Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Speed-time graphs

Time allowed: 1 hour 10 minutes

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 71

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 71 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 Fig. 1.1 shows the speed–time graph for a car travelling along a flat straight road.

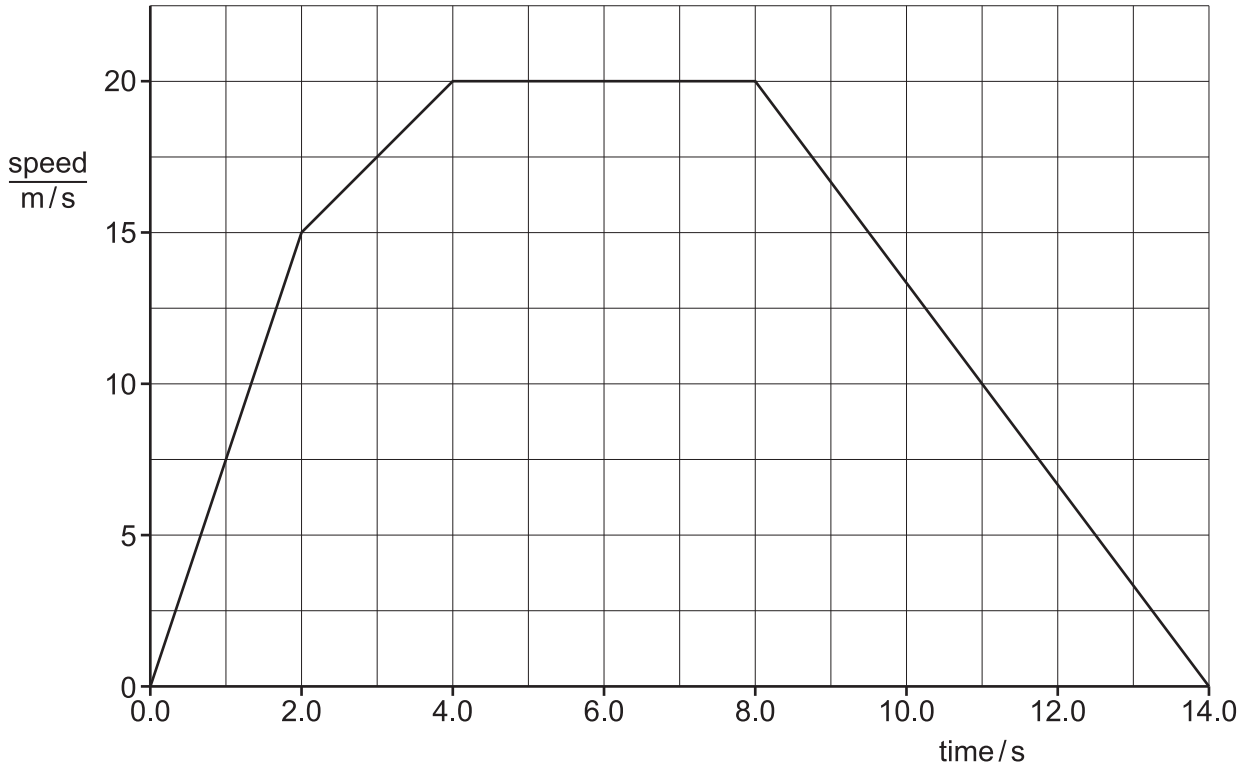


Fig. 1.1

(a) Describe the motion of the car between time = 0 and time = 2.0 s.

..... [1]

(b) State the value of the acceleration of the car between time = 4.0 s and time = 8.0 s.

..... [1]

(c) Calculate the distance travelled by the car between time = 8.0 s and time = 14.0 s.

distance travelled = ... m [3]

[Total: 5]

Motion Click for more variations

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1(a)	(constant) acceleration **OR** accelerating **OR** increasing speed	**B1**
1(b)	zero	**B1**
1(c)	60 (m)	**A3**
	½ × 6(.0) × 20	(C2)
	distance = area under (speed–time) graph **OR** ½ × *b* × *h*	(C1)

2 Fig. 1.1 shows a space rocket accelerating away from a launch pad.

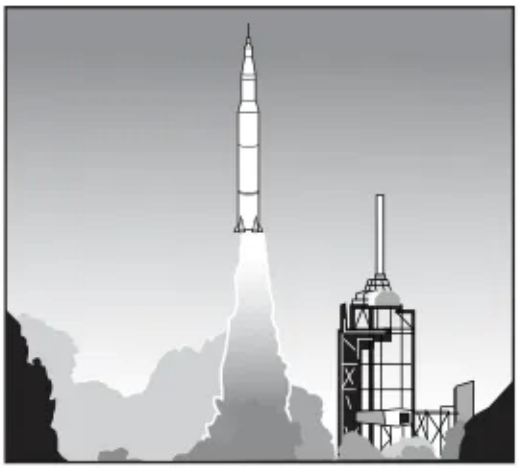


Fig. 1.1

Fig. 1.2 is a speed–time graph for the first 30 s of the rocket's flight.

