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

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Motion

Time allowed: 1 hour 15 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

/ 78

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 78 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 is an incomplete graph that shows the motion of an object. The axes labels are incomplete.

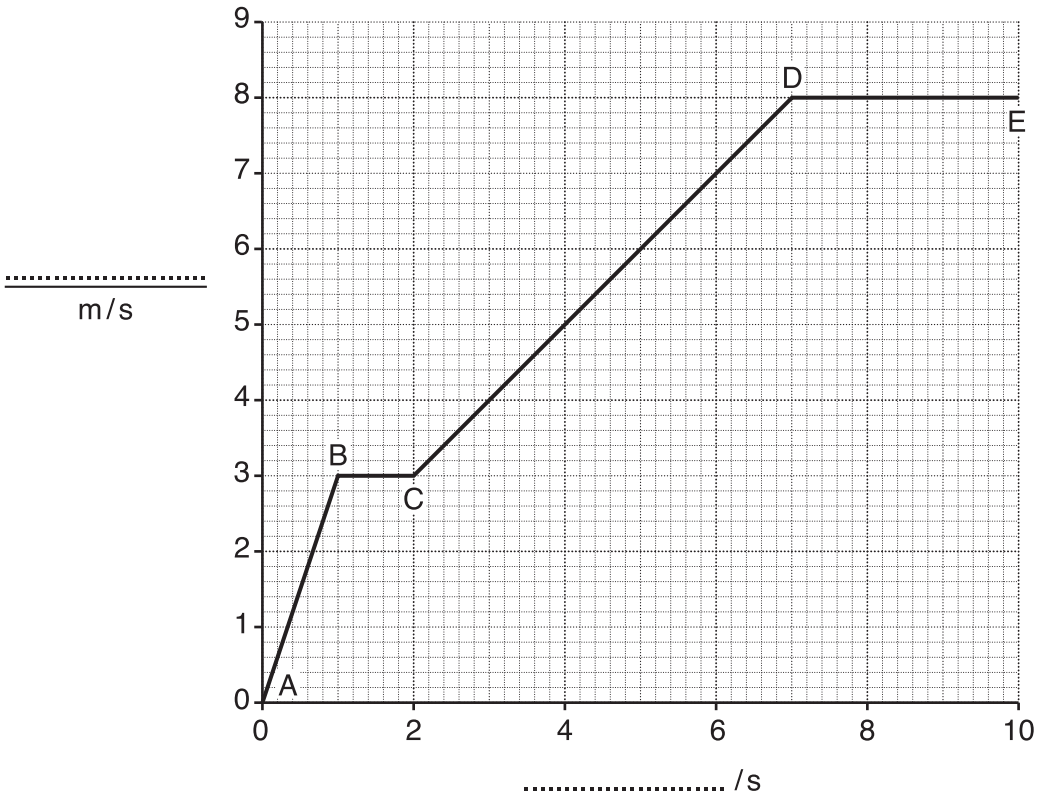


Fig. 1.1

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

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2 A girl cycles to meet a friend. The distance-time graph for her journey from start to finish is shown in Fig. 5.1.

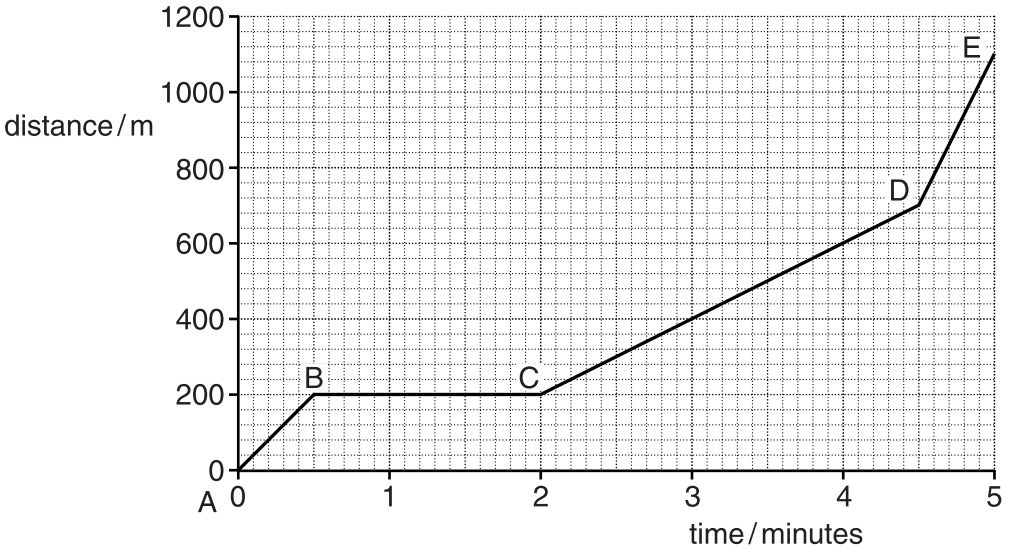


Fig. 5.1

(a) How far does the girl travel from start to finish?

distance = ...[1]

(b) Describe the motion of the girl between points B and C.

