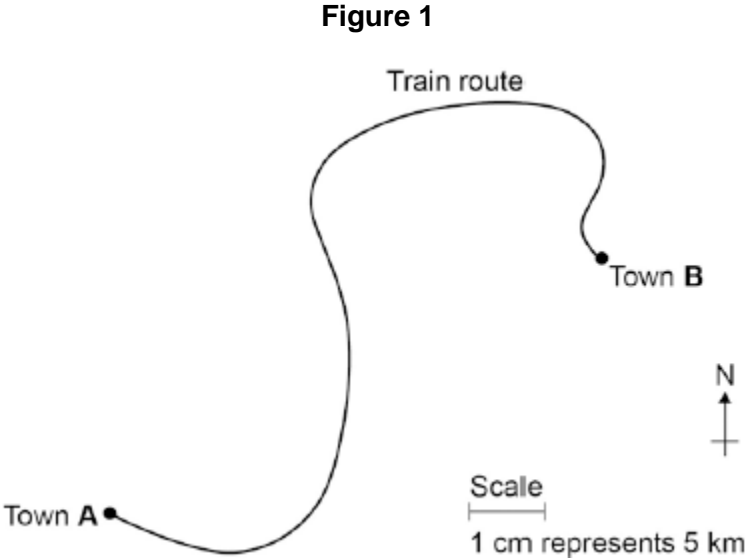


1

A train travels from town **A** to town **B**.

Figure 1 shows the route taken by the train.

Figure 1 has been drawn to scale.



(a) The distance the train travels between **A** and **B** is not the same as the displacement of the train.

What is the difference between distance and displacement?

.....
.....
.....

(1)

(b) Use **Figure 1** to determine the displacement of the train in travelling from **A** to **B**.

Show how you obtain your answer.

.....
.....

Displacement = km

Direction =

(2)

(c) There are places on the journey where the train accelerates without changing speed.

Explain how this can happen.

.....

.....

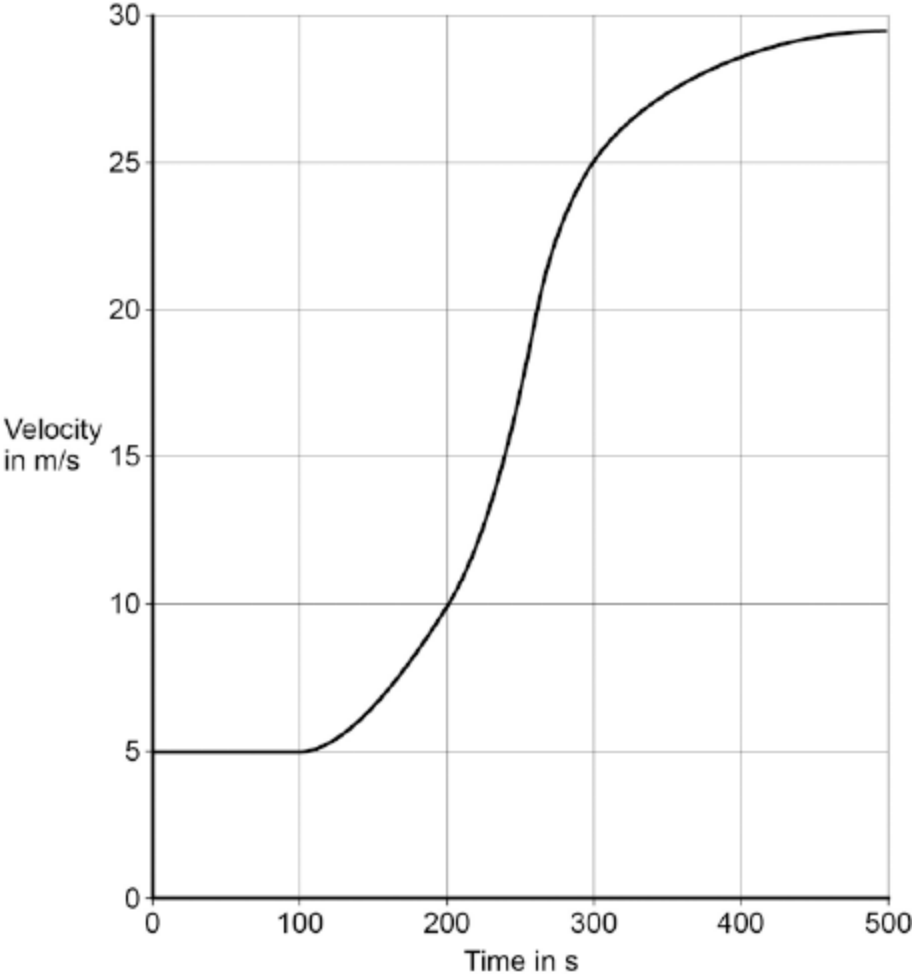
.....

.....

(2)

(d) **Figure 2** shows how the velocity of the train changes with time as the train travels along a straight section of the journey.

Figure 2



Estimate the distance travelled by the train along the section of the journey shown in **Figure 2**.

To gain full marks you must show how you worked out your answer.

.....

.....

.....

.....

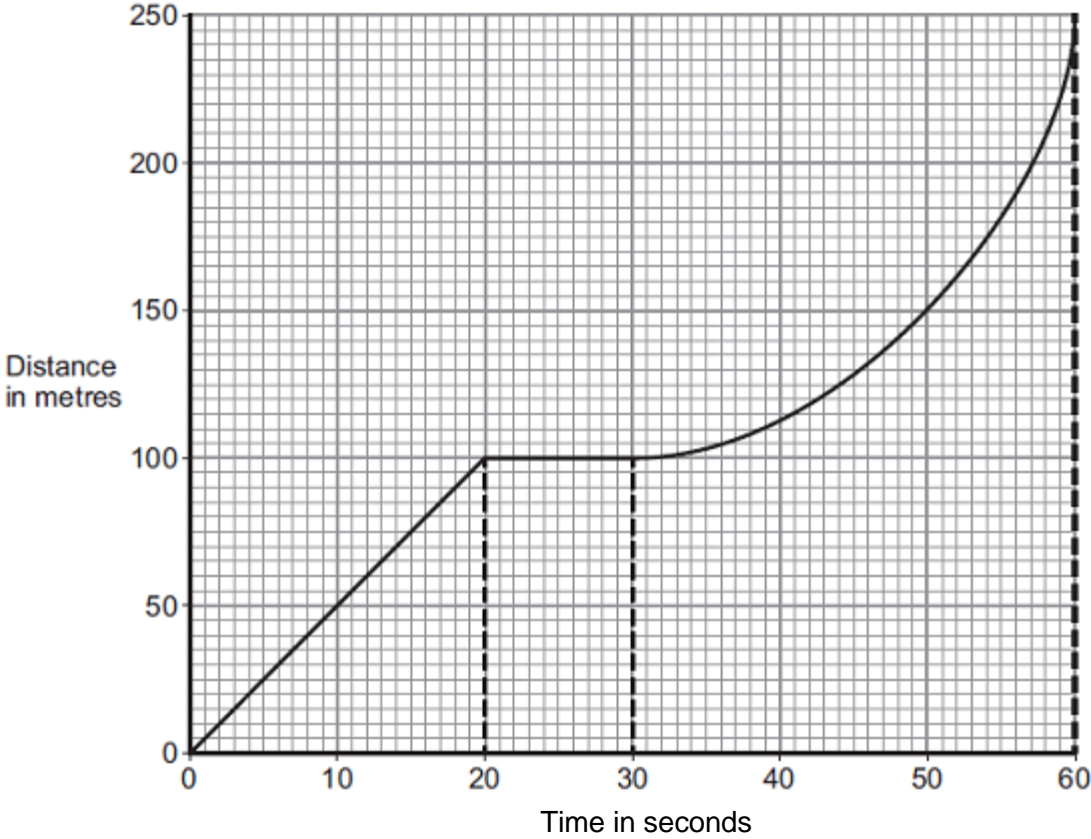
Distance = m

(3)
(Total 8 marks)

2

A bus is taking some children to school.

(a) The bus has to stop a few times. The figure below shows the distance–time graph for part of the journey.



(i) How far has the bus travelled in the first 20 seconds?

Distance travelled = m

(1)

(ii) Describe the motion of the bus between 20 seconds and 30 seconds.

.....
.....

(1)

(iii) Describe the motion of the bus between 30 seconds and 60 seconds.

Tick (✓) **one** box.

	Tick (✓)
Accelerating	
Reversing	
Travelling at constant speed	

(1)

(iv) What is the speed of the bus at 45 seconds?

Show clearly on the figure above how you obtained your answer.

.....
.....
.....

Speed = m / s

(3)

(b) Later in the journey, the bus is moving and has 500 000 J of kinetic energy.

The brakes are applied and the bus stops.

(i) How much work is needed to stop the bus?

.....

Work = J

(1)

(ii) The bus stopped in a distance of 25 m.

Calculate the force that was needed to stop the bus.

.....
.....

Force = N

(2)

(iii) What happens to the kinetic energy of the bus as it is braking?

.....
.....
.....
.....

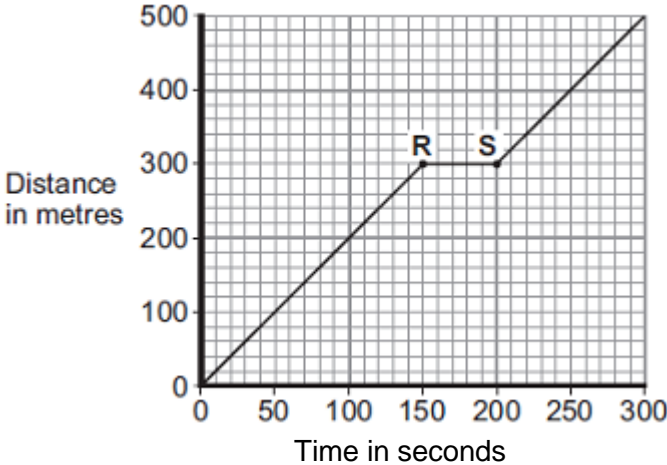
(2)

(Total 11 marks)

3

(a) **Figure 1** shows the distance–time graph for a person walking to a bus stop.

Figure 1



(i) Which **one** of the following statements describes the motion of the person between points **R** and **S** on the graph?

Tick (✓) **one** box.