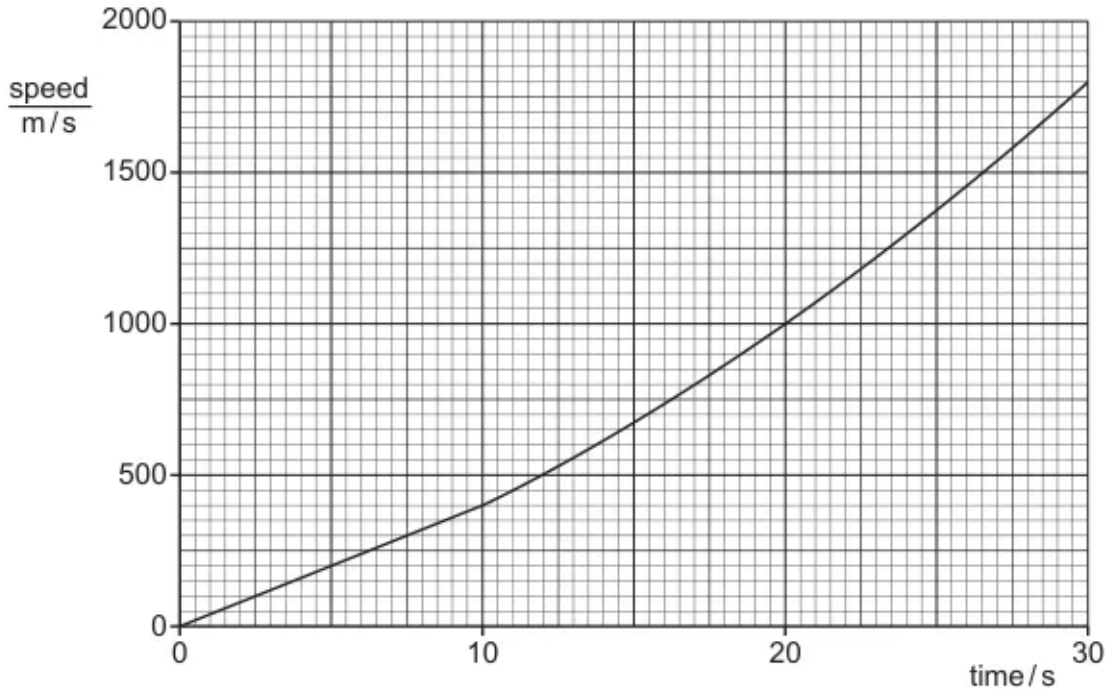


Fig. 1.2

(a) Describe how the acceleration of the rocket changes between time = 10 s and time = 30 s.

..... [1]

(b) By drawing a tangent to the graph, determine the acceleration of the rocket at time = 25 s.

acceleration = ... [2]

(c) Determine the distance travelled by the rocket between time = 0 and time = 10 s.

distance = ... [2]

[Total: 5]

Motion Click for more variations

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2(a)	(acceleration) increases	**B1**
2(b)	tangent drawn at 25 s	**M1**
	78 to 82 m / s^2	**A1**
2(c)	(distance =) area under graph (stated or correct area clearly shown on graph) OR (400 x 10) / 2 OR (b x h) ÷ 2	**C1**
	2000 m	**A1**

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3 Fig. 1.1 is an incomplete graph that shows the motion of an object. The axes labels are incomplete.

