO3
	gradient = 0.031	allow answer correctly given to any number of significant figures	1	AO3
	0.031 = B × 0.125	allow correct substitution using correctly calculated value given to any number of significant figures	1	AO2
	B = 0.25 T	allow answer correctly given to any number of significant figures	1	AO2
		any rounding must be correct for subsequent marks to be awarded.		6.7.2.2
		max **2** marks if a pair of readings from the graph are used instead of gradient calculation		
Total			**8**	

6.7.2.2 Fleming's left-hand rule (HT only)

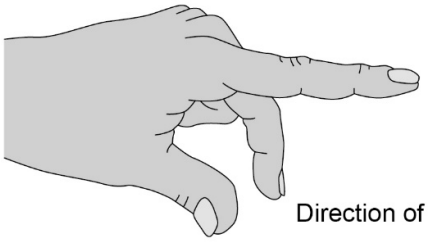
Answer 03 · Mark scheme

November 2021 | 8464/P/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	at the poles		1	AO1 6.7.1.2
04.2	the distance between the field lines varies		1	AO1 6.7.1.2
04.3	electromagnet is easy to demagnetise so easy to remove separated metal	allow electromagnet can be switched off allow electromagnet is (generally) stronger than a permanent magnet for **1** mark if no other marks are awarded	1 1	AO1 6.7.2.1
04.4	cobalt nickel		1 1	AO1 6.7.1.2
04.5	increases the current in the coil of the electromagnet bring the electromagnet closer to the pieces of iron and steel	allow increase potential difference across the coil	1 1	AO1 AO3 6.7.2.1

6.7.2.2 Fleming's left-hand rule (HT only)

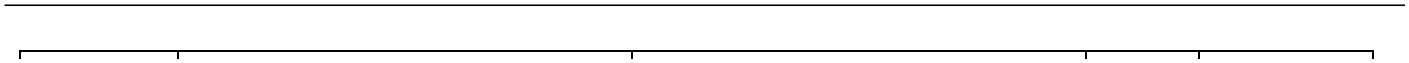
Answer 03 · Mark scheme

04.6	L = 0.120 m 0.36 = B × 4.0 × 0.120 $B = \frac{0.36}{(4.0 \times 0.120)}$ B = 0.75 T	 allow a correct substitution of an incorrectly / not converted value of L allow a correct rearrangement using an incorrectly / not converted value of L allow a correct calculation using an incorrectly / not converted value of L	1 1 1 1 1	AO2 6.7.2.2
04.7	 Direction of magnetic field Direction of current Direction of force allow **1** mark for 1 or 2 correct		2	AO1 6.7.2.2
Total			**15**	

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 03 · Mark scheme

November 2021 | 8464/P/2H | Original Q4



6.7.2.2 Fleming's left-hand rule (HT only)

Answer 04 · Mark scheme

June 2022 | 8464/P/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	there is a magnetic field due to the (permanent) magnets and the current in the wire produces a magnetic field		1 1	6.7.2.1 AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	use (Fleming's) left hand rule	allow place first two fingers and thumb of left hand at right angles to each other	1	6.7.2.2 AO1
	place first finger in direction of the field lines **and** place second finger in direction of current		1	
	then thumb will show direction of the force	allow thumb points downwards allow force is downwards	1	

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 04 · Mark scheme

June 2022 | 8464/P/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	any **one** from: • more turns of the wire on the coil • increase the current in the coil	allow use a cell with a greater potential difference	1	6.7.2.3 AO1
	• stronger magnet	allow move the coil closer to the magnet ignore bigger magnet	1	
	this will increase the force on the coil (due to the motor effect)			

Total Question 4		7

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 05 · Mark scheme

June 2023 | 8464/P/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	inertia		1	AO1 6.5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	→		1	AO2 6.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	increase the current so that the (resultant) force increases	allow use a stronger magnet	1 1	AO1 6.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	bring the (same end of the) iron bar close to each pole / end of the permanent magnet any repulsion shows the iron bar is a permanent magnet **or** if one end of the iron bar is attracted to both poles it is not a permanent magnet	allow bring each end of the iron bar to the same pole of the magnet	1 1	AO3 6.7.1.1

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 05 · Mark scheme

June 2023 | 8464/P/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	the compass (needle always) points in the same direction because it aligns itself with the Earth's magnetic field	allow the compass (needle always) points north dependent on MP1	1 1	AO1 6.7.1.2

Total Question 4	**8**

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 03 · Examiner comments

November 2021 | 8464/P/2H | Original Q4

Question 4 (standard demand and standard/high demand)

04.1 33% of students knew that the field was strongest at the poles.

04.2 12% of students were able to correctly describe how the diagram showed that the field was not the same at all places. Many incorrect answers did not refer to ay feature of Figure 4.

04.3 40% of students gained 1 mark on this question. Most of them identified that the electromagnet could be easily demagnetised. A further 8% went on to say that this meant that the pieces of metal could be easily removed.

Some of the 40% that scored 1 mark scored the mark because they said that electromagnets are (generally) stronger.

04.4 20% of students could name one of the magnetic metals, and 20% of those students could name both the metals. Of those that could only name 1 magnetic metal, there was an approximately even number for each correct answer.

04.5 Approximately 35% of students scored one mark, nearly all of these suggested increasing the current. Only a handful of students also suggested moving the electromagnet closer and scored 2 marks.

04.6 This standard/high demand calculation was reasonably well answered. Nearly 40% scored 3 or 4 marks for a correct calculation, but either did not recall the unit, did not convert the length or did neither. 5% of students scored full marks.

04.7 30% of students scored at least 1 mark for getting at least 1 word correct and in the correct place. 10% were able to write the correct word in the correct place for each finger.

The majority of students that scored 0 marks wrote words that were not related to electromagnetism.

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 04 · Examiner comments June 2022 | 8464/P/2H | Original Q4

Question 4 (Standard and standard/high demand)

04.1 Nearly 50% of students were able to gain at least 1 mark. This was mainly for stating that there is a magnetic field due to the permanent magnets, or describing the field. Only about 10% went on to say that a current in the wire produces a magnetic field.

04.2 Nearly 50% of students were able to gain at least 1 mark on this question. Those that only scored 1 mark correctly stated that Fleming's left hand rule, or just the left hand rule, should be used. Half of students that scored the first mark failed to gain any further credit as they were then unable to describe what the direction of each finger represents.

04.3 Just over 50% of students scored at least 1 mark for giving one change that would increase the speed of rotation. Less than 10% were able to explain that the change would increase the force exerted on the coil. Many students mentioned using a bigger magnet instead of stronger magnet.

Answer 05 · Examiner comments June 2023 | 8464/P/2H | Original Q4

Question 4 (standard demand and standard/high demand)

04.1 Fewer than 20% of students correctly answered inertia.

04.2 Just over 50% of students gave the correct direction for the acceleration.

6.7.2.2 Fleming's left-hand rule (HT only)

Answer 05 · Examiner comments June 2023 | 8464/P/2H | Original Q4

04.3 Approximately 50% of students gained one mark on this question. Most of those that did suggested increasing the current or the strength of the magnet. Very few went on to explain that this would increase the force on the copper rod.

04.4 Approximately 20% scored two marks on this question. Of the 20% that scored 1 mark, most suggested bringing both sides of the magnet close to the iron bar (or vice versa) but then incorrectly stated that any attraction proves it is a magnet.

04.5 Approximately 40% of students gained at least one mark on this question. Even the credit worthy responses mostly contained simple statements like ‘it always points north’. Only a small percentage explained that this was because the magnet aligns itself with the Earth’s magnetic field.