Topical Past Paper Workbook

IGCSE Physics (0625) Paper 4

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Introduction

Each topical past paper book consists of hundreds of questions and their answer schemes, in the form of worksheets. Questions are assigned to each chapter according to their corresponding topic. Topics, in turn, are based on the items of the latest Cambridge IGCSE or AS/A level syllabus content. This book's specifications are as follows:

Title: IGCSE Physics (0625) Paper 4 Topical Past Paper Workbook
Subtitle: Exam Practice Worksheets With Answer Scheme
Examination board: Cambridge Assessment International Education (CAIE)
Subject code: 0625
Years covered: 2012 – 2021
Paper: 4 (Structured Questions)
Number of pages: 1188
Number of questions: 659

Contents

Chapter 1

General physics

1.1 Length and time

1. 0625_s12_qp_31 Q: 1

The period of the vertical oscillations of a mass hanging from a spring is known to be constant.

(a) A student times single oscillations with a stopwatch. In 10 separate measurements, the stopwatch readings were:

1.8s, 1.9s, 1.7s, 1.9s, 1.8s, 1.8s, 1.9s, 1.7s, 1.8s, 1.8s.

What is the best value obtainable from these readings for the time of one oscillation? Explain how you arrive at your answer.

best value = ...

explanation .....

.....

..... [1]

(b) Describe how, using the same stopwatch, the student can find the period of oscillation more accurately.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 5]

1.2 Motion

2. 0625_s21_qp_41 Q: 1

A skydiver of mass 76 kg is falling vertically in still air. At time $t = 0$, the skydiver opens his parachute.

Fig. 1.1 is the speed–time graph for the skydiver from $t = 0$.

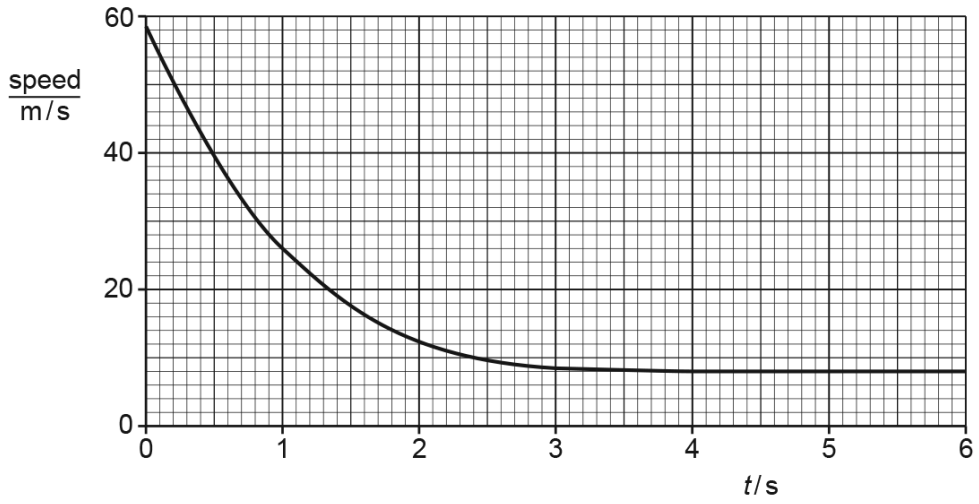

Fig. 1.1

(a) Using Fig. 1.1, determine:

(i) the deceleration of the skydiver immediately after the parachute opens

deceleration = ... [2]

(ii) the force due to air resistance acting on the skydiver immediately after the parachute opens.

force = ... [3]

(b) Explain, in terms of the forces acting on the skydiver, his motion between $t = 0$ and $t = 6.0$ s.

.....

.....

.....

..... [3]

(c) Explain why opening the parachute cannot reduce the speed of the skydiver to zero.

.....

.....

..... [2]

[Total: 10]

3. 0625_m20_qp_42 Q: 1

A rocket is launched vertically upwards from the ground. The rocket travels with uniform acceleration from rest. After 8.0 s, the speed of the rocket is 120 m/s.

(a) Calculate the acceleration of the rocket.

acceleration = ... [2]

(b) (i) On Fig. 1.1, draw the graph for the motion of the rocket in the first 8.0 s.

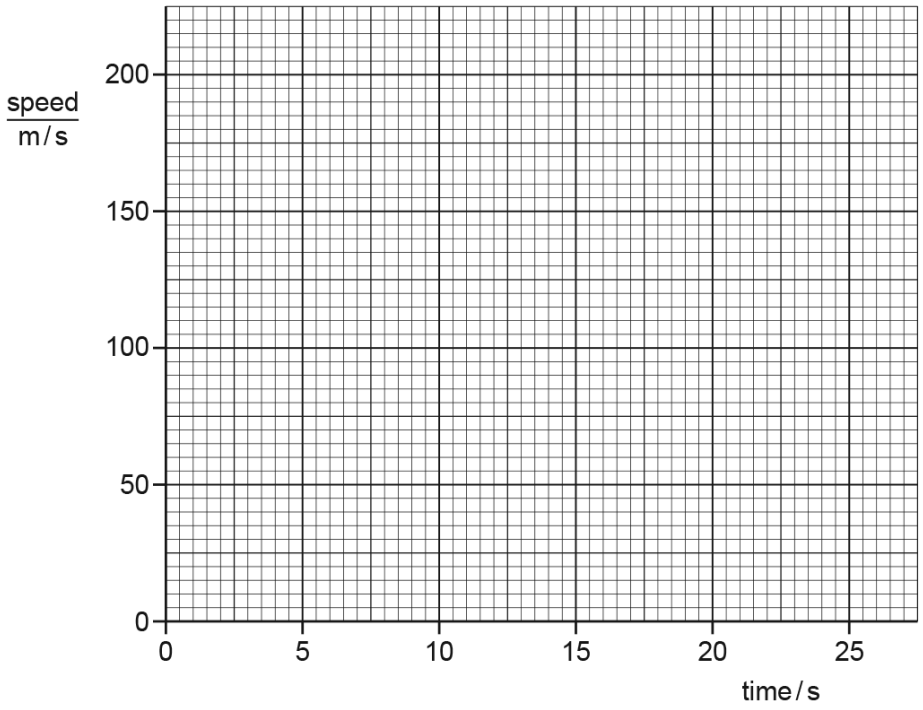

Fig. 1.1

[1]

(ii) Use the graph to determine the height of the rocket at 8.0 s.

height = ... [2]

(iii) From time = 8.0 s to time = 20.0 s, the rocket rises with increasing speed but with decreasing acceleration.

From time = 20.0 s to time = 25.0 s, the rocket has a constant speed of less than 200 m/s.

On Fig. 1.1, draw the graph for this motion. [3]

[Total: 8]

4. 0625_p20_qp_40 Q: 1

Fig. 1.1 shows the speed-time graph for a car travelling along a straight road.

The graph shows how the speed of the car changes as the car passes through a small town.

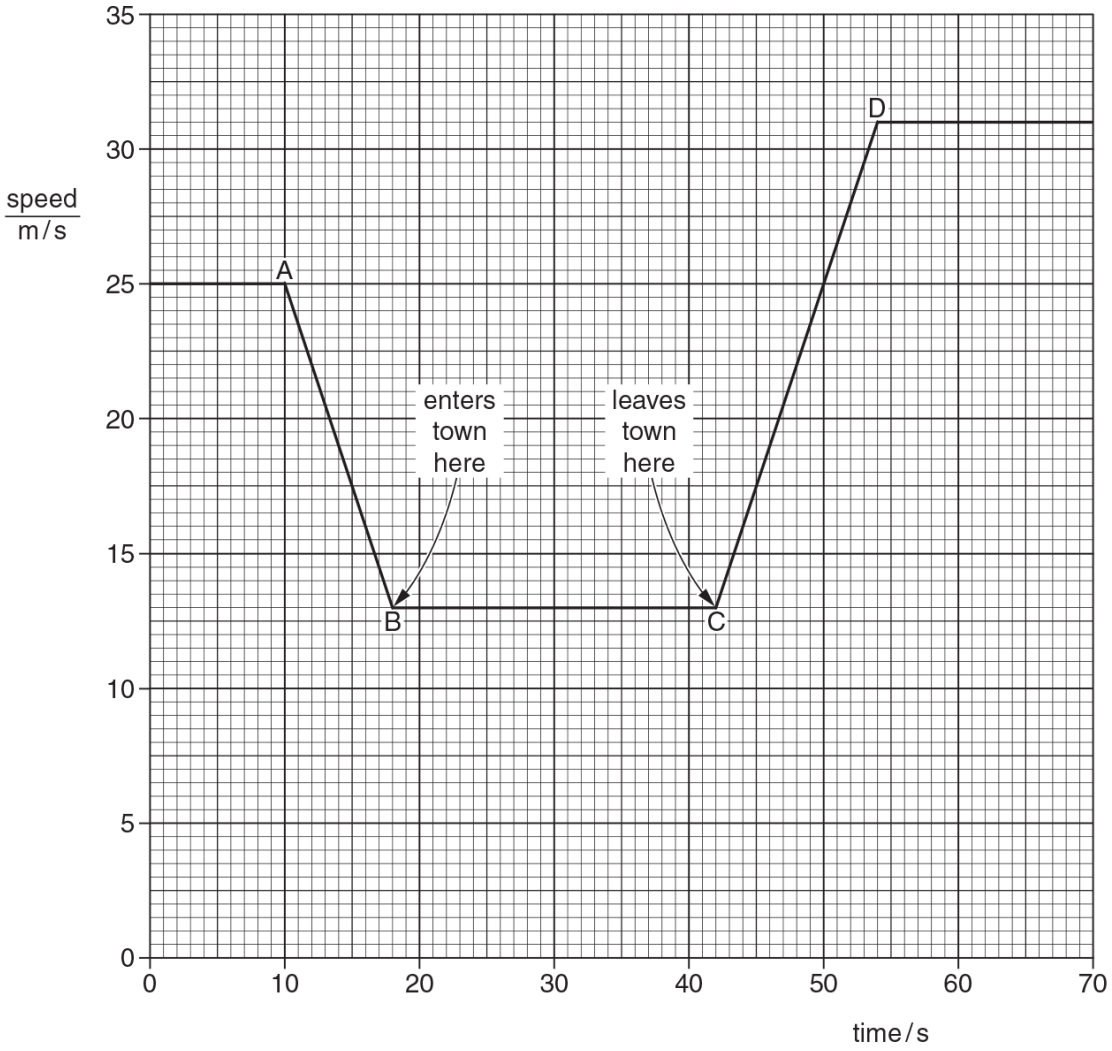

Fig. 1.1

(a) Calculate the distance between the start of the town and the end of the town.

distance = ... [3]

(b) Calculate the acceleration of the car between C and D.

acceleration = ... [3]

(c) State how the graph shows that the deceleration of the car has the same numerical value as its acceleration.

.....

..... [1]

[Total: 7]

5. 0625_s20_qp_42 Q: 1

Fig. 1.1 shows the speed–time graph of a person on a journey.

On the journey, he walks and then waits for a bus. He then travels by bus. He gets off the bus and waits for two minutes. He then walks again. His journey takes 74 minutes.