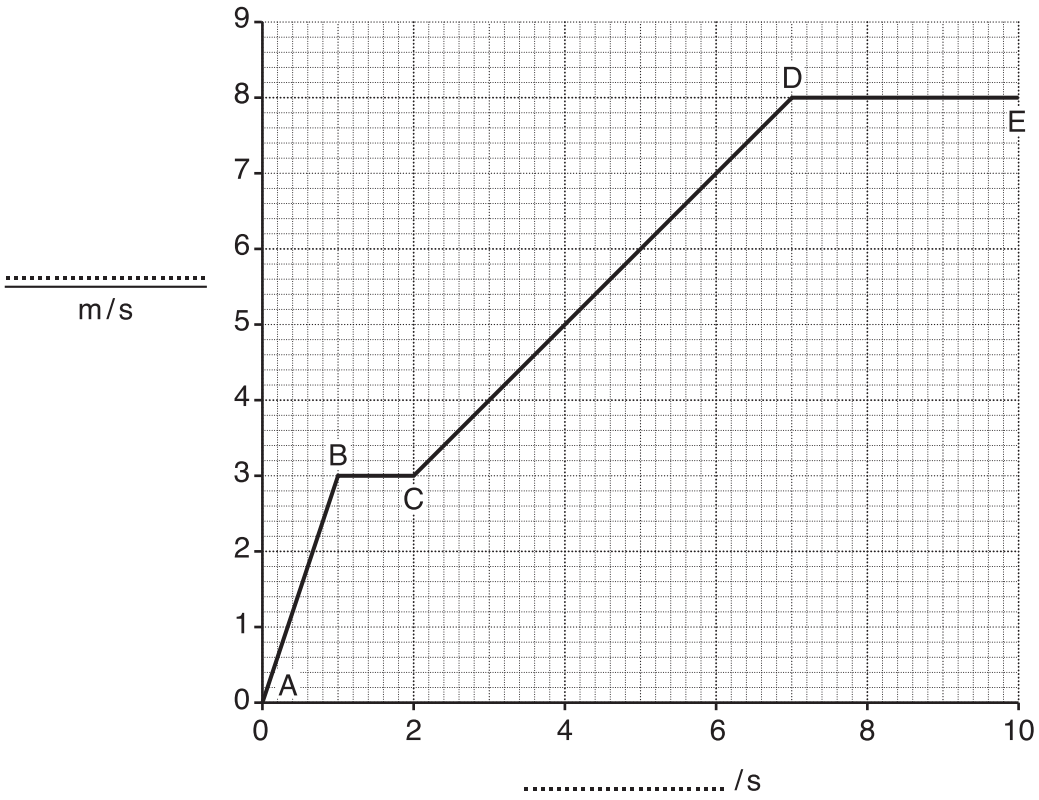


Fig. 1.1

(a) On Fig. 1.1, complete the label on each of the axes. [1]

(b) Identify the part of the graph which shows the greatest acceleration. Tick **one** box.

- ☐ A to B
- ☐ B to C
- ☐ C to D
- ☐ D to E

[1]

(c) Calculate the distance travelled by the object between points C and D.

distance = ... m [3]

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(d) Another object starts from rest at the same time as the object shown by the graph in Fig. 1.1.

This object has constant acceleration for 10 s. After 10 s it moves at 8.0 m/s.

On Fig. 1.1, draw a line to show the motion of this object between 0 and 10 s. [1]

[Total: 6]

Motion Click for more variations

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3(a)	speed **OR** velocity on y-axis **AND** time x-axis	**B1**
3(b)	A to B	**B1**
3(c)	area under graph	**C1**
	$0.5 \times 5 \times 5$ (+ (3×5))	**C1**
	27.5 (m)	**A1**
3(d)	correctly placed continuous single thin straight line from A to E drawn using a rule	**B1**
	Total:	**6**

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4 Fig. 2.1 shows a speed-time graph for a ship starting to move.

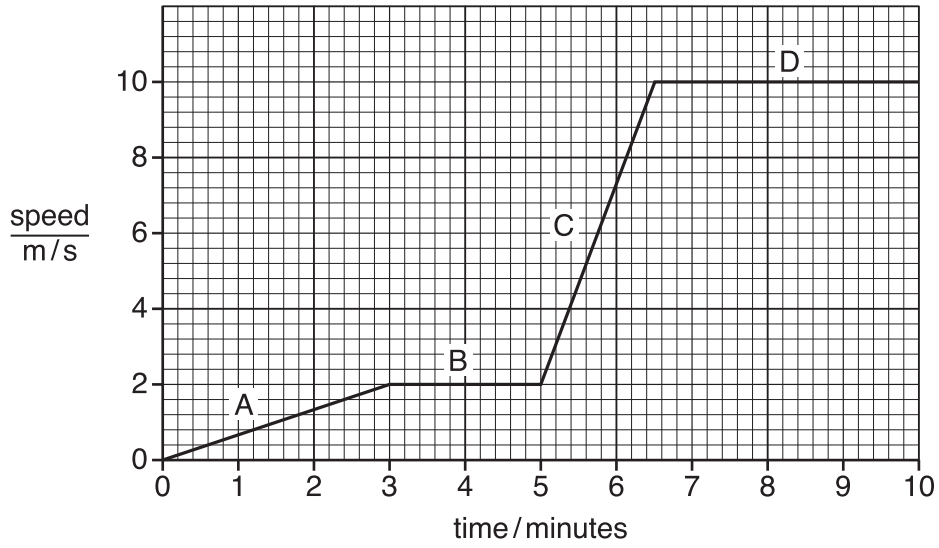


Fig. 2.1

(a) Describe the motion of the ship during each section of the graph.

A .....

.....

B .....

.....

C .....

.....

D .....

..... [4]

(b) Determine the distance travelled by the ship in section B of the graph.

distance = ... m [3]

[Total: 7]

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4(a)	A – accelerates (from rest)	**B1**
	B – constant speed (of 2 m / s)	**B1**
	C – accelerates at faster rate / higher acceleration than previously	**B1**
	D – faster constant speed (of 10 m / s)	**B1**
4(b)	2 minutes = 120 s	**C1**
	area under the graph OR $d = s \times t$ OR 2×120	**C1**
	240 (m)	**A1**

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5 Fig. 1.1 shows the speed-time graph for a car.

