

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

2 Kinematics in one dimension

Exercise B, Question 15

Question:

A train starts from rest and moves along a straight track with constant acceleration $\frac{1}{3} \text{ m s}^{-2}$ for 2 minutes.

For the next 4 minutes the train moves with zero acceleration, after which a uniform retardation of 2 m s^{-2} brings it to rest. Find the total distance travelled by the train from starting to stopping. [A]

Solution:

$$\text{1st part, } s = ut + \frac{1}{2}at^2$$

$$s_1 = 0 \times 120 + \frac{1}{2} \times \frac{1}{3} \times 120^2$$

$$s_1 = 2400 \text{ m}$$

$$v = u + at$$

$$v_1 = 0 + \frac{1}{3} \times 120$$

$$v_1 = 40 \text{ m s}^{-1}$$

$$\text{2nd part, } s = ut$$

$$s_2 = 40 \times 240 = 9600 \text{ m}$$

$$\text{3rd part, } v^2 = u^2 + 2as$$

$$0^2 = 40^2 + 2(-2)s_3$$

$$\therefore 4s_3 = 1600$$

$$s_3 = 400 \text{ m}$$

$$\begin{aligned} \therefore \text{total distance} &= s_1 + s_2 + s_3 = 2400 + 9600 + 400 \\ &= 12400 \text{ metres} \end{aligned}$$

