AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.4.1.4

The distance–time relationship

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**2**
Available paper years	**2018–2025**

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.

6.5.4.1.4 The distance–time relationship

Answer 01 · Mark scheme June 2018 | 8464/P/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	either: 7.5 (m) **and** 12.3 (m) from the graph **or** 15 (m/s) × 0.32 (s) using speed extra distance = 4.8 (m)	an answer between 4.7 (m) and 4.9 (m) scores **2** marks allow 7.5 (m) and between 12.2 (m) and 12.4 (m)	1 1	AO2 6.5.4.3
06.2	there is a decrease in kinetic energy of the car so this (causes) the internal / thermal energy store of the brakes to increase	allow work is done by friction (on the brakes)	1 1	AO1 6.1.1.1 6.5.4.3.4
06.3	$19^2 - u^2 = 2 \times 2 \times 84$ $u^2 = 19^2 - (2 \times 2 \times 84)$ u = 5 (m/s)	an answer of 5 (m/s) scores **3** marks $u = \sqrt{19^2 - (2 \times 2 \times 84)}$	1 1 1	AO2 6.5.4.1.5

6.5.4.1.4 The distance–time relationship

Answer 01 · Mark scheme

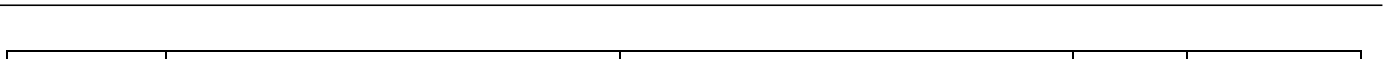
June 2018 | 8464/P/2H | Original Q6

Question	Answers	Mark	AO / Spec. Ref.
06.4	**Level 3:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	5–6	AO3
	Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.	3-4	AO1 AO3
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	AO1
	No relevant content	0	
	Indicative content • use of drugs, alcohol, tiredness and distractions would increase the thinking distance • thinking distance increases with speed • thinking distance is directly proportional to speed • use of drugs, alcohol, tiredness and distractions would increase the gradient of thinking distance • poor brakes, poor tyres, wet / icy roads and mass would increase the braking distance • braking distance increases with speed • braking distance increases at an increasing (accept greater) rate (with speed) • poor brakes, poor tyres, wet/icy roads and mass would increase the gradient of braking distance • braking distance is directly proportional to speed squared • stopping distance = thinking distance + braking distance • factors that increase thinking and / or braking distance would increase the gradient of stopping distance • stopping distance increases at an increasing (accept greater) rate (with speed)		6.5.4.3.1
Total			**13**

6.5.4.1.4 The distance–time relationship

Answer 01 · Mark scheme

June 2018 | 8464/P/2H | Original Q6



6.5.4.1.4 The distance–time relationship

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

6.5.4.1.4 The distance–time relationship

Answer 01 · Examiner comments June 2018 | 8464/P/2H | Original Q6

Question 6 (standard / high & high demand)

06.1 About 30% gained both marks, with fewer than 1% gaining just one mark. There was widespread misreading of the graph, in some cases misreading the scale but in a very large proportion there was little attempt to read between the grid lines.

Those who were successful adopted one of three routes: reading the distance off the graph between the given times; finding the time interval from the data given and reading that off the graph from the origin; using the data from the graph along with distance = speed x time to find the extra distance.

06.2 This was not answered well, with many students simply talking about heat energy, and many of those who referred to kinetic energy talking about kinetic energy in the brakes.

Many students overcomplicated their responses to this question. Over three quarters of students gained no marks.

06.3 This calculation was fairly well done with just over 42% gaining full marks. There were not many able to score compensation marks and so 40% scored zero.

The major problem was the inability to rearrange the equation, and substitution marks were rare as students were trying to substitute into an incorrect equation. A significant minority divided rather than subtracted when moving v^2 from one side of the equation to the other.

06.4 Many students did not grasp that a specific requirement of the question was to include factors that would affect the gradient and only a minority talked about the gradient being altered by factors rather than simply describing the graphs presented.

Lower attaining students described the graphs, often saying that “everyone has stopped by 112 km/h” as this was seen as an end point. Many mentioned factors that would affect each of the distances but the factors were not always attributed to the correct distance. A significant number of students cited factors that affected the stopping distance in their own right.

Fewer than 6% of responses achieved level three.