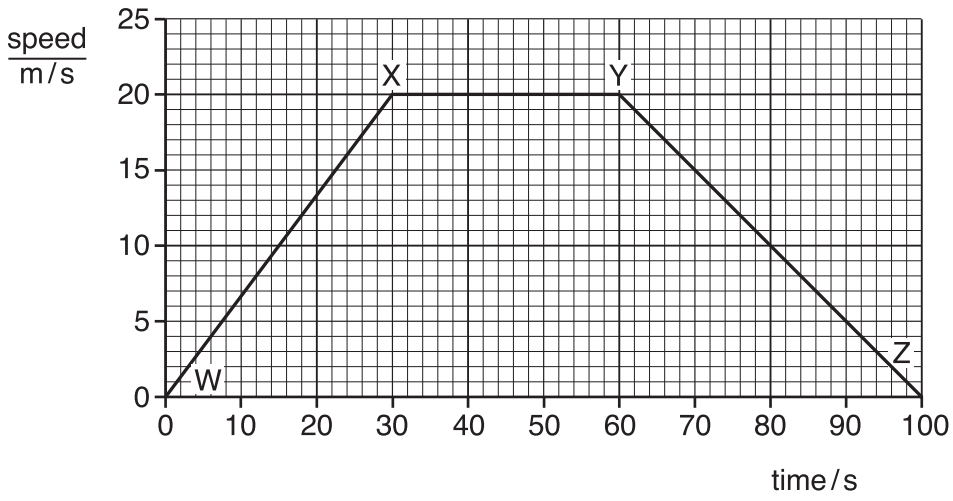


Fig. 1.1

(a) On Fig. 1.1, the labels W, X, Y and Z show the points when the car's motion changed.

On Fig. 1.2, draw a line from each section of the graph to the correct description of the motion.

section of graph	description of the motion
from W to X	accelerating
from X to Y	decelerating
from Y to Z	stationary
	constant speed

Fig. 1.2 [3]

(b) Calculate the distance that the car travels between 60 s and 100 s.

distance travelled = ... m [3]

(c) Fig. 1.1 shows that the car's acceleration is greater than its deceleration.

Explain how the graph shows this.

.....

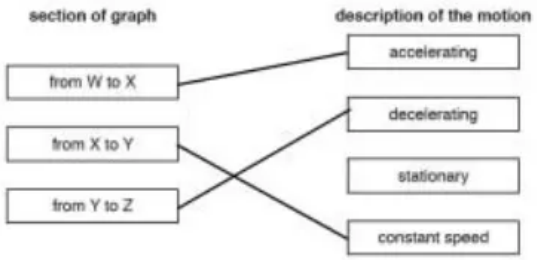
.....[1]

[Total: 7]

Motion Click for more variations

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5(a)	 1 mark for each correct line. 2 or more lines from any section loses the mark.	3
5(b)	(distance travelled) = area under graph OR ½ × base × height	1
	½ × 40 × 20	1
	400 (m)	1
5(c)	1st section/WX/from 0 s to 30 s has greater gradient than last (section)/YZ/from 60 s to 100 s	1

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6 At a sports event, a champion runner and a car take part in a race.

(a) The runner runs at a constant speed of 10 m/s from the start of the race. During the first 5.0 s of the race, the car's speed increases from 0 m/s to 25 m/s at a uniform rate.

On Fig. 1.1, draw

(i) a graph to show the motion of the runner, [1]

(ii) a graph to show the motion of the car.

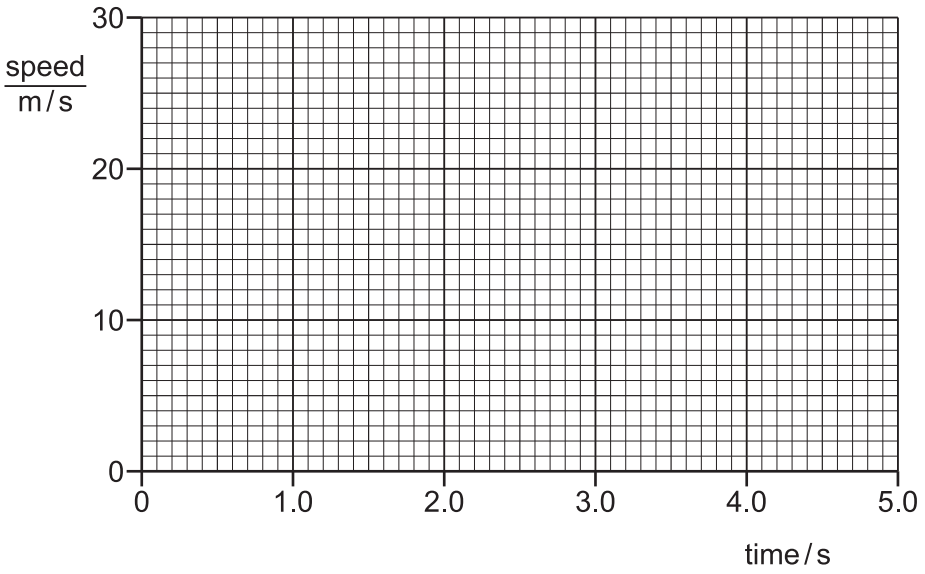


Fig. 1.1

[1]

