**Constant Acceleration Questions**

1. A train goes into a tunnel at 20 m s-1 and emerges from it at 55 m s-1. The tunnel is 1500 m long. Assuming constant acceleration, find how long the train is in the tunnel for, and the acceleration of the train.
2. A milk float moves from rest with acceleration 0.1 m s-2. Find an expression for its speed $v$ m s-1, after it has gone $s$ metres. Illustrate your answer by sketching an $(s,v)$ graph.
3. A cyclist riding at 5 m s-1 starts to accelerate, and 200 metres later she is riding at 7 m s-1. Find her acceleration, assumed constant.
4. A train travelling at 55 m s-1 has to reduce speed to 35 m s-1 to pass through a junction. If the deceleration is not to exceed 0.6 m s-2, how far ahead of the junction should the train begin to slow down?
5. A liner leaves the harbour entrance travelling at 3 m s-1, and accelerates at 0.04 m s-2 until it reaches its cruising speed of 15 m s-1.
(a) How far does it travel in accelerating to its cruising speed?
(b) How long does it take to travel 2 km from the harbour entrance?
6. A downhill skier crosses the finishing line at a speed of 30 m s-1 and immediately starts to decelerate at 10 m s-2. There is a barrier 50 metres beyond the finishing line.
(a) Find an expression for the skier's speed when she is $s$ metres beyond the finishing line
(b) How fast is she travelling when she is 40 m beyond the finishing line?
(c) How far short of the barrier does she come to a stop?
(d) Display an $(s, v)$ graph to illustrate the motion.
7. A boy kicks a football up a slope with a speed of 6 m s-1. The ball decelerates at 0.3 m s-2. How far up the slope does it roll?
8. A cyclist comes to the top of a hill 165 metres long travelling at 5 m s-1, and free-wheels down it with an acceleration of 0.8 m s-2. Write expressions for his speed and the distance he has travelled after $t$ seconds. Hence find how long he takes to reach the bottom of the hill, and how fast he is then travelling.
9. A car travelling at 10 m s-1 is 25 metres from a pedestrian crossing when the traffic light green to amber. The light remains at amber for 2 seconds before it changes to red. The driver has two choices: to accelerate so as to reach the crossing before the light changes to red, or to try to stop at the light. What is the least acceleration which would be necessary in the first case, and the least deceleration which would be necessary in the second?
10. A cheetah is pursuing an impala. The impala is running in a straight line at a constant speed of 16 m s-1. The cheetah is 10 m behind the impala, running at 20 m s-1 but tiring so that it is decelerating at 1 m s-2.
	1. How far does the impala run in $t$ seconds?
	2. How far does the cheetah run in $t$ seconds?
	3. Show that after $t$ seconds, the cheetah is $\left(\frac{1}{2}t^{2}-4t+10\right)$ metres behind the impala.
	4. By writing the expression in part (c) in completed square form, find whether or not the impala gets away.