Not moving

Moving at constant speed

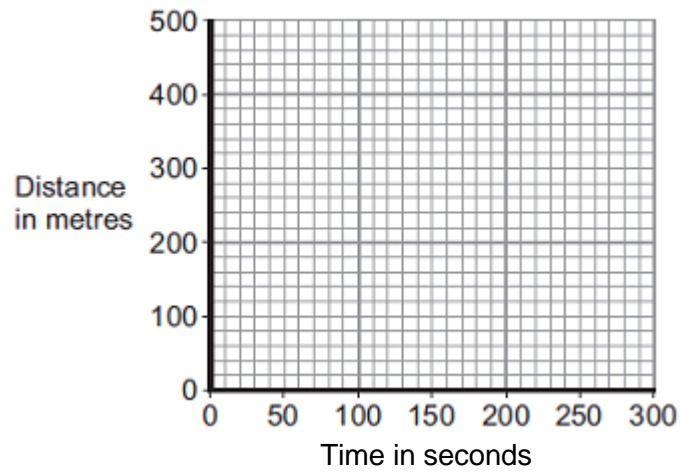
Moving with increasing speed

(1)

- (ii) Another person, walking at constant speed, travels the same distance to the bus stop in 200 seconds.

Complete **Figure 2** to show a distance–time graph for this person.

Figure 2



(1)

- (b) A bus accelerates away from the bus stop at 2.5 m/s^2 .

The total mass of the bus and passengers is 14 000 kg.

Calculate the resultant force needed to accelerate the bus and passengers.

.....

.....

.....

Resultant force = N

(2)

(Total 4 marks)

4

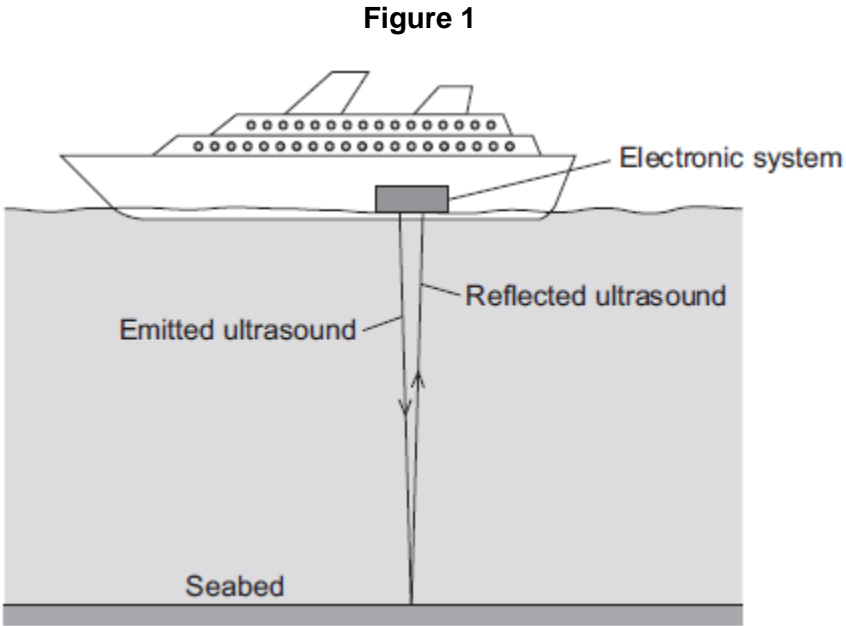
- (a) What is ultrasound?

.....

.....

(1)

(b) **Figure 1** shows how ultrasound is used to measure the depth of water below a ship.



A pulse of ultrasound is sent out from an electronic system on-board the ship.

It takes 0.80 seconds for the emitted ultrasound to be received back at the ship.

Calculate the depth of the water.

Speed of ultrasound in water = 1600 m / s

.....
.....
.....
.....

Depth of water = metres

(3)

(c) Ultrasound can be used in medicine for scanning.

State **one** medical use of ultrasound scanning.

.....

(1)

- (d) Images of the inside of the human body can be made using a Computerised Tomography (CT) scanner. The CT scanner in **Figure 2** uses X-rays to produce these images.

Figure 2



monkeybusinessimages/iStock/Thinkstock

State **one** advantage and **one** disadvantage of using a CT scanner, compared with ultrasound scanning, for forming images of the inside of the human body.

Advantage of CT scanning

.....

.....

Disadvantage of CT scanning

.....

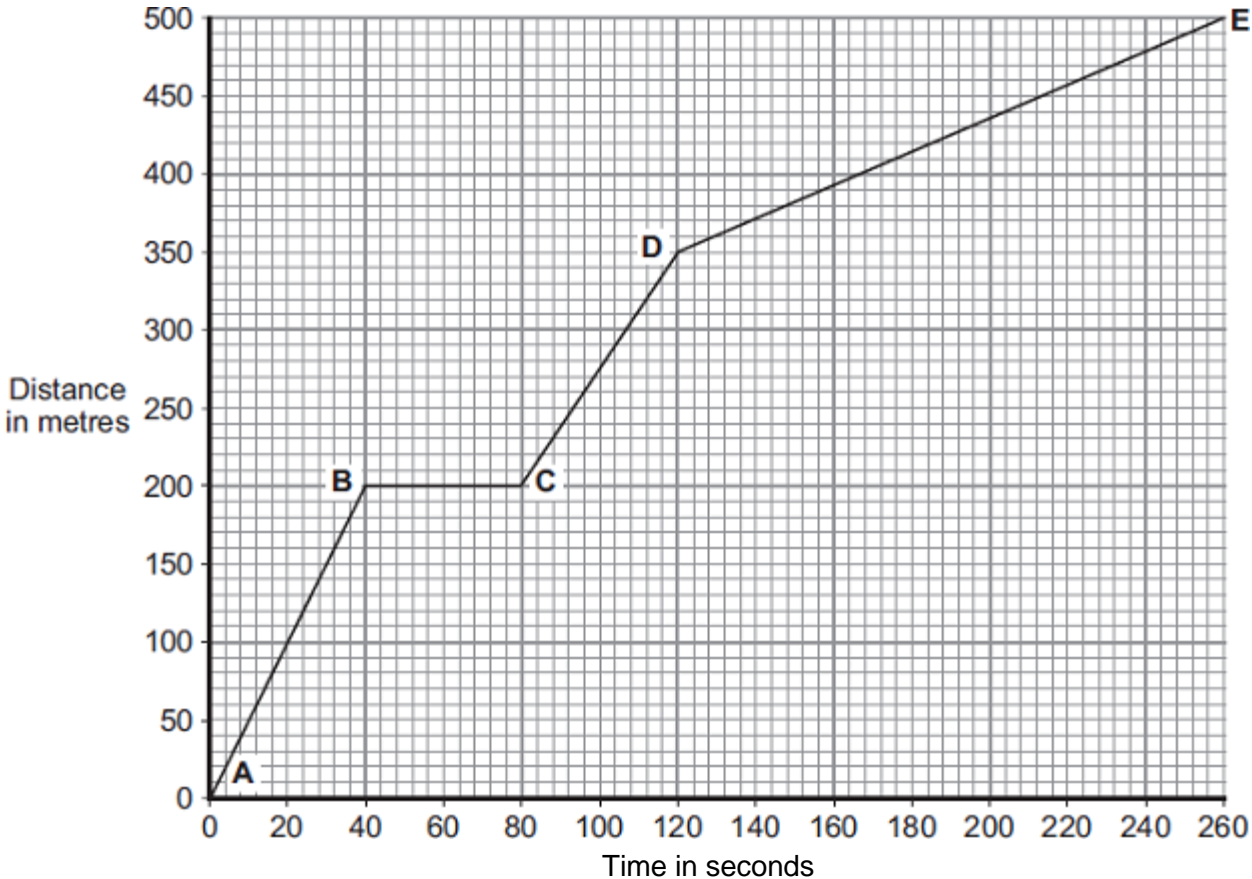
.....

(2)
(Total 7 marks)

5

Part of a bus route is along a high street.

The distance-time graph shows how far the bus travelled along the high street and how long it took.



(a) Between which two points was the bus travelling the slowest?

Put a tick (✓) in the box next to your answer.

Points	Tick (✓)
A – B	
C – D	
D – E	

Give a reason for your answer.

.....
.....

(2)

- (b) The bus travels at 5 m/s between points **A** and **B**.
The bus and passengers have a total mass of 16 000 kg.

Use the equation in the box to calculate the momentum of the bus and passengers between points **A** and **B**.

momentum = mass x velocity

Show clearly how you work out your answer.

.....
.....

Momentum = kg m/s

(2)

- (c) A cyclist made the same journey along the high street.
The cyclist started at the same time as the bus and completed the journey in 220 seconds.
The cyclist travelled the whole distance at a constant speed.

(i) Draw a line on the graph to show the cyclist's journey.

(2)

(ii) After how many seconds did the cyclist overtake the bus?

The cyclist overtook the bus after seconds.

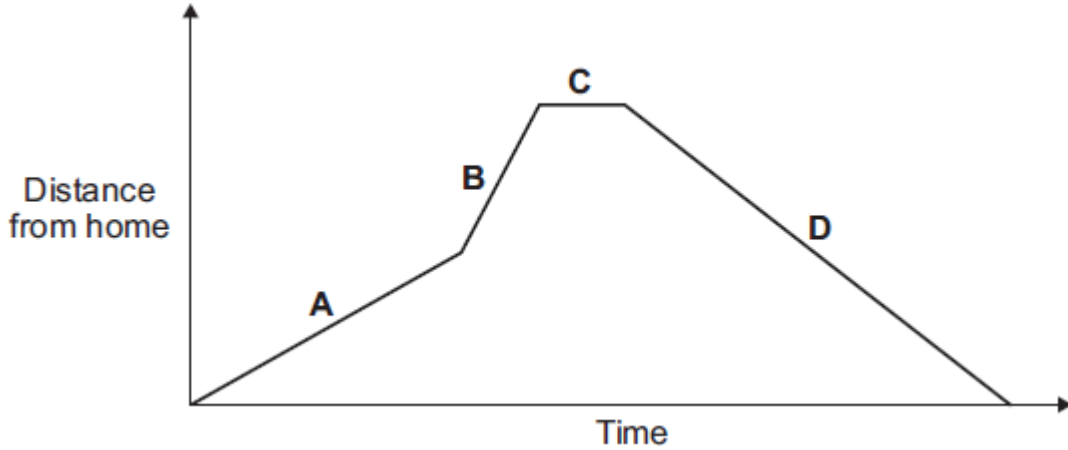
(1)

(Total 7 marks)

6

(a) A person takes their dog for a walk.

The graph shows how the distance from their home changes with time.



Which part of the graph, **A**, **B**, **C** or **D**, shows them walking the fastest?

Write your answer in the box.

Give the reason for your answer.

.....
.....

(2)

(b) During the walk, both the speed and the velocity of the person and the dog change.

How is *velocity* different from *speed*?

.....
.....

(1)

(Total 3 marks)

7

A high-speed train accelerates at a constant rate in a straight line.

The velocity of the train increases from 30 m/s to 42 m/s in 60 seconds.