(b) Use your graphs to determine

(i) the distance travelled by the runner in the 5.0 s,

distance = ...[1]

(ii) the distance travelled by the car in the 5.0 s,

distance = ...[2]

(iii) the time at which the car overtakes the runner.

time = ...[2]

[Total: 7]

Motion Click for more variations

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6	**(a)**	**(i)**	horizontal line at 10 m / s	B1
		(ii)	straight line from origin to (5.0, 25)	B1
	(b)	**(i)**	50 m	B1
		(ii)	area of triangle OR ½ × 25 × 5.0	C1
			62.5 m OR 63 m	A1
		(iii)	when areas under graphs are equal	C1
			4.0 s	A1

[Total: 7]

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7 Fig. 1.1 shows a student travelling down a hill in an unpowered vehicle.

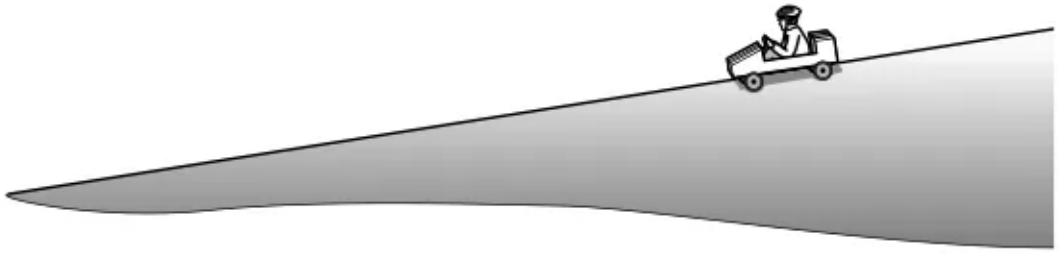


Fig. 1.1

Fig. 1.2 is part of the speed-time graph for the vehicle travelling down the hill.

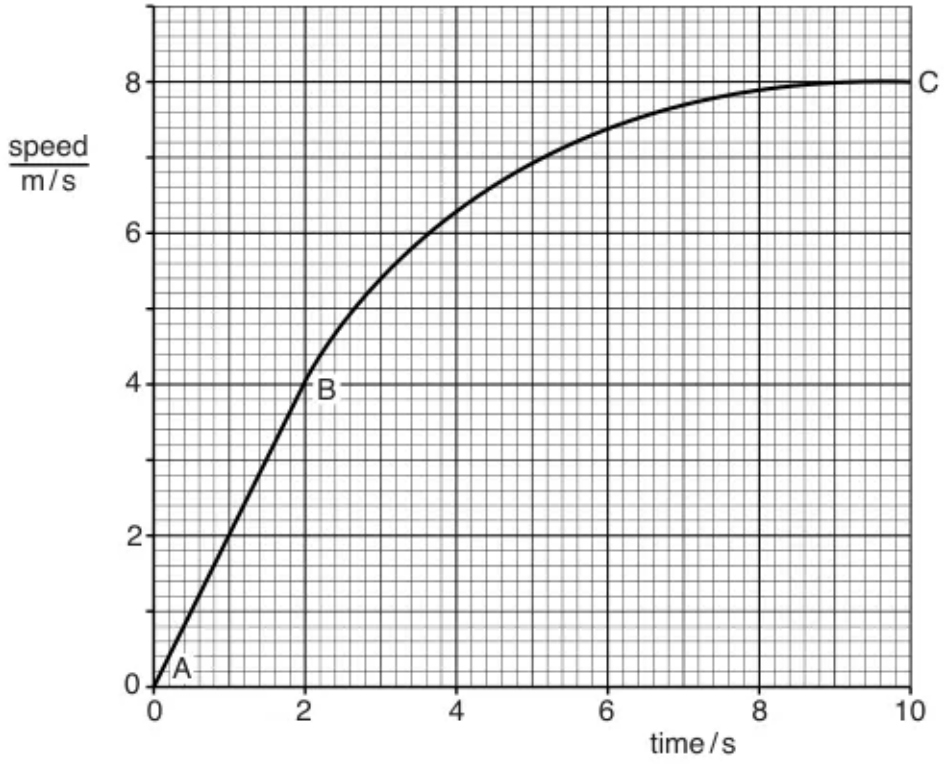


Fig. 1.2

(a) (i) State how the graph shows that the acceleration is constant between A and B.

..... [1]

(ii) Calculate the acceleration between A and B.

acceleration = ... [2]

(iii) Describe how the acceleration changes between B and C.

..... [1]

(b) Use Fig. 1.2 to obtain an approximate value for the distance travelled by the vehicle in the first 10 s, as shown on the graph.

distance = ... [4]

[Total: 8]

Motion Click for more variations

Reduced to 77% to fit the page (wider than A4).

