AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.1.1

Scalar and vector quantities

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**3**
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.

4.5.1.1 Scalar and vector quantities

Answer 01 · Mark scheme June 2018 | 8463/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	arrow of equal size pointing vertically upwards	judged by eye ignore horizontal arrows if equal and opposite horizontal arrows of unequal length negates this mark	1	AO2 4.5.1.4
	labelled 'upthrust'	ignore buoyancy ignore 25 kN	1	AO1 4.5.5.1.2
06.2		an answer of 2600 scores **4** marks		
	weight = 25 kN	allow 24 to 25 kN inclusive	1	AO3
	25 000 = mass x 9.8 **or** $m = \frac{25\,000}{9.8}$	allow their W correctly converted and substituted	1	AO2
	m = 2551 kg	allow correctly calculated value using their converted W allow a value correctly calculated with W in kN	1	AO2
	m = 2600 kg	allow a calculated answer correctly rounded to 2 significant figures	1	AO2 4.5.1.1 4.5.1.3
06.3	Newton's 3rd law (of motion)		1	AO1 4.5.6.2.3

4.5.1.1 Scalar and vector quantities

Answer 01 · Mark scheme

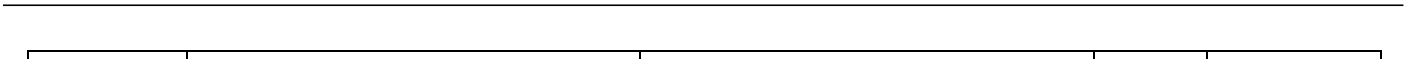
June 2018 | 8463/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	vertical force (50 N) drawn **and** horizontal force (150 N) drawn to the same scale		1	AO2 4.5.1.4
	resultant tension force in the correct direction	shown by an arrowhead	1	
	value of the tension force in the range 156 N–160 N	allow a calculated value of 158	1	
	value of direction in the range 18°–20° (from the horizontal)	allow 70° to 72° (from the vertical) allow a bearing in the range 288 to 290	1	
Total			**11**	

4.5.1.1 Scalar and vector quantities

Answer 01 · Mark scheme

June 2018 | 8463/2H | Original Q6



4.5.1.1 Scalar and vector quantities

Answer 02 · Mark scheme

November 2021 | 8463/2H | Original Q7

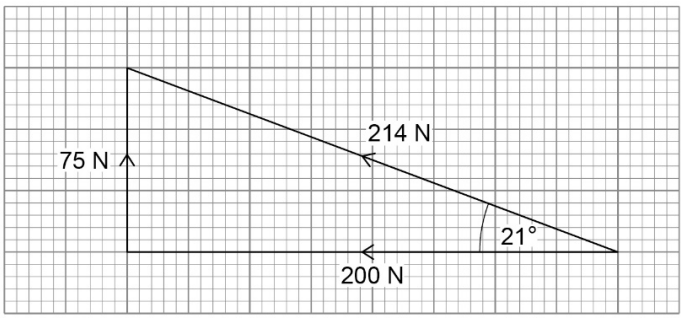
Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	friction		1	AO1 4.5.1.2
07.2	(area of rectangle =) 108 (m) (area of triangle =) 54 (m) (total area / distance =) 162 (m)	 allow a correctly calculated total area / distance from an incorrectly calculated area of rectangle and / or triangle	1 1 1	AO2 4.5.6.1.5
07.3	(the force on the pedal) causes a moment about the pedal axle which causes a force on the chain (which causes a moment about the rear axle)	 allow gear B for chain	1 1	AO1 4.5.4
07.4	$2.4^2 (- 0^2) = 2 \times a \times 18$ $a = \frac{2.4 \times 2.4}{36}$ $a = 0.16$ (m/s^2) alternative method t = 18 / 1.2 t = 15 (s) (1) a = 2.4 / 15 (1) a = 0.16 (m/s^2) (1)	 this mark may be awarded if the time is incorrectly calculated allow a correctly calculated acceleration from an incorrectly calculated time	1 1 1	AO2 4.5.6.1.5

4.5.1.1 Scalar and vector quantities

Answer 02 · Mark scheme

November 2021 | 8463/2H | Original Q7

07.5	horizontal (200N) **and** vertical (75N) forces drawn to the same scale		1	AO2 4.5.1.4
	resultant force drawn in the correct direction	shown by an arrow head from bottom right to top left	1	
	resultant force with a value in the range 212 to 218 (N)	allow a calculated value of 213.6 **or** 214 (N)	1	
	direction in the range 20–22 (degrees from the horizontal)	allow 68–70 (degrees from the vertical) allow a bearing in the range 290–292 to gain full marks a vector diagram must have been drawn	1	
				
