Q1. (2018)

a)

06.1	either: 7.5 (m) **and** 12.3 (m) from the graph **or** 15 (m/s) × 0.32 (s) using speed extra distance = 4.8 (m)	an answer between 4.7 (m) and 4.9 (m) scores **2** marks allow 7.5 (m) and between 12.2 (m) and 12.4 (m)	 1 1	AO2 6.5.4.3

b)

06.2	there is a decrease in kinetic energy of the car so this (causes) the internal / thermal energy store of the brakes to increase	allow work is done by friction (on the brakes)	1 1	AO1 6.1.1.1 6.5.4.3.4

Q2. (2018)

06.4	**Level 3:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	5–6	AO3
	Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.	3-4	AO1 AO3
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	AO1
	No relevant content	0	
	Indicative content • use of drugs, alcohol, tiredness and distractions would increase the thinking distance • thinking distance increases with speed • thinking distance is directly proportional to speed • use of drugs, alcohol, tiredness and distractions would increase the gradient of thinking distance • poor brakes, poor tyres, wet / icy roads and mass would increase the braking distance • braking distance increases with speed • braking distance increases at an increasing (accept greater) rate (with speed) • poor brakes, poor tyres, wet/icy roads and mass would increase the gradient of braking distance • braking distance is directly proportional to speed squared • stopping distance = thinking distance + braking distance • factors that increase thinking and / or braking distance would increase the gradient of stopping distance • stopping distance increases at an increasing (accept greater) rate (with speed)		6.5.4.3.1

Q3. (2020)

a)

06.1	$13.5 \times \frac{2}{3}$ 9.0 (m/s) OR $13.5 \times \frac{1}{3} = 4.5$ (1) 13.5 - 4.5 = 9.0 (m/s) (1)	 allow 9 (m/s)	1 1	AO2 6.5.4.3

b)

06.2	reduced speed reduces stopping distance means less chance of collision **OR** the car will have less kinetic energy (1) so less likely to cause injury in the event of a collision (1)	allow reduces thinking / braking distance	1 1	AO1 6.5.4.3.2 6.5.4.3.3

Q4. (2020)

06.3	$14 = v \times 0.70$ $v = \frac{14}{0.70}$ $v = 20$ (m/s) $0^2 - 20^2 = 2 \times (-6.25) \times s$ $s = \frac{20^2}{(2 \times 6.25)}$ $s = 32$ (m)	ignore minus signs throughout	1 1 1 1 1 1	AO2 6.5.4.1.2 6.5.4.1.5

Q5. (2020)

06.4	same maximum force applied by the brakes because mass is less there is a greater deceleration braking distance is less **OR** reducing the mass reduced the kinetic energy of the van (at a given speed) (1) less work needed to be done to bring the van to a stop (1) (force from the brakes is the same) so braking distance is less (1)	allow momentum for mass	1 1 1	AO2 AO1 AO1 6.5.2

Q6. (2022)

a)

06.1	$21 = 30 \times t$ $t = \frac{21}{30}$ $t = 0.7$ (s)	allow use of any correct pair of values from the graph allow 0.70 (s)	1 1 1	AO2 6.5.4.1.2

b)

06.2	one square represents 5 (m)		1	AO2 6.5.4.1.2
	number of squares = 9	allow number of squares in the range 8.5 to 10	1	
	braking distance = 9 × 5 = 45 (m)	allow an answer in the range 42.5 (m) to 50 (m)	1	

Q7. (2023)

07.3	the brakes can overheat		1	AO1 6.5.4.3.4
	(so) the brakes will not work properly	dependent on MP1	1	
	OR			
	can lead to loss of control (1)	allow the car may skid		
	(because) the tyres lose traction / grip (1)	dependent on MP1		
	OR			
	the greater the deceleration the greater the force (1)			
	(and) large forces can cause injury (1)	dependent on MP1		
		ignore accidents and crashes throughout		

Q8. (2024)

a)

05.2	multiply the speed of the car by the reaction time		1	AO3 6.5.4.3.2

b)

05.3	braking distance $\propto$ speed^2		1	AO3 6.5.4.3.4