7(a)(i)	constant gradient OR straight line	**B1**
7(a)(ii)	calculation of gradient (a = 4 / 2 =) 2.0 m / s^2	**C1** **A1**
7(a)(iii)	decreases / becomes zero	**B1**
7(b)	area or s = (av)v x t use of any triangle or trapezium (total distance =) 54–66 (m) (total distance =) 58–62 m	**C1** **C1** **C1** **A1**

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8 A rocket, initially at rest on the ground, accelerates vertically.

It accelerates uniformly until it reaches a speed of 900 m/s after 30 s.

After this period of uniform acceleration, the rocket engine cuts out. During the next 90 s, the upward speed of the rocket decreases uniformly to zero.

(a) On Fig. 4.1, plot a speed-time graph for the rocket for the first 120 s of its flight.

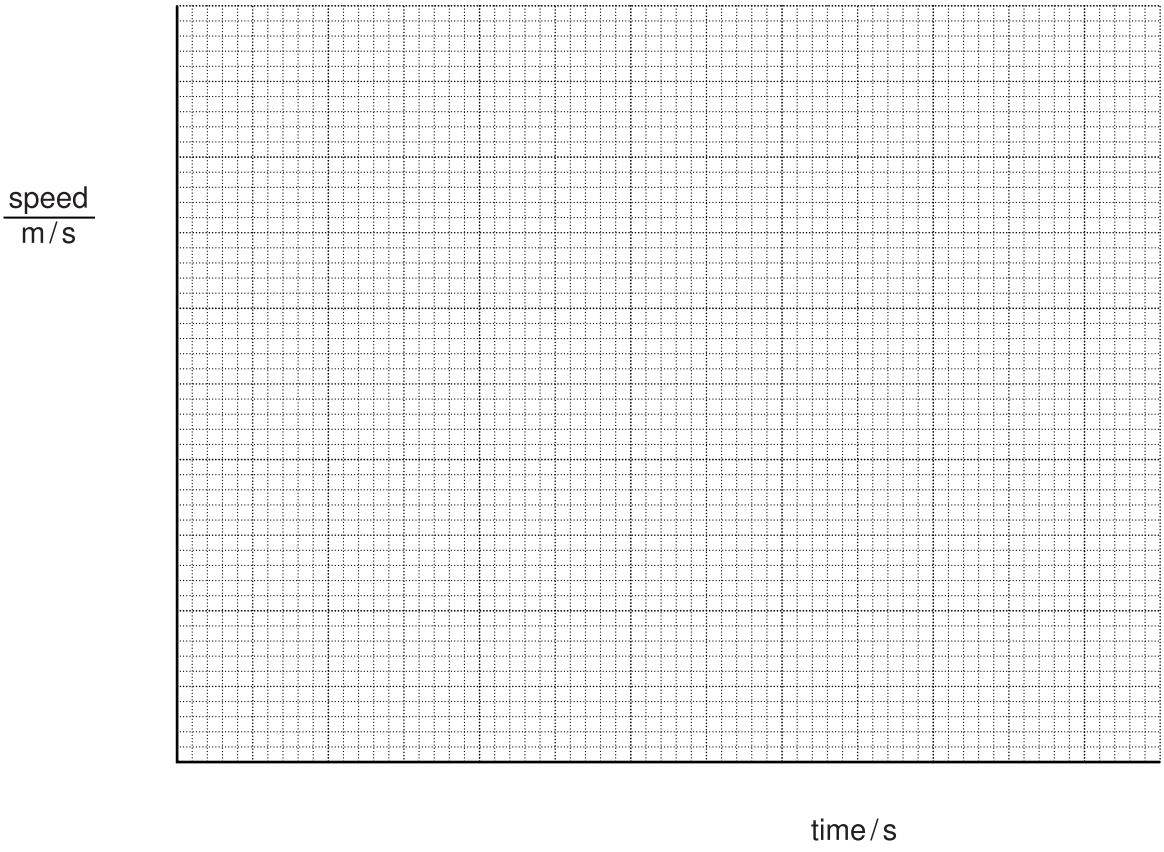


Fig. 4.1 [4]

(b) Using the graph,

(i) calculate the acceleration during the first 30 s,

acceleration = ... [2]

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(ii) determine the height reached by the rocket after 120 s.

height reached = ...[2]

[Total: 8]

Motion Click for more variations

8 **(a)** suitable scales (more than half each scale used, no products of 3 s, 7 s etc.) B1
2 straight line sections, continuous 0 to 120 s, 1st section positive gradient,
2nd section negative gradient B1
section 1 straight line, from(0, 0) to (30, 900) B1
section 2 straight line from end of section 1 to (120, 0) B1 [4]

(b) **(i)** use of $a = \Delta v / t$ or $\Delta v / t$ in any form words, symbols or numbers C1
(a = 900 / 30 =) 30 m / s^2 A1 [2]
e.c.f. from graph

(ii) use of s = area under graph (accept valid equation(s)) C1
(distance = 0.5 × 900 × 120 =) 54 000 m A1 [2]
e.c.f. from continuous graph, if curves working must be clear
no e.c.f. from graph if it's a single rectangle

[Total: 8]

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9 Fig. 2.1 shows the speed–time graphs for two cars, A and B.

