Q1. (2018)

a)

01.1	its acceleration would decrease to zero the resultant force on it would decrease to zero		1 1	AO3 6.5.4.2.2

b)

01.2	any **one** from: • move the second light gate closer to the first • shorten the string length	allow use a taller table	1	AO3 6.5.4.2.2

c)

01.5	all points correctly plotted within ½ small square curved line of best fit	allow **1** mark for 3 or 4 points correctly plotted	2 1	AO2 6.5.4.2.2

Q2. (2018)

06.3	$19^2 - u^2 = 2 \times 2 \times 84$ $u^2 = 19^2 - (2 \times 2 \times 84)$ $u = 5$ (m/s)	an answer of 5 (m/s) scores **3** marks $u = \sqrt{19^2 - (2 \times 2 \times 84)}$	 1 1 1	AO2 6.5.4.1.5

Q3. (2019)

a)

01.1	(4 - 0) + (10 - 7) **or** 4 + 3 **or** 10 - 3 7 (s)	an answer of 7 (s) gains **2** marks	 1 1	AO2 6.5.4.1.5	E

b)

01.2	gradient = $\frac{0-2}{24-14}$ (-)0.2 (m/s^2)	an answer of 0.2 (m/s^2) gains **2** marks allow readings from any two points correctly substituted allow correct use of $a = \frac{\Delta v}{t}$	 1 1	AO2 6.5.4.1.5	E

Q4. (2020)

a)

02.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	AO1
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	6.5.4.2.2 RPA19
	Indicative content **<u>measurements</u>** • place one wooden block under the ramp • vary the height by placing a different number of wooden blocks • measure the height of the ramp using a metre rule • measure the distance travelled using a metre rule • measure time taken using light gates (and computer/datalogger) • measure time taken using a stopclock or ticker timer • release trolley from the same position each time • release the trolley without applying a force **<u>results</u>** • repeat at the same height and calculate a mean • repeat for different heights • calculate acceleration using a = (v-u)/t or a = $\frac{v^2 - u^2}{2s}$		

b)

02.2	all points plotted correctly	allow **1** mark for 3 points plotted correctly	2	AO2 6.5.4.2.2 RPA19
	height of ramp in metres on x-axis **and** acceleration in m/s^2 on y-axis)	both quantity and unit required for both axes	1	
	correct line of best fit		1	

Q5. (2021)

a)

02.3	gradient = $\frac{(4 - 0)}{(1.6 - 0)}$		1	AO2 6.5.4.1.5
	acceleration = 2.5 m/s^2	allow use of a = Δv / t	1	

b)

02.4	constant deceleration	allow large deceleration allow decelerates to a stop	1	AO2 6.5.4.1.5

Q6. (2022)

06.3	gradient is equal to acceleration		1	AO1
	gradient / acceleration is not constant		1	AO3
	so resultant force is not constant because resultant force is directly proportional to acceleration (for constant mass)	allow resultant force is not constant because F = ma	1	AO3 6.5.4.2.2

Q7. (2022)

07.2	$9.8 = \frac{\Delta v}{0.5}$		1	AO2 6.5.4.1.5
	$\Delta v = 9.8 \times 0.5$		1	
	final velocity = Δv = 4.9 (m/s)		1	
	$4.9^2 - 0^2 = 2 \times 9.8 \times s$	allow a correct substitution of an incorrectly calculated value of final velocity	1	
	$s = \frac{4.9^2}{2 \times 9.8}$	allow a correct rearrangement of an incorrectly calculated value of final velocity	1	
	s = 1.2 m	allow 1.23 or 1.225 do **not** accept 1.22 allow a correct calculation using an incorrectly calculated value of final velocity	1	

Q8. (2023)

a)

07.1	$a = \frac{26 - 0}{5.25 - 2.0}$	allow any pair of correct points substituted allow ± half a small square for reading of time	1	AO2 6.5.4.1.5
	a = 8	allow 8.0 allow a correct calculation using their acceptable values from the graph ignore any minus sign	1	
	m/s^2		1	

b)

07.2		allow ecf for acceleration and initial velocity from question **07.1**		
	thinking distance			
	s = 26 × 0.75	to award MP1 and MP2 a time of 0.75 must have been used	1	AO3
	s = 19.5 (m)		1	AO2
	braking distance			
	$s = \frac{(5.25 - 2.0) \times 26}{2}$ **or** $s = \frac{26^2 - 0^2}{2 \times 8.0}$	allow a range of 5.2 to 5.3 for final time	1	AO3
	s = 42.25 (m)		1	AO2
		marks for thinking distance and braking distance may be awarded independently		
	stopping distance			
	s = 19.5 + 42.25 = 61.75 (m)	for this mark to be awarded both the thinking distance and braking distance must have been calculated using correct equations allow an answer correctly rounded to 2 or 3 sig figs	1	AO2 6.5.4.1.5

Q9. (2024)

05.1	$5.8 = \frac{\Delta v}{2.5}$		1	AO2 6.5.4.1.5
	$\Delta v = 5.8 \times 2.5$		1	
	$\Delta v = 14.5$		1	
	$v = (20 - 14.5) = 5.5$ (m/s)	allow use of an incorrectly calculated Δv if the correct equation has been used	1	

Q10. (2024)

06.1	$s = 40\,000$		1	AO2 6.5.4.1.5
	$v^2 (- 0^2) = 2 \times 6.48 \times 40\,000$	allow $v^2 = 518\,400$ allow a correct substitution using an incorrectly / not converted value of height	1	
	$v = \sqrt{(2 \times 6.48 \times 40\,000)}$	allow a correct rearrangement using an incorrectly / not converted value of height	1	
	$v = 720$ (m/s)	allow a correct calculation using an incorrectly / not converted value of height	1	