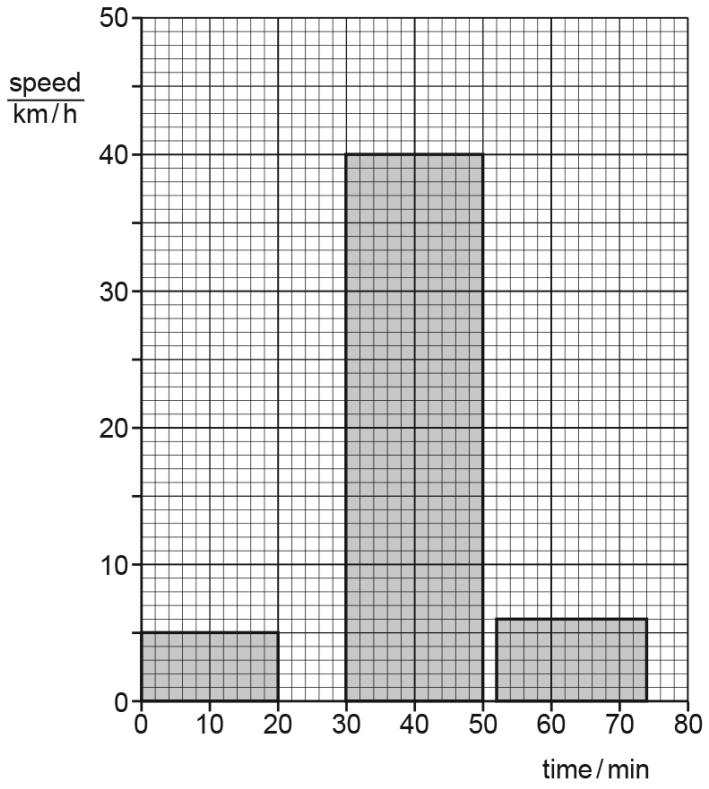

Fig. 1.1

(a) For the whole journey calculate:

(i) the distance travelled

distance = ... [3]

(ii) the average speed.

average speed = ... [2]

(b) State and explain which feature of a speed–time graph shows acceleration.

.....

..... [2]

(c) State and explain the acceleration of the person at time = 40 minutes.

.....

..... [2]

[Total: 9]

---

6. 0625_s20_qp_43 Q: 1

(a) Define *acceleration*.

.....

..... [1]

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

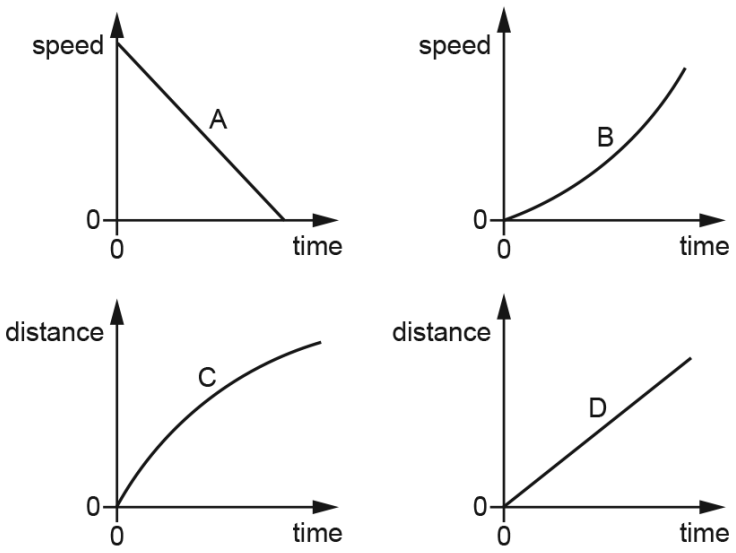

Fig. 1.1

Describe the motion shown by:

(i) graph A .....

..... [2]

(ii) graph B .....

..... [2]

(iii) graph C .....

..... [1]

(iv) graph D. .....

..... [1]

[Total: 7]

7. 0625_m19_qp_42 Q: 1

(a) Define *acceleration*.

..... [1]

(b) Fig. 1.1 shows the distance-time graph for the journey of a cyclist.

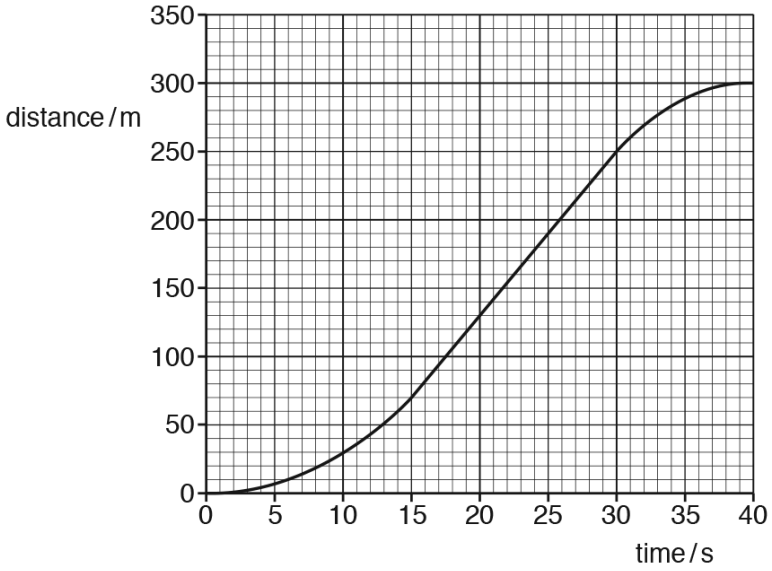

Fig. 1.1

(i) Describe the motion of the cyclist in the time between:

1. time = 0 and time = 15 s

.....

2. time = 15 s and time = 30 s

.....

3. time = 30 s and time = 40 s.

.....
[3]

(ii) Calculate, for the 40 s journey:

1. the average speed

average speed = ... [2]

2. the maximum speed.

maximum speed = ... [2]

[Total: 8]

8. 0625_s19_qp_42 Q: 1

A bus is travelling between points A and D. There are bus stops at A, B, C and D but the bus does not stop at B and C. Fig. 1.1 is a speed-time graph for the bus.

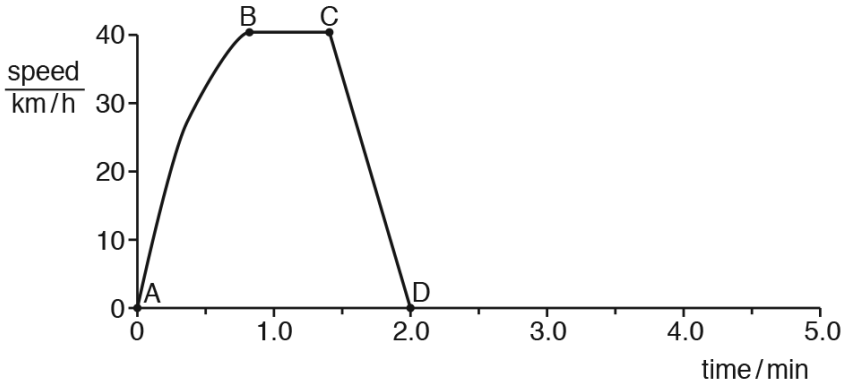

Fig. 1.1

(a) Describe the motion of the bus between each of the bus stops. Select the appropriate description from the list below.

constant acceleration **decreasing acceleration**

increasing acceleration **moving backwards at constant speed**

moving forwards at constant speed **stationary**

1. between A and B .....

2. between B and C .....

3. between C and D .....

[3]

(b) The average speed of the bus between A and D is 23 km/h.

Calculate the distance between A and D.

distance = ... [3]

(c) The bus stops at D for 1 min and then travels at a constant acceleration for 30 seconds.

On Fig. 1.1, sketch a possible graph for this additional motion. Label X when the bus starts to accelerate and label Y for 30 seconds later. [3]

[Total: 9]

9. 0625_s19_qp_43 Q: 1

Fig. 1.1 shows a distance-time graph for a cyclist travelling between points P and V on a straight road.

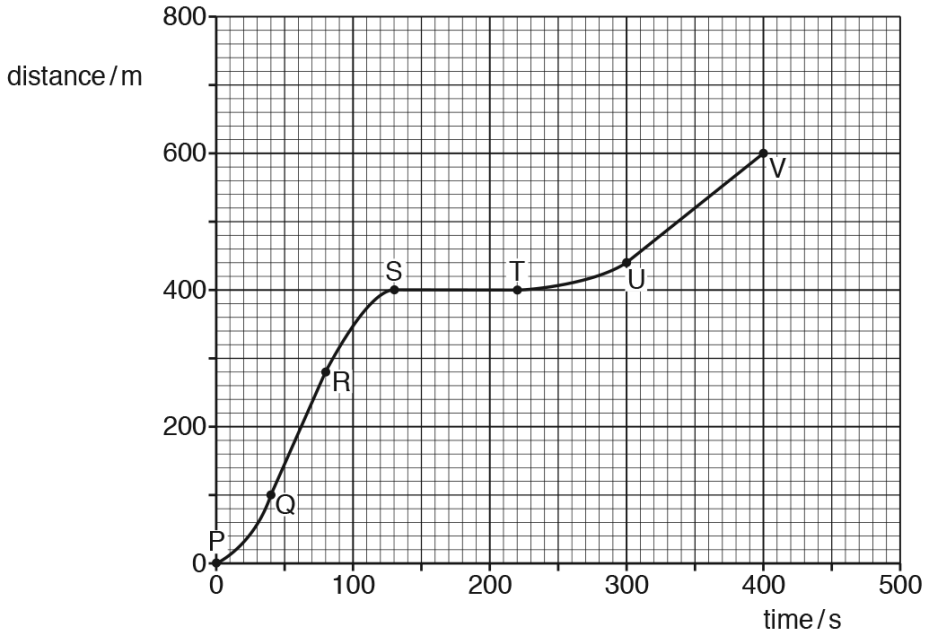

Fig. 1.1

(a) Describe the motion between:

Q and R .....

R and S .....

S and T. .....

[3]

(b) Calculate the speed between U and V.

speed = ... [2]

(c) After point V, the straight road continues down a steep hill. The cyclist travels down the steep hill. He does not apply the brakes and all resistive forces can be ignored.

On Fig. 1.1, sketch a possible motion for the cyclist after V. [1]

[Total: 6]

10. 0625_s18_qp_42 Q: 1

(a) Fig. 1.1 shows the axes of a distance-time graph for an object moving in a straight line.

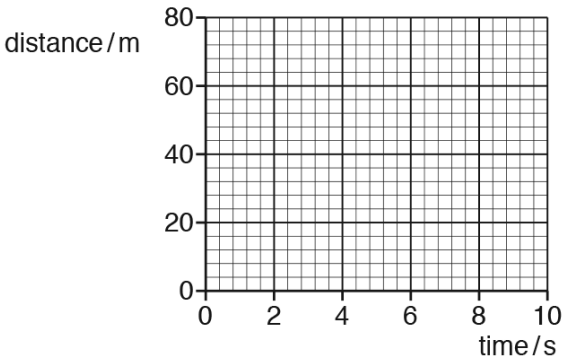

Fig. 1.1

(i) **1.** On Fig. 1.1, draw between time = 0 and time = 10 s, the graph for an object moving with a constant speed of 5.0 m / s. Start your graph at distance = 0 m.