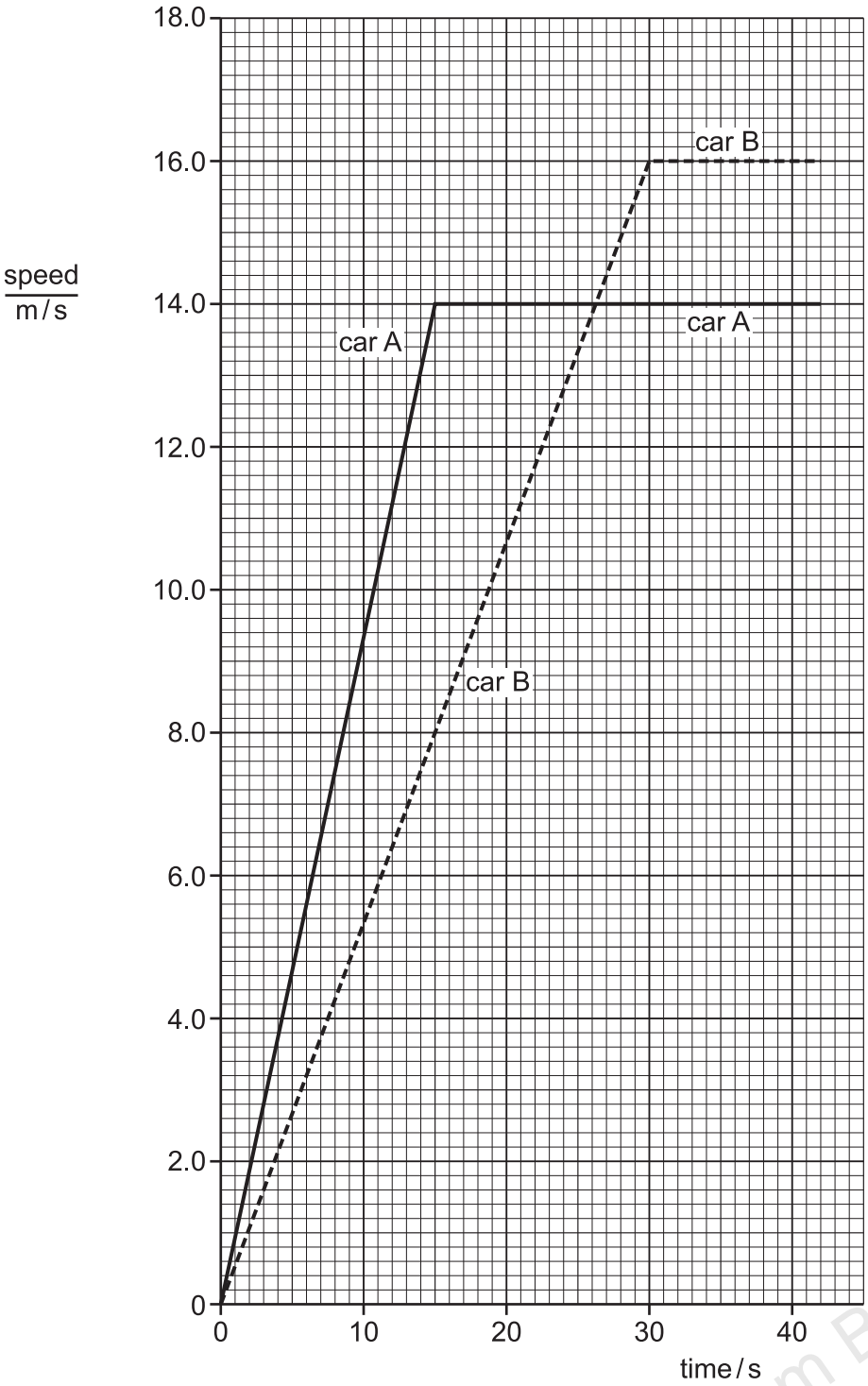


Fig. 2.1

(a) (i) Determine the speed of car A at time = 10 s.

speed = ... m/s [2]

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(ii) State and explain which car, A or B, has the greater acceleration during the first 10 seconds. Use information from the graph in Fig. 2.1 in your explanation.

.....

..... [2]

(b) (i) Describe the motion of car B after 30 s.

.....