(a) (i) Calculate the change in the velocity of the train.

.....

Change in velocity = m/s

(1)

(ii) Use the equation in the box to calculate the acceleration of the train.

$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken for change}}$
--

Show clearly how you work out your answer and give the unit.
Choose the unit from the list below.

m/s

m/s²

N/kg

Nm

.....

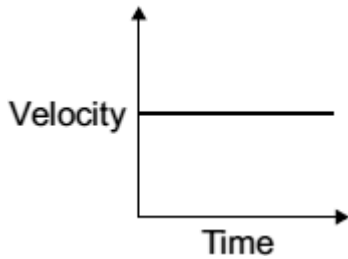
.....

Acceleration =

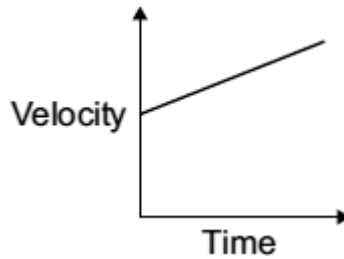
(2)

(b) Which **one** of the graphs, **A**, **B** or **C**, shows how the velocity of the train changes as it accelerates?

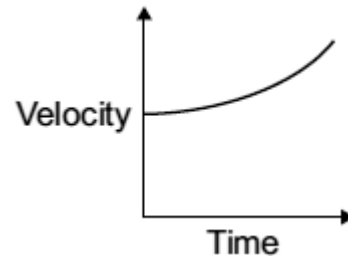
Write your answer, **A**, **B** or **C**, in the box.



A



B



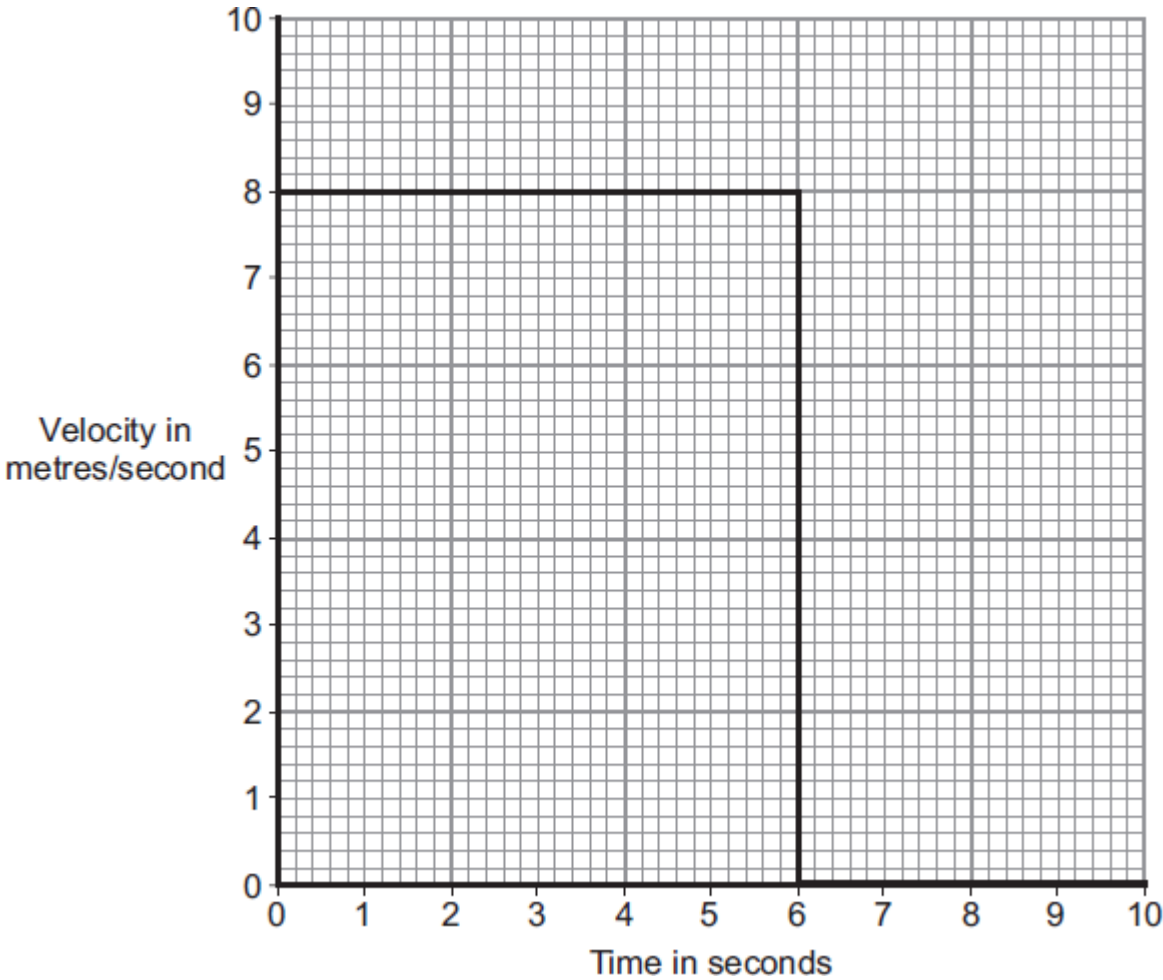
C

Graph

(1)
(Total 4 marks)

8

The diagram shows the velocity-time graph for an object over a 10 second period.



(a) Use the graph to calculate the distance travelled by the object in 10 seconds.

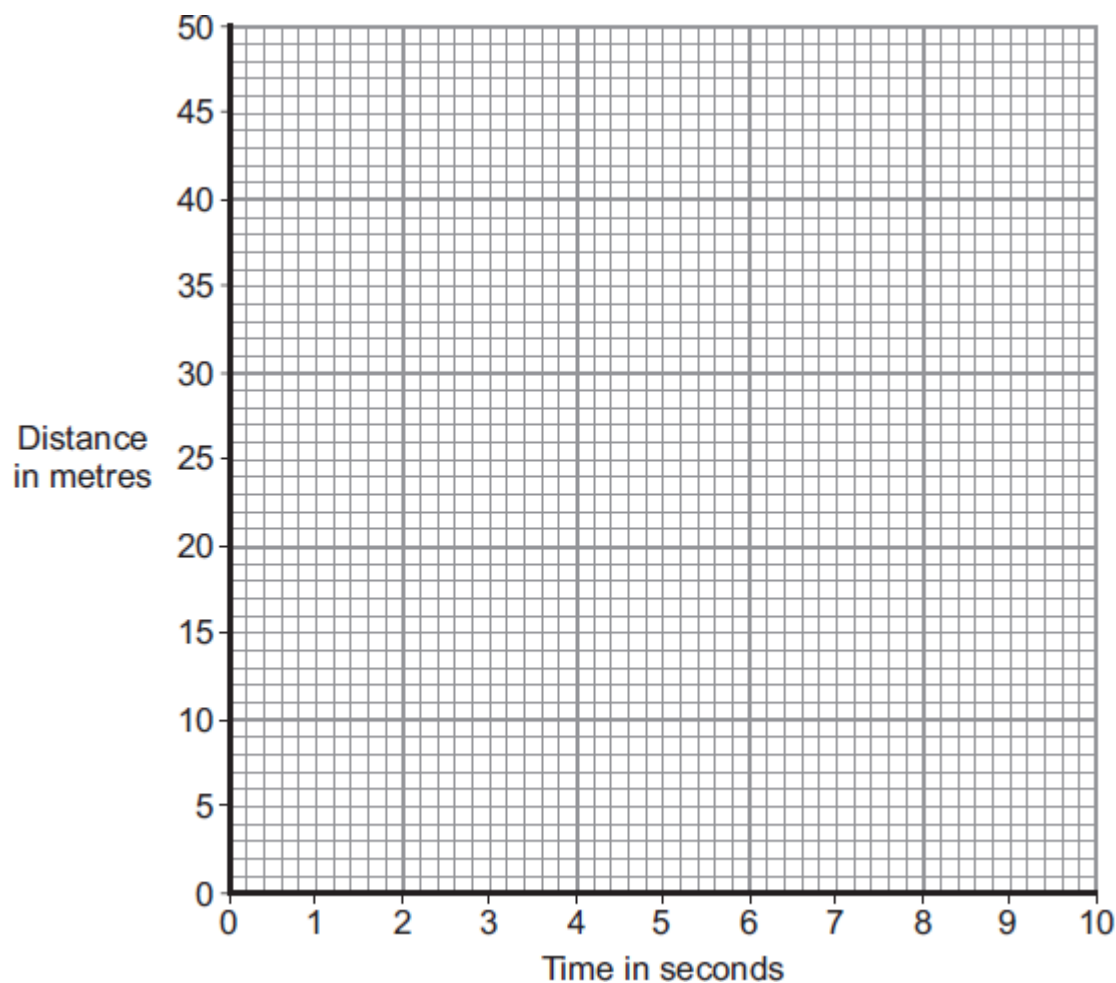
Show clearly how you work out your answer.

.....
.....

Distance = m

(2)

(b) Complete the distance-time graph for the object over the same 10 seconds.



(2)
(Total 4 marks)

9

A cyclist travelling along a straight level road accelerates at 1.2 m/s^2 for 5 seconds. The mass of the cyclist and the bicycle is 80 kg.

(a) Calculate the resultant force needed to produce this acceleration.

