Motion GCSE AQA Higher Physics Past Papers Answers

01.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	accept any value between 12 (mm) and 13(mm) inclusive		1	AO2/2 4.5.3
2	to reduce the error in measuring the extension of the spring as the ruler at an angle would make the measured extensions shorter	accept length for extension throughout	1 1	AO3/3a 4.5.3
3	1 (N) to 6 (N)	accept from 0 (N) to 6 (N)	1	AO2/2 4.5.3
4	gives a straight line through the origin		1	AO3/1a 4.5.3
5	any practical technique that would improve the accuracy of length measurement eg use a set square to line up the bottom of the spring with the ruler scale **or** attach a horizontal pointer to the bottom of the spring (1) so that the pointer goes across the ruler scale (1)		 1 1	AO3/3b 4.5.3
6	the spring has been inelastically deformed because it went past its limit of proportionality	 accept elastic limit for limit of proportionality accept it does not go back to its original length when the weights are removed	1 1	AO3/2a AO2/2 4.5.3
Total			**9**	

02.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	distance is a scalar and displacement is a vector **or** distance has magnitude only, displacement has magnitude and direction		1	AO1/1 4.5.6.1.1
2	37.5 km 062° or N62°E	accept any value between 37.0 and 38.0 inclusive accept 62° to the right of the vertical accept an angle in the range 60° -64° accept the angle correctly measured and marked on the diagram	1 1	AO2/2 4.5.6.1.1
3	train changes direction so velocity changes acceleration is the rate of change of velocity		1 1	AO1/1 4.5.6.1.3/5
4	number of squares below line = 17 each square represents 500 m distance = number of squares x value of each square correctly calculated – 8500 m	accept any number between 16 and 18 inclusive	1 1 1	AO2/2 4.5.6.1.5
Total			**8**	

03.

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**	

04.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	uniform acceleration	allow constant / steady acceleration allow velocity / speed increasing at a constant rate ignore reference to direction acceleration scores **1** mark **or** velocity / speed is increasing scores **1** mark do **not** accept acceleration increases	2	AO1 4.5.6.1.5
2	up(wards)		1	AO1 4.5.6.1.5
3	a group of objects that interact		1	AO1 4.1.1.1
4	velocity just after bounce is less than just before bounce **or** the height at the top of the bounce is less than the height from which it was dropped	allow velocity is less / decreases allow speed for velocity velocity decreases to zero – on its own scores zero	1	AO3 4.5.6.1.5
	so the ball has lost energy		1	AO1 4.1.1.2
	correct reference to (loss of) ke or (reduced) gpe		1	AO1 4.1.2.1
	total energy of ball and Earth / ground is constant	allow 'a system' for ball and Earth allow energy is conserved	1	AO1 4.1.2.1
Total			**8**	

05.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	longer arrow pointing vertically downwards	one arrow only	1	AO2/1 4.5.1.4 4.5.6.1.5
	labelled weight	allow (force of) gravity	1	AO1/1 4.5.6.1.5
2	initially air resistance is less than weight / gravity so the skydiver accelerates	allow drag for air resistance allow increased velocity / speed for accelerates	1	AO3/1a AO1/1 AO2/1 4.5.6.1.4 4.5.6.1.5 4.5.6.2.1
	acceleration causes the air resistance to increase	acceleration **or** increased velocity / speed is not required here if given in the first mark point	1	
	resultant force decreases to zero	allow air resistance becomes equal to weight / gravity	1	
	so the skydiver falls at terminal velocity	allow constant velocity/speed for terminal velocity ignore any mention of subsequent motion and use of parachute	1	
3		an answer of 50 (m/s) scores **3** marks		AO2 4.5.6.1.4
	distance at 7s = 200 (m) distance at 12s = 450 (m)	**both** distances required	1	
	speed = $\frac{450-200}{12-7}$ **or** $\frac{250}{5}$	allow correct use of their two distances divided by 5	1	
	50 (m/s)	allow an answer consistent with their two distances	1	
4	The higher the altitude the less dense the air		1	AO1/1 4.5.5.2
	so the air resistance on the skydiver (falling from 39000m) was less (at the same speed)		1	AO1/1
	so the skydiver was able to accelerate for longer before reaching (a higher) terminal velocity **or** so the skydiver was able to accelerate for longer before air resistance = weight / gravity	allow constant velocity/speed for terminal velocity	1	AO2/1
Total			**12**	

06.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
☐	chicken	allow a correct answer indicated in Table 3 provided the answer space in blank	1	AO3

07.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
☐	2×10^{-6}		1	AO1/1 4.5.6.1.2 WS4.4

08.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
☐		an answer 0.025 (m) scores **4** marks		AO2/1 4.6.1.5 4.5.6.1.2
	time = 8μs = 8×10^{-6} (s) or 4 × their answer to 9.2	subsequent marks may be scored if the number of squares is miscounted or t = 2μs is used	1	
	distance = ½ × 6300 × 8×10^{-6}	allow 8×10^{3} or 8×10^{-3} or 8×10^{-9} for 8×10^{-6}	1	
	distance = 0.0252 (m)	allow a correctly calculated answer using 8×10^{3} or 8×10^{-3} or 8×10^{-9}	1	
	distance = 0.025 (m)	allow a calculated value correctly rounded to 2 sig figs an answer 0.050 (m) scores **3** marks an answer 0.05 or 0.0504 (m) scores **2** marks	1	

09.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
☐	accelerating	allow speeding up	1	AO3 4.5.6.1.4

10.