2. State the property of the graph that represents speed.

.....

[2]

(ii) Between time = 10 s and time = 20 s the object accelerates. The speed at time = 20 s is 9.0 m / s.

Calculate the average acceleration between time = 10 s and time = 20 s.

acceleration = ...[2]

(b) Fig. 1.2 shows the axes of a speed-time graph for a different object.

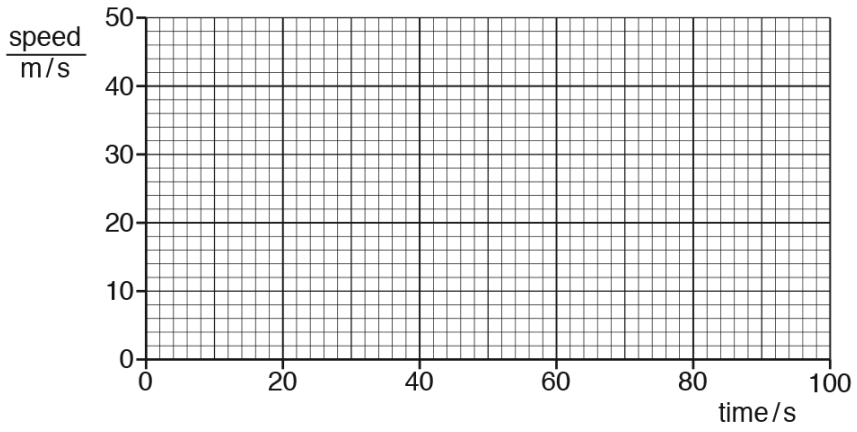

Fig. 1.2

(i) The object has an initial speed of 50 m/s and decelerates uniformly at 0.35 m/s^2 for 100 s.

On Fig. 1.2, draw the graph to represent the motion of the object. [2]

(ii) Calculate the distance travelled by the object from time = 0 to time = 100 s.

distance = ...[3]

[Total: 9]

11. 0625_s18_qp_43 Q: 1

There is no atmosphere on the Moon.

A space probe is launched from the surface of the Moon. Fig. 1.1 shows the speed-time graph of the space probe.

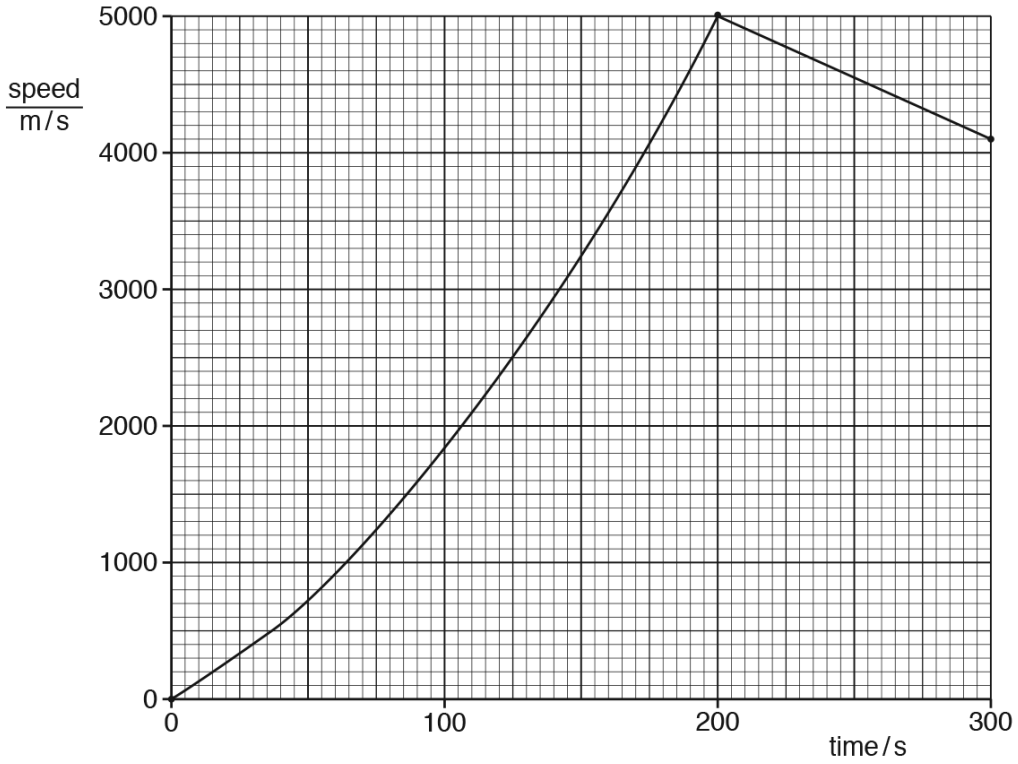

Fig. 1.1

(a) Determine the acceleration of the space probe at time = 0.

acceleration = ...[3]

(b) Between time = 0 and time = 150 s, the acceleration of the space probe changes.

(i) Without calculation, state how the graph shows this.

.....

.....[1]

(ii) During this time, the thrust exerted on the space probe by the motor remains constant.

State one possible reason why the acceleration changes in the way shown by Fig. 1.1.

.....

.....[1]

(c) Calculate the distance travelled by the space probe from time = 200 s to time = 300 s.

distance = ...[3]

[Total: 8]

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12. 0625_w18_qp_43 Q: 1

Fig. 1.1 is the distance-time graph for a moving car.

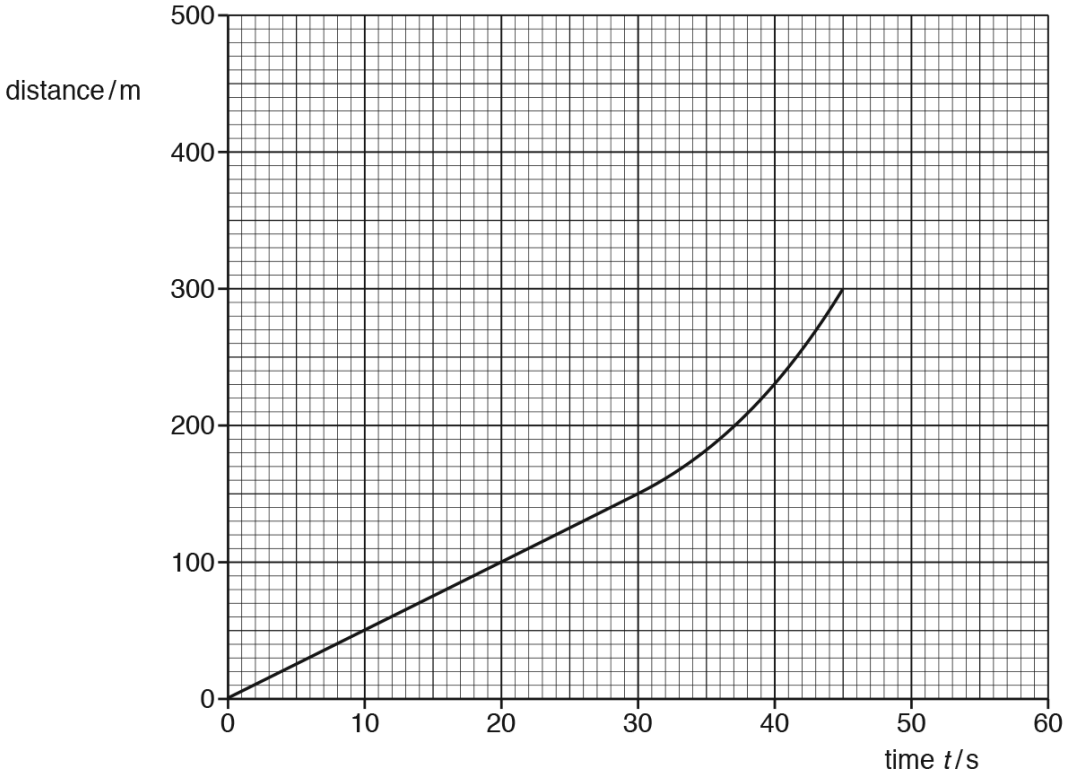

Fig. 1.1

(a) On Fig. 1.1, mark a point P where the acceleration of the car is zero. [1]

(b) Determine:

(i) the speed of the car at time $t = 15\,s$

speed = ...[2]

(ii) the average speed of the car between time $t = 30\,s$ and time $t = 45\,s$.

average speed = ...[2]

(c) At time $t = 45\,s$, the car starts to decelerate. At time $t = 55\,s$ and at a distance of 400 m from the starting point, the car stops. It then remains stationary for 5.0 s.

On Fig. 1.1, draw a possible continuation of the distance-time graph. [3]

[Total: 8]

13. 0625_p16_qp_40 Q: 1

Fig. 1.1 shows the speed-time graph for a car travelling along a straight road.

The graph shows how the speed of the car changes as the car passes through a small town.

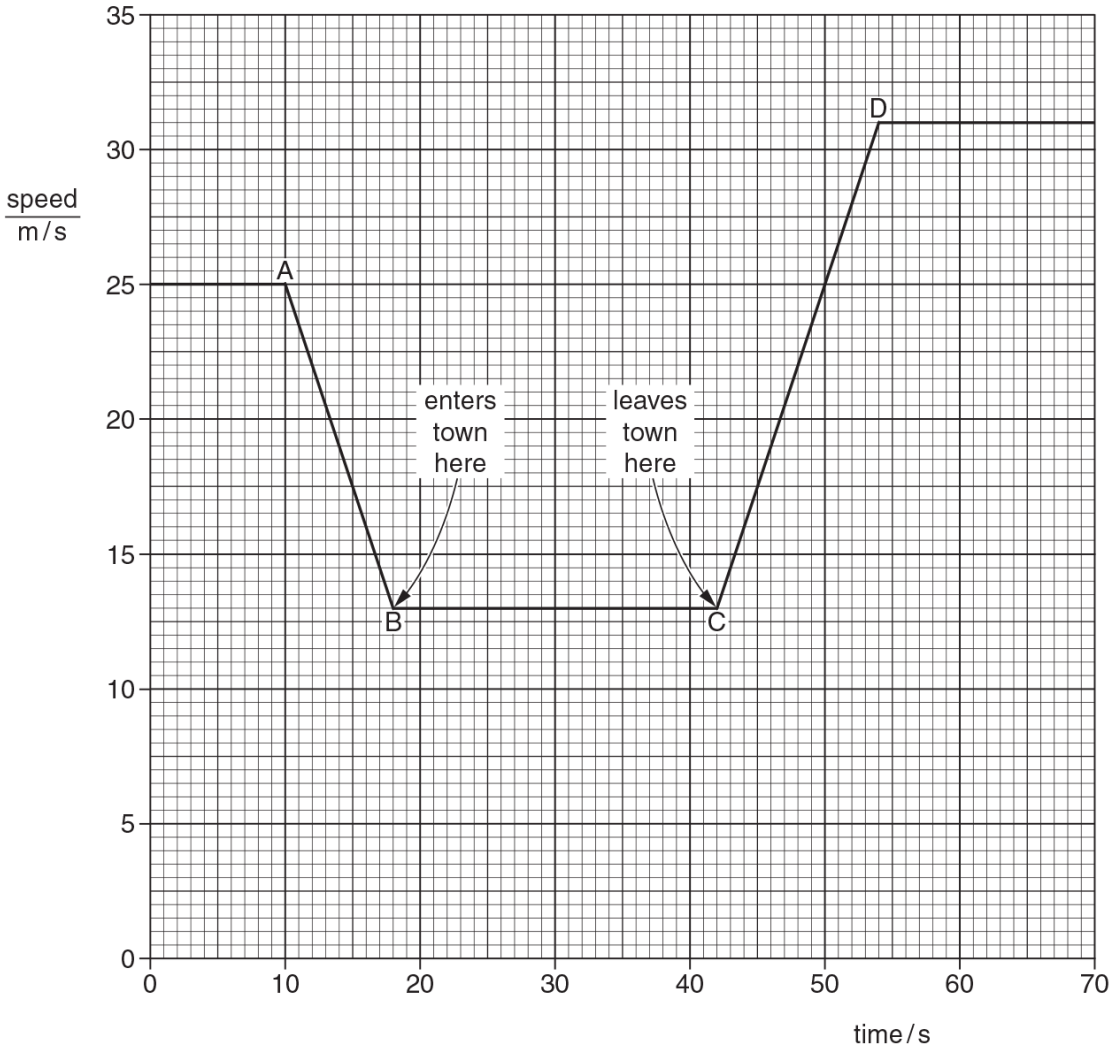

Fig. 1.1

(a) Calculate the distance between the start of the town and the end of the town.

distance = ... [3]

(b) Calculate the acceleration of the car between C and D.

acceleration = ... [3]

(c) State how the graph shows that the deceleration of the car has the same numerical value as its acceleration.