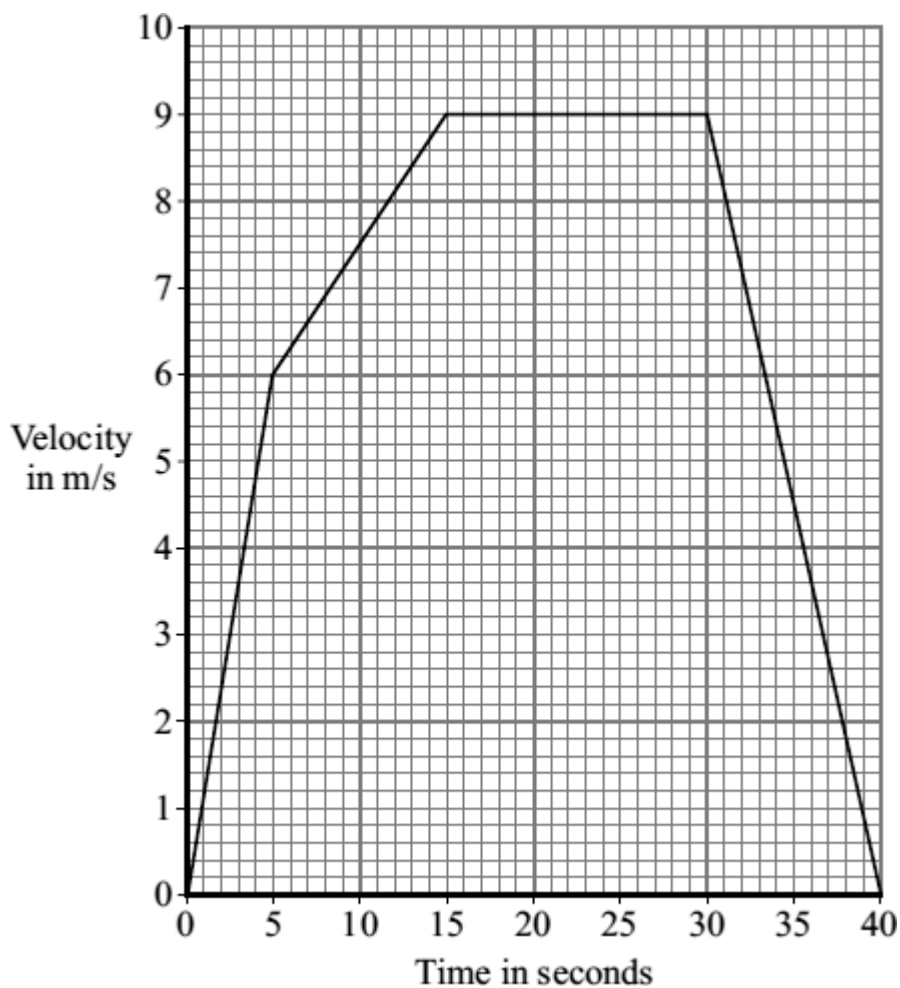
Show clearly how you work out your answer and give the unit.

.....
.....

Resultant force =

(3)

(b) The graph shows how the velocity of the cyclist changes with time.



(i) Complete the following sentence.

The velocity includes both the speed and theof the cyclist.

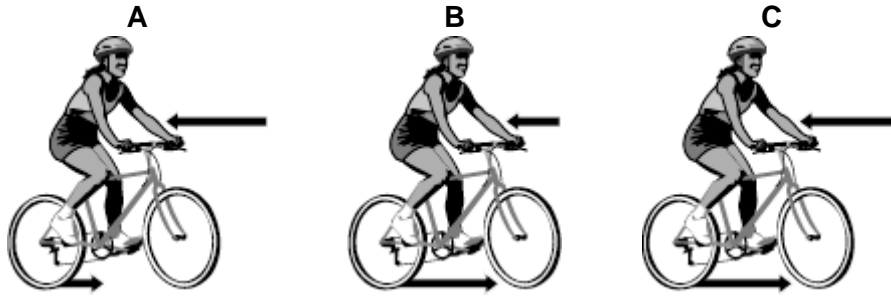
(1)

(ii) Why has the data for the cyclist been shown as a line graph instead of a bar chart?

.....
.....

(1)

- (iii) The diagrams show the horizontal forces acting on the cyclist at three different speeds. The length of an arrow represents the size of the force.



Which **one** of the diagrams, **A**, **B** or **C**, represents the forces acting when the cyclist is travelling at a constant 9 m/s?

.....

Explain the reason for your choice.

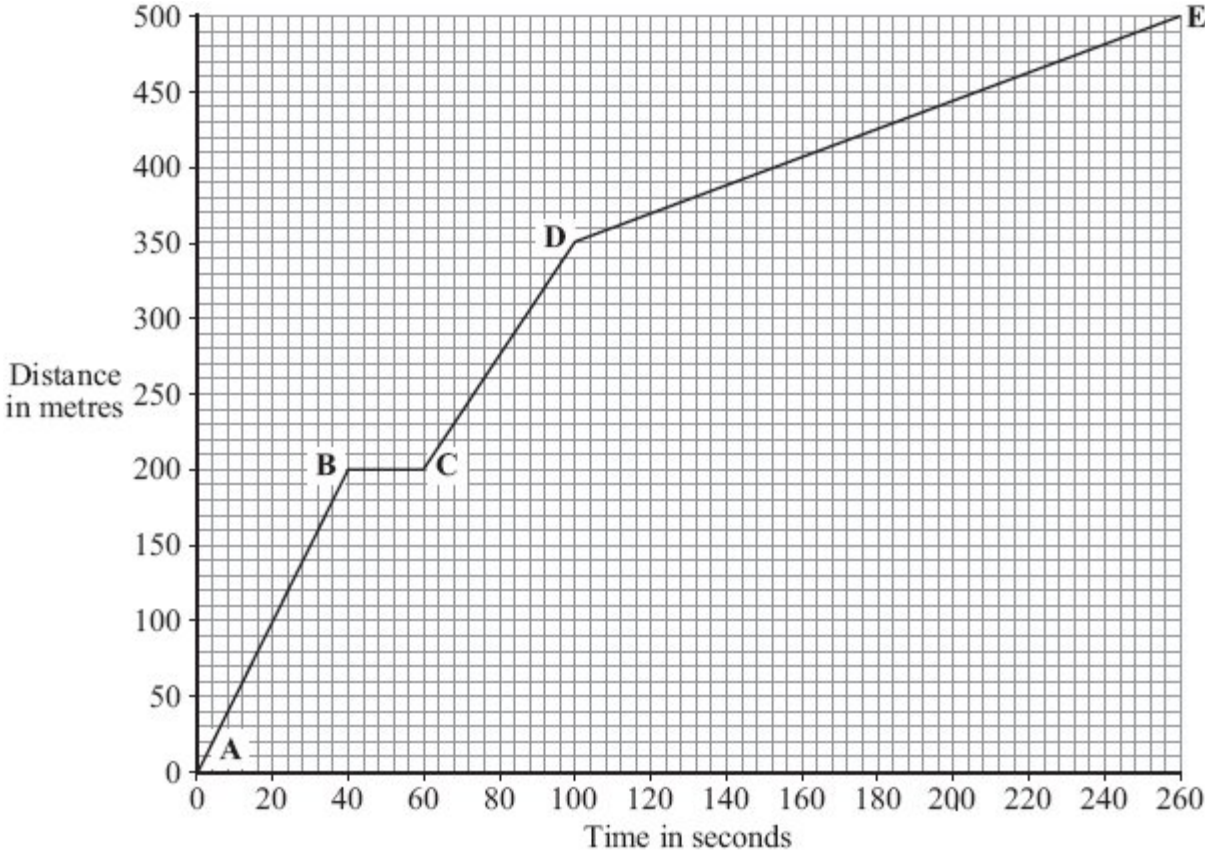
.....
.....
.....
.....
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.....

(3)
(Total 8 marks)

10

Part of a bus route is along a high street.

The distance – time graph shows how far the bus travelled along the high street and how long it took.



(a) The bus travels the **slowest** between points **D** and **E**.

How can you tell this from the graph?

.....
.....

(1)

(b) Between which two points was the bus travelling the **fastest**?

Put a tick (✓) in the box next to your answer.

Points	
A – B	
B – C	
C – D	

(1)

(c) There is a bus stop in the high street.
This is marked as point **B** on the graph.

(i) What is the distance between point **A** on the graph and the bus stop?

Distance metres

(1)

(ii) How long did the bus stop at the bus stop?
Show clearly how you work out your answer.

.....

Time = seconds

(2)

(d) A cyclist made the same journey along the high street.
The cyclist started at the same time as the bus and completed the journey in 200 seconds.
The cyclist travelled the whole distance at a constant speed.

(i) Draw a line on the graph to show the cyclist's journey.

(2)

(ii) After how many seconds did the cyclist overtake the bus?

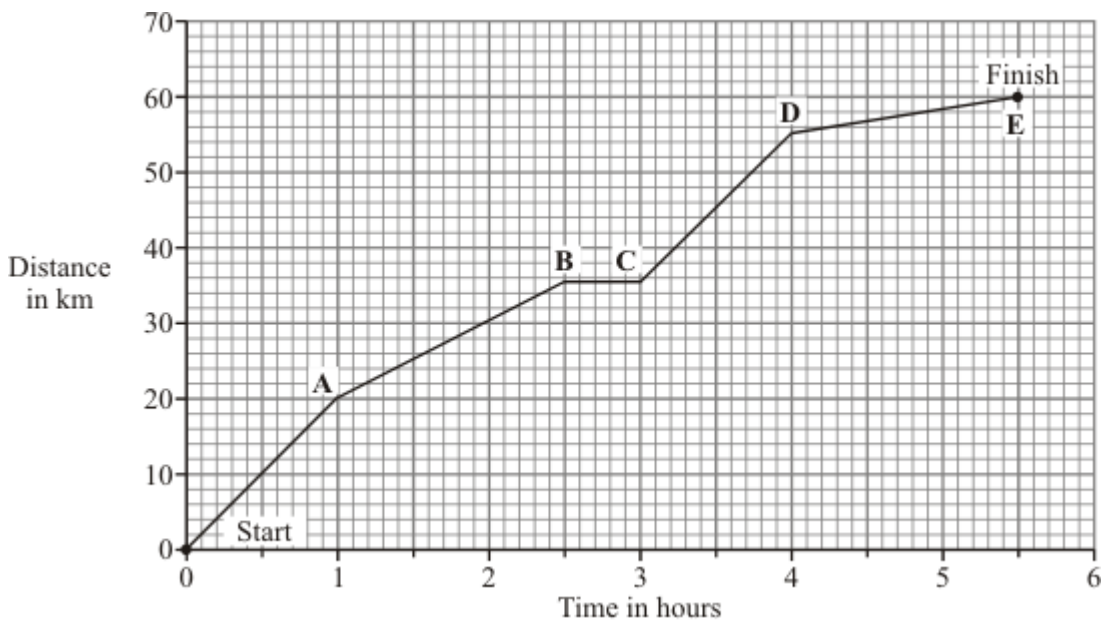
The cyclist overtook the bus after seconds.

(1)

(Total 8 marks)

11

A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.



(a) What was the distance of the race?

distance = km

(1)

(b) How long did it take the horse and rider to complete the race?

.....

(1)

(c) What distance did the horse and rider travel in the first 2 hours of the race?

distance = km

(1)

(d) How long did the horse and rider stop and rest during the race?

.....

(1)

(e) Not counting the time it was resting, between which two points was the horse moving the slowest?

..... and

Give a reason for your answer.