.....[1]

(c) Which section of the graph shows

(i) the part of the girl's journey that involves cycling up a hill 500 m long,

between ..... and ..... [1]

(ii) the girl travelling at the fastest speed?

between ..... and ..... [1]

(d) Calculate her average speed, in m / s, for the whole journey.

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average speed = ... m / s [3]

[Total: 7]

Motion Click for more variations

2 **(a)** 1100 (m) ± 20 B1

(b) stationary / not moving / at rest B1

(c) **(i)** C **AND** D B1

(ii) D **AND** E B1

(d) (speed=) distance ÷ time, in any form: symbols, words, numbers, ecf from **(a)** C1

use of 300 s **OR** conversion of time to s **OR** ÷ 60 C1

3.7 **OR** 3.67 (m / s) A1

[Total: 7]

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3 Fig. 1.1 shows a tram. Trams carry passengers from one place to another.

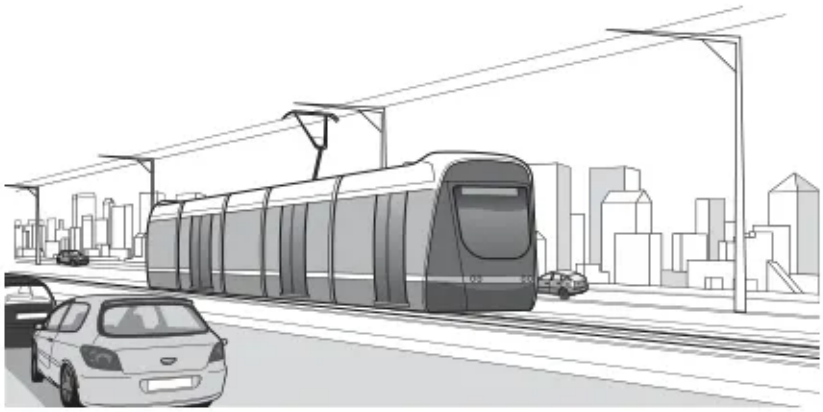


Fig. 1.1

A tram travels from A to E, stopping at B, C and D on the way.
Fig. 1.2 shows the speed–time graph for this tram journey.

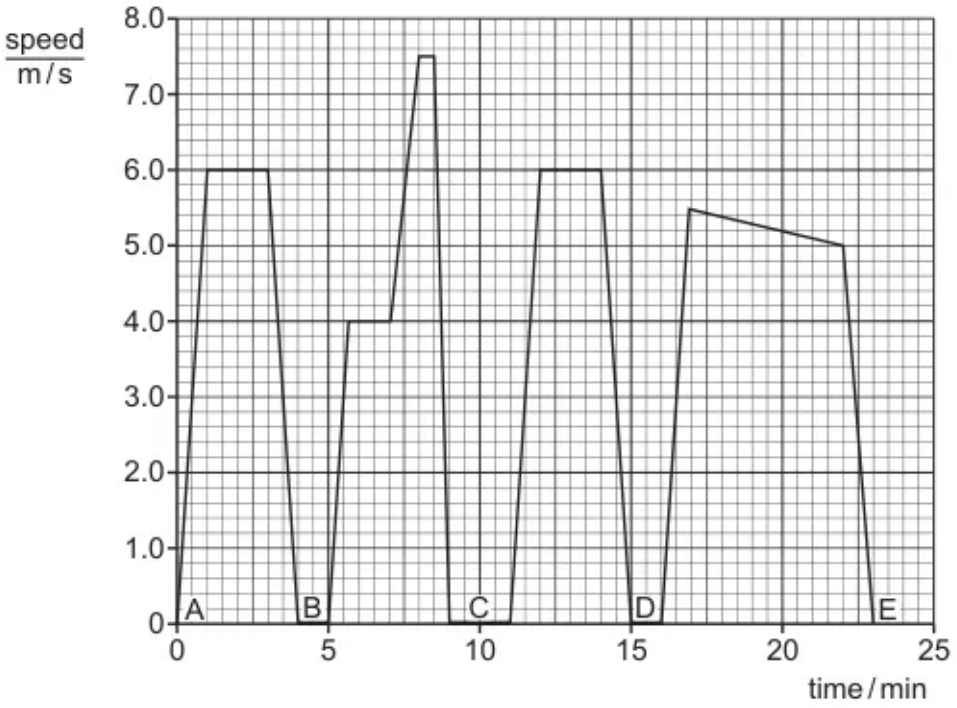


Fig. 1.2

(a) (i) Determine the time between the tram leaving A and arriving at C.

time = ... min [1]

(ii) Determine the maximum speed of the tram during the journey from A to E.

