Section 3: The constant acceleration formulae

Exercise level 2

1. A cyclist travels 1.3 km as he accelerates at a rate of k ms^{-2} from 15 kmh^{-1} to 30 kmh^{-1}. Find a value for k.

2. A cheetah has the ability to accelerate from rest to 108 kmh^{-1} in 25 metres. Find the acceleration. What assumption have you made?

3. A train starts from rest and after 20 seconds is travelling at 30 ms^{-1}. It travels at this speed for 1 minute. Find the acceleration in the first 20 s and the total distance travelled. What assumptions are inherent in the question?

4. A driver is keeping to a steady 70 kmh^{-1} when she sees that 60 m ahead the road is blocked because of an accident. She immediately applies her brakes to produce a deceleration of 5 ms^{-2}. Does she come to rest before the accident and if so by how much?

5. The Highway Code states that a car travelling at 20 ms^{-1} requires a minimum braking distance of 30 m. What deceleration is this and how long will it take for the car to come to rest?

6. A particle moves in a straight line increasing its velocity from 2 ms^{-1} to 16 ms^{-1} in 10 seconds. Find the acceleration of the particle in this time and the distance that it travels.

7. A girl standing on a bridge throws a stone vertically upwards at 6 ms^{-1}. It hits the water below the bridge after 2 seconds. Find the speed at which the stone hits the water and the initial height of the stone.

8. A ball is thrown vertically upwards at 25 ms^{-1}. Find the length of time for which the ball is above 3 m from the point of projection.

9. A train stops at two stations A and B. It accelerates from rest from station A to a speed of 144 kmh^{-1} in 3 minutes and maintains this speed for 10 minutes. It then decelerates for 2 minutes and comes to rest at station B. Find the total distance between A and B.

10. A particle moving in a straight line with a constant acceleration covers 10 m in 2 seconds and 22 m in a further 2 seconds. How much further does it travel in the next two seconds?

11. A train is brought to rest with uniform deceleration. It travels 30 m in the first 2 seconds, and a further 30 m in the next 4 seconds. Find
    (i) the initial velocity,
    (ii) the deceleration,
    (iii)total time to come to rest.

12. A particle accelerates from rest with an acceleration of 3 ms^{-2} to a speed V. It continues at this speed for time T and then decelerates to rest at 1.5 ms^{-2}. The total time for the motion is 1 minute, and the total distance travelled is 1 km. Find a value for V.

Edexcel AS Maths Kinematics 3 Exercise

13. A ball is thrown vertically upwards at 25 ms^{-1} at the same time as another is thrown vertically downwards, from the same point, at 25 ms^{-1}. How far apart are the balls after 2 seconds?

14. A bus sets off from stop A and accelerates uniformly for t_1 seconds covering 300 m. It then travels at a constant speed v for t_2 seconds covering another 1250 m. It decelerates for t_3 seconds to come to rest at stop B. Given that the total time for the journey is 3 minutes and that $2t_1 = 3t_3$, find t_1, t_2, t_3, v, and the distance AB.

15. A particle P_1 is projected vertically upwards, from horizontal ground, with a speed of 30 m s^{-1}. At the same instant another particle P_2 is projected vertically upwards from the top of a tower of height 25 m, with a speed of 10 m s^{-1}. Find
    (i) The time for which P_1 is higher than the top of the tower,
    (ii) The velocities of the particles at the instant when the particles are at the same height,
    (iii) The time for which P_1 is higher than P_2 and is moving upwards.