.....

..... [1]

[Total: 7]

---

14. 0625_s16_qp_41 Q: 1

(a) A bus travels at a constant speed. It stops for a short time and then travels at a higher constant speed.

Using the axes in Fig. 1.1, draw a distance-time graph for this bus journey.

Fig. 1.1

[3]

(b) A lift (elevator) starts from rest at the ground floor of a building.

Fig. 1.2 is the speed-time graph for the motion of the lift to the top floor of the building.

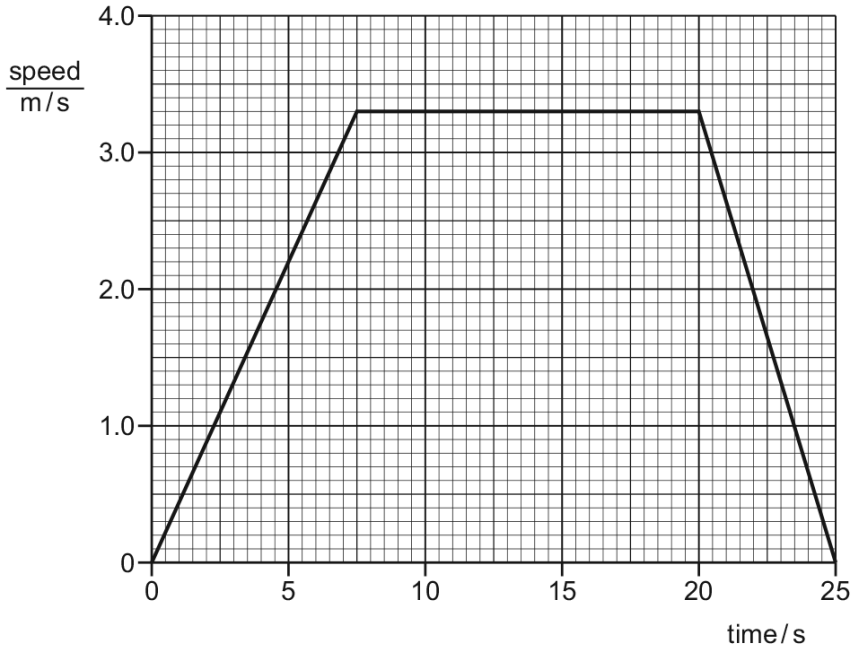

Fig. 1.2

Use the graph to determine the distance from the ground floor to the top floor of the building.

distance = ... [4]

[Total: 7]

---

15. 0625_w16_qp_41 Q: 1

An astronaut on the Moon drops a feather from rest, off the top of a small cliff. The acceleration due to gravity on the Moon is 1.6 m/s^2. There is no air on the Moon.

(a) The feather falls for 4.5 s before it hits the ground.

(i) On Fig. 1.1, draw the speed-time graph for the falling feather. [2]

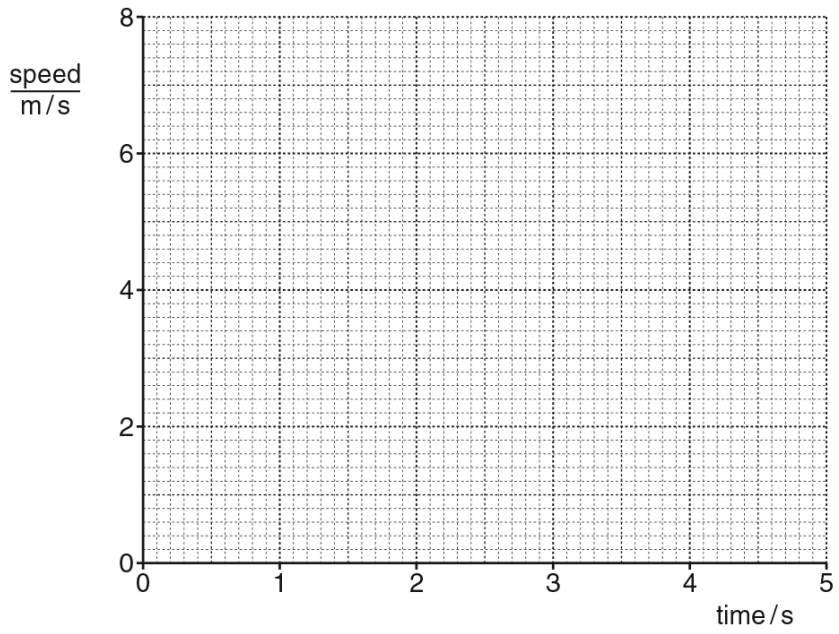

Fig. 1.1

(ii) Determine the distance fallen by the feather.

distance = ... [2]

(b) On Fig. 1.2, sketch the shape of a speed-time graph for the same feather falling on Earth.

Fig. 1.2

[2]

(c) Explain the difference between speed and velocity. Include the words *vector* and *scalar* in your answer.

.....

.....

.....

.....[2]

[Total: 8]

16. 0625_w16_qp_42 Q: 1

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

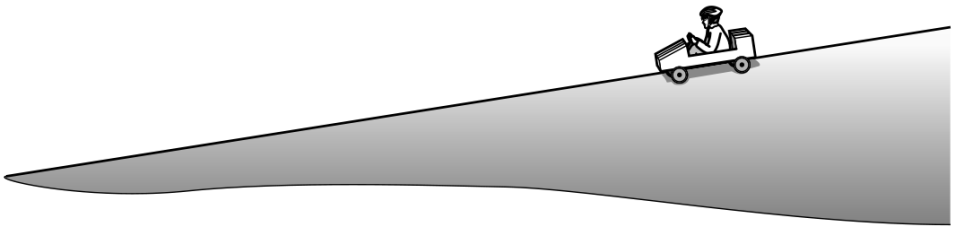

Fig. 1.1

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

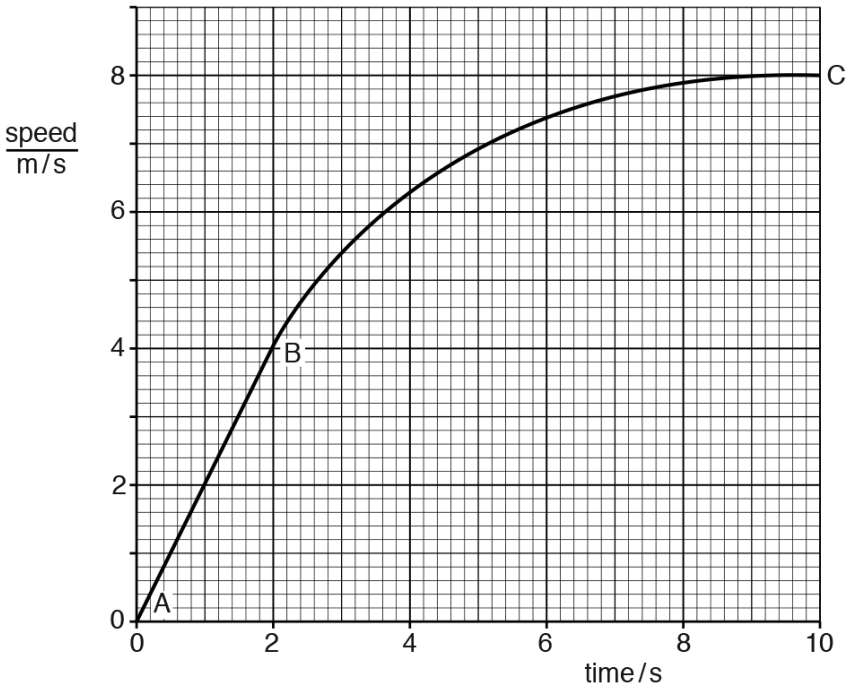

Fig. 1.2

(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]

---

17. 0625_w16_qp_43 Q: 1

A diver in the sea uses breathing apparatus, which releases gas bubbles.

Fig. 1.1 shows bubbles rising to the surface.

Fig. 1.1

The bubbles start from rest and, at first, they move upwards with a constant acceleration.

Fig. 1.2 is an incomplete speed-time graph for one of the bubbles from time $t = 0$ s until $t = 10$ s.

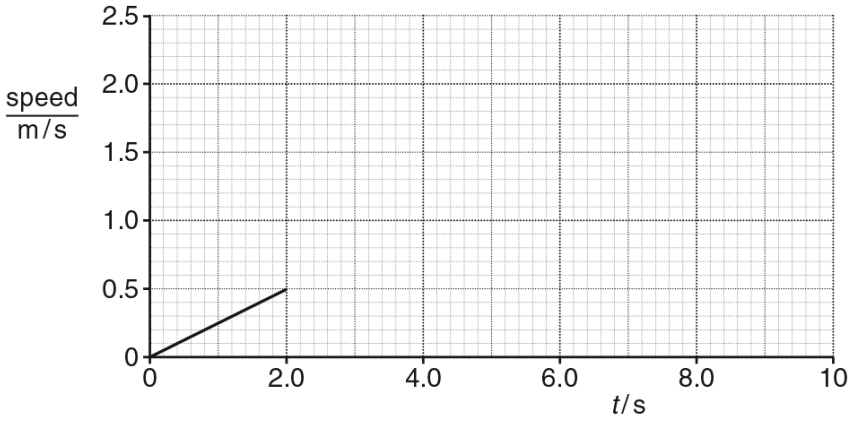

Fig. 1.2

(a) Using Fig. 1.2, determine the acceleration of the bubble during the first 2.0 s.

acceleration = ... [3]

(b) (i) After $t = 2.0$ s, the acceleration of this bubble decreases gradually until at $t = 10$ s its acceleration is zero.

