**1** A motorist travelling at 13 m $s^{-1}$ approaches traffic lights, which turn red when he is 25 m away from the stop line. His reaction time (i.e. the interval between seeing the red light and applying the brakes) is 0.70 s. The condition of the road and his tyres is such that the car cannot slow down at a rate of more than 4.5 m $s^{-2}$.

**(a)** Calculate the time it takes for the car to come to a complete stop from the moment the motorist steps on the brakes.

Time taken = …….. s [1]

**(b)** Sketch a labelled velocity-time graph for the motion of the motorist, starting from the time when he first sees the traffic lights turn red, till the time his car comes to a complete stop.

……..[3]

**(c)** Calculate the distance from the stop line when the car comes to a stop.

Distance = ……. m [2]

**(d)** A bird is flying horizontally in a straight line at a constant height of 50 m above the car with a speed of 6.0 m $s^{-1}$. It drops a twig at the same time that the motorist sights the red light when the bird is directly above the car. Deduce whether the twig will hit the car, showing the necessary calculations.

…….. [4]