SPEED-TIME

1 A school athlete does a sprint training run. Fig. 1.1 shows how her speed varies with time.

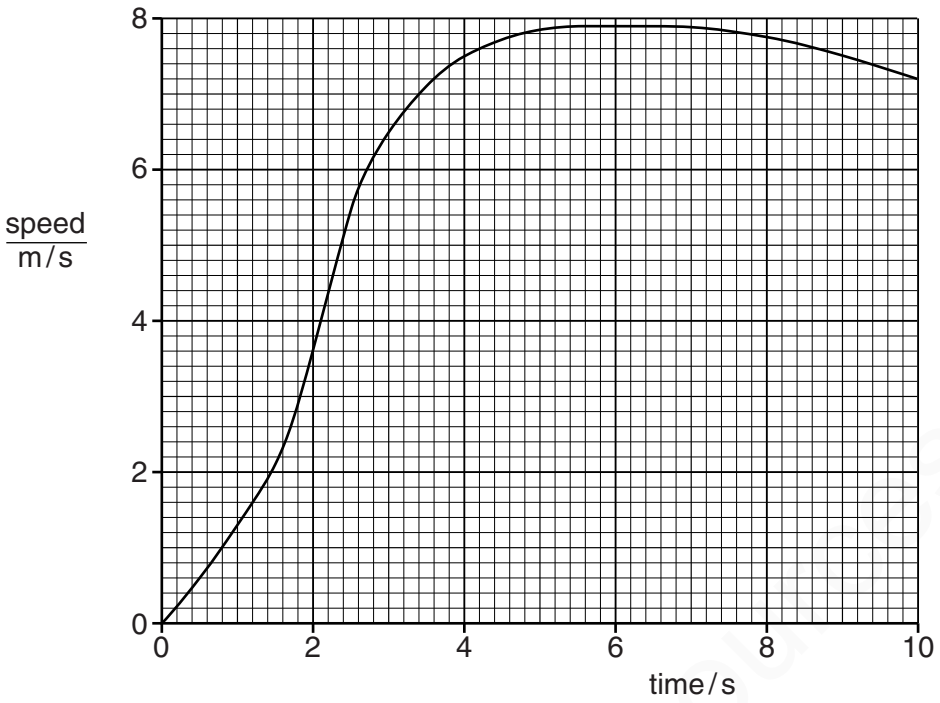

Fig. 1.1

(a) Explain how the graph in Fig. 1.1 can be used to determine the distance she runs.

.....

.....[1]

(b) Determine her maximum acceleration. Show clearly on the graph how you obtained the necessary information.

maximum acceleration = ...[4]

(c) She runs a distance of 62 m.

Calculate her average speed.

average speed = ...[2]

[Total: 7]

(a)	measure area (under curve)	B1	[1]
(b)	draws tangent at steepest part by eye, within thickness of lines accept triangle / lines to indicate values on straight steepest part of curve	B1	
	finds Δv and Δt from tangent or at straight steepest part of curve	B1	
	any v divided by any t or in equation	B1	
	$3.0 - 4.2\,m/s^2$	B1	[4]
(c)	uses 62 and 10 NOT 2 × 62	C1	
	6.2 m / s	A1	[2]
		[Total: 7]	

2 A bus travels from one bus stop to the next. The journey has three distinct parts. Stated in order they are

uniform acceleration from rest for 8.0 s,
uniform speed for 12 s,
non-uniform deceleration for 5.0 s.

Fig. 1.1 shows only the deceleration of the bus.

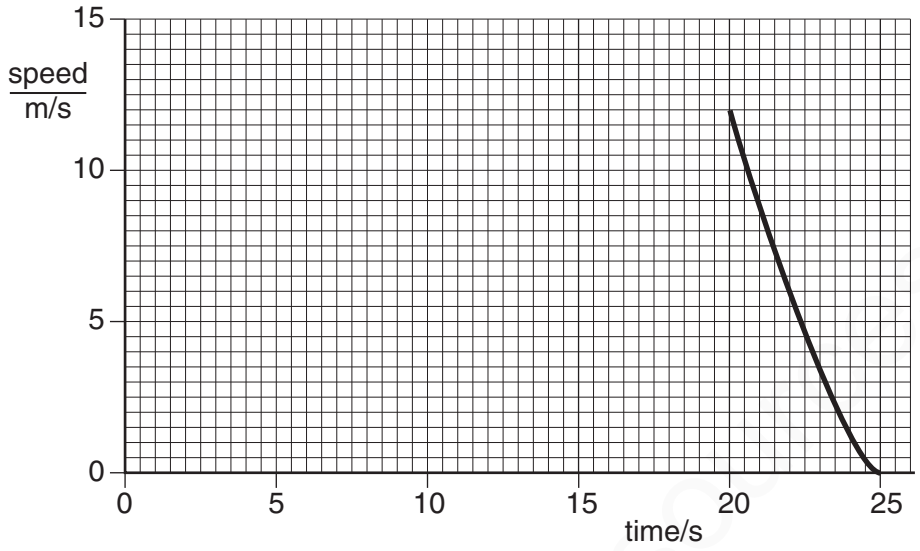

Fig. 1.1

(a) On Fig. 1.1, complete the graph to show the first two parts of the journey. [3]

(b) Calculate the acceleration of the bus 4.0 s after leaving the first bus stop.

acceleration = ...[2]

(c) Use the graph to estimate the distance the bus travels between 20 s and 25 s.

estimated distance = ...[2]

(d) On leaving the second bus stop, the uniform acceleration of the bus is 1.2 m/s^2. The mass of the bus and passengers is 4000 kg.
Calculate the accelerating force that acts on the bus.

force = ...[2]

(e) The acceleration of the bus from the second bus stop is less than that from the first bus stop.
Suggest two reasons for this.