Complete Fig. 1.2, by sketching a possible continuation of the speed-time graph. [2]

(ii) State the name given to a negative acceleration.

..... [1]

[Total: 6]

18. 0625_m15_qp_32 Q: 1

(a) A large stone, initially at rest, falls from the top of a building. The stone takes 3.2 s to fall to the ground. For this stone, air resistance can be ignored.

(i) Stating the formula that you use, show that the speed of the stone when it hits the ground is 32 m/s.

[1]

(ii) On Fig. 1.1, draw the speed-time graph for the fall of the stone. Label with an X the line on the graph. [1]

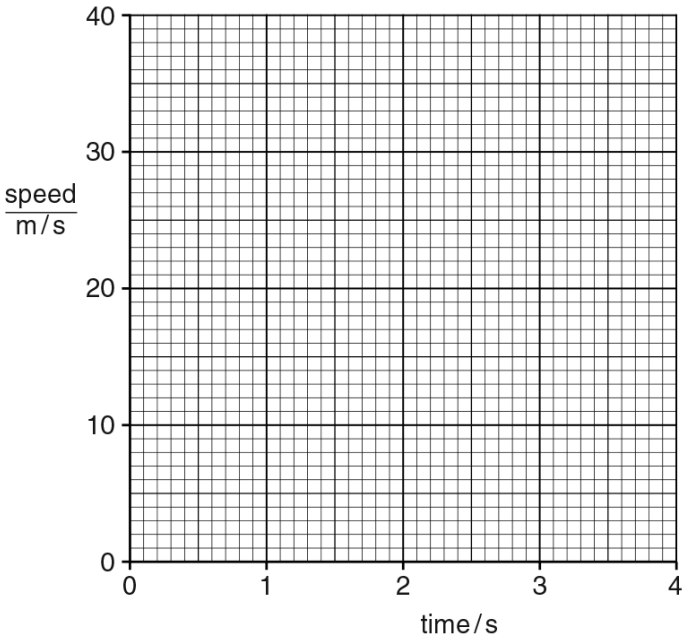

Fig. 1.1

(iii) Use the graph in **(ii)** to determine the height of the building.

height = ... [2]

(b) A smaller stone than the stone in **(a)** falls from the same building. This stone is affected by air resistance.

(i) What happens to the air resistance as the stone falls? Underline your choice of answer.

Air resistance decreases. Air resistance is constant. Air resistance increases. [1]

(ii) On Fig. 1.1, draw a possible speed-time graph for the fall of this stone. Label with a Y this line on the graph. [3]

[Total: 8]

19. 0625_s15_qp_32 Q: 1

An experiment is carried out to find the acceleration of free fall.

A strip of paper is attached to a heavy object. The object is dropped and falls to the ground, pulling the paper strip through a timer. The timer marks dots on the paper strip at intervals of 0.020 s.

Fig. 1.1 shows a section of the paper strip with the first three dots marked. The first dot on the paper strip, labelled A, is marked at the instant the object is dropped.

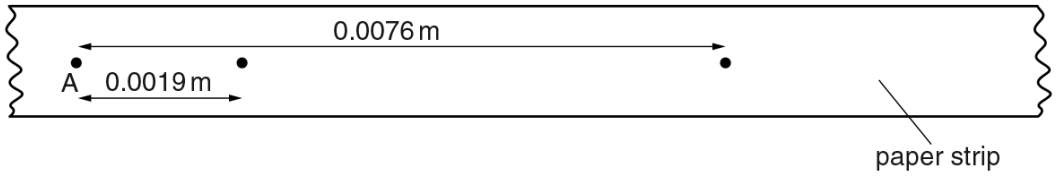

Fig. 1.1 (not to scale)

(a) State how the dots on the paper strip show that the object is accelerating.

.....

.....[1]

(b) Calculate the average speed of the object

(i) in the first 0.020 s after the object is dropped,

average speed = ...

(ii) in the second 0.020 s after the object is dropped.

average speed = ...
[3]

(c) Use the results from **(b)** to calculate the acceleration of the falling object.

acceleration = ...[3]

[Total: 7]

20. 0625_s15_qp_33 Q: 1

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.

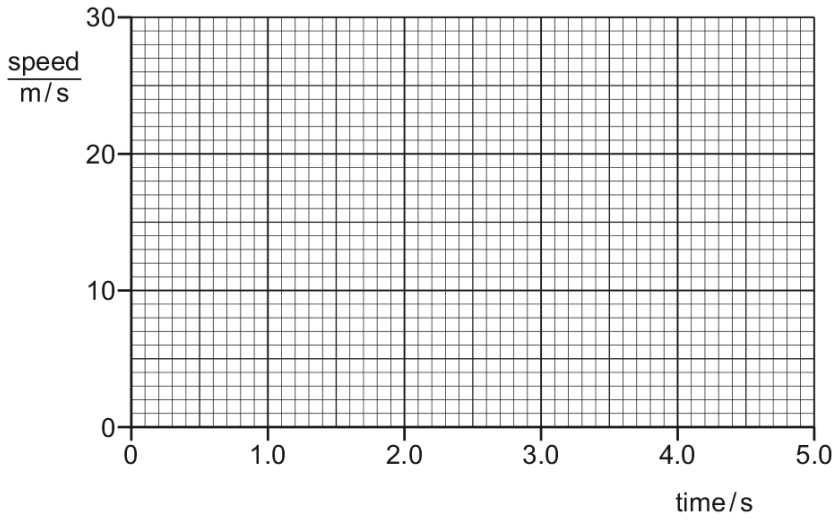

Fig. 1.1

[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]

21. 0625_w15_qp_32 Q: 1

A comet, travelling in space, enters the atmosphere of a planet.

Fig. 1.1 is the speed-time graph for the comet from time $t = 0$ s.

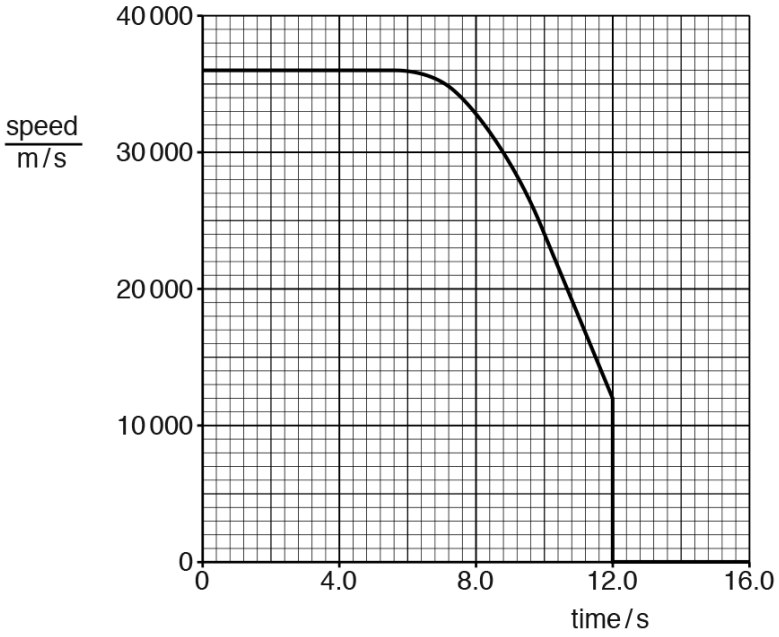

Fig. 1.1

(a) (i) During the period $t = 0$ s to $t = 6.0$ s, both the speed of the comet and the velocity of the comet remain constant.

State what this suggests about the motion of the comet.

.....

.....[1]

(ii) Determine the distance travelled during the period $t = 0$ s to $t = 6.0$ s.

distance = ...[2]

(b) Explain what the graph shows about the motion of the comet during the period $t = 6.0$ s to $t = 10.0$ s.

.....

.....

.....[2]

(c) Determine the acceleration of the comet at $t = 11.0\,\text{s}$.

acceleration = ...[2]

(d) Suggest what happens to the comet at $t = 12.0\,\text{s}$.

.....

.....[1]

[Total: 8]

---

22. 0625_s14_qp_32 Q: 1

Fig. 1.1 shows a distance-time graph for a moving object.

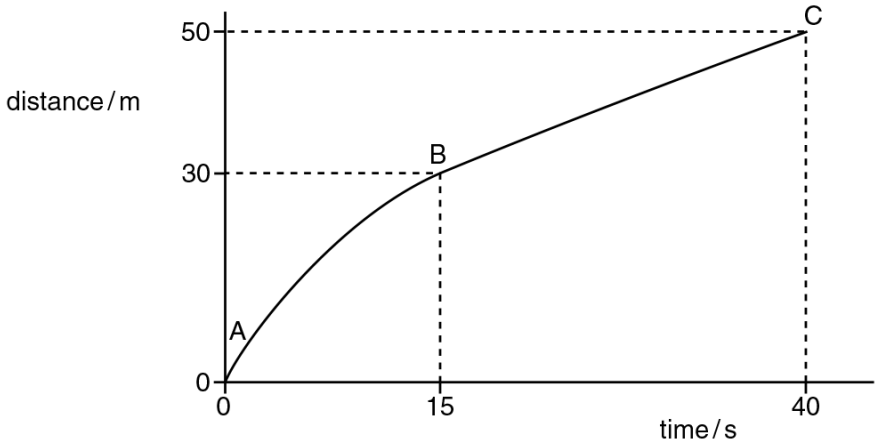

Fig. 1.1

(a) Describe the speed of the object between points

(i) A and B,

.....

(ii) B and C.

.....
[2]

(b) State whether the acceleration of the object is zero, negative or positive, as shown on the graph between points

(i) A and B,

.....

(ii) B and C.

.....
[2]

(c) Calculate the average speed of the object during the 40 seconds.

speed = ... [2]

[Total: 6]

23. 0625_w14_qp_32 Q: 3

Fig. 3.1 shows the speed-time graph of a firework rocket as it rises and then falls to the ground.

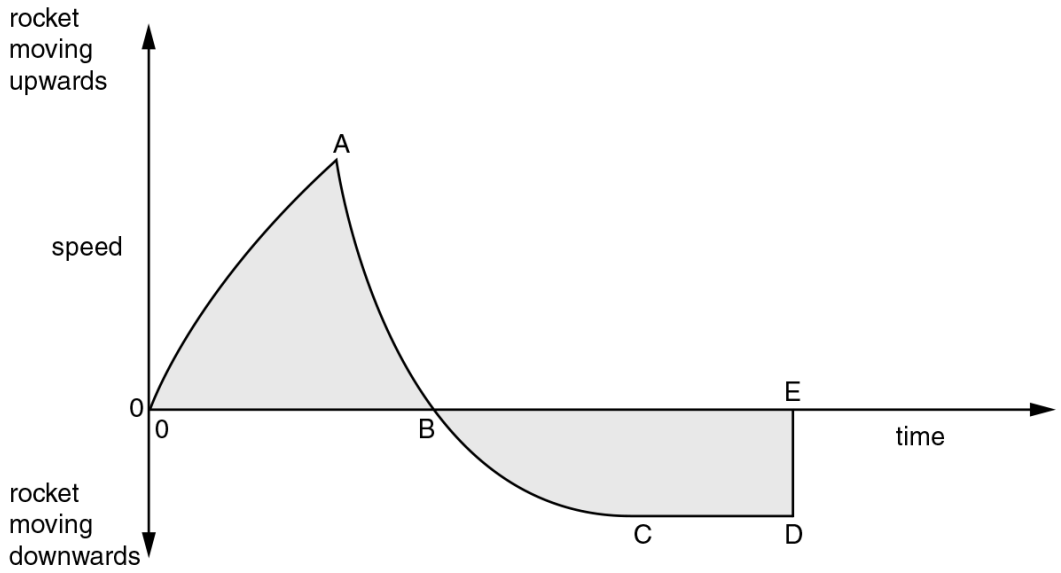

Fig. 3.1

The rocket runs out of fuel at A. It reaches its maximum height at B. At E it returns to the ground.

