

Solutions

2.1 $v = s/t = 300/240 = \mathbf{1.25}$ m/s (C1, A1); close to the typical 1.5 m/s walking value – a normal walking pace.

2.2 Distance = $5 + 5 = \mathbf{10}$ km; displacement = $\mathbf{0}$ – she is back at the start; time 40 min is extra context (no mark but must not enter the displacement).

2.3 Acceleration = 0 (constant velocity, B1); distance = $12 \times 25 = \mathbf{300}$ m.

3.1 (a) Gradient = rise/run with time converted: 6.0 min = 360 s (C1).

$$v = \frac{900 \text{ m}}{360 \text{ s}} = \mathbf{2.5} \text{ m/s}$$

(gradient described C1, answer A1) (b) A horizontal (flat) line; speed zero – stationary. (c) $2.5 < 6$ m/s – she cycles slower than the typical cyclist.

3.2 (a) First 3 s: weight downwards exceeds drag, resultant force down, so it accelerates; as speed grows drag grows; after 3 s drag = weight – resultant zero, constant velocity. (b) Terminal velocity; reached when the drag (air resistance) equals the weight. (c) $s = \bar{v}t = 4.0 \times 3.0 = \mathbf{12}$ m (C1, A1).

3.3 (a) Stage 1: $a = 30/600 = \mathbf{0.050}$ m/s²; stage 2: $\mathbf{0}$; stage 3: $a = -30/300 = \mathbf{-0.10}$ m/s² (deceleration 0.10 m/s²). (b) (HT) Areas: $\frac{1}{2} \times 600 \times 30 = 9000$ m; $1200 \times 30 = 36\,000$ m; $\frac{1}{2} \times 300 \times 30 = 4500$ m; total = $\mathbf{49\,500}$ m (each stage C1 accumulated, total A1). (c) Total time = $600 + 1200 + 300 = 2100$ s.

$$\bar{v} = \frac{49\,500}{2100} = \mathbf{24} \text{ m/s (2 s.f.)}$$

(C1, A1)