AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.4.2.3

Newton's Third Law

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**2**
Available paper years	**2024–2025**

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.

6.5.4.2.3 Newton's Third Law

Answer 01 · Mark scheme

June 2024 | 8464/P/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	into the page		1	AO2 6.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	$0.092 = B \times 4.6 \times 0.080$ $B = \frac{0.092}{4.6 \times 0.080}$ $B = 0.25$ tesla or T	 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	AO2 6.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	Newton's third law		1	AO1 6.5.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	any **two** from: • move the electromagnet closer to the permanent magnet • add more turns to the coil / electromagnet • increase the current (in the coil / electromagnet)	allow increase the potential difference (across the coil / electromagnet)	2	AO1 6.7.2.1

6.5.4.2.3 Newton's Third Law

Answer 01 · Mark scheme

June 2024 | 8464/P/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	any **two** from • reverse the current in the coil / electromagnet • turn the electromagnet around (to reverse the poles) • wrap the coil (around the iron core) in the opposite direction		2	AO1 AO3 6.7.2.1

Total Question 4	**10**

6.5.4.2.3 Newton's Third Law

Answer 02 · Mark scheme

June 2025 | 8464/P/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	distance travelled = speed × time		1	AO1 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	1 500 000 = v × 670 000 $v = \frac{1\ 500\ 000}{670\ 000}$ V = 2.2… (m/s)		1 1 1	AO2 6.5.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	F = (6 × 370) - 520 F = 1700 (N)	if no other mark awarded allow **1** mark for 370 - 520 = (-)150 (N)	1 1	AO2 6.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	speed	allow velocity	1	AO1 6.5.4.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	friction + air resistance = pull of the rope on the sled		1	AO1 6.5.1.4 6.5.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	the force of the sled on the rope		1	AO1 6.5.4.2.3

Total Question 1	9

6.5.4.2.3 Newton's Third Law

Answer 01 · Examiner comments — June 2024 | 8464/P/2H | Original Q4

Question 4 (standard & standard/high demand)

04.1 A third of students were able to use Fleming's left-hand rule and give the correct direction.

04.2 The majority of students were able to access this calculation, with 80% gaining at least 2 marks and 13% full marks. 25% of students either did not know the unit or missed the conversion, so were limited to gaining 2 of the 3 marks available.

04.3 About two-thirds of students knew that the forces were an example of Newton's Third Law. The most common incorrect answer was Newton's First Law.

04.4 About a third of students gave two correct changes and a third of students one correct change. The most popular correct answer was to increase the current. Students should be encouraged to state that the number of turns *on the coil* should be increased, as 'increasing the number of coils' is ambiguous and would not gain the mark.

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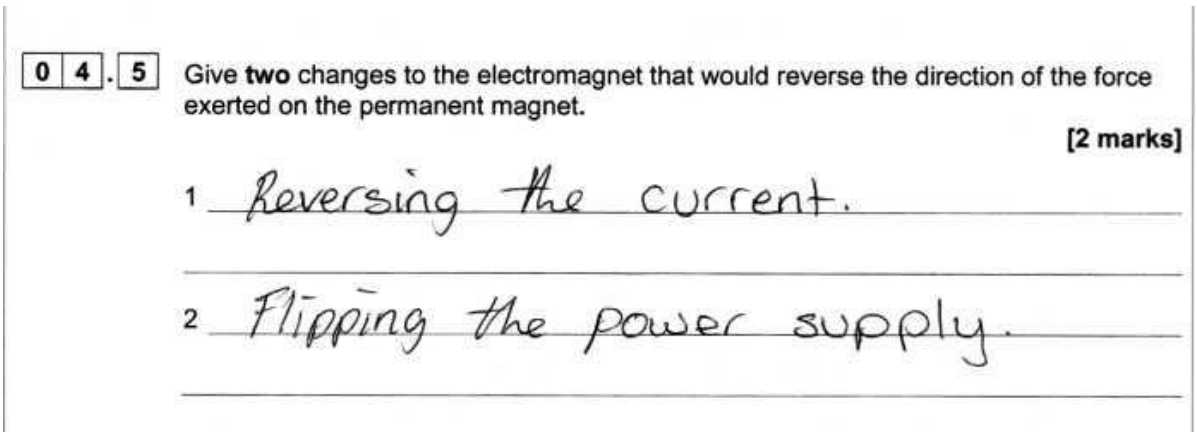
Answer 01 · Examiner comments — June 2024 | 8464/P/2H | Original Q4

04.5 This question was more demanding than question 04.4 with less than 50% of students gaining a mark. 10% of students were able to give two changes that would reverse the direction of the force.