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

(iii) The tram decelerates as it approaches each stop. Use information from Fig. 1.2 to identify the greatest deceleration. Give a reason for your answer.

Complete the sentence.

The greatest deceleration occurs as the tram approaches ..... .

reason .....

.....

[2]

(b) The total distance between A and E is 5200 m.
The tram takes 1380 s to travel from A to E.

Calculate the average speed of the tram between A and E.

average speed = ... m/s [3]

[Total: 7]

Motion Click for more variations

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3(a)(i)	9 (min)	**B1**
3(a)(ii)	7.5 (m / s)	**B1**
3(a)(iii)	C	**M1**
	greatest slope / greater change of speed in same time interval owtte	**A1**
3(b)	3.8 (m / s)	**A3**
	5200 ÷ 1380	(C2)
	(average speed =) (total) distance ÷ (total) time in any form	(C1)

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4 Fig. 1.1 shows the speed–time graph for a car travelling along a flat, straight road. The graph has four sections, labelled JK, KL, LM and MN.

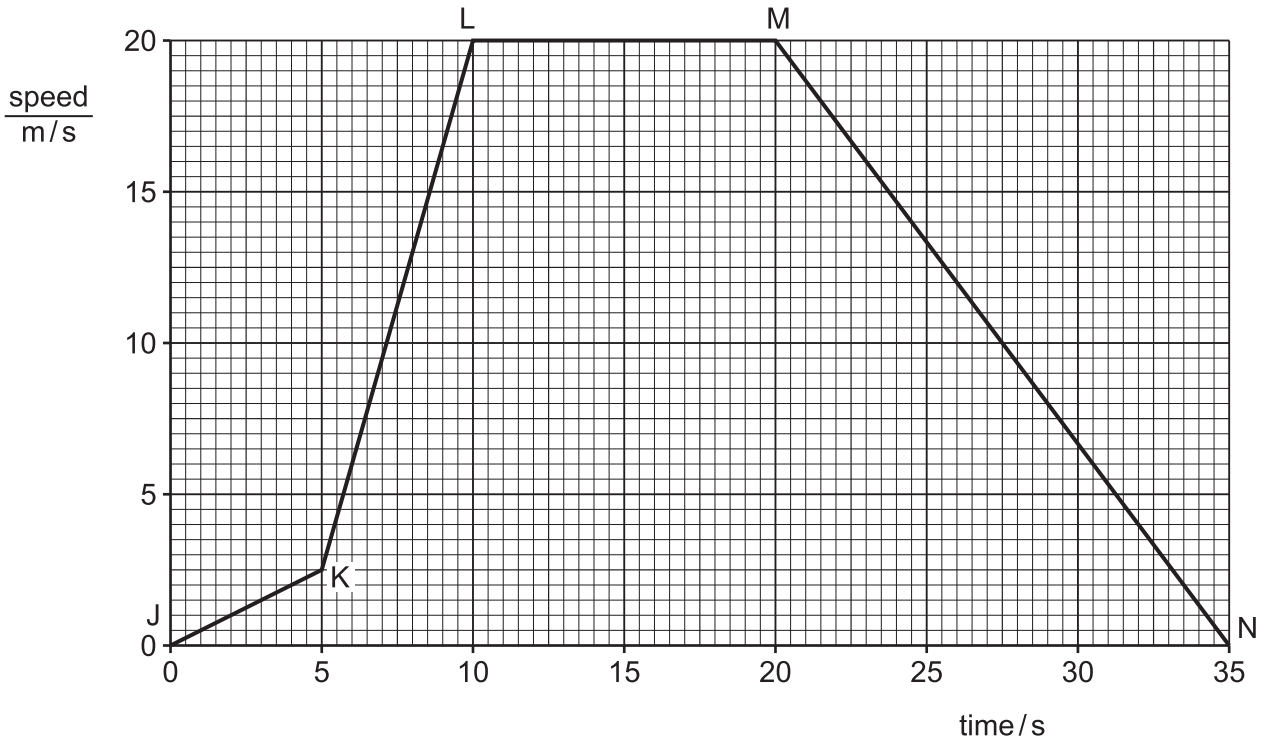


Fig. 1.1

(a) Complete the following sentence.