..... [2]

(ii) Calculate the distance moved by car B from time = 0 to time = 30.0 s.

distance = ... m [3]

[Total: 9]

Motion Click for more variations

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9(a)(i)	9.3 (m/s)	**A2**
	any indication on graph or in working of vertical line from 10.0 s	**(C1)**
9(a)(ii)	(car) A (has greater acceleration)	**M1**
	(speed-time graph/line) has greater gradient OR is steeper	**A1**
9(b)(i)	speed (of car) is steady OR speed is constant	**B1**
	(at) 16 m/s	**B1**
9(b)(ii)	240 (m)	**A3**
	(distance =) ½ × 16 × 30	**(C2)**
	distance travelled = area under graph OR (d =)speed × time OR ½ × b × h	**(C1)**

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10 Fig. 1.1 shows the speed–time graph for a cyclist beginning a race. The motion of the cyclist changes at points A, B and C.

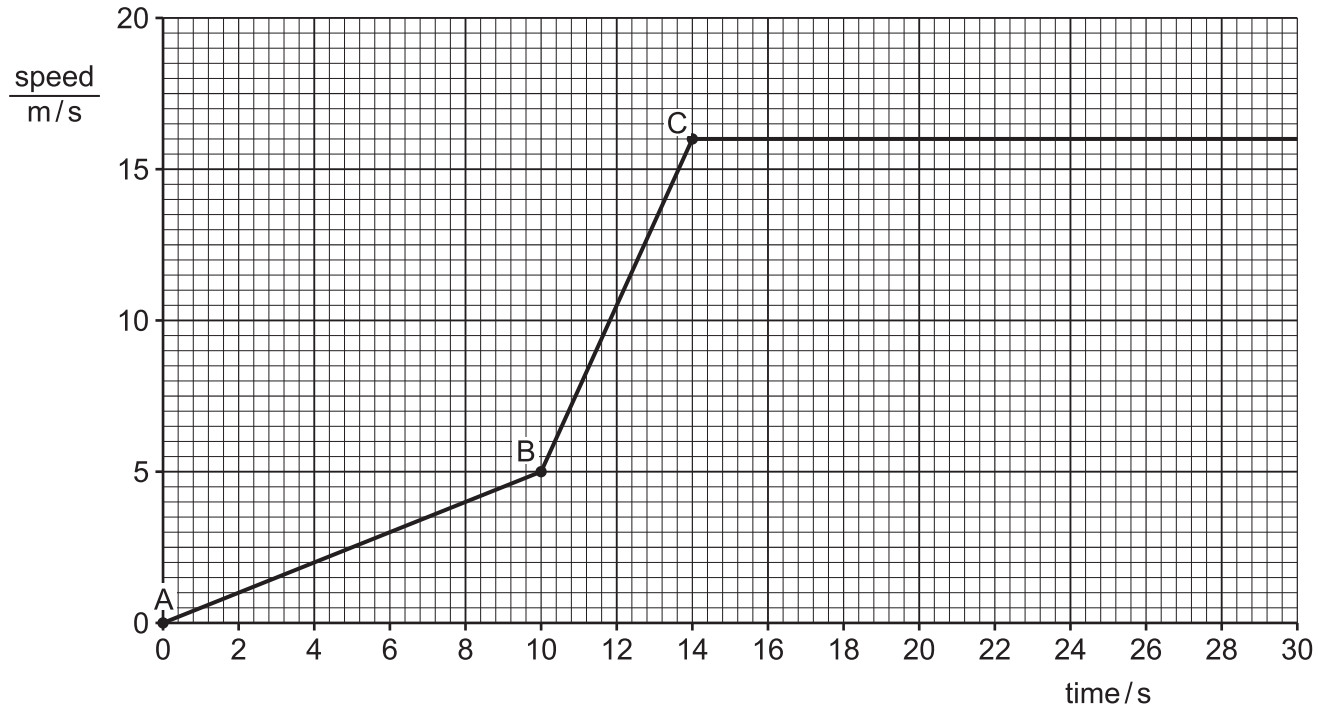


Fig. 1.1

(a) Using information from Fig. 1.1, determine:

(i) the speed of the cyclist at time = 6.0 s

speed = ... m/s [2]

(ii) the maximum speed of the cyclist.

maximum speed = ... m/s [1]

(b) **(i)** Describe the motion of the cyclist between point A and point B.

..... [1]

(ii) Describe how the motion of the cyclist between points B and C differs from the motion between points A and B.

Give a reason for your answer.

difference .....

reason .....
[2]

(c) Determine the distance travelled by the cyclist between point A and point B.

distance = ... m [3]

[Total: 9]

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10(a)(i)	3(.0) (m / s)	**A2**
	any indication on graph or in working of vertical / horizontal line from 6.0 s	C1
10(a)(ii)	16 (m / s)	**B1**
10(b)(i)	(constant) accelerating / speed increasing	**B1**
10(b)(ii)	greater acceleration	**B1**
	line is steeper / greater gradient	**B1**
10(c)	25 (m)	**A3**
	½ × 5 × 10	(C2)
	(distance =) area under graph OR ½ × *b* × *h* OR (distance =) speed × time	(C1)

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