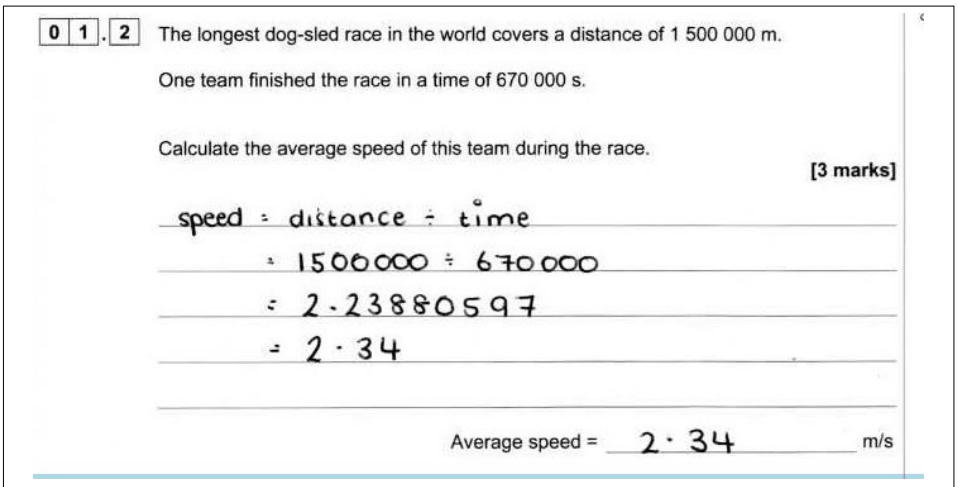
6.5.4.1.4 The distance–time relationship

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.

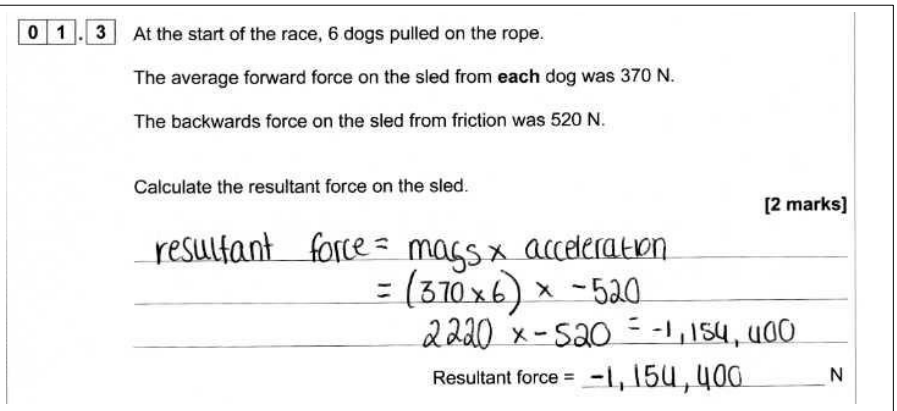
If this student had left their answer as 2.23880597 they would have scored all three marks, but the incorrect rounding meant that their final answer was incorrect and so only two marks were awarded.

© 2024 AQA and its licensors. All rights reserved.

6.5.4.1.4 The distance–time relationship

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.

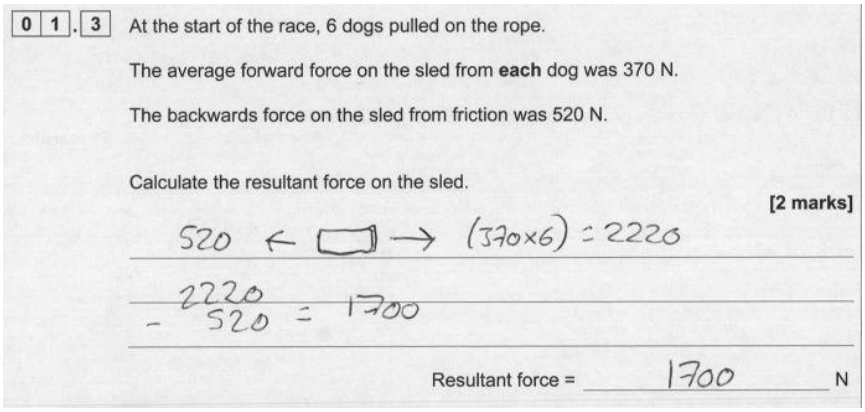
The backwards force on the sled from friction was 520 N.

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 ← □ → (370x6) = 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.

© 2024 AQA and its licensors. All rights reserved.

6.5.4.1.4 The distance–time relationship

Answer 02 · Examiner comments

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

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.

© 2024 AQA and its licensors. All rights reserved.