The car has the largest acceleration in section ..... . [1]

(b) Calculate the distance travelled by the car between time = 20 s and time = 35 s.

distance travelled = ... m [3]

(c) Describe the motion of the car during:

(i) section LM

..... [1]

(ii) section MN.

..... [1]

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(d) Another car travels a distance of 500 m in a time of 20 s.

Calculate the average speed of this car.

average speed = ... m / s [3]

[Total: 9]

Motion Click for more variations

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4(a)	(section) KL **OR** LK	**B1**
4(b)	(distance travelled =) 150 (m)	**A3**
	(distance travelled =) ½ × 20 × 15	C2
	(distance travelled =) area under graph **OR** ½ × b × h	C1
4(c)(i)	(section LM is) constant / steady speed	**B1**
4(c)(ii)	(section MN is) decelerating	**B1**
4(d)	(average speed =) 25 (m / s)	**A3**
	(average speed =) 500 ÷ 20	C2
	(average speed =) (total) distance travelled ÷ (total) time	C1

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5 A student watches a car race around a track. He uses a stopwatch to measure the time for the car to make one lap of the track.

(a) The student forgets to reset the stopwatch at the start of the race. Fig. 1.1 shows the time on the stopwatch at the start and the time after going around the track once.

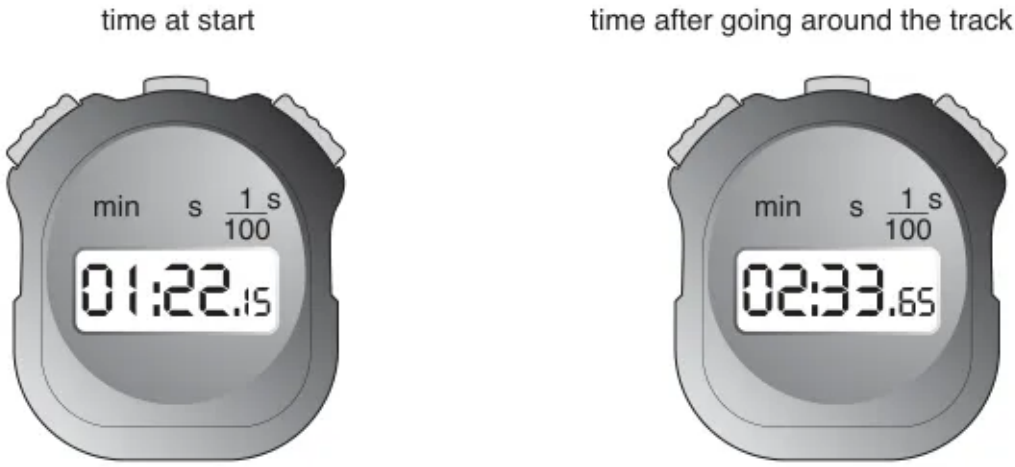


Fig. 1.1

Calculate the time the car takes to go around the track once, in seconds.

time = ... s [2]

(b) The length of the track is 4.0 km. The car goes around the track 20 times. The car takes 26 minutes and 40 seconds to complete the 20 laps.

Calculate the average speed of the car in m/s.

average speed = ... m/s [4]

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(c) Fig. 1.2 shows a speed-time graph for the car during part of the race.

