AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.1

Scalar and vector quantities

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**5**
Available paper years	**2018–2023**

Using this booklet

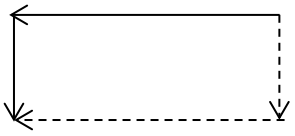
1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

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.

6.5.1.1 Scalar and vector quantities

Answer 01 · Mark scheme June 2018 | 8464/P/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	constant velocity	allow constant speed ignore references to stationary	1	AO1 6.5.4.2.1
07.2		allow drag for force B		AO1 6.5.4.2.1
	the man will accelerate		1	
	so force B increases		1	
	until force B equals force A	allow until resultant force is 0 (N)	1	
	the man moves at a higher constant velocity		1	
07.3	horizontal arrow pointing left (3000 N) and vertical arrow pointing down (1000 N) drawn to the same scale		1	AO2 6.5.1.4
	resultant force with a value in the range 3100 N–3200 N	allow and answer of 3000 N if a scale diagram has been drawn using the cm squares	1	
	direction in the range 251º–253º (clockwise from north)	allow 17º–19º (to the horizontal)	1	
07.4	the magnitude will increase	allow size	1	AO1 6.5.1.4
	direction will change towards the south	allow answers consistent with their response to question **07.3**	1	
Total			**10**	

6.5.1.1 Scalar and vector quantities

Answer 02 · Mark scheme June 2019 | 8464/P/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
03.1	distance speed		1 1	AO1 6.5.4.1.3	A
03.2	(both have magnitude) only a vector has direction	allow scalar does not have a direction	1	AO1 6.5.1.1	E
03.3	any **two** from: • mass • velocity • friction • power of the motor	allow weight allow speed or direction allow air resistance or drag	2	AO1 6.5.5.2	E

6.5.1.1 Scalar and vector quantities

Answer 02 · Mark scheme

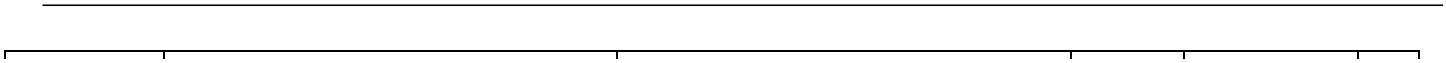
June 2019 | 8464/P/2H | Original Q3

03.4	total momentum is zero after the collision (because the bumper cars are stationary) because the momentum of each car before the collision was equal (in magnitude) and opposite (in direction) so the total momentum of the bumper cars was zero before the collision and momentum is conserved **OR** total momentum is zero after the collision (because the bumper cars are stationary) (1) because the momentum of each car before the collision was equal (in magnitude) and opposite (in direction) (1) both cars exert an equal and opposite force on each other (for equal periods of time) (1) so the cars accelerate (in opposite directions) (1)		1 1 1 1	AO3 5.5.5.2	E
Total			**9**		

6.5.1.1 Scalar and vector quantities

Answer 02 · Mark scheme

June 2019 | 8464/P/2H | Original Q3



6.5.1.1 Scalar and vector quantities

Answer 03 · Mark scheme

November 2020 | 8464/P/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(vector quantity) has magnitude and a direction (scalar quantity) has magnitude only		1 1	AO1 6.5.4.1.3
04.2	resistive force acts on the ball so (resultant) force in opposite direction to velocity **or** so work is done on the ball	allow friction or air resistance	1 1	AO2 6.5.4.2.1
04.3	momentum = mass × velocity or p = mv		1	AO2 6.5.5.1
04.4	26 = m × 5.0 $m = \frac{26}{5.0}$ 5.2 (kg)		1 1 1	AO2 6.5.5.1
04.5	momentum is conserved in the collision (assuming no external forces) momentum of the pin increases therefore the momentum of the ball must decrease.	if no other mark is awarded, allow **1** mark for when the ball exerts a force on the pin, the pin	1 1 1	AO1 6.5.5.2

6.5.1.1 Scalar and vector quantities

Answer 03 · Mark scheme

November 2020 | 8464/P/2H | Original Q4

		exerts an equal and opposite force on the ball		
Total			**11**	

6.5.1.1 Scalar and vector quantities

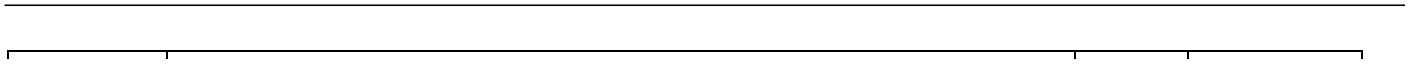
Answer 04 · Mark scheme November 2021 | 8464/P/2H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a quantity with both magnitude and direction		1	AO1 6.5.1.1
02.2	displacement		1	AO1 6.5.4.1.1
02.3	gradient = $\frac{(4 - 0)}{(1.6 - 0)}$ acceleration = 2.5 m/s^2	 allow use of a = Δv / t	1 1	AO2 6.5.4.1.5
02.4	constant deceleration	allow large deceleration allow decelerates to a stop	1	AO2 6.5.4.1.5
02.5	resultant force = mass × acceleration **or** F = ma	allow force = mass × acceleration	1	AO1 6.5.4.2.2
02.6	1800 = m × 25 m = $\frac{1800}{25}$ m = 72 (kg)		1 1 1	AO2 6.5.4.2.2
02.7	performance can be monitored during the game	allow do not have to wait until the end of the game to download data	1	AO3 6.6.2.4
Total			**10**	