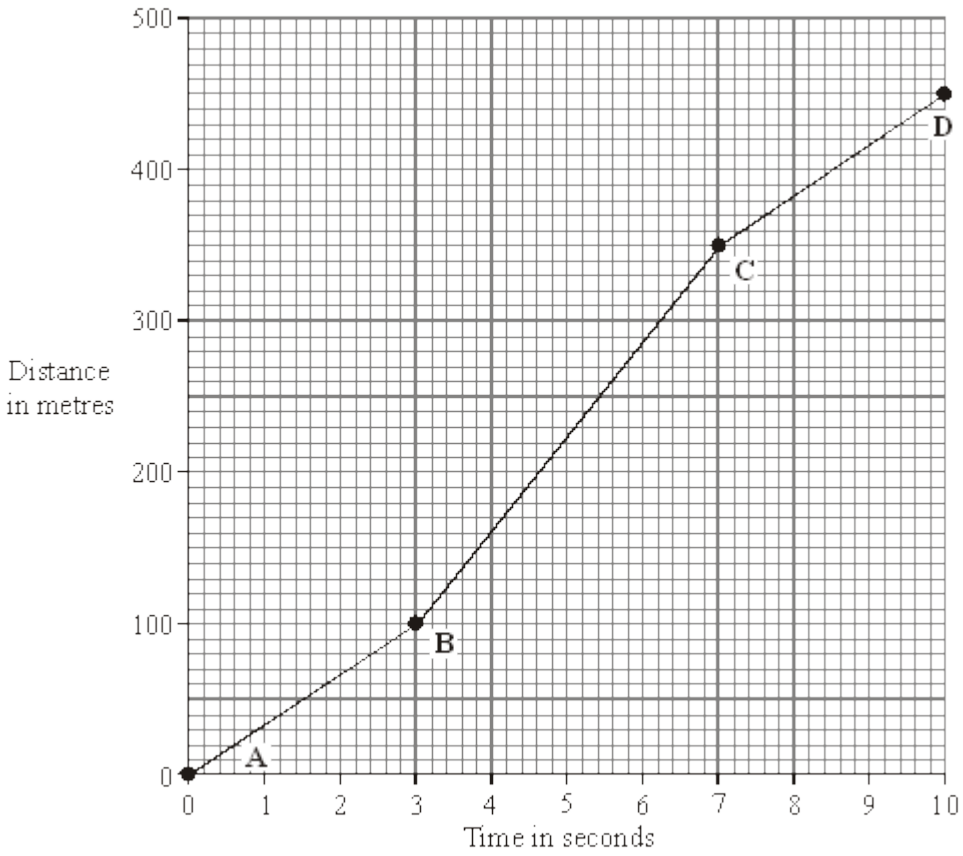
.....

.....

(2)
(Total 6 marks)

12

The distance-time graph represents the motion of a car during a race.



(a) Describe the motion of the car between point A and point D. You should not carry out any calculations.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

(3)

(b) Calculate the gradient of the graph between point **B** and point **C**. Show clearly how you get your answer.

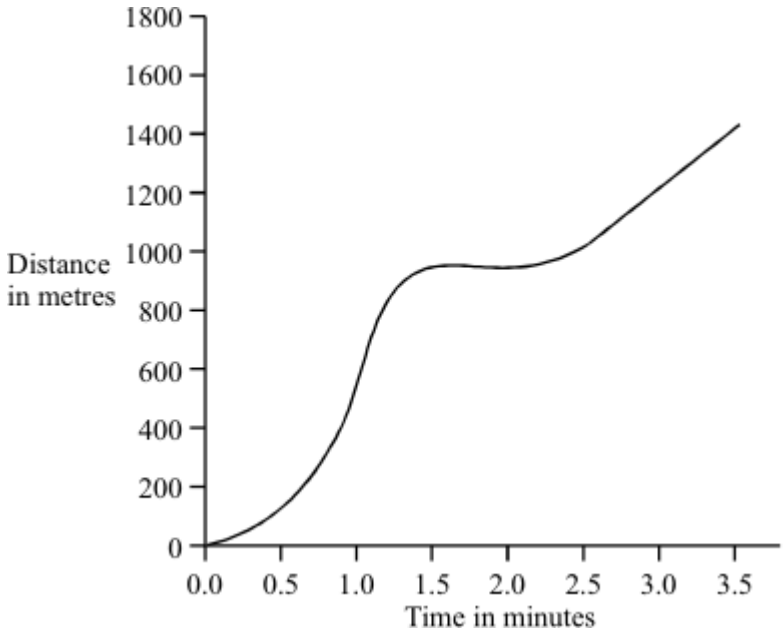
.....
.....
.....

gradient =

(3)
(Total 6 marks)

13

The graph shows how the distance travelled by a car changes with time during a short journey.



(i) Describe fully the motion of the car during the first **two** minutes of the journey.

.....
.....
.....
.....
.....

(3)

- (ii) During the last minute of the journey the velocity of the car changes although the speed remains constant. How is this possible?

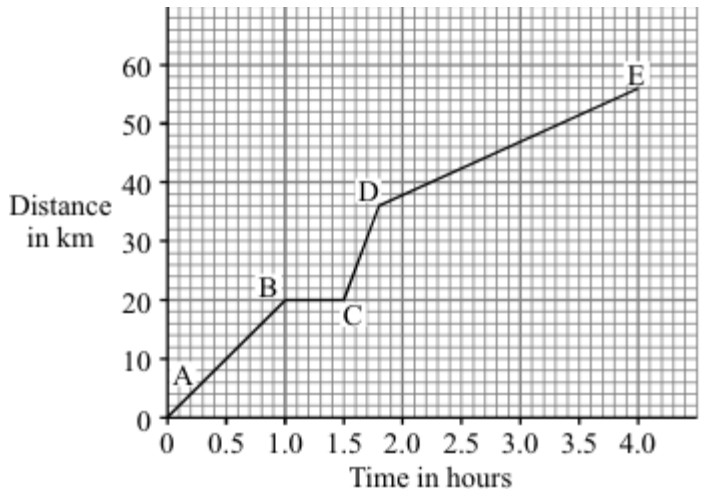
.....

.....

(1)
(Total 4 marks)

14

A cyclist goes on a long ride. The graph shows how the distance travelled changes with time during the ride.



- (i) Between which **two** points on the graph was the cyclist moving at the fastest speed?

.....

(1)

- (ii) State **one** way cyclists can reduce the air resistance acting on them.

.....

.....

(1)

- (iii) How long did the cyclist stop and rest?

.....

(1)

- (iv) Write down the equation which links distance, speed and time.

.....

(1)

(v) Calculate, in km/hr, the average speed of the cyclist while moving.

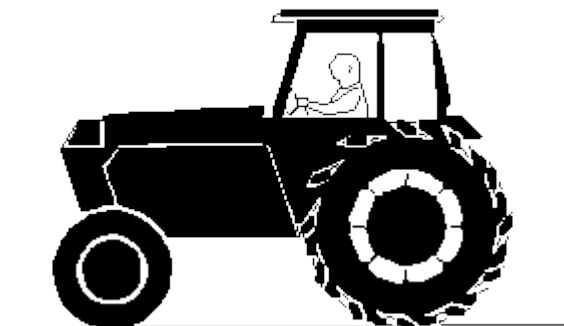
.....
.....
.....
.....

Average speed = km/hr

(3)
(Total 7 marks)

15

(a) The diagram below shows a moving tractor. The forward force from the engine exactly balances the resisting forces on the tractor.



(i) Describe the motion of the tractor.

.....

(ii) The tractor comes to a drier part of the field where the resisting forces are less. If the forward force from the engine is unchanged how, if at all, will the motion of the tractor be affected?

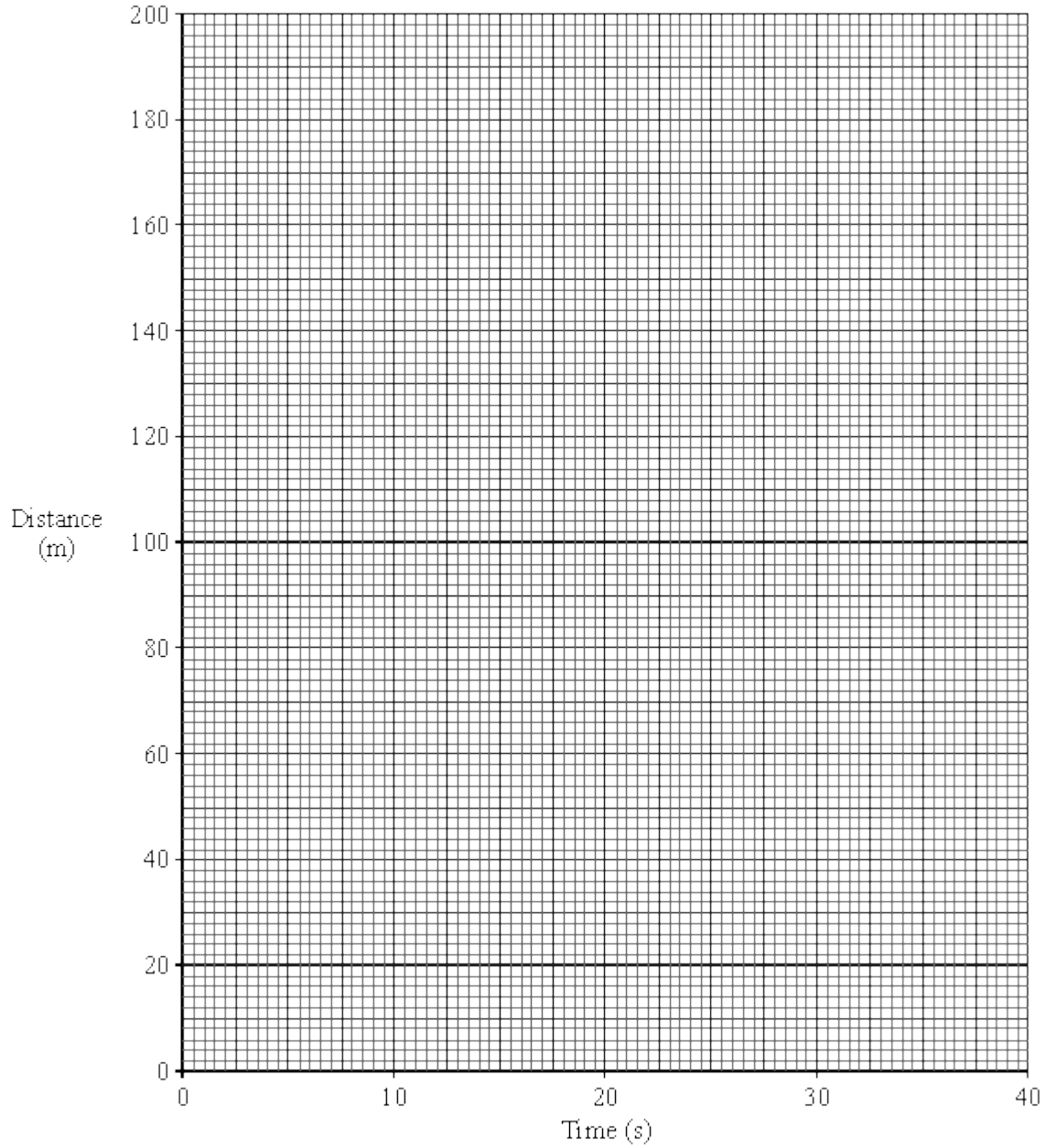
.....
.....