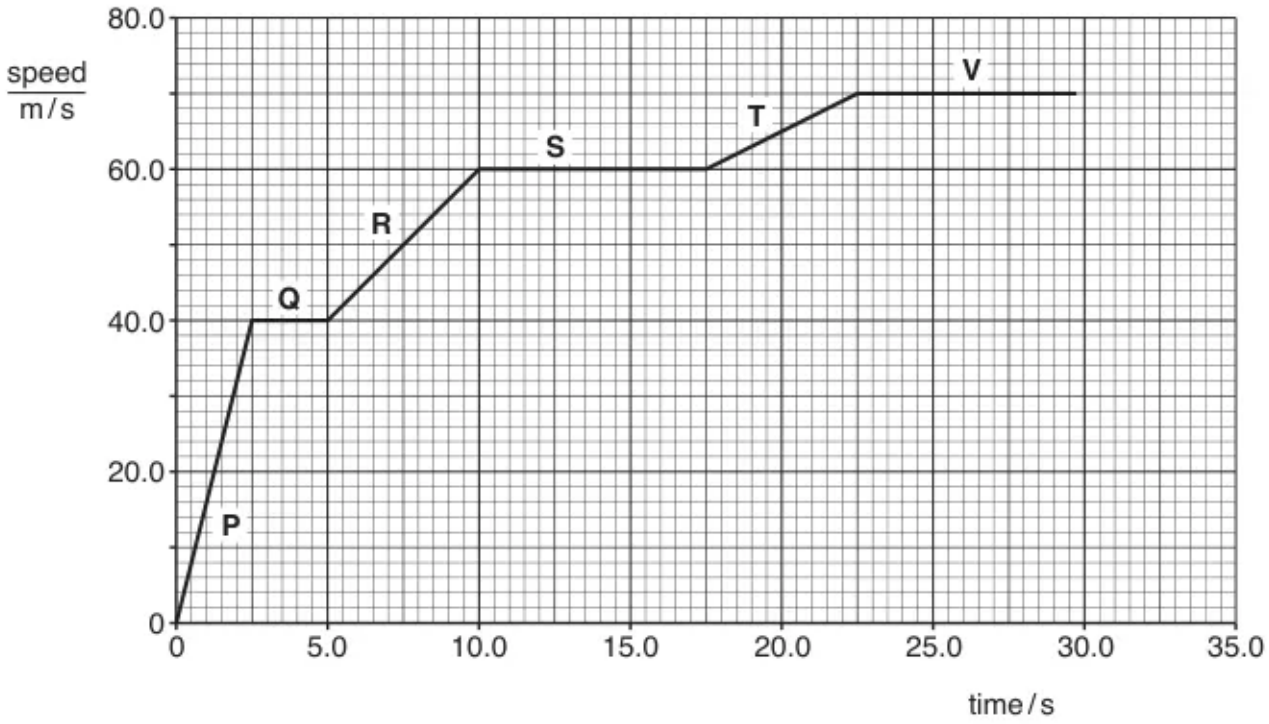


Fig. 1.2

(i) State the section of the graph that shows the greatest acceleration.

.....

Explain your answer.

.....

[2]

(ii) Calculate the distance travelled by the car during the first 2.5 seconds.

distance = ... m [3]

[Total: 11]

Motion Click for more variations

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5(a)	2 : 33 : 65 – 1 : 22 : 15 **OR** 153.65 – 82.15	**1**
	71.50 (s)	**1**
5(b)	4 × 20 **OR** 4000 × 20	**1**
	(average speed =) distance ÷ time	**1**
	80 000 ÷ 1600	**1**
	50 (m / s)	**1**
5(c)(i)	(section) P or from 0 s to 2.5 s	**1**
	(line has) greatest gradient	**1**
5(c)(ii)	dist travelled = area under graph **OR** ½ × b × h	**1**
	½ × 2.5 × 40	**1**
	50 (m)	**1**

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6 **(a)** Define *acceleration*.

.....

..... [1]

(b) Fig. 1.1 shows two speed–time graphs, A and B, and two distance–time graphs, C and D.

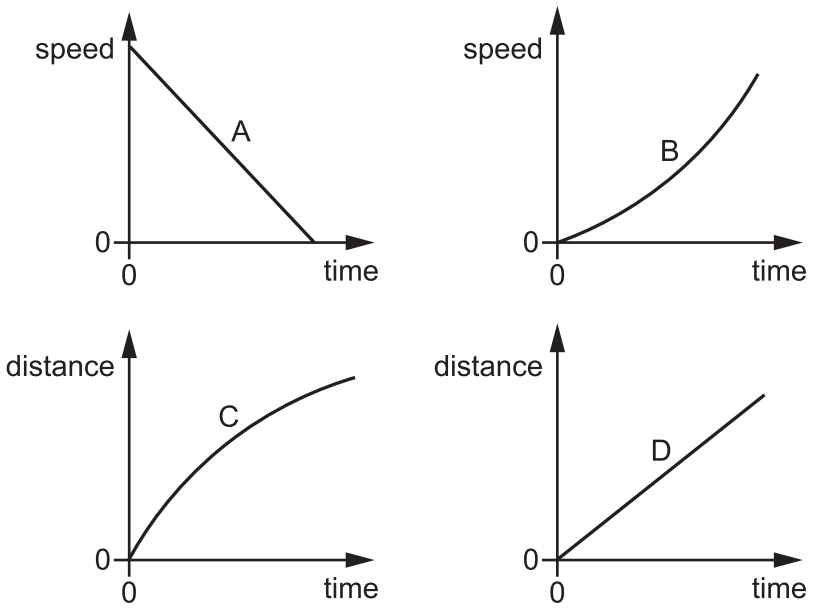


Fig. 1.1

Describe the motion shown by:

(i) graph A .....

..... [2]

(ii) graph B .....

..... [2]

(iii) graph C .....

..... [1]

(iv) graph D. .....