6.5.1.1 Scalar and vector quantities

Answer 04 · Mark scheme

November 2021 | 8464/P/2H | Original Q2



6.5.1.1 Scalar and vector quantities

Answer 05 · Mark scheme

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$v^2 - 3.1^2 = 2 \times 9.8 \times 6.3$		1	AO2 6.5.4.1.5
	$v = \sqrt{(3.1^2 + (2 \times 9.8 \times 6.3))}$	allow $v^2 = 3.1^2 + (2 \times 9.8 \times 6.3)$	1	
	$v = 11.5\ldots$		1	
	$v = 12$ (m/s)	this mark can only be awarded if the correct equation is used and a value of v is calculated	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(magnitude) increases (uniformly)		1	AO2
	direction remains constant		1	AO3 6.5.1.1 6.5.4.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3		allow resistive / frictional force for drag throughout		AO3 6.5.4.1.5
	drag is greater than weight	allow upward force is greater than downward force	1	
	(so) there is a resultant force acting in the opposite direction to the velocity (causing deceleration)		1	
	as velocity decreases the drag decreases		1	
	(until) drag is equal to weight (so velocity is constant)	allow until the resultant force is zero ignore upthrust	1	

Total Question 6	10

6.5.1.1 Scalar and vector quantities

Answer 01 · Examiner comments

June 2018 | 8464/P/2H | Original Q7

Question 7 (standard / high & high demand)

07.1 Only 27% gained this mark, with many referring to the swimmer being pulled down by gravity and/or sinking. A large number referred to the swimmer being stationary, although this was permissible providing a constant speed was also given as an option.

07.2 Over 75% were able to score on this question although very few gained more than two marks as they did not give sufficient detail.

Answers scoring three of the four marks often did not say that the final constant speed was higher than the initial speed.

07.3 This appeared to be an accessible question for those who had drawn vector diagrams, with one mark being allocated for the very basic scale diagram. However, nearly 10% did not attempt this question.

There were a number of responses where students had used calculation rather than a diagram to determine the resultant and this was given some credit. Many incorrect responses simply stated the difference in the two forces, suggesting that students were familiar with forces acting in a straight line.

07.4 Over 50% scored on this question, usually noting that the force increased, although the error in question **07.3** reappeared as some students used the same method, incorrectly stating that the resultant force was smaller as the difference between the two components was now smaller.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

6.5.1.1 Scalar and vector quantities

Answer 04 · Examiner comments November 2021 | 8464/P/2H | Original Q2

Question 2 (standard demand)

02.1 85% of students knew that a vector was a quantity with both magnitude and direction.

02.2 50% of students knew that displacement was the vector.

02.3 Approximately 40% of students were able to determine the acceleration from the graph.

02.4 Just over 35% of students were able to describe the motion of the player. Of those that were unable to and scored no marks, most wrote answers such as 'the motion decreased'.

02.5 Just under 80% of students correctly recalled the equation.

02.6 This standard demand calculation was very well answered. Over 85% were able to substitute into the correctly rearranged equation, and the vast majority of those went on to correctly evaluate the answer and score full marks.

02.7 Nearly 25% of students wrote a reasonable suggestion that the data could be analysed during the game. Many of the incorrect answers suggested that the data could be analysed after the game.

Answer 05 · Examiner comments June 2023 | 8464/P/2H | Original Q6

Question 6 (high demand)

06.1 45% of students did the calculation correctly and 35% gave the answer correctly to two significant figures. Of the 45% that scored either no marks or one mark, a significant number rearranged the equation incorrectly and subtracted u^2 from $2as$.

06.2 Despite being clued into the fact that velocity is a vector, very few students referred to the direction of the stone. 55% of students scored one mark for referring to the magnitude, with most making simple statements like the velocity increases. Only 3% of students scored 2 marks for adding that the direction does not change.

06.3 This was an extremely challenging question. 85% of students scored zero marks, and of those that did score the vast majority scored one mark. The question asked students to explain why the stone slows to a constant velocity, but most students just explained why it travelled at a constant velocity. Most students that did score a mark stated that the resultant force on the stone was zero when the velocity was constant.