Collisions and Monentum GCSE AQA Higher Physics Past Papers Answers

01.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	the distance travelled under the braking force		1	AO1/1 4.5.6.3.1
2	the reaction time will increase increasing the thinking distance (and so increasing stopping distance)	 increases stopping distance is insufficient	1 1	AO1/1 4.5.6.3.2
3	No, because although when the speed increases the thinking distance increases by the same factor the braking distance does not. eg increasing from 10 m/s to 20 m/s increases thinking distance from 6 m to 12 m but the braking distance increases from 6 m to 24 m		1 1	AO3/1a 4.5.6 WS3.3/5
4	If the sled accelerates the value for the constant of friction will be wrong.		1	AO1/2 4.5.6.2.1
5	only a (the horizontal) component of the force would be pulling the sled forward the vertical component of the force (effectively) lifts the sled reducing the force of the surface on the sled		1 1	AO1/2 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	$-u^2 = 2 \times -7.2 \times 22$	award this mark even with 0^2 and / or the negative sign missing	1	AO2/2 4.5.6.1.5 WS4.6
	u = 17.7(99)		1	
	18		1	
		allow 18 with no working shown for **3** marks		
		allow 17.7(99) then incorrectly rounded to 17 for **2** marks		
Total			**11**	

02.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	the tendency of an object to continue in its state of rest or motion	allow how difficult it is to change the velocity of an object	1	AO1/1 4.5.6.2.1 iso
2	(soft foam) increases the time taken to stop or increases the time taken to decrease momentum	allow increases impact/contact time allow increases the time of the collision do not accept slows down time	1	AO1/1 4.5.7.3
	decreases the rate of change in momentum	allow reduces acceleration/deceleration reduces momentum is insufficient allow increases the time to reduce the momentum to zero for **2** marks	1	
	reducing the force (on the egg)	allow impact for force	1	

3		an answer 4.5 (m/s) scores **4** marks an answer 4500 scores **3** marks		AO2/1 4.5.7.3
	180 ms = 0.18 s	if incorrectly or not converted, subsequent marks may still be awarded for correct method and calculations	1	
	$800 = \frac{32 \times v}{0.18}$		1	
	$v = \frac{800 \times 0.18}{32}$		1	
	v = 4.5 (m/s)		1	
	Alternative method			
	180 ms = 0.18 s (1)			
	Δmv = 144 (kgm/s) (1)			
	Δv = 144 ÷ 32 (1)			
	v = 4.5 (m/s) (1)			
	Alternative method			
	180 ms = 0.18 s (1)			
	a = 25 (m/s^2) (1)			
	25 = Δv ÷ 0.18 (1)			
	v = 4.5 (m/s) (1)			
Total			**8**	

03.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	(total) momentum before = (total) momentum after	allow (total) momentum stays the same	1	AO1 4.5.7.2
2	momentum of player A = 585 (kg m/s) momentum of player B = –500.5 (kg m/s) $\frac{(-500.5 + 585)}{(78 + 91)}$ OR $\frac{84.5}{169}$ = 0.5 (m/s)	 allow $\frac{1085.5}{169}$ this answer only	1 1 1 1	AO2 4.5.7.1 4.5.7.2
3	(protective pads) increase the time taken to stop (during the collision) so the rate of change of momentum decreases reducing the force (on the ice hockey player)	allow increases impact / contact / collision time do **not** allow slows down time allow reduces acceleration/deceleration allow increases the time to reduce the momentum to zero for **2** marks allow impact for force do **not** allow if linked to an incorrect explanation	1 1 1	AO1 4.5.7.3
Total			**8**	

04.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
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.
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.
3	$F = \frac{700}{0.28}$ $F = 2\,500$ (N)		1 1	AO2 4.5.7.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
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.
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 4	10