..... [1]

[Total: 7]

Motion Click for more variations

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6(a)	rate of change of velocity OR change in speed per unit time / s	**B1**
6(b)(i)	deceleration	**C1**
	constant deceleration	**A1**
6(b)(ii)	acceleration	**C1**
	increasing acceleration	**A1**
6(b)(iii)	decreasing speed / velocity OR deceleration	**B1**
6(b)(iv)	constant speed	**B1**

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7 A girl rides her bicycle along a straight level road. Fig. 2.1 shows a graph of her distance moved against time.

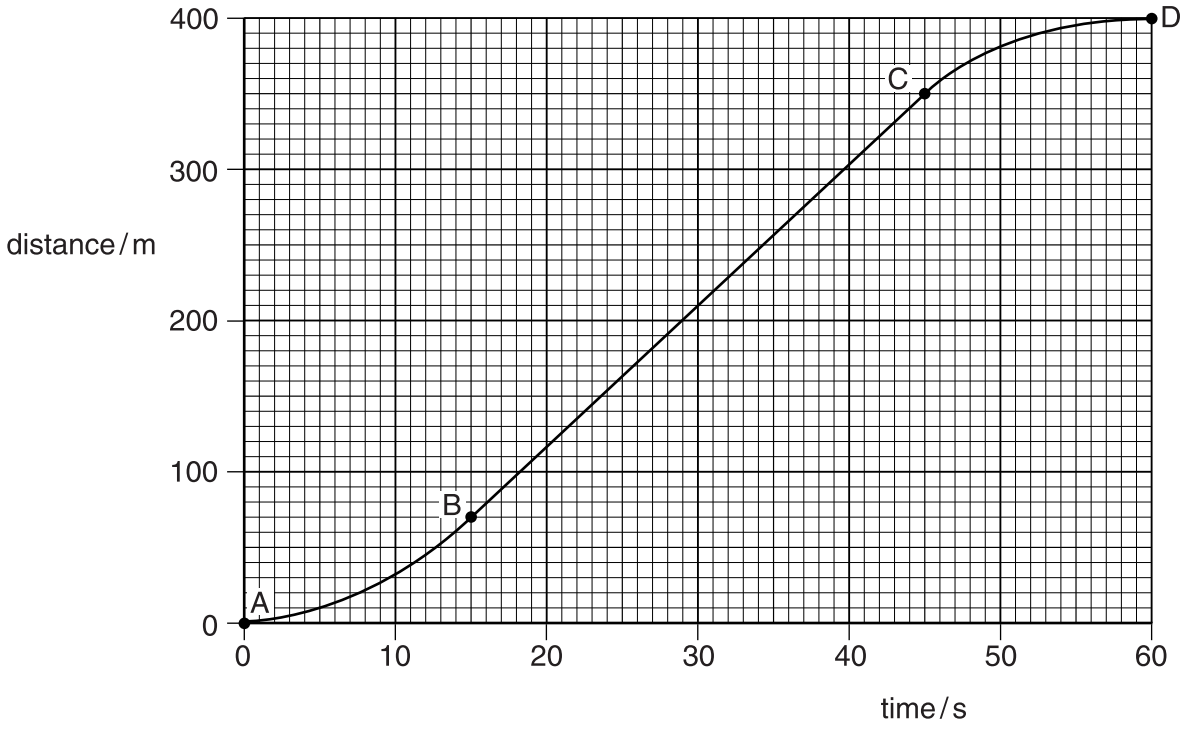


Fig. 2.1

(a) Describe her motion

(i) from A to B, ...

(ii) from B to C, ...

(iii) from C to D. .....

[3]

(b) Calculate

(i) her average speed from A to D,

average speed = ... [2]

(ii) her maximum speed.

maximum speed = ... [3]

[Total: 8]

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7	**(a)**	**(i)**	Increasing speed / acceleration	B1
		(ii)	Constant / steady / uniform speed or motion	B1
		(iii)	Decreasing speed / deceleration / braking / slowing / stopping / negative acceleration	B1
	(b)	**(i)**	(Total) distance / (total) time OR d / t OR 400 / 60	C1
			6.67 m/s at least 2 s.f.	A1
		(ii)	Mention of maximum gradient OR clear that whole or part of B to C is used	C1
			Use of correct data from graph to +/– ½ square	C1
			Answer rounds to 9.2 to 9.4 m/s, at least 2 s.f.	A1

[Total: 8]

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8 **(a)** Figs. 1.1 and 1.2 show speed-time graphs for two objects, each moving in a straight line.