0 4 . 5 Give **two** changes to the electromagnet that would reverse the direction of the force exerted on the permanent magnet.

[2 marks]

1 Reversing the current.

2 Flipping the power supply.

This example shows the most popular correct response, which was to reverse the direction of the current. The second answer would have gained the mark on its own because it will result in the current's direction reversing. However, both answers are the same marking point so only 1 mark is awarded.

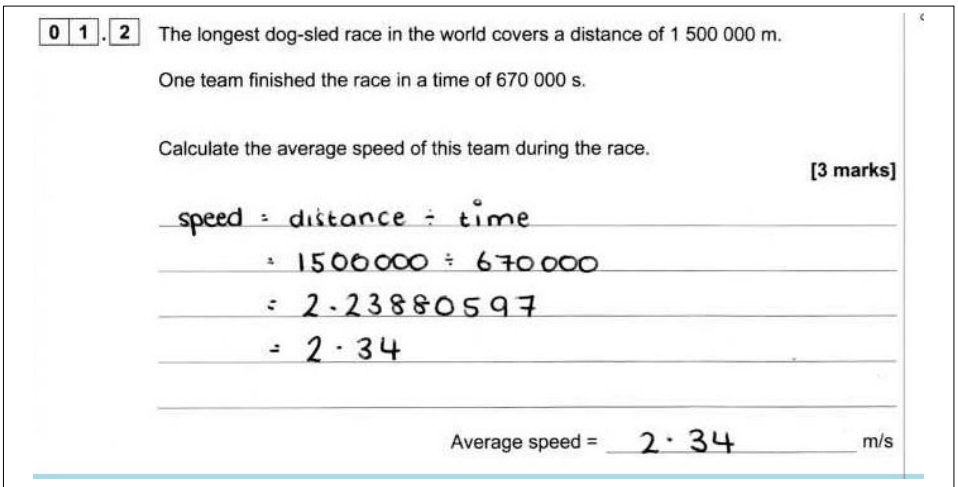
6.5.4.2.3 Newton's Third Law

Answer 02 · Examiner comments June 2025 | 8464/P/2H | Original Q1

Question 1 (Standard demand)

01.1 Almost all students selected the correct equation.

01.2 Almost all students were able to calculate the answer using the relevant equation. Of those who did not, it was surprisingly common to see answers where the student had attempted to round their answer to two significant figures and decided that 2.23 should be rounded to 2.3. This led to an incorrect final answer.



0 1 . 2 The longest dog-sled race in the world covers a distance of 1 500 000 m.

One team finished the race in a time of 670 000 s.

Calculate the average speed of this team during the race.

[3 marks]

speed = distance ÷ time
= 1500000 ÷ 670000
= 2.23880597
= 2.34

Average speed = 2.34 m/s

This student's response shows incorrect rounding after calculating their answer. A small but significant proportion of students made errors such as this.

If this student had left their answer as 2.23880597 they would have scored all three marks, but the incorrect rounding meant that their final answer was incorrect and so only two marks were awarded.

