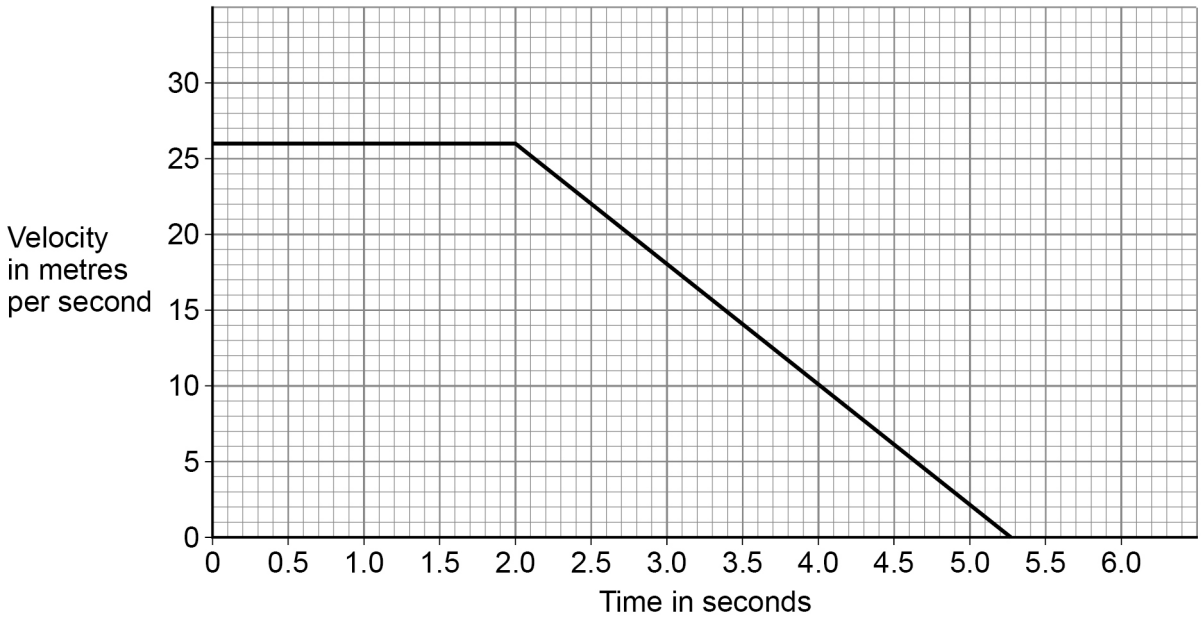
Do not write outside the box

0 7 A car contains a device called a black box. The black box records the velocity and acceleration of the car.

The car was travelling at a constant velocity. The driver then reacted to a hazard.

Figure 11 shows the velocity–time graph for the car.

Figure 11



0 7 . 1 Determine the deceleration of the car.

Give the unit.

[3 marks]

Deceleration = _____ Unit _____

Do not write outside the box

0 7 . 2 The driver of the car has a reaction time of 0.75 s.

Determine the stopping distance of the car.

Use the Physics Equations Sheet.

Use **Figure 11**.

[5 marks]

Stopping distance = _____ m

0 7 . 3 If the black box records large decelerations, it identifies that the driving may be dangerous.

Explain why large decelerations may be dangerous.

[2 marks]

10

END OF QUESTIONS

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
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	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2		allow ecf for acceleration and initial velocity from question **07.1**		
	thinking distance			
	$s = 26 \times 0.75$	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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
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		

Total Question 7	**10**