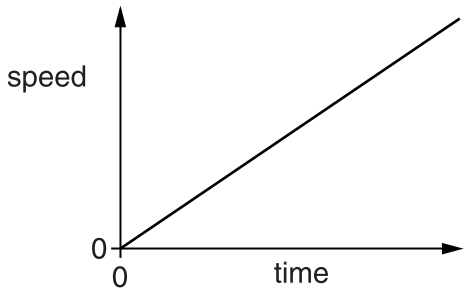


Fig. 1.1

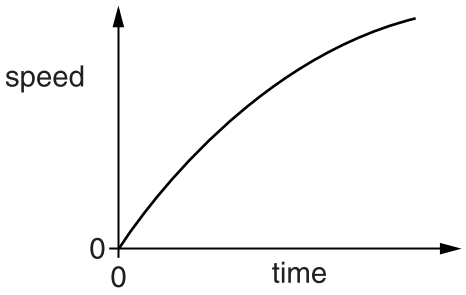


Fig. 1.2

(i) Describe the motion of the object shown by the graph in Fig. 1.1.

.....

.....

(ii) Describe the motion of the object shown by the graph in Fig. 1.2.

.....

.....

[3]

(b) On a day with no wind, a large object is dropped from a tall building. The object experiences air resistance during its fall to the ground.

State and explain, in terms of the forces acting, how the acceleration of the object varies during its fall.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

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Motion Click for more variations

8	**(a)**	**(i)**	acceleration OR increasing speed	C1
			constant acceleration OR constant rate of increase in speed	A1
		(ii)	decreasing acceleration OR decreasing rate of increase in speed NOT deceleration	B1
	(b)		mention of air resistance AND weight (of object) / force due to gravity	B1
			acceleration at start (of fall) is acceleration of gravity / 10 m / s^2 / a maximum / *g* OR acceleration decreases (as it falls)	B1
			air resistance increases as speed increases/as it accelerates	B1
			acceleration zero/terminal velocity/constant speed/maximum speed when air resistance = weight	B1

[Total: 7]

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9 **(a)** Underline the vectors in the following list of quantities.

density energy force mass velocity volume [2]

(b) A small metal ball is projected into the air with a velocity of 40 m/s vertically upwards.

The graph in Fig. 2.1 shows how the velocity changes with time until the ball reaches its maximum height.

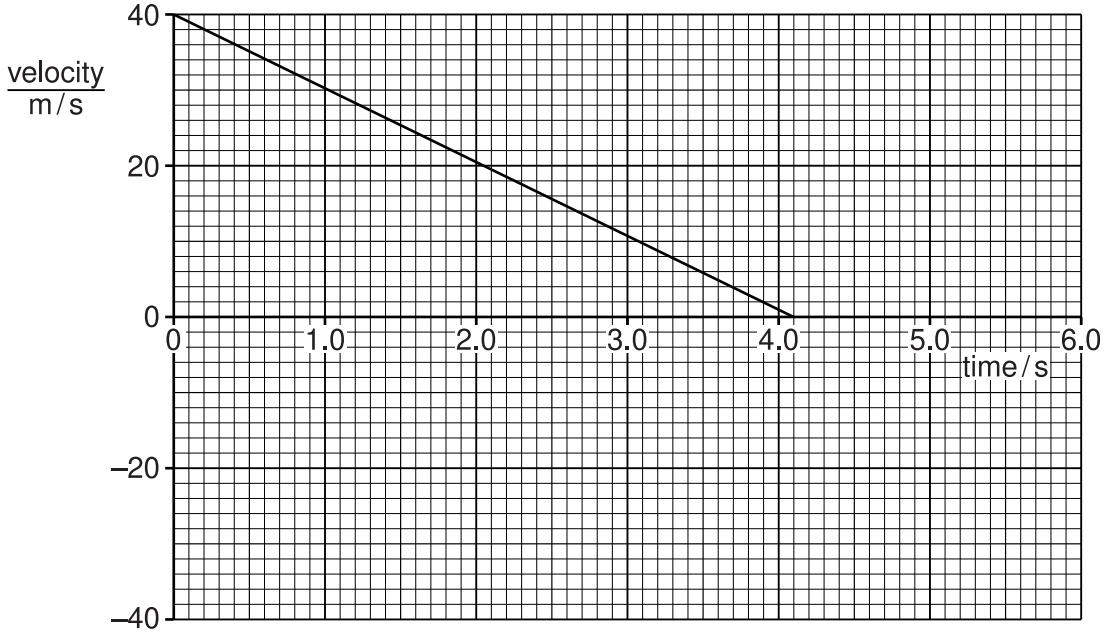


Fig. 2.1

Use the graph to find,

(i) the time at which the ball reaches its maximum height,

time = ...[1]

(ii) the deceleration of the ball,

deceleration = ...[2]

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(iii) the maximum height reached by the ball.

maximum height = ...[2]

