

Lesson 8

Constant Acceleration Kinematics Applied Mathematics (Mechanics) Year 1

8.1 Topic Summary (Homework)

Whenever a numerical value of g is required, take $g = 9.8 \text{ m.s}^{-2}$

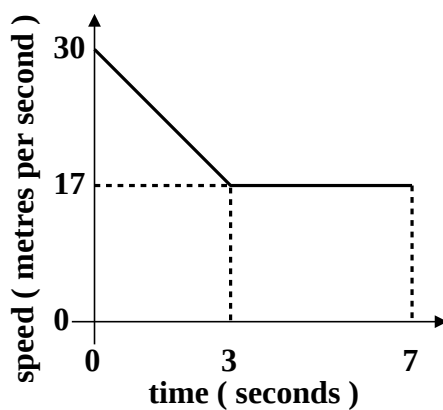
Question 1

A car moves along a straight horizontal road.

In order to obey a speed restriction, the brakes of the car are applied for 3 seconds, reducing the car's speed from 30 m.s^{-1} to 17 m.s^{-1} .

The brakes are then released and the car continues at a constant speed of 17 m.s^{-1} for a further 4 seconds.

The speed - time graph of the car during this 7 second interval is shown below.



Find the total distance moved by the car during this 7 second interval.

[4 marks]

Question 2



James Bond needs to run 100 metres in a straight line to intercept an enemy agent. He starts by stepping off a bus moving at a speed of 6 m.s^{-1} . He then accelerates uniformly for 2 seconds to his top speed of $v \text{ m.s}^{-1}$. He then maintains this top speed of $v \text{ m.s}^{-1}$ for the rest of the distance. He covers the whole distance of 100 metres in a total time of 11 seconds.

- (i) In the space below, sketch a speed - time graph to illustrate the motion of Mr Bond during the time of the race.

[3 marks]

- (ii) Find the top speed, $v \text{ m.s}^{-1}$, of James Bond.

[3 marks]

Question 3

M1 Examination Question, June 2015, Q2

A small stone is projected vertically upwards from a point O with a speed of 19.6 m.s^{-1}

Modelling the stone as a particle moving freely under gravity,

(a) find the greatest height above O reached by the stone

[2 marks]

(b) find the length of time for which the stone is more than 14.7 m above O .

[5 marks]

Question 4

A yellow bus travels along a straight road at a constant speed u for 20 seconds.

It then accelerates uniformly to a speed of 13 m.s^{-1} over the next 30 seconds.

(i) Illustrate this information on a sketch velocity-time graph.

[2 marks]

(ii) Given that the bus travels a total distance of 496 metres, find u .

[3 marks]

(iii) How long does it take the bus to travel 250 metres ?

[4 marks]

Question 5

A stone is dropped from the edge of a cliff, 320 metres above sea level.

(i) How long does it take to land in the sea ?

[2 marks]

(ii) What is its speed on impact ?

[3 marks]

Suppose another stone was thrown downwards at 25 m.s^{-1} from the cliff edge, two seconds after the first stone was released.

Further suppose that his second stone catches up, and collides with, the first stone.

(iii) How long after the first stone was dropped will the stones to collide ?

[5 marks]

(iv) At what height *above the sea* would the two stones be when they collided ?

[2 marks]

(v) Do you consider your part (ii) answer to be greater than or less than the answer that might be obtained in reality ?
Justify your answer.

[2 marks]

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