1

(a)
- acceleration = gradient **M1**
- $\frac{\text{change in } y}{\text{change in } x} = \frac{14-4}{5-0} = \frac{10}{5} = 2$ **A1**
- Final answer: $2\ \text{ms}^{-2}$

(b)
- total distance = area under graph **M1**
- Area of trapezium + Area of rectangle: $\frac{4+14}{2} \times 5 + (12-5) \times 14 = 45 + 98 = 143$ **A1**
- Final answer: $143\ \text{m}$

(Total for question 1 is 4 marks)

2

(a)
- acceleration = gradient **M1**
- $\frac{\text{change in } y}{\text{change in } x} = \frac{9-1}{2-0} = \frac{8}{2} = 4$ **A1**
- Final answer: $4\ \text{ms}^{-2}$

(b)
- total distance = area under graph **M1**
- Area of trapezium + Area of rectangle: $\frac{1+9}{2} \times 2 + (10-2) \times 9 = 10 + 72 = 82$ **A1**
- Final answer: $82\ \text{m}$

(Total for question 2 is 4 marks)

3

(a)
- acceleration = gradient **M1**
- $\frac{\text{change in } y}{\text{change in } x} = \frac{8-2}{6-0} = \frac{6}{6} = 1$ **A1**
- Final answer: $1\ \text{ms}^{-2}$

(b)
- total distance = area under graph **M1**
- Area of trapezium + Area of rectangle: $\frac{2+8}{2} \times 6 + (10-6) \times 8 = 30 + 32 = 62$ **A1**
- Final answer: $62\ \text{m}$

(Total for question 3 is 4 marks)

4

(a)
- Total area = 160 m **M1**
- Let v be max speed. Area = $\frac{4v}{2} + (18.0-4)v = 160$ **M1**
- $2v + 14v = 160 \Rightarrow 16v = 160$ **M1**
- $v = 10.0\ \text{ms}^{-1}$ **A1**

(b)
- Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$ **M1**
- $\frac{4 \times 10}{2} = 20.0\ \text{m}$ **A1**

(Total for question 4 is 6 marks)

5

(a)

- Total area = 600 m (M1)
- Let v be max speed. Area = $\frac{6v}{2} + (40.2 - 6)v = 600$ (M1)
- $3v + 34.2v = 600 \Rightarrow 37.2v = 600$ (M1)
- $v = \frac{600}{37.2} = 16.1 \text{ ms}^{-1}$ (3sf) (A1)

(b)

- Area of triangle = $\frac{1}{2} \times$ base $\times$ height (M1)
- $\frac{6 \times 16.129...}{2} = 48.4$ m (3sf) (A1)

(Total for question 5 is 6 marks)

6

- Convert 1.2 km to 1200 m (B1)
- Area up to 100 s = $\frac{1}{2}(20)(8) + (80)(8) = 80 + 640 = 720$ m (M1)
- Remaining distance = $1200 - 720 = 480$ m. Area of final triangle = $\frac{1}{2}(T - 100)(8) = 480 \Rightarrow 4(T - 100) = 480 \Rightarrow T - 100 = 120 \Rightarrow T = 220$ (A1)

(Total for question 6 is 3 marks)

7

- Convert 0.8 km to 800 m (B1)
- Area for first 60 s = $\frac{1}{2}(10)(10) + (50)(10) = 50 + 500 = 550$ m (M1)
- Area of final deceleration phase = $800 - 550 = 250$ m. $\frac{1}{2}(T - 60)(10) = 250 \Rightarrow 5(T - 60) = 250 \Rightarrow T - 60 = 50 \Rightarrow T = 110$ (A1)

(Total for question 7 is 3 marks)

8

- Convert 3 km to 3000 m (B1)
- Area of acceleration and constant speed phases = $\frac{1}{2}(40)(15) + (100)(15) = 300 + 1500 = 1800$ m (M1)
- Area of final triangle = $3000 - 1800 = 1200$ m. Hence $\frac{1}{2}(T - 140)(15) = 1200 \Rightarrow 7.5(T - 140) = 1200 \Rightarrow T - 140 = 160 \Rightarrow T = 300$ (A1)

(Total for question 8 is 3 marks)