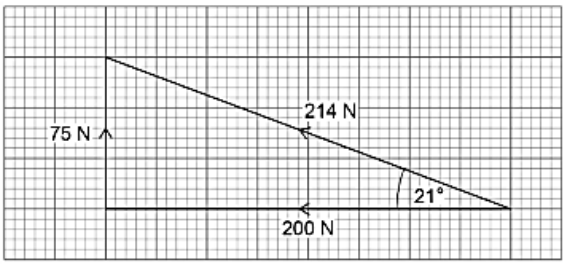
Question	Answers	Extra information	Mark	AO / Spec. Ref.
	appropriate tangent drawn		1	AO2 4.5.6.1.4
	correct reading from graph for change in distance and change in time (eg 5.6 (m) and 20 (s))	allow correct reading from their tangent for change in distance and change in time	1	
	gradient of tangent shown (eg 5.6/20)	allow correct gradient from their tangent	1	
	0.28 (m/s)	this answer only allow 0.25 to 0.30 (m/s) if the tangent is appropriate allow 2.8 / 20 = 0.14 (m/s) for **1** mark	1	

11.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
☐	there is a maximum forward force (provided by the motor)	allow driving force for forward force - throughout the car has a maximum acceleration is insufficient	1	AO1 4.5.6.1.5
	as the speed of the car increases air resistance increases	allow friction / drag for air resistance - throughout	1	
	until air resistance is equal in size to forward force	allow (until) the resultant force is zero allow forces are in equilibrium / balanced	1	
	so the car can no longer accelerate	allow the car travels at terminal velocity	1	

12.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	friction		1	AO1 4.5.1.2
2	(area of rectangle =) 108 (m)		1	AO2 4.5.6.1.5
	(area of triangle =) 54 (m)		1	
	(total area / distance =) 162 (m)	allow a correctly calculated total area / distance from an incorrectly calculated area of rectangle and / or triangle	1	
3	(the force on the pedal) causes a moment about the pedal axle		1	AO1 4.5.4
	which causes a force on the chain (which causes a moment about the rear axle)	allow gear B for chain	1	
4	$2.4^2 (- 0^2) = 2 \times a \times 18$		1	AO2 4.5.6.1.5
	$a = \frac{2.4 \times 2.4}{36}$		1	
	$a = 0.16$ (m/s^2)		1	
	alternative method			
	t = 18 / 1.2 t = 15 (s) (1)			
	a = 2.4 / 15 (1)	this mark may be awarded if the time is incorrectly calculated		
	a = 0.16 (m/s^2) (1)	allow a correctly calculated acceleration from an incorrectly calculated time		

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**	

13.

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	$20 = \frac{28}{t}$		1	AO2 4.5.6.1.5
	$t = \frac{28}{20}$		1	
	1.4 (s)		1	

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

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)		1	AO2 4.5.2
	$W = 4000 \times 7500$	allow correct substitution using incorrectly / not converted value of s	1	
	$W = 30\ 000\ 000$ (J)	allow correct calculation using incorrectly / not converted value of s	1	

Total Question 6		**13**

14.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	any **two** from: • wet / icy road conditions • poor condition of brakes • poor condition of tyres • increased mass of car • negative gradient of the road	ignore weather allow weight for mass allow going downhill	2	AO1 4.5.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	distance = speed × time (so) longer reaction time = longer distance		1 1	AO1 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	mean reaction time increases after drinking alcohol the change in reaction time is not the same for all people after drinking alcohol		1 1	AO3 4.5.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	distance = 1500 (m)		1	AO2 4.5.6.1.2
	$1500 = 20 \times t$	allow a correct substitution using an incorrectly / not converted value of distance	1	
	$t = \frac{1500}{20}$	allow a correct rearrangement using an incorrectly / not converted value of distance	1	
	75 (s)	allow a correctly calculated value using an incorrectly / not converted value of distance	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	velocity is a vector and speed is a scalar	allow velocity includes direction (speed does not)	1	AO3 4.5.6.1.2
	road is not straight	allow driver may change lanes	1	
	therefore direction changes so the velocity changes		1	

Total Question		13

15.

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**

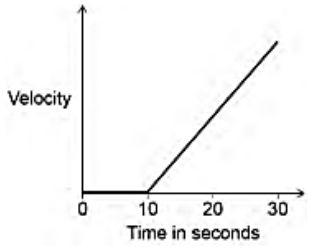
16.

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