(3)

(b) Two pupils are given the task of finding out how fast a tractor moves across a field. As the tractor starts a straight run across the field the pupils time how long it takes to pass a series of posts which are forty metres apart. The results obtained are shown in the table below.

Distance travelled (m)	0	40	80	120	160	200
Time taken (s)	0	8	16	24	32	40

- (i) Draw a graph of distance travelled against time taken using the axes on the graph below. Label your graph line A.



(2)

- (ii) Calculate the speed of the tractor.

.....
.....

(3)

- (c) In another, wetter field there is more resistance to the movement of the tractor. It now travels at 4 m/s.

(i) Calculate the time needed to travel 200m.

.....
.....
.....

(ii) On the graph in part (b) draw a line to represent the motion of the tractor across the second field. Label this line B.

(4)

(d) On a road the tractor accelerates from rest up to a speed of 6 m/s in 15 seconds.

Calculate the acceleration of the tractor.

.....
.....
.....

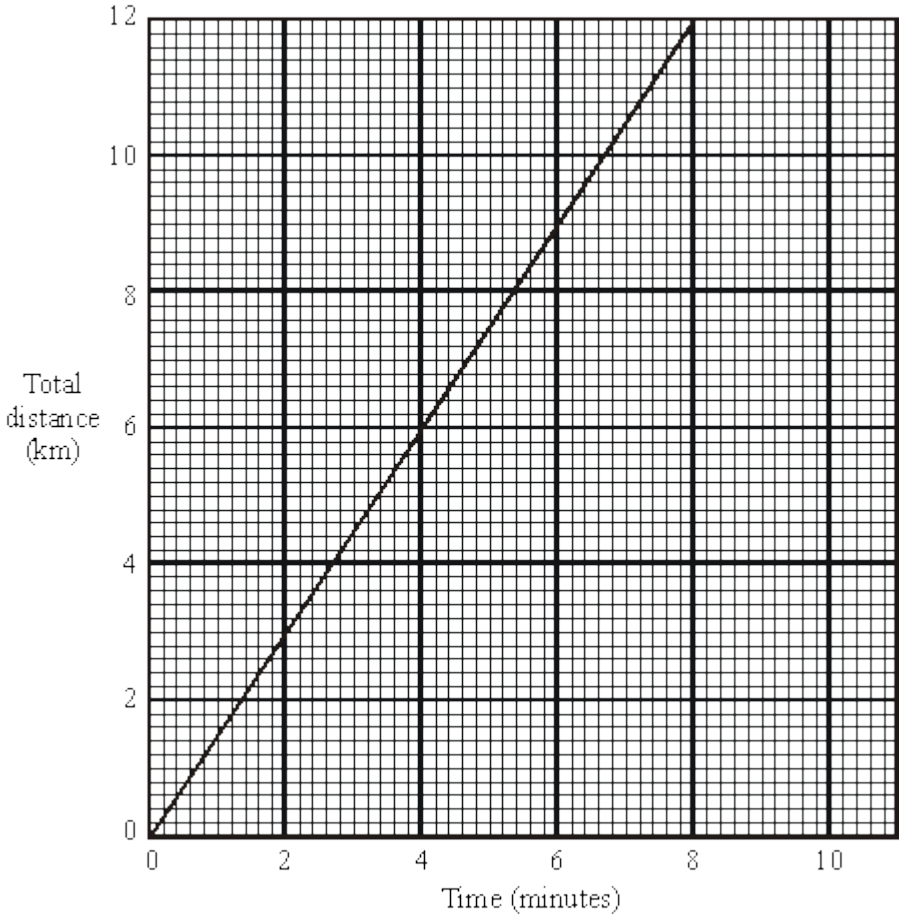
.....Acceleration =m/s²

(3)

(Total 15 marks)

16

Below is a distance-time graph for part of a train journey.
The train is travelling at a constant speed.



- (a) Use the graph to find
 - (i) how far the train travels in 2 minutes km.
 - (ii) how long it takes the train to travel a distance of 10 kilometres minutes.

(2)

(b) Calculate the speed of the train.

.....

.....

.....

.....

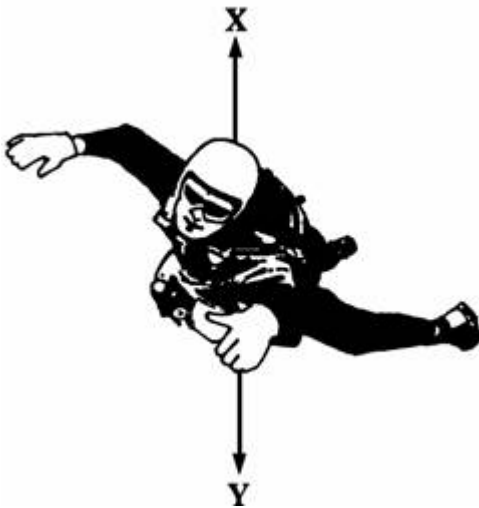
.....

(4)
(Total 6 marks)

17

A sky-diver jumps from a plane.

The sky-diver is shown in the diagram below.



(a) Arrows **X** and **Y** show two forces acting on the sky-diver as he falls.

(i) Name the forces **X** and **Y**.

X

Y

(2)

(ii) Explain why force **X** acts in an upward direction.

.....
.....

(1)

(iii) At first forces **X** and **Y** are unbalanced.

Which of the forces will be bigger?

(1)

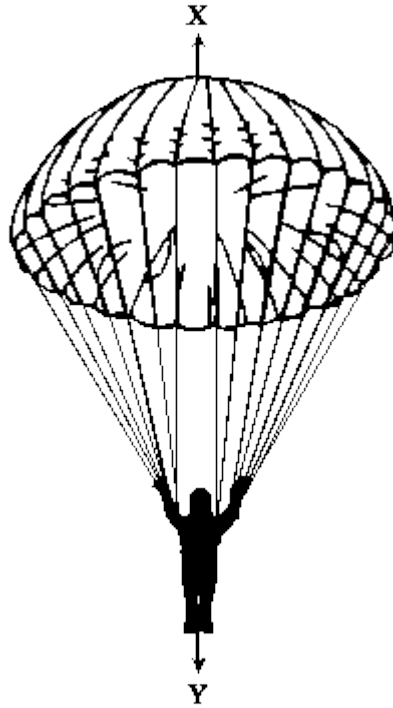
(iv) How does this unbalanced force affect the sky-diver?

.....
.....

(2)

(b) After some time the sky-diver pulls the rip cord and the parachute opens.

The sky-diver and parachute are shown in the diagram below.



After a while forces **X** and **Y** are balanced.

Underline the correct answer in each line below.

Force **X** has

increased / stayed the same / decreased.

Force **Y** has

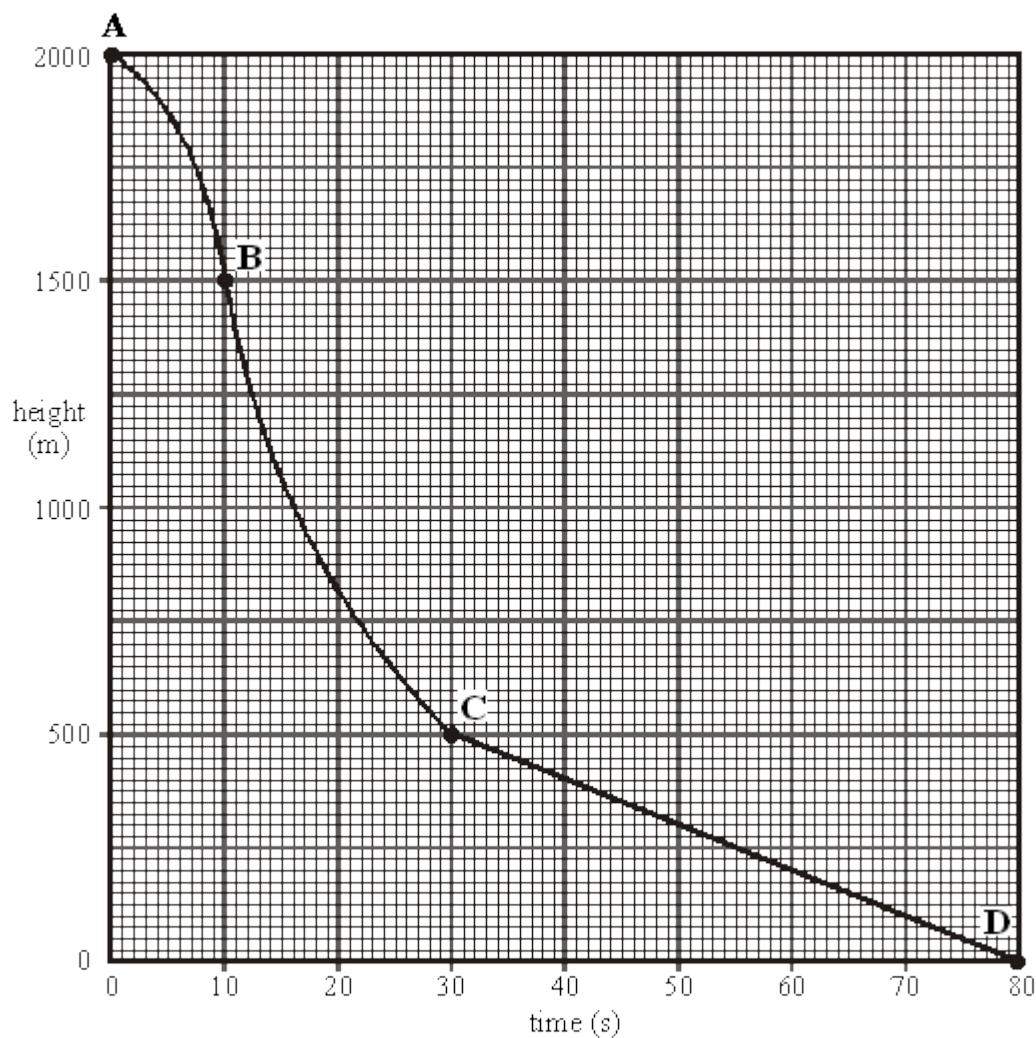
increased / stayed the same / decreased.

The speed of the sky-diver will

increase / stay the same / decrease.

(3)

(c) The graph below shows how the height of the sky-diver changes with time.



(i) Which part of the graph, **AB**, **BC** or **CD** shows the sky-diver falling at a constant speed?

.....

(1)

(ii) What distance does the sky-diver fall at a constant speed?

Distance m

(1)

(iii) How long does he fall at this speed?