(a) **(i)** State the gradient of the graph at B. gradient = ... [1]

(ii) State why the gradient has this value at B.

.....

..... [1]

(b) State and explain the relationship between the shaded areas above and below the time axis.

.....

.....

.....

.....

.....

..... [3]

(c) Another rocket, of the same size and mass, opens a parachute at point B.

On Fig. 3.1, sketch a possible graph of its speed from B until it reaches the ground. [3]

[Total: 8]

24. 0625_s13_qp_32 Q: 4

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.

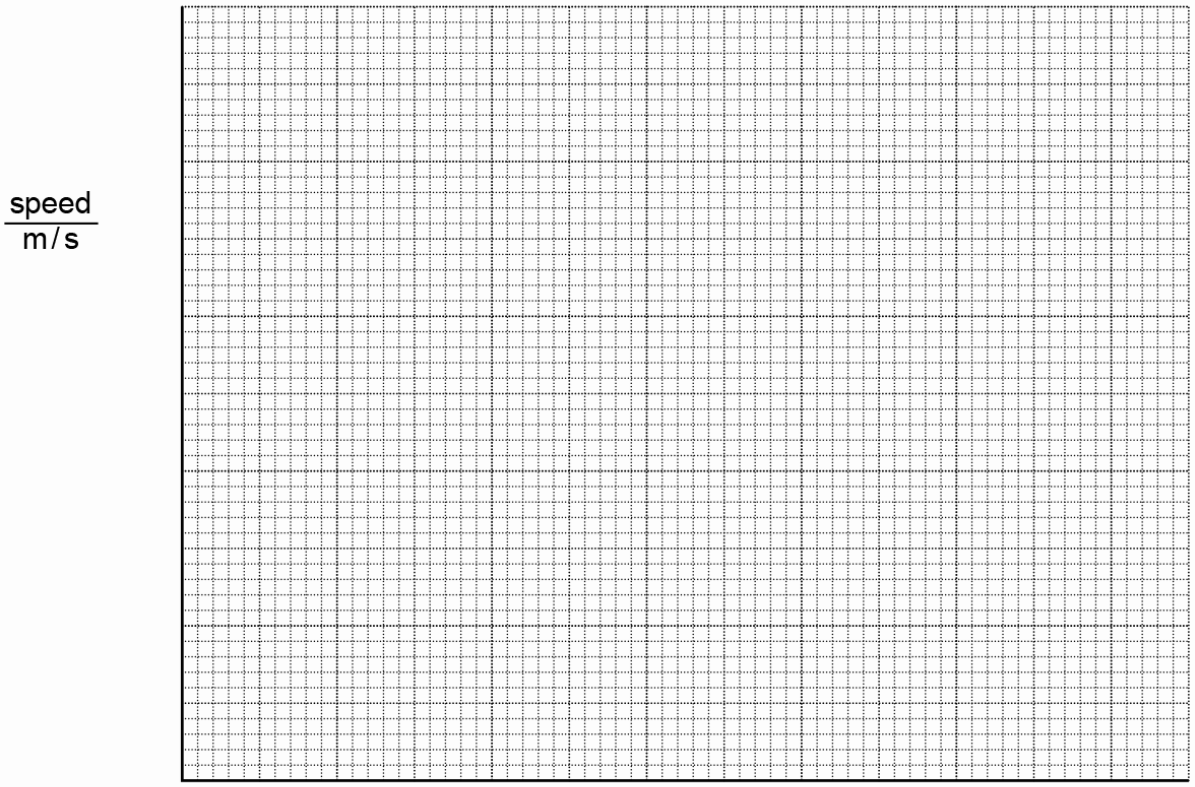

Fig. 4.1 [4]

(b) Using the graph,

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

acceleration = ...[2]

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

height reached = ...[2]

[Total: 8]

25. 0625_s13_qp_33 Q: 1

A train is at rest in a railway station. At time $t = 0$, the train starts to move forwards with an increasing speed until it reaches its maximum speed at time $t = 48$ s.

Fig. 1.1 is the speed-time graph for the first 48 s of the journey.

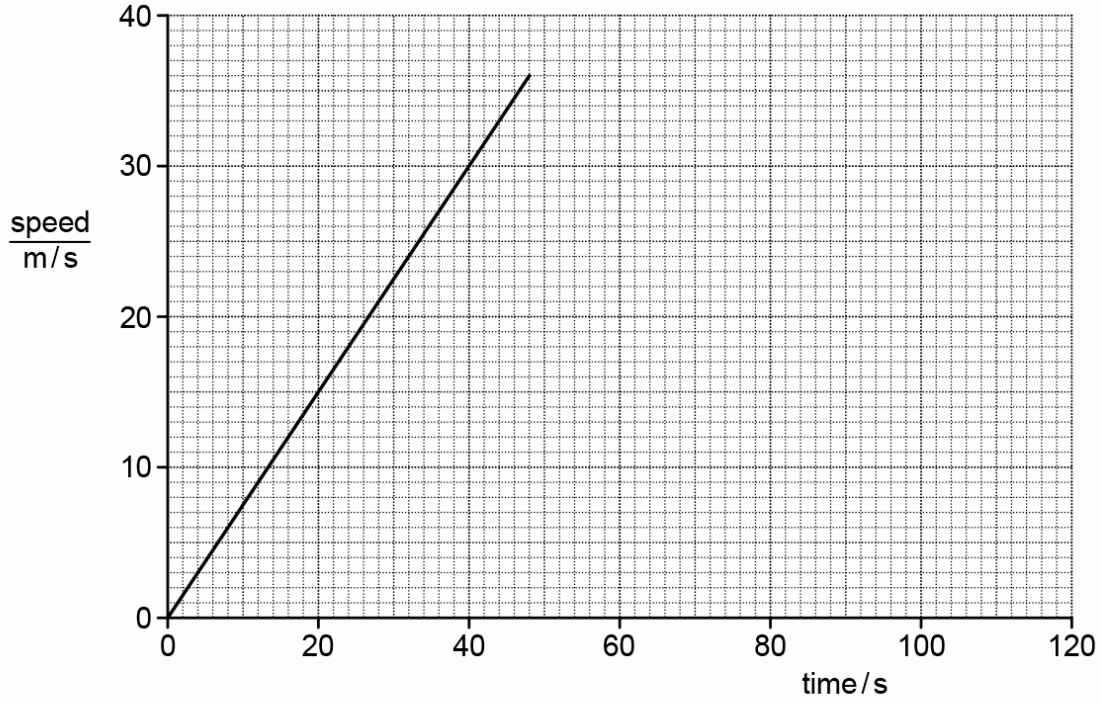

Fig. 1.1

(a) (i) State how the graph shows that, during the first 48 s of the journey, the acceleration of the train is constant.

.....

..... [1]

(ii) Calculate the acceleration of the train during the first 48 s of the journey.

acceleration = ... [2]

(b) After time $t = 48$ s, the train continues at its maximum speed for another 72 s.

(i) On Fig. 1.1, sketch the speed-time graph for the next 72 s of the journey. [1]

(ii) Determine the total distance travelled by the train in the 120 s after it starts moving.

distance = ... [3]

[Total: 7]

26. 0625_w13_qp_32 Q: 1

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

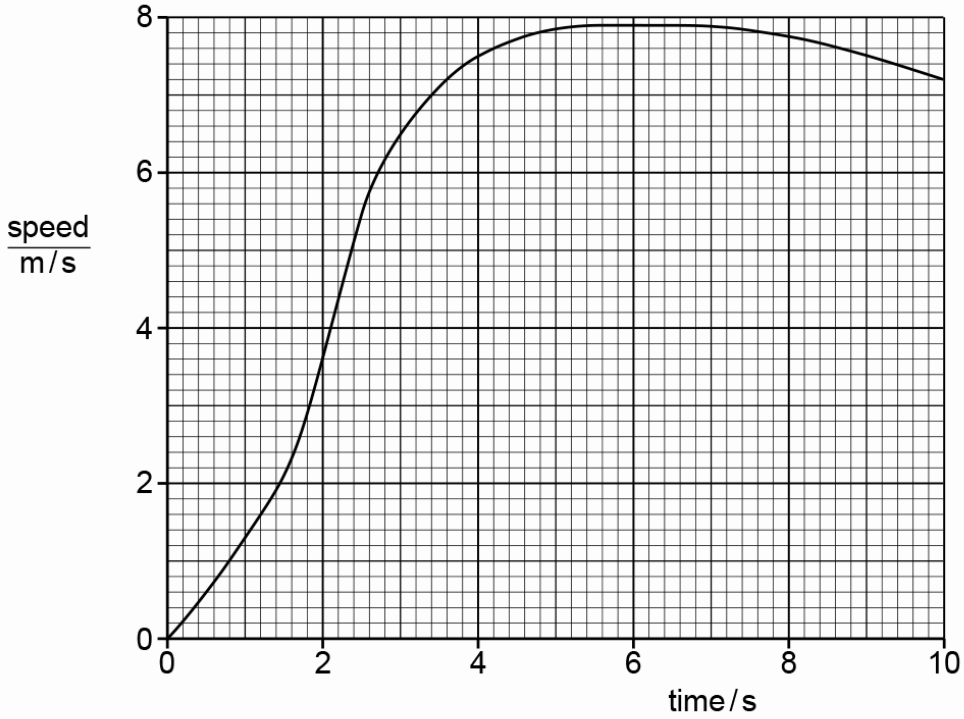

Fig. 1.1

(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]

