AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.2.3

Newton's Third Law

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**2**
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.

4.5.6.2.3 Newton's Third Law

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

4.5.6.2.3 Newton's Third Law

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**	

4.5.6.2.3 Newton's Third Law

Answer 01 · Mark scheme

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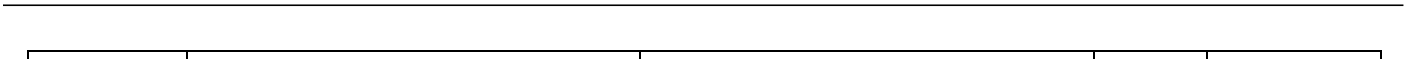

4.5.6.2.3 Newton's Third Law

Answer 02 · Mark scheme

June 2023 | 8463/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the total amount of energy (of the bumper car and barrier) remains constant. **or** total momentum (of bumper car and barrier) before collision equals total momentum (of bumper car and barrier) after collision **or** the resultant external force acting (on the system) is zero	allow there are no external forces (acting on the system)	1	AO1 4.5.7.2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	the force of the car on the barrier is equal to the force of the barrier on the car and in the opposite direction		1	AO1 4.5.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$F = \frac{700}{0.28}$ F = 2 500 (N)		1 1	AO2 4.5.7.3

4.5.6.2.3 Newton's Third Law

Answer 02 · Mark scheme

June 2023 | 8463/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	increases the time taken for the collision to occur	allow increases contact time do **not** accept slows down time	1	AO1 4.5.7.3
	(so) the rate of change of momentum decreases	allow reduces acceleration / deceleration	1	
	reducing the force (on the people)	reduces impact is insufficient	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	$2.5^2 - u^2 = 2 \times 2.0 \times 1.5$		1	AO2 4.5.6.1.5
	$u^2 = 2.5^2 - (2 \times 2.0 \times 1.5)$		1	
	$u = 0.50$ (m/s)	allow 0.5 (m/s)	1	

Total Question 5	10

4.5.6.2.3 Newton's Third Law

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 June 2023 | 8463/2H | Original Q5

05.1

41% of students were awarded this mark. There were a lot of good answers in terms of both conservation of energy and momentum. Answers in terms of no external forces were also credited. Some answers were too vague to score or were answered outside of the context of the question, for example, in terms of a Chemistry approach.

05.2

30% of students answered the question correctly. Those who did not, tended to just state Newton's 3rd Law, rather than stating how it applied in this context.

05.3

96% of students scored both mars for calculating the force.

05.4

10% of students were given all three marks for this explanation. Most responses were creditworthy. Reducing force was the most common 1 mark awarded. Many students also gained the first marking point, about increasing the time for the collision to occur.

4.5.6.2.3 Newton's Third Law

Answer 02 · Examiner comments

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05.5

Students find it difficult to use this equation of motion. This was where not showing the substitution of the data in the equation had the biggest impact. Many students were unable to rearrange the equation with some dividing the two expressions instead of subtracting them. 68% gained all 3 marks, recognising that they had to square root their value to obtain the velocity.