(c) On Fig. 2.1, add a line to the graph to show how the velocity of the ball changes after it reaches its maximum height. Your line should extend to time 6.0 s. [1]

[Total: 8]

Scalars and vectors Click for more variations

9 **(a)** underline or circle force B1
underline or circle velocity B1

(b) **(i)** 4.07 – 4.1 (s) B1

(ii) $(v - u)/t$ OR $\Delta v/t$ OR in words OR use of 40 ÷ (ans. to **(b)(i)**)
OR other correct values from graph C1
answer between 9.7 and 10 m/s^2 or m/s/s A1

(iii) area under graph OR ½ $(u + v)t$ OR ½ × 40 × (ans. to **(b)(i)**) C1
OR $s = ut + ½at^2$ OR $v^2 = u^2 + 2as$ OR numbers substituted
82 m A1

(c) graph continues in straight line to 6 s B1

[Total 8]

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10 A ship sails in a straight line between two ports.
Fig. 1.1 shows the speed–time graph of the ship for the first 100 minutes of its journey between the two ports.

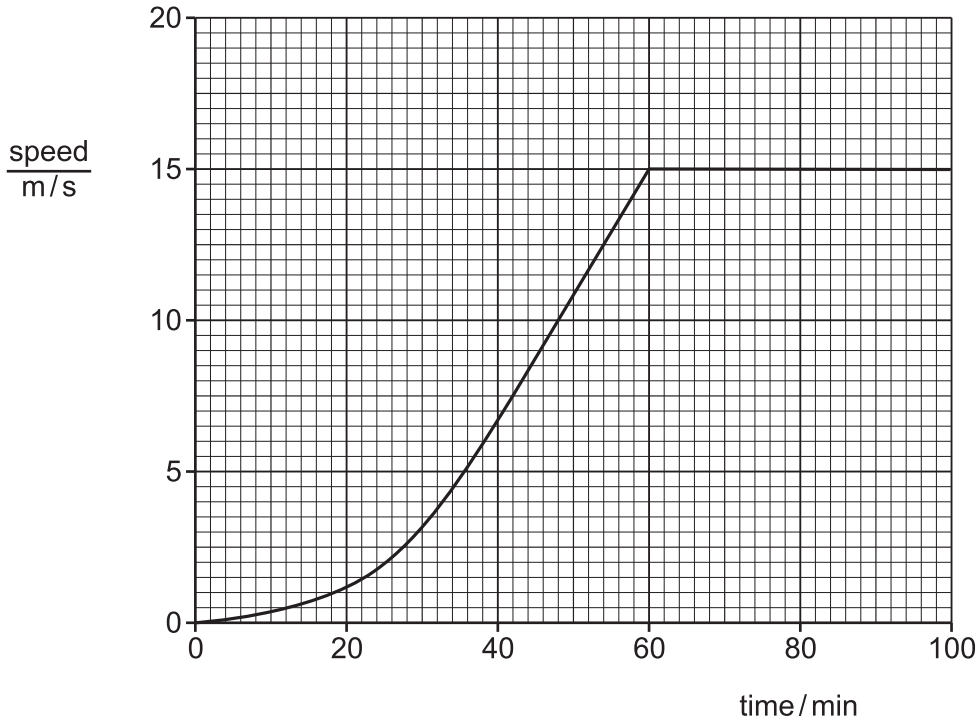


Fig. 1.1

(a) Calculate the maximum acceleration during the first 100 minutes of the ship's journey.

maximum acceleration = ... [2]

(b) Calculate the total distance travelled by the ship between time = 42 min and time = 100 min.

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distance travelled = ... [3]

(c) At a time not shown on the graph, the acceleration of the ship is $0.0087\,m/s^2$. The total mass of the ship and its passengers is 2.3×10^7 kg.

(i) Calculate the resultant force on the ship.

force = ... [2]

(ii) Explain why the force on the ship due to the ship's engine is greater than the value you calculated in **(c)(i)**.

.....

..... [1]

[Total: 8]

Motion Click for more variations

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10(a)	$0.0069\,m/s^2$	**A2**
	(acceleration =) gradient of graph or $\Delta v / \Delta t$ in any form OR $\frac{15-7.5}{(60-42)60}$	C1
10(b)	48 000 m or 48 km	**A3**
	area under graph	C1
	$\frac{1}{2}(18\times7.5\times60)+(7.5\times18\times60)+(15\times40\times60)$	C1
10(c)(i)	(force =) 2.0×10^5 N	**A2**
	(F =) ma OR $2.3 \times 10^7 \times 0.0087$ in any form	C1
10(c)(ii)	there is a backward / drag force OR water resistance	**B1**

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