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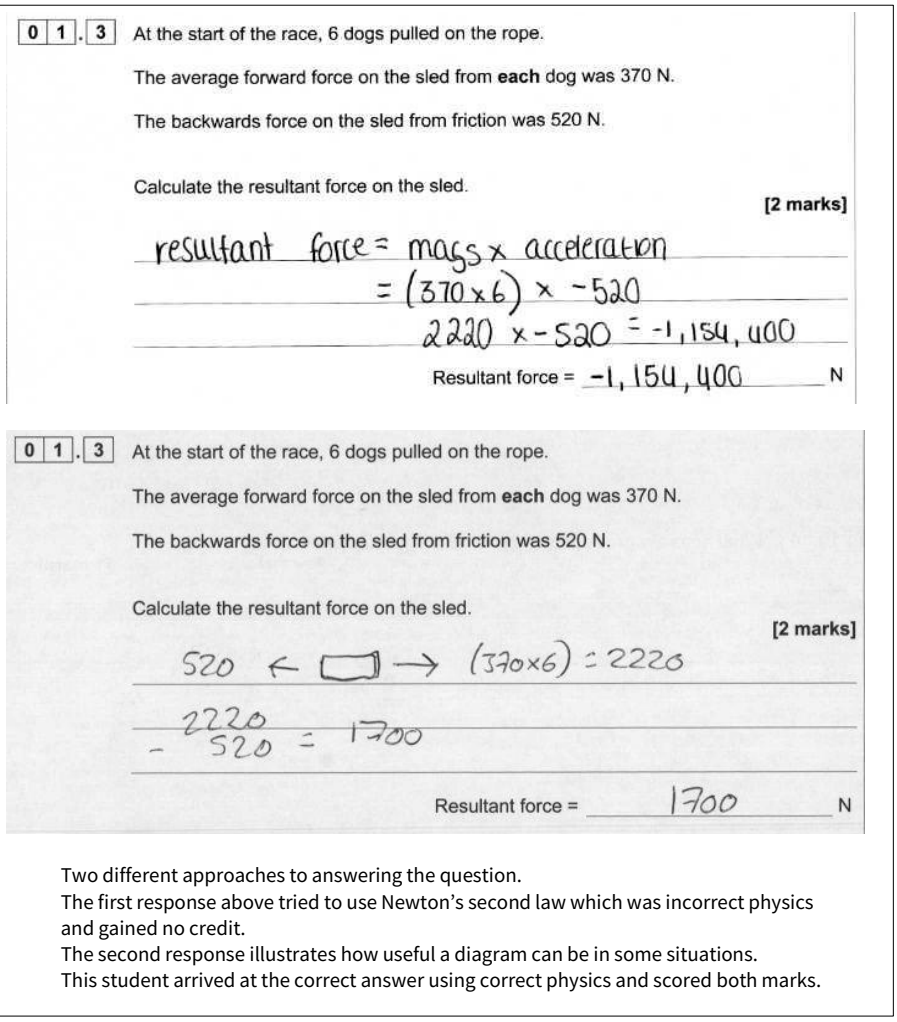
6.5.4.2.3 Newton's Third Law

Answer 02 · Examiner comments June 2025 | 8464/P/2H | Original Q1

01.3 Slightly more than 60% of students answered this question correctly, with another fifth scoring 1 mark. The instruction to 'Calculate the resultant force…' had many students attempting to use $F = ma$ which was not possible given the information provided. Some students drew sketch diagrams to help them answer, which tended to lead them along the right lines.



0 1 . 3 At the start of the race, 6 dogs pulled on the rope.

The average forward force on the sled from **each** dog was 370 N.

The backwards force on the sled from friction was 520 N.

Calculate the resultant force on the sled.

[2 marks]

resultant force = mass x acceleration
= (370 x 6) x -520
2220 x -520 = -1,154,400

Resultant force = -1,154,400 N

0 1 . 3 At the start of the race, 6 dogs pulled on the rope.

The average forward force on the sled from **each** dog was 370 N.

The backwards force on the sled from friction was 520 N.

Calculate the resultant force on the sled.

[2 marks]

520 ← □ → (370×6) = 2220

2220
- 520 = 1700

Resultant force = 1700 N

Two different approaches to answering the question.
The first response above tried to use Newton's second law which was incorrect physics and gained no credit.
The second response illustrates how useful a diagram can be in some situations.
This student arrived at the correct answer using correct physics and scored both marks.

01.4 Fewer than half the students were able to recall that the gradient of a distance-time graph represents speed. Many responses gave descriptions of the distance increasing with time, or the steepness of the line. A description of the trend shown in the graph is not the same as what the gradient represents, so these answers did not gain any credit. Other common incorrect answers included suggestions that the gradient shows the average speed of the sled.

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6.5.4.2.3 Newton's Third Law

Answer 02 · Examiner comments

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01.5 Just under three quarters recalled that at a constant speed the resultant force is zero and therefore selected the correct option.

01.6 Only about four in ten students were able to identify the Newton's third law pair to the force of the rope on the sled.

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