SUVAT and Travel Graph Exam Questions

1. A motor boat travels in a straight line across a lake. During part of its motion the boat travels with constant acceleration, and its velocity increases from 9 m s^{-1} to 15 m s^{-1} in 4 seconds.

(i) Find the distance travelled by the boat during this time.

(2)

(ii) Show that the acceleration of the boat is 1.5 m s^{-2}.

(2)

(Total 4 marks)

2. A rabbit runs in a horizontal straight line *ABC* across a field.

(a) The rabbit runs from rest at *A* with a constant acceleration of 0.8 m s^{-2} and reaches *B* after 3 seconds.

Find its speed at *B*.

(2)

(b) The rabbit then runs from *B* with constant speed and reaches *C* after a further 4 seconds.

Sketch a velocity-time graph of the motion of the rabbit as it runs from *A* to *C*.

(3)

(c) Find the average speed of the rabbit as it runs from *A* to *C*.

(5)
(Total 10 marks)

3. A train is travelling at a constant speed of 40 m s^{-1}, when the driver sees a warning light. Over the next 1000 m the speed of the train drops to 20 m s^{-1}. The train travels at this speed for 5 minutes. The speed returns to 40 m s^{-1} after a further 5 minutes. Assume that the acceleration of the train is constant on each stage of its journey.

(a) Find the total distance travelled by the train, while its speed is less than its normal operating speed of 40 m s^{-1}.

(3)

(b) The train **would normally** have travelled this distance at a constant 40 m s^{-1}.
Find the time by which it was delayed.

(5)
(Total 8 marks)

4. A car travelling on a straight road accelerates uniformly from rest. It travels 375 metres in the first 30 seconds.

(a) Find the speed of the car at the end of the first 30 seconds.

(3)

(b) The car accelerates until its speed is 30 m s^{-1}. It then travels at this constant speed. Find the time that it takes the car to travel 810 metres from the start of its journey.

(5)
(Total 8 marks)

5. A train accelerates uniformly from rest along a straight horizontal track. After it has travelled 400 metres, its speed is 16 m s^{-1}.

(a) (i) Show that the acceleration of the train is 0.32 m s^{-2}.

(2)

(ii) Find the time that it takes the train to travel the 400 metres.

(2)

(b) When the train has reached a speed of 16 m s^{-1}, its acceleration is increased to 0.5 m s^{-2}.

(i) Find the distance that the train travels as its speed increases from 16 m s^{-1} to 30 m s^{-1}.

(2)

(ii) Find the total time that the train has been moving when it reaches a speed of 30 m s^{-1}.

(3)
(Total 9 marks)

6. A car travels along a straight horizontal road. The motion of the car can be modelled as three separate stages.

During the first stage, the car accelerates uniformly from rest to a velocity of 10 m s^{-1} in 6 seconds.

During the second stage, the car travels with a constant velocity of 10 m s^{-1} for a further 4 seconds.

During the third stage of the motion, the car travels with a uniform retardation of magnitude 0.8 m s^{-2} until it comes to rest.

(a) Show that the time taken for the **third** stage of the motion is 12.5 seconds.

(2)

(b) Sketch a velocity–time graph for the car during the three stages of the motion.

(4)

(c) Find the total distance travelled by the car during the motion.

(3)

(Total 9 marks)

7. A car starts from rest at a set of traffic lights and moves in a straight line with constant acceleration 4ms^{-2}. A motorcycle, travelling parallel to the car with constant speed 16ms^{-1}, passes the same traffic lights exactly $1\frac{1}{2}$ seconds after the car starts to move.

(a) Given that the time after the car starts to move is t seconds, show that the car and the motorcycle are momentarily level when

$$t^2 = 8t - 12$$

(5)

(b) (i) By solving the above equation find the two times, t_1, and t_2, when the car and the motorcycle are momentarily level.

(3)

(ii) Describe the relative positions of the car and the motorcycle when $t_1 < t < t_2$.

(1)

(Total 9 marks)