

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

## 2 Kinematics in one dimension

### Exercise B, Question 9

#### Question:

The world record for the men's 60 m race was 6.41 seconds.

(a) Assuming that the race was carried out under constant acceleration, calculate the acceleration of the runner and his speed at the end of the race.

(b) Now assume that in a 100 m race the runner accelerates for the first 60 m and completes the race by running the next 40 m at the speed you calculated in (a). Calculate the time for the athlete to complete the race.

#### Solution:

$$s = ut + \frac{1}{2}at^2$$

$$60 = 0 \times 6.41 + \frac{1}{2} \times a \times 6.41^2$$

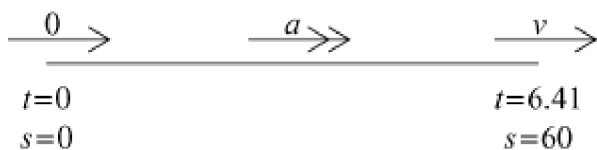
$$(a) \quad \frac{60}{\frac{1}{2} \times 6.41^2} = a$$

$$\text{i.e. } a = 2.9205\dots = 2.92 \text{ m s}^{-2} \text{ (3 s.f.)}$$

$$s = \frac{(u+v)}{2} \times t$$

$$60 = \frac{(0+v)}{2} \times 6.41, \quad \therefore \frac{60 \times 2}{6.41} = v$$

$$\therefore v = 18.720\dots = 18.7 \text{ m s}^{-1} \text{ (3 s.f.)}$$



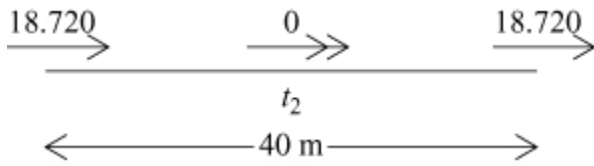
(b) uniform speed so

$$s = vt$$

$$40 = 18.720 \times t_2$$

$$\therefore t_2 = 2.1366\dots \text{ s}$$

$$\therefore \text{total time} = 6.41 + 2.1366 = 8.55 \text{ s (3 s.f.)}$$



© Harcourt Education Ltd 2005