1. .....

.....

2. .....

.....[2]

(a)	point 8,12 identified		B1	
	straight line joining 0,0 and 8,12		B1	
	straight line joining 8,12 and 20,12		B1	**3**
(b)	acceleration = change in v/change in t or 12/8 etc		C1	
	= 1.5 m/s^2		A1	**2**
(c)	distance = area under graph between t = 20 and t = 25		C1	
	= 24 m to 28 m		A1	**2**
(d)	F = ma or 4000 x 1.2		C1	
	= 4800 N		A1	**2**
(e)	more passengers got on (so mass increased) driver pressed accelerator less (so force decreased) more traffic or going uphill	any two lines	B2	**2** **[11]**

3 Fig. 1.1 is a distance/time graph showing the motion of an object.

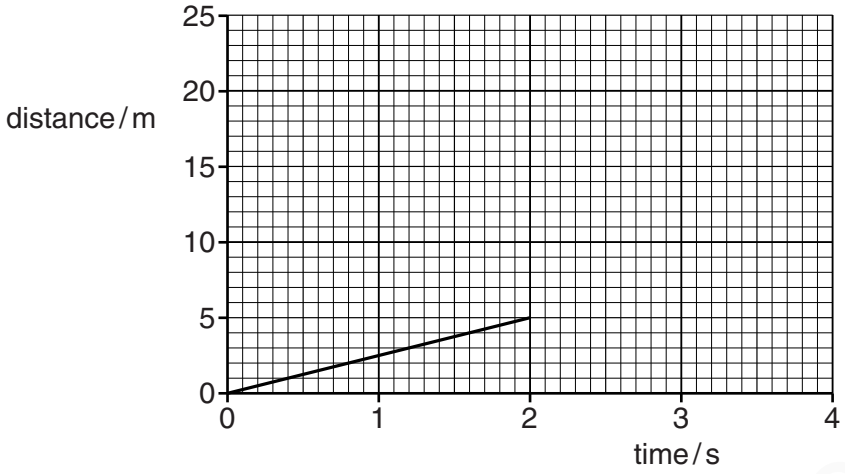

Fig. 1.1

(a) (i) Describe the motion shown for the first 2 s, calculating any relevant quantity.

.....

.....
[2]

(ii) After 2 s the object accelerates.

On Fig. 1.1, sketch a possible shape of the graph for the next 2 s.
[1]

(b) Describe how a distance/time graph shows an object that is stationary.

.....

..... [1]

(c) Fig. 1.2 shows the axes for a speed/time graph.

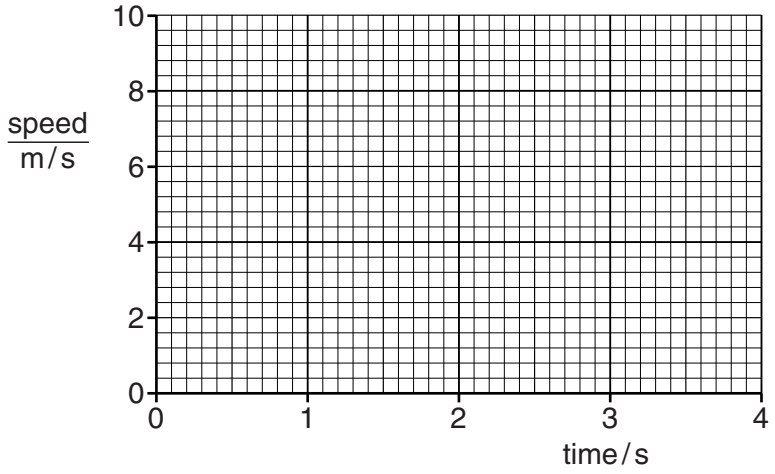

Fig. 1.2

On Fig. 1.2, draw

(i) the graph of the motion for the first 2 s as shown in Fig. 1.1,

(ii) an extension of the graph for the next 2 s, showing the object accelerating at 2 m/s^2.
[3]

(d) Describe how a speed/time graph shows an object that is stationary.

.....

..... [2]

[Total: 9]

(a) **(i)** constant/steady/uniform speed/velocity OR speed/velocity = 2.5 (m/s) B1
speed/velocity = 2.5 m/s accept fraction, average speed/velocity = 2.5 m/s B1 [2]

(ii) shape curving upward but not to vertical, at least to 3.5 s unless reaches 25 m B1 [1]

(b) horizontal (straight) line OR careful sketch
accept parallel to time/*x*-axis B1 [1]

(c) tolerance on both axes ± ½ small square throughout both parts

(i) horizontal straight line at 2.5 m/s from 0 to 2 s, ecf from **(a)(i)** B1

(ii) straight line rising to the right as far as the edge of the graph area M1
Δv = 4 m/s or gradient clearly 2 m/s^2 A1 [3]

(d) horizontal (straight) line M1
at 0 m/s A1 [2]
accept for both marks: line in/along time/*x*-axis OR line with $y/v = 0$ OR careful sketch

[Total: 9]