27. 0625_s12_qp_31 Q: 2

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

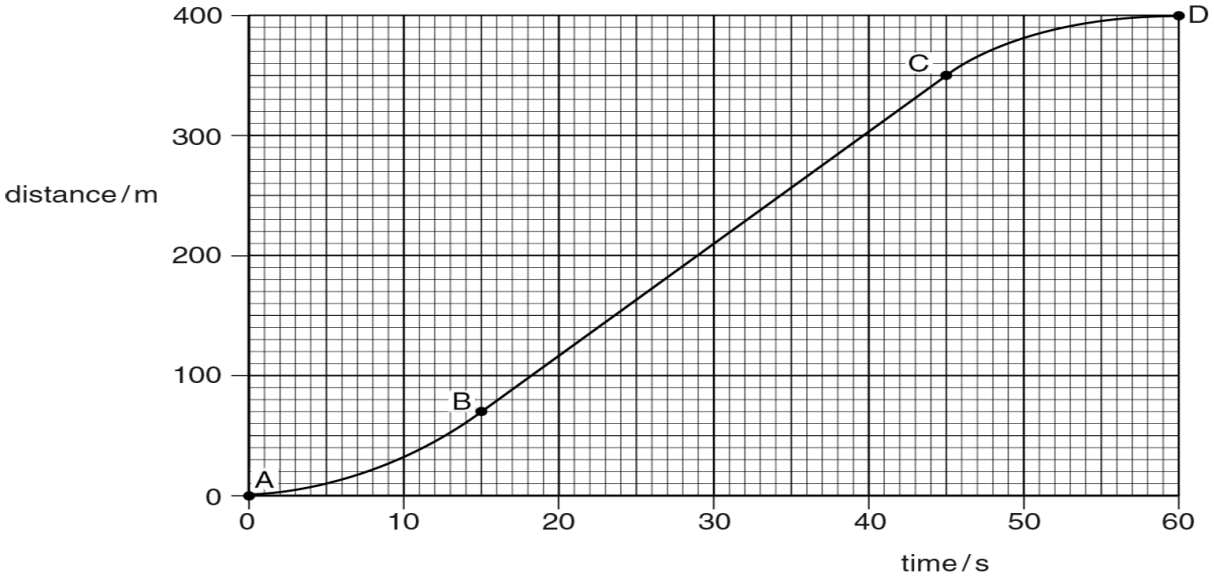

Fig. 2.1

(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]

28. 0625_s12_qp_32 Q: 1

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

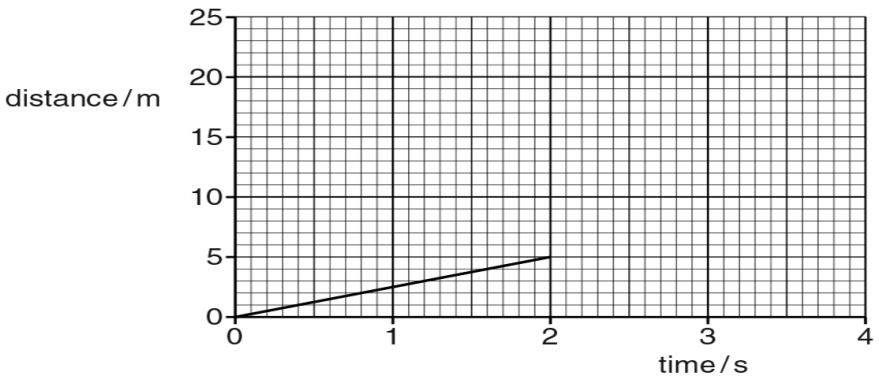

Fig. 1.1

(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.

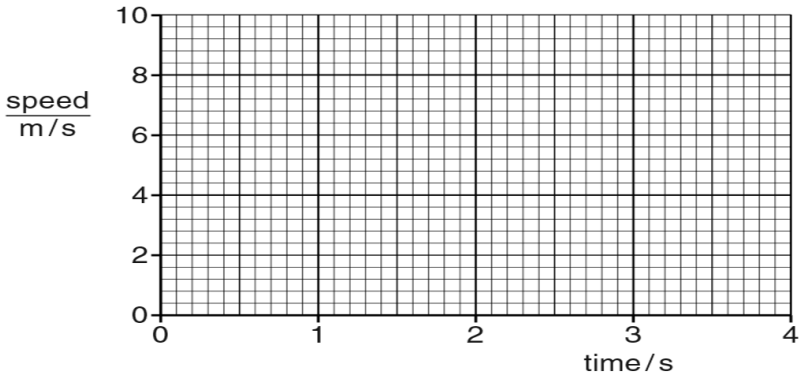

Fig. 1.2

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]

29. 0625_w12_qp_33 Q: 1

A brick is dropped from the top of a very tall building as it is being constructed.

Fig. 1.1 is the speed/time graph for the brick as it falls to the ground.

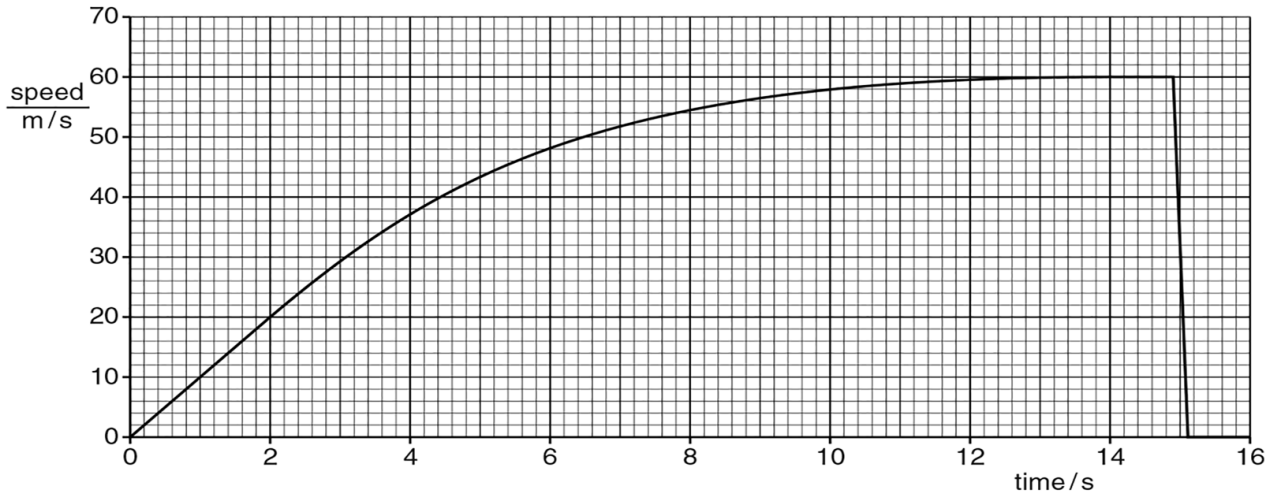

Fig. 1.1

(a) State a time at which the acceleration of the brick is

(i) zero,

time = ... [1]

(ii) constant but not zero,

time = ... [1]

(iii) not constant.

time = ... [1]

(b) Explain in terms of the forces acting on the brick why, between 0 and 14.0 s, its speed varies in the way shown by the graph.

.....

.....

.....

.....

..... [4]

(c) State the direction of the resultant force acting on the brick at time 15.0 s.

..... [1]

[Total: 8]

1.3 Mass and weight

30. 0625_s21_qp_42 Q: 1

(a) Fig. 1.1 shows a sealed weather balloon which is stationary in still air.

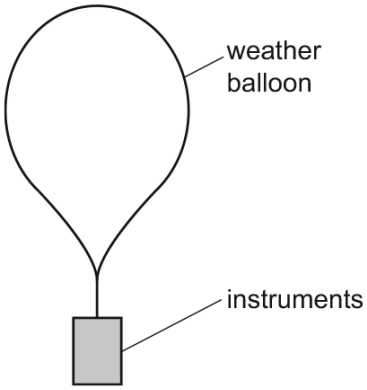

Fig. 1.1

State whether the overall density of the balloon and its instruments is greater than, less than, or the same as the density of the surrounding air.

..... [1]

(b) At night, the gas inside the balloon cools. The pressure of the air outside the balloon remains the same.

(i) State whether the balloon rises, falls or remains stationary.

..... [1]

(ii) Explain your answer.

.....

.....

..... [2]

Appendix A

Answers

1. 0625_s12_ms_31 Q: 1

(a) Period: 1.81 s OR 1.8 s as mean value
OR 1.8 s as most common reading / the mode — B1

(b) Time a minimum of 2 (successive) oscillations — B1
Divide result by the number of oscillations — B1
OR
Count no. of oscillations in at least 20 s — (B1)
Divide the time by the number of oscillations
OR Divide no. of oscillations by time and find reciprocal — (B1)
2 of:
Repeat (several times) and find mean
Time with reference to fixed / fiducial point or top or bottom of oscillation
Check / set zero of stop-watch
Show knowledge of what is meant by one oscillation — B2

[Total: 5]

---

2. 0625_s21_ms_41 Q: 1

	Answer	Mark
(a)(i)	any value from 35 to 43 m / s^2	**A2**
	(a =) (v – u) / t in any form **or** gradient (of line) **or** (58 – 50) / 0.20 **or** equivalent values from the graph	**C1**
(a)(ii)	3800 N	**A3**
	(F =) ma in any form **or** $\Delta p / \Delta t$ in any form **or** 76 × candidate's **1(a)(i)** **or** 760 seen	**C1**
	76 × candidate's **1(a)(i)** evaluated **or** 76 × (candidate's **1(a)(i)** + 10) **or** 76 × (candidate's **1(a)(i)**)+ 760	**C1**
(b)	(deceleration because) upward force greater than weight **or** upward resultant force	**B1**
	air resistance decreases (with decreasing speed / with time) **or** deceleration decreases **or** resultant (upward) force decreases	**B1**
	(until / finally) weight equals air resistance **or** forces balance **or** at terminal / constant velocity / speed	**B1**
(c)	at zero speed there is no air resistance	**B1**
	weight / downwards force is (still) acting **or** there is (now) a resultant force (downwards at zero speed)	**B1**
	OR forces balance at a speed greater than zero	**(B1)**
	speed cannot decrease / no deceleration once forces balance	**(B1)**

3. 0625_m20_ms_42 Q: 1

(a)	(a=)Δv / Δt in any form OR (a=)Δv / Δt OR (a)=120 / 8	C1
	(a) = 15 m / s^2	A1
(b)(i)	straight line from (0,0) to (8,120)	B1
(b)(ii)	(h = A =) ½ × 120 × 8	C1
	(h=) 480 m	A1
(b)(iii)	rising curve from 8 s to 20 s	B1
	decreasing gradient from 8 s to 20 s	B1
	horizontal from 20 s to 25 s AND below 200 m / s, AND above 120 m / s	B1

4. 0625_p20_ms_40 Q: 1

(a) speed × time in any form, symbols, numbers or words
OR any area under graph used or stated [1]
13 (m/s) OR 24 (s) seen or used in correct context [1]
312 m (2 or 3 sig. figs.) [1]

(b) rate of change of speed OR gradient of graph OR 18/12 [1]
18 (m/s) OR 12 (s) seen or used in correct context [1]
1.5 m/s^2 [1]

(c) same gradient / slope OR equal speed changes in equal times OR
allow graph symmetrical [1]

5. 0625_s20_ms_42 Q: 1

(a)(i)	s = vt in any form OR (s =) vt OR relates distance to area (under graph)	C1
	any **one** of: 5 × 20 / 60 OR 40 × 20 / 60 OR 6 × 22 / 60	C1
	(s = 1.667 + 13.333 + 2.2 =) 17 km	A1
(a)(ii)	average speed = candidate's (i) / time	C1
	(average speed = 17 × 60 / 74 =) 14 km / h	A1
(b)	gradient	B1
	(gradient =) change of speed / time	B1
(c)	0	B1
	(constant) gradient = 0 OR speed constant	B1

6. 0625_s20_ms_43 Q: 1

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

7. 0625_m19_ms_42 Q: 1

(a)	Rate of change of speed / time OR $\Delta v / t$ OR $(v - u) / t$	**B1**
(b)(i)	**1** Acceleration OR increasing speed OR going faster	**B1**
	2 Constant speed OR steady speed	**B1**
	3 Deceleration OR decreasing speed OR slowing down	**B1**
(b)(ii)	**1** Total distance / total time OR 300 / 40	**C1**
	7.5 m / s	**A1**
	2 Change of distance / change of time OR (250 – 70) / (30 – 15) OR 180 / 15	**C1**
	12 m / s	**A1**