Total			**13**	

4.5.1.1 Scalar and vector quantities

Answer 03 · Mark scheme

June 2025 | 8463/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	single arrow starting from dot, pointing vertically upwards and shorter than weight arrow		1	AO2
	labelled air resistance	allow drag	1	AO1
				4.5.1.4 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	2.5 minutes = 150 s	all subsequent marks may be awarded if time is incorrectly / not converted	1	AO2 4.5.6.1.5
	$0.64 = \frac{v-0}{150}$		1	
	$v = 0.64 \times 150$		1	
	$v = 96$ (m/s)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(as the skydiver's velocity / speed increased) the air resistance increased	allow drag for air resistance throughout	1	AO1 4.5.6.1.5
	until the air resistance was equal to the weight of the sky diver (and in the opposite direction)		1	
	(so) the resultant force was zero		1	
	(so) the acceleration was zero (so the velocity was constant)		1	

4.5.1.1 Scalar and vector quantities

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	greater weight of air above the skydiver as distance fallen increases and pressure = *F/A* (so pressure increases) **OR** the density of the air surrounding the skydiver increases as the skydiver falls (1) more frequent collisions of air particles with skydiver (so pressure increases) (1)	allow the mass / number of air molecules above the skydiver increases	1 1	AO1 4.5.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	triangle / parallelogram drawn with vertical line longer than horizontal line resultant force arrow in correct direction magnitude of resultant force in range 300 N to 320 N angle to vertical of resultant force in range 38 °– 42 °		1 1 1 1	AO2 AO2 AO3 AO3 4.5.1.4

Total Question 5	16

4.5.1.1 Scalar and vector quantities

Answer 01 · Examiner comments — June 2018 | 8463/2H | Original Q6

Question 6 (Standard/**high** demand)

06.1 Most students knew there should be two arrows in opposite directions and there was evidence of attempts by most to use a ruler and to make the arrows the same length. Most put arrow heads on their lines. A small number of students did not know that the arrows should start from the same point and drew them on a diagram of the boat. Most students added a label but only 50% of the students used 'upthrust'. Incorrect labels included gravity, water resistance, buoyancy, air resistance, drag and upward pressure.

06.2 Many students used the values 24, 24.5 or 25 kN and so knew how to use the scale correctly. A common incorrect value was 5 kN. A wide variety of marks were given for values not in the range but correctly used. In general the conversion to newtons was done correctly, but a significant number of students did not do the conversion. A number of students were unable to re-arrange W = mg correctly.

06.3 Just over 64% of the students identified the correct law.

06.4 9% of the students scored all four marks. Most drew two lines to scale, usually with the 150N horizontal, but sometimes vertical. Many lines did not have arrows to indicate the direction of the forces and it was rare for the resultant force to have an arrow drawn. Values for the tension force were often obtained by calculation rather than scale drawing. Few students measured the direction of the force from the diagram and gave vague compass directions with no numerical angle.

Answer 02 · Examiner comments — November 2021 | 8463/2H | Original Q7

Question 7

In part **07.1**, few students could name a force. Most of the students gave answers such as 'energy', momentum' and 'speed'. Once again reading a correct value from a graph proved difficult and prevented many of the students from scoring full marks. Despite part **07.3** using both the word 'force' and the word 'moment' few of the answers used either word and so scored no marks. Clear working out in part **07.4** allowed some students to gain some credit even when the final answer was wrong. An approach that was often seen was to first calculate time and then acceleration. However, those doing this tended to use the final velocity, instead of the average velocity. The final part produced few totally correct answers. Common errors included: showing the wrong direction, or not indicating the direction, of the resultant force; inaccurate scale drawing; no indication of what angle was being given; and giving a calculated answer with no vector diagram attempted.

4.5.1.1 Scalar and vector quantities

Answer 03 · Examiner comments — June 2025 | 8463/2H | Original Q5

5.1

Students answered this free-body diagram question well with just over 60 % gaining both marks. Some students failed to realise that the air resistance should be represented by a smaller arrow than the one given in the diagram. Some students had drawn the dot again with labels added to their dot. Other arrows were occasionally added stating 'gravity' alongside weight.

5.2

Just over 60% of the students completed this calculation correctly. Most students understood the need to convert minutes into seconds. However, some students took data from elsewhere in the question, instead of using that given in the stem of this question part.

5.3

Students answered this question well. They generally had a good understanding of how the skydiver reached terminal velocity and described that air resistance increased to become

Answer 03 · Examiner comments — June 2025 | 8463/2H | Original Q5

equal to the weight of the skydiver. A lot of the students were also correctly stating that the resultant force was zero.

5.4

There were two ways to explain why the atmospheric pressure changed as the sky diver fell. In both methods many students were awarded only one mark, often by giving both versions of the 1st mark point.
Method 1: Some students described more air above not referring to more weight of air. The second mark point was often missed as many students just stated so pressure increases, without referring to P=F/A.
Method 2: Many students correctly described that the density of the air increases, but the second mark point was often missed as students did not describe more ‘frequent’ collisions with the skydiver.

5.5

Only a small proportion of the students were able to draw a completely correct vector diagram and find the magnitude and direction of the resultant force. Most students were able to draw a triangle/parallelogram with the correct shape and orientation. The resultant force arrow head was often missing and when drawn was sometimes difficult to see. The magnitude was often correctly measured from the diagram or calculated. However, a significant number of the students measured the wrong angle.