Force and Motion 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	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
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
3	Newton's 3rd law (of motion)		1	AO1 4.5.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
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**	

03.

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) $\Delta mv = 144$ (kgm/s) (1) $\Delta v = 144 \div 32$ (1) v = 4.5 (m/s) (1)			
	Alternative method 180 ms = 0.18 s (1) $a = 25$ (m/s^2) (1) $25 = \Delta v \div 0.18$ (1) v = 4.5 (m/s) (1)			
Total			**8**	

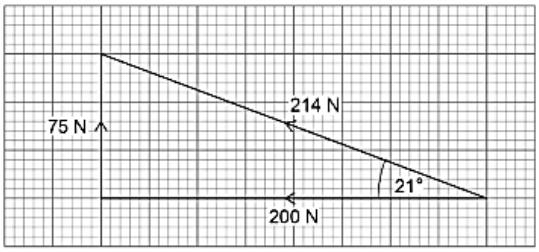
04.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	Move the wooden block to the left.		1	AO3 4.5.6.2.2 RPA7
2	use a pulley (on the edge of the bench)	allow any feasible method to stop the string from rubbing	1	AO3 4.5.6.2.2 RPA7
3	suitable scale points plotted correctly line of best fit	 allow 5 correctly plotted for **2** marks **OR** 3–4 correctly plotted for **1** mark 	1 2 1	AO2 4.5.6.2.2 RPA7
4	(directly) proportional	allow a correct description of direct proportionality ignore positive correlation allow weight (added to mass holder) for force allow **f** = ma for **1** mark	1	AO3 4.5.6.2.2 RPA7
5	repeat the measurements/investigation ignore anomalies **and** calculate the mean / average		1 1	AO3 4.5.6.2.2 RPA7
6	resultant force = mass × acceleration **or** F = m a		1	AO1 4.5.6.2.2 RPA7

7	$0.375 = 0.60 \times a$ $a = \frac{0.375}{0.60}$ $a = 0.625$ (m/s^2) $a = 0.63$ (m/s^2)		1 1 1 1	AO2 4.5.6.2.2 RPA7
Total			**14**	

05.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	friction		1	AO1 4.5.1.2
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
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
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) <u>alternative method</u> 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

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**	

06.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	any **two** from: • capacity of the battery • speed • mass / weight • uphill / downhill • stopping at traffic lights • condition of the road • (air) temperature • (incorrect) tyre pressure • streamlining of the car	 allow energy/charge stored in battery allow efficiency of battery ignore size of battery allow terrain ignore 'the road' only ignore 'weather' only allow efficiency of engine allow anything that would use charge from the battery **or** anything that will reduce the energy stored	2	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	acceleration = change in velocity/time (taken) **or** $a = \frac{\Delta v}{t}$	allow any correct rearrangement allow $a = \frac{v - u}{t}$ do **not** accept $a = \frac{v}{t}$	1	AO1 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	$20 = \frac{28}{t}$ $t = \frac{28}{20}$ 1.4 (s)		1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	$v^2 (- 0^2) = 2 \times 10 \times 605$ $v^2 = 12\ 100$ $v = 110$ (m/s)		1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	work done = force × distance **or** $W = Fs$	allow any correct rearrangement	1	AO1 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	$s = 7500$ (m) $W = 4000 \times 7500$ $W = 30\ 000\ 000$ (J)	 allow correct substitution using incorrectly / not converted value of s allow correct calculation using incorrectly / not converted value of s	1 1 1	AO2 4.5.2

Total Question		13

07.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	there is a resultant force acting	allow weight/gravity is greater than air resistance allow (initially) weight/gravity is the only force acting	1	AO1 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	as the velocity of the hailstone increases air resistance increases	allow speed for velocity	1	AO1 4.5.6.1.5
	until air resistance becomes equal to the weight of the hailstone		1	
	so the <u>resultant force</u> is (equal to) zero		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	as mass increases the weight of a hailstone increases		1	AO3 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	kinetic energy depends on both mass and velocity	allow $E_k = ½ mv^2$	1	AO1
	as mass increases so does terminal / maximum velocity	a statement is required	1	AO1
	kinetic energy ∝ m and kinetic energy ∝ v^2 so as mass doubles kinetic energy more than doubles	this mark can be scored by relevant calculations	1	AO3 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	1 N m		1	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	mass = 0.0185 (kg)	allow 0.018 to 0.019 inclusive	1	AO2 4.5.7.3
	$F = \frac{0.0185 \times 25}{0.060}$	allow a correct substitution using an incorrectly / not converted value of m	1	
	$F = 7.708$ (N)	allow 7.7 (N) allow correct calculation using an incorrectly / not converted value of m **if no other marks are awarded** a misreading of the scale giving a value between 15.6 and 15.7 inclusive that is then correctly converted giving an answer between 6.50 and 6.54 scores 2 marks a misreading of the scale giving a value between 15.6 and 15.7 inclusive that is then not converted giving an answer between 6500 and 6542 scores 1 mark	1	

Total Question		**12**

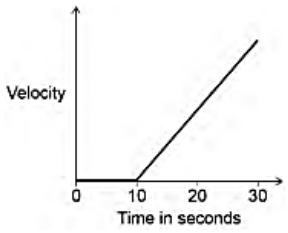
08.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	7.1 (cm) 497 (m)	allow 7.0 to 7.3 (cm) allow 70 × their incorrect measurement of displacement	1 1	AO2 4.5.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	0 (N)		1	AO2 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	constant velocity	allow constant speed (in a straight line) do **not** accept stationary allow constant acceleration if a **mathematical error** in 02.2 gives a non-zero value for resultant force	1	AO1 4.5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	any **one** from: • tension • normal contact (force) • upthrust	allow lift, thrust and water resistance allow normal reaction (force) ignore drag	1	AO1 4.5.1.2

Question	Answers		Mark	AO / Spec. Ref.
5	horizontal line drawn to 10s along the *x*-axis		1	AO3 4.5.6.1.4
	line with a positive gradient starting from 10 s	allow an upward curving line with increasing gradient starting from 10 s  	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	line of best fit drawn and extrapolated to 10 km	do **not** accept a straight line	1	AO2 4.5.5.2
	28 (kPa)	allow 26 to 32 (kPa) allow a value correctly extrapolated from their line allow 2 marks for a correct mathematically extrapolated value	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7	the average density of the air above the aeroplane decreases		1	AO3 4.5.5.2

Total Question	10