8. 0625_s19_ms_42 Q: 1

(a)	(A and B) decreasing acceleration	**B1**
	(B and C) moving forwards at constant speed	**B1**
	(C and D) constant acceleration	**B1**
(b)	(average) speed = distance/time OR $v = s/t$ in any form OR (s =) (average) speed × time OR $v \times t$ OR area under graph stated or used	**C1**
	(s =) 23 × 2/60	**C1**
	0.77 km round candidates response to 2 sfs	**A1**
(c)	horizontal line starting at t = 2.0 min AND at speed = 0 for 1 minute	**B1**
	line of constant positive gradient starting at t >= 2.0 min NOT wrong labels X OR Y	**B1**
	for 30 seconds line continuously rising	**B1**

9. 0625_s19_ms_43 Q: 1

(a)(i)	constant velocity / speed	**B1**
(a)(ii)	deceleration / negative acceleration	**B1**
(a)(iii)	Stationary	**B1**
(b)	v = gradient OR $\frac{\text{distance}}{\text{time}}$ OR 160 $\frac{160}{100}$ OR evidence of use of gradient	**C1**
	(v =) 1.6 m/s	**A1**
(c)	line curves upwards with increasing gradient NOT vertical	**B1**

10. 0625_s18_ms_42 Q: 1

(a)(i)	**1** straight line from (0,0) to (10,50)	**1**
	2 gradient/slope	**1**
(a)(ii)	$a = \Delta v \div \Delta t$ in any form **OR** (a=) $\Delta v \div \Delta t$ **OR** (a =) (9–5) ÷ 10 **OR** 4 ÷ 10	**1**
	(a =) 0.40 m / s^2	**1**
(b)(i)	straight line down from any point on y-axis to any speed at 100 s	**1**
	from (0,50) to (100,15)	**1**
(b)(ii)	uses area under graph **OR** av speed × time **OR** $s=ut + ½ at^2$ **OR** $v^2=u^2 + 2as$	**1**
	100 × (50 + 15) ÷ 2 **OR** 100 × 15 + ½ (100 × 35) **OR** 5000 – ½ × 0.35 × 100^2	**1**
	3300 m	**1**

11. 0625_s18_ms_43 Q: 1

(a)	tangent on graph **OR** gradient **OR** (a =) $\Delta v \div \Delta t$ or $(v - u) \div t$	**C1**
	accept gradient increases; **not** gradient decreases	**C1**
	values from tangent or line 13 to 14 m / s^2	**A1**
(b)(i)	gradient changes **OR** graph is curved	**B1**
(b)(ii)	mass of space rocket decreases **OR** gravitational field strength decreases	**B1**
(c)	area under graph **OR** (distance =) average speed × time	**C1**
	4550 × 100 **OR** (4100 + 5000) ÷ 2 × 100	**C1**
	4.5/4.55/4.6 × 10^5 m	**A1**

12. 0625_w18_ms_43 Q: 1

(a)	P marked on line between t = 0 s and t = 30 s	**B1**
(b)(i)	(v =) gradient **or** 150 / 30 **or** appropriate division using other points	**C1**
	5.0 m / s	**A1**
(b)(ii)	(v =) x / t **or** (300 – 150) / (45 – 30) **or** 150 / 15	**C1**
	10 m / s	**A1**
(c)	gradient decreasing	**B1**
	smooth transition to horizontal **and** line not too thick	**B1**
	horizontal to (60 s, 400 m)	**B1**

13. 0625_p16_ms_40 Q: 1

(a) speed × time in any form, symbols, numbers or words
OR any area under graph used or stated [1]
13 (m/s) OR 24 (s) seen or used in correct context [1]
312 m (2 or 3 sig. figs.) [1]

(b) rate of change of speed OR gradient of graph OR 18/12 [1]
18 (m/s) OR 12 (s) seen or used in correct context [1]
1.5 m/s^2 [1]

(c) same gradient / slope OR equal speed changes in equal times OR
allow graph symmetrical [1]

---

14. 0625_s16_ms_41 Q: 1

(a)	From time zero, line of constant positive gradient, not necessarily from origin Horizontal line from end of sloping line Line of steeper positive gradient from end of horizontal line	**B1** **B1** **B1**
(b)	(distance =) area under graph stated 0.5 × 7.5 × 3.3 (= 12.375) + 12.5 × 3.3 (= 41.25) + 0.5 × 5 × 3.3 (= 8.25) OR ½ (a + b)h = 0.5 × (25 + 12.5) × 3.3 OR (25 × 3.3) – (0.5 × 12.5 × 3.3) 62 m	**C1** **C2** **(C1)** **(C1)** **(C2)** **A1**
		Total: 7

15. 0625_w16_ms_41 Q: 1

(a)(i)	Straight line from origin to (4.5 s, 7.2 m/s) Tolerance in plotting: ½ a square	**B2**
(a)(ii)	Use of area stated or implied by numbers used OR average speed × time OR s = (u+v)/t/2 OR vt/2 OR 0.5 × 4.5 × 7.2 16(.2) m	**C1** **A1**
(b)	Rises from origin and curves with decreasing gradient Finishes horizontal	**B1** **B1**
(c)	Speed is scalar Velocity is vector Speed has magnitude / size / value (only) Velocity has magnitude / size / value and direction OR velocity has direction; speed does not	**B1** **B1**
	Total:	**8**

16. 0625_w16_ms_42 Q: 1

(a)(i)	constant gradient OR straight line	**B1**
(a)(ii)	calculation of gradient (a = 4/2 =) 2.0 m/s^2	**C1** **A1**
(a)(iii)	decreases / becomes zero	**B1**
(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**

17. 0625_w16_ms_43 Q: 1

(a)	(*a* =)Δ*v*/*t* **or** gradient 0.50/2.0 0.25 m/s^2	**C1** **C1** **A1**
(b)(i)	decreasing gradient from gradient zero at end **and** joins first part smoothly	**B1** **B1**
(b)(ii)	deceleration **or** retardation	**B1**
	Total	**6**

18. 0625_m15_ms_32 Q: 1

(a) (i) $a = (v - u) \div t$ OR $a = \Delta v \div t$ in any form OR in words in any form
AND with correct numbers substituted — B1

(ii) Straight line from origin to point (3.2 s, 32 m/s) — B1

(iii) Area under graph OR ½ × 3.2 × 32
OR $s = ½ at^2$ OR ½ × 10 × 3.2^2 — C1
51 m — A1

(b) (i) Air resistance increases — B1

(ii) Graph line Y under graph line X — B1
Graph has decreasing gradient — B1
Graph extends to value of *t* greater than 3.5 s and greater than X — B1

[Total: 8]

19. 0625_s15_ms_32 Q: 1

(a) dots farther apart (in 2nd time interval) owtte B1

(b) (i) (average speed =) $d \div t$, in any form, e.g. words, symbols, numbers C1

0.095 m / s A1

(ii) (average speed =) 0.29 m / s B1

(c) (a =) ($v - u$) ÷ t C1

= (candidate's **(b)(ii)** – candidate's **(b)(i)**) ÷ 0.02 C1

correct value calculated from candidate's values in **(b)(i)(ii)**, expect 9.5 m / s^2 A1

---

20. 0625_s15_ms_33 Q: 1

(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]

---

21. 0625_w15_ms_32 Q: 1

(a) (i) (it / comet) travels in a straight line B1

(ii) area (under graph) OR s = vt in any form OR vt C1
220 000 m OR 220 km A1

(b) negative acceleration OR deceleration OR (it / the comet) is slowing down B1
acceleration / deceleration (only accept **it** if acc / decel already mentioned)
not constant allow either increasing or decreasing B1

(c) attempt at gradient OR (a =) $\Delta v / \Delta t$ OR (0–)12 000 / 2.0 OR other correct values for $\Delta v / \Delta t$ C1
(–)6000 m / s^2 tolerance 5000 – 7000 m / s^2 A1

(d) (it / comet) hits surface (of planet)
OR stops o.w.t.t.e. B1

[Total: 8]

---

22. 0625_s14_ms_32 Q: 1

(a)	**(i)**	decreases / <u>average</u> speed 2 m / s	B1
	(ii)	constant / speed 0.8 m / s	B1
(b)	**(i)**	negative	B1
	(ii)	zero	B1
(c)		uses $v = d/t$ in any form or d/t	C1
		(av. vel = 50 / 40 =) 1.3 m / s or 1.25 m / s	A1
			[Total: 6]

23. 0625_w14_ms_32 Q: 3

(a)	**(i)**	10 m / s^2 ignore sign	B1
	(ii)	(same as) acceleration (of rocket at B) **OR** gravitational acceleration	B1
(b)		same area	B1
		area represents distance travelled	B1
		distance up = distance down **OR** overall displacement = 0 **OR** area above = distance up **AND** area below = distance below	B1

(c) any three from:
- all of graph below *x*-axis after B
- final section horizontal and above CD **AND** gradient always $\leqslant 0$
- continuous graph from B until time > at DE
- new area not clearly different from old B3

[Total: 8]

---

24. 0625_s13_ms_32 Q: 4

(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]

---

25. 0625_s13_ms_33 Q: 1

(a) (i) constant/uniform gradient/slope OR straight line B1

(ii) ($a = \Delta$) $v \div t$ OR 36 ÷ 48 C1
0.75 m / s^2 (NOT 0.76) A1

(b) (i) horizontal line from (48, 36) to (120, 36) B1

(ii) area under graph (mentioned **or** implied) B1
864 OR 2592 C1
3500/3460/3456 m A1 [7]

---

26. 0625_w13_ms_32 Q: 1

(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]

27. 0625_s12_ms_31 Q: 2

(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]

28. 0625_s12_ms_32 Q: 1

(a)	**(i)**	constant/steady/uniform speed/velocity OR speed/velocity = 2.5 (m/s) speed/velocity = 2.5 m/s accept fraction, average speed/velocity = 2.5 m/s	B1 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 Δv = 4 m/s or gradient clearly 2 m/s^2	M1 A1	[3]
(d)		horizontal (straight) line at 0 m/s accept for both marks: line in/along time/*x*-axis OR line with *y*/*v* = 0 OR careful sketch	M1 A1	[2]
				[Total: 9]

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29. 0625_w12_ms_33 Q: 1

(a)	**(i)**	a time from 12.5 – 14.9 s **or** 15.1 – 16.0 s *Unit penalty applies	B1	
	(ii)	a time from 0 – 2.5 s **or** 14.9 – 15.1 s *Unit penalty applies	B1	
	(iii)	a time from 2.5 – 12.5 s *Unit penalty applies	B1	
(b)		(initially) weight/force of gravity **and** air friction/resistance act	B1	
		it speeds up/accelerates **and** (air) friction/resistance increases	B1	
		reaches terminal/constant velocity	B1	
		(air) friction/resistance = weight **or** no resultant (force) **or** forces in equilibrium	B1	
(c)		upwards	B1	**[8]**

*Apply unit penalty once only
