Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

2 Kinematics in one dimension

Exercise B, Question 7

Question:

A train signal is placed so that a train can decelerate uniformly from a speed of 96 km h^{-1} to come to rest at the end of a platform. For passenger comfort the deceleration must be no greater than 0.4 m s^{-2}. Assume that the train travels along a straight line. Calculate:

(a) the shortest distance the signal can be from the end of the platform

(b) the shortest time for the train to decelerate.

Solution:

$$96 \text{ km } h^{-1} = \frac{96 \times 1000}{3600} \text{ m } s^{-1} = 26\frac{2}{3} \text{ m } s^{-1}$$

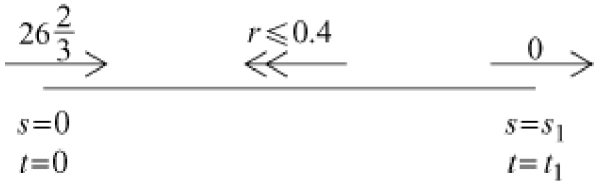
(a) $v^2 = u^2 + 2as$ with maximum deceleration

$$0^2 = \left(26\frac{2}{3}\right)^2 + 2(-0.4)(s_1)$$

$$\therefore 0.8s_1 = \left(26\frac{2}{3}\right)^2$$

$$\therefore s_1 = \frac{\left(26\frac{2}{3}\right)^2}{0.8} = 888.88... \text{ m}$$

i.e. $s_1 = 889$ m (3 s.f.)



$$v = u + at$$

$$0 = 26\frac{2}{3} + (-0.4) \times t_1$$

(b) $$\therefore 0.4t_1 = 26\frac{2}{3}$$

$$t_1 = \frac{26\frac{2}{3}}{0.4} = 66.666... = 66.7 \text{ s (3 s.f.)}$$

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