Time s

(1)

(iv) Calculate this speed.

.....
.....
.....

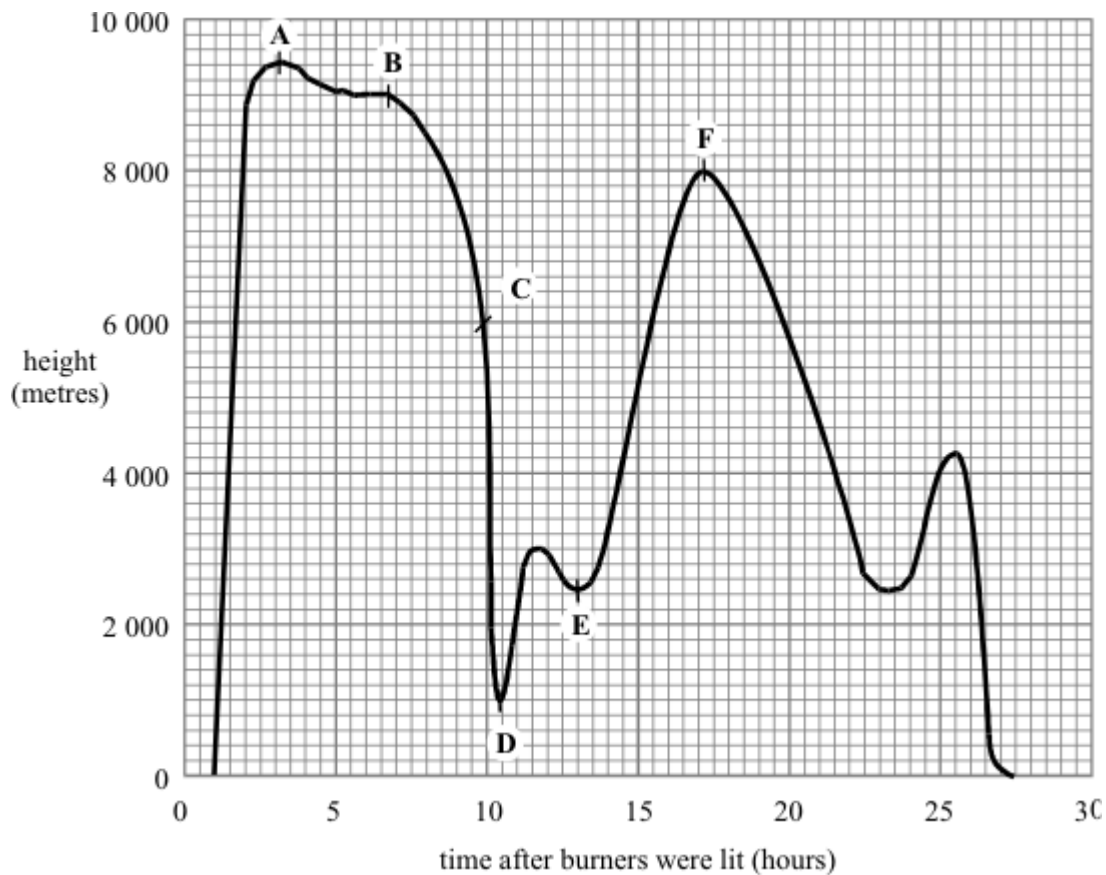
Speed m/s

(2)
(Total 14 marks)

18

A hot air balloon called Global Challenger was used to try to break the record for travelling round the world.

The graph shows how the height of the balloon changed during the flight.



The balloon took off from Marrakesh one hour after the burners were lit and climbed rapidly.

(a) Use the graph to find:

(i) the maximum height reached.

Maximum height metres.

(ii) the total time of the flight.

Total time hours.

(2)

(b) Several important moments during the flight are labelled on the graph with the letters **A, B, C, D, E** and **F**.

At which of these moments did the following happen?

(i) The balloon began a slow controlled descent to 2500 metres.

.....

(ii) The crew threw out all the cargo on board in order to stop a very rapid descent.

.....

(iii) The balloon started to descend from 9000 metres.

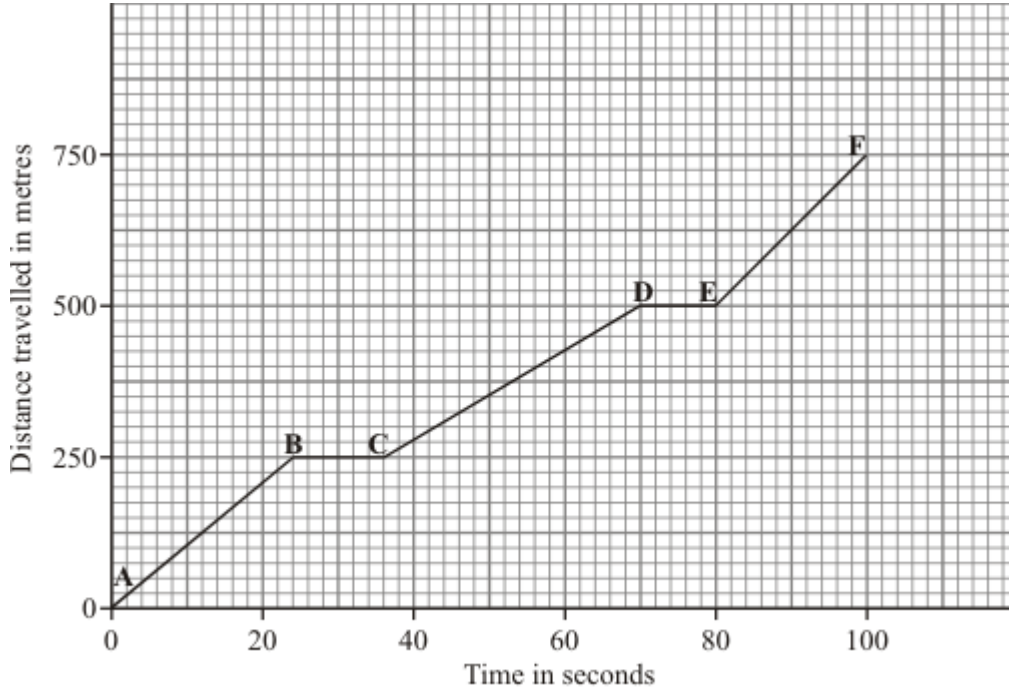
.....

(3)
(Total 5 marks)

19

This question is about a car travelling through a town.

(a) The graph shows how far the car travelled and how long it took.



(i) Between which points was the car travelling fastest? Tick (✓) your answer.

Points	Tick (✓)
A – B	
B – C	
C – D	
D – E	
E – F	

(1)

(ii) Between which points was the car stationary?

.....
.....

(1)

(b) Complete the sentences by writing the correct words in the spaces.

When a car has to stop, the **overall** stopping distance is greater if:

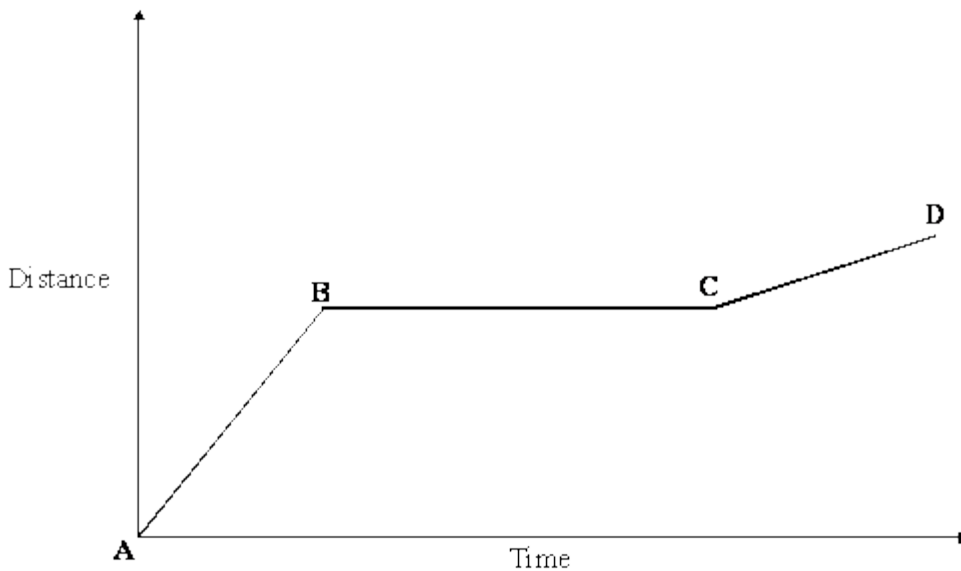
- the car is poorly maintained;
- there are adverse weather conditions;
- the car is travelling ;
- the driver's reactions are

Also, the greater the speed of the car, then the greater the braking
needed to stop in a certain time.

(3)
(Total 5 marks)

20

The graph shows the distance a person walked on a short journey.



(a) Choose from the phrases listed to complete the statements which follow. You may use each statement once, more than once or not at all.

standing still

walking at constant speed

walking with an increasing speed

walking with a decreasing speed

(i) Between points **A** and **B** the person is

.....

(1)

(ii) Between points **B** and **C** the person is

.....

(1)

(b) Complete the sentence.

You can tell that the speed of the person between points **A** and **B** is

than the speed between points **C** and **D** because

.....

(2)

(c) Write the equation which relates distance, speed and time.

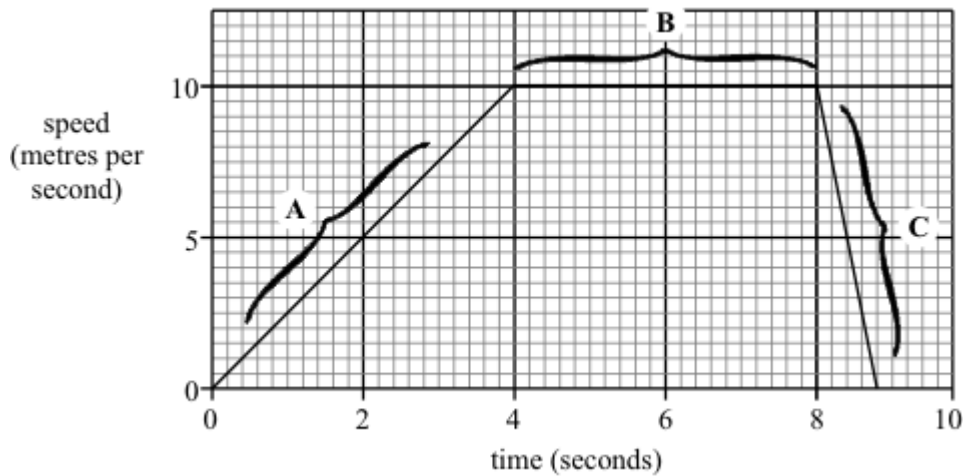
.....

(1)

(Total 5 marks)

21

The graph shows the speed of a runner during an indoor 60 metres race.



(a) Choose words from this list to complete the sentences below.

moving at a steady speed

slowing down

speeding up

stopped

Part **A** of the graph shows that the runner is

Part **B** of the graph shows that the runner is

Part **C** of the graph shows that the runner is

(3)

(b) Calculate the acceleration of the runner during the first four seconds.
(Show your working.)

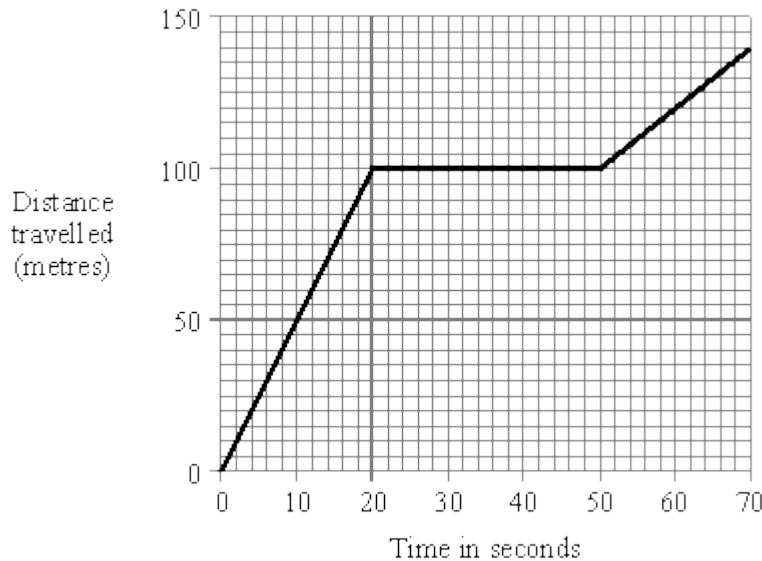
.....
.....
.....

(3)

(Total 6 marks)

22

A child goes out to visit a friend.
The graph shows the child's journey.



(a) Calculate the child's average speed for the whole journey.
[Show your working and give the units in your answer.]

.....
.....

(3)

- (b) How many times faster is the child travelling in part A of the graph than in part C?
[You should show how you obtained your answer.]

.....
.....
.....

(2)
(Total 5 marks)

Mark schemes

1

- (a) distance is a scalar and displacement is a vector

or

distance has magnitude only, displacement has magnitude and direction

1

- (b) 37.5 km

accept any value between 37.0 and 38.0 inclusive

1

062° or N62°E

accept 62° to the right of the vertical

1

accept an angle in the range 60° – 64°

accept the angle correctly measured and marked on the diagram

- (c) train changes direction so velocity changes

1

acceleration is the rate of change of velocity

1

- (d) number of squares below line = 17

accept any number between 16 and 18 inclusive

1

each square represents 500 m

1

distance = number of squares × value of each square correctly calculated – 8500 m

1

[8]

2

- (a) (i) 100 (m)

1

(ii) stationary

1

(iii) accelerating

1

(iv) tangent drawn at $t = 45$ s

1

attempt to determine slope

1

speed in the range 3.2 – 4.2 (m / s)

dependent on 1st marking point

1

(b) (i) 500 000 (J)
ignore negative sign 1

(ii) 20 000 (N)
ignore negative sign
allow 1 mark for correct substitution, ie
 $500\,000 = F \times 25$
or their part (b)(i) = $F \times 25$
provided no subsequent step 2

(iii) *(kinetic) energy transferred by heating* 1

to the brakes
ignore references to sound energy
if no other marks scored allow k.e. decreases for 1 mark 1

[11]

3

(a) (i) not moving 1

(ii) straight line from origin to (200,500)
ignore a horizontal line after (200,500) 1

(b) 35 000
allow 1 mark for correct substitution, ie $14\,000 \times 2.5$ provided no
subsequent step
an answer of 87 500 indicates acceleration (2.5) has been squared
and so scores zero 2

[4]

4

(a) (sound waves) which have a frequency higher than the upper limit of hearing for humans
or

a (sound) wave (of frequency) above 20 000 Hz

sound waves that cannot be heard is insufficient

a wave of frequency 20 000 Hz is insufficient

1

(b) 640

an answer of 1280 gains 2 marks

allow 2 marks for the correct substitution

ie 1600×0.40 provided no subsequent step

allow 2 marks for the substitution $\frac{1600 \times 0.80}{2}$

provided no subsequent step

allow 1 mark for the substitution 1600×0.80 provided no subsequent step

allow 1 mark for the identification that time (boat to bed) is 0.4

3

(c) any **one** from:

- pre-natal scanning / imaging
- imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles

accept heart

*do **not** allow brain **or** lungs (either of these negates a correct answer)*

- Doppler scanning blood flow

1

(d) advantage

any **one** from:

- (images are) high quality or detailed or high resolution

clearer / better image is sufficient

- (scan) produces a slice through the body
- image can be viewed from any direction

allow images are (always) 3D / 360°

- an image can be made of any part (inside the body)

allow whole body can be scanned

- easier to diagnose **or** see a problem (on the image)

1

disadvantage

any **one** from:

- (the X-rays used **or** scans) are ionising

allow a description of what ionising is

- mutate cells **or** cause mutations **or** increase chances of mutations

allow for cells:

DNA / genes / chromosomes / nucleus / tissue

- turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells
- kill cells
damage cells is insufficient
- shielding is needed
can be dangerous (to human health) unqualified, is insufficient

1

[7]

5

(a) D – E

reason only scores if D – E chosen

1

shallowest slope / gradient

accept smallest distance in biggest time

accept longest time to travel the same distance

accept the line is not as steep

accept it is a less steep line

*do **not** accept the line is not steep*

1

(b) 80 000

allow 1 mark for correct substitution, ie 16 000 × 5 provided no subsequent step shown

2

(c) (i) straight line starting at origin

accept within one small square of the origin

1

passing through t = 220 and d = 500

1

(i) 186

accept any value between 180 and 188

accept where their line intersects given graph line correctly read

±4 s

1

[7]

6

(a) B

reason only scores if B is chosen

1

gradient / slope is the steepest / steeper

answers must be comparative

accept steepest line

ignore greatest speed

1

(b) (velocity includes) direction
'it' refers to velocity

1

[3]

7 (a) (i) 12

1

(ii) 0.2

allow 1 mark for their (a)(i) $\div 60$ and correctly calculated

1

m/s²

accept correct unit circled in list

accept ms⁻²

*do **not** accept mps²*

1

(b) **B**

1

[4]

8 (a) 48

allow for 1 mark correct method shown, ie 6×8

or correct area indicated on the graph

2

(b) diagonal line from (0,0) to (6,48) / (6, their (a))

if answer to (a) is greater than 50, scale must be changed to gain this mark

1

horizontal line at 48m between 6 and 10 seconds

accept horizontal line drawn at their (a) between 6 and 10 seconds

1

[4]

9 (a) 96

allow 1 mark for correct substitution

ie 80×1.2

2

newton or N

allow Newton

*do **not** allow n*

1

(b) (i) direction

1

(ii) velocity and time are continuous (variables)

answers must refer to both variables

accept the variables are continuous / not categoric

accept the data / 'it' is continuous

accept the data / 'it' is not categoric

1

(iii) **C**

1

velocity is not changing

*the **2** marks for reason may be scored even if **A** or **B** are chosen*

accept speed for velocity

accept speed is constant (9 m/s)

*accept **not** decelerating*

*accept **not** accelerating*

accept reached terminal velocity

1

forces must be balanced

accept forces are equal

accept arrows are the same length / size

or

resultant force is zero

*do **not** accept the arrows are equal*

1

[8]

10

(a) shallowest slope/ gradient

accept smallest distance in biggest time

accept longest time to travel the same distance

accept the line is not as steep

accept it is a less steep line

*do **not** accept the line is not steep*

1

(b) **A – B**

If 2 or 3 boxes are ticked no mark

1

- (c) (i) 200 m 1
- (ii) 20 s
allow 1 mark for correctly identifying 60 s or 40 s from the graph 2
- (d) (i) straight line starting at origin
accept within one small square of the origin 1
- passing through $t = 200$ and $d = 500$ 1
- (ii) 166
accept any value between 162 and 168
accept where their line intersects
given graph line correctly read ± 3 s 1
- [8]**

11

- (a) 60 1
- (b) $5\frac{1}{2}$ hours
must include unit 1
- (c) 30 1
- (d) 30 minutes or
 $\frac{1}{2}$ hour
must include unit 1

(e) D and E

accept finish for E
accept correct numbers from axes with units

1

least steep part of the graph

accept covers smallest distance in a set time
accept only moves 5 km in 1 ½ hours (accept anything between 5 and 6)
ignore horse is tired

1

[6]

12

(a) **Quality of written communication**

for correct use of term speed in all correct examples
Q ✓ Q ✗

1

describes all 3 sections correctly for 2 marks
describes 2 or 1 section correctly for 1 mark

max 2

A – B constant speed

*do **not** accept pace for speed*

B – C (has accelerated) to a higher (constant) speed

C – D goes back to original / lower (constant) speed

allow for 1 mark, initial and final (constant) speeds are the same
accept velocity for speed
ignore reference to direction

(b) 62.5

allow answer to 2 s.f.
*allow 1 mark for drawing a correct triangle **or** for using two correct pairs of coordinates*
allow 1 mark for correct use of y/x
ignore units

3

[6]

13

(i) first statement must be accelerated
if it just accelerated then decelerates award 2 marks

1

final statement must be stationary

1

interim statement decelerates

1

(ii) direction is changing

1

[4]

14

(i) C and D **or** D and C
accept CD
accept DC
accept answers in terms of time

1

(ii) any **one** from:

streamline position streamline clothes

accept crouched position

accept tight clothes

accept design of cycle

accept cycle slower

1

(iii) 0.5 hours **or** 30 minutes **or** 1800 seconds

must have unit


1


(iv) speed = $\frac{\text{distance}}{\text{time (taken)}}$

accept any correct rearrangement

*accept $s = d/t$ **or** $v = s/t$*

accept velocity for speed

accept 

if subsequent use of  *correct*

1

(v) 16

*allow for mark for each of time = 3.5 hours
distance = 56km
allow e.c.f. from part (a)(iii) if correctly used
an answer of 14 gains 2 marks
allow 1 mark for correct attempt to average the three sections*

3

[7]

15

(a) (i) Constant speed

2

(ii) Accelerates to higher constant speed

1

(b) (i) Points correct (allow one major or two minor mistakes)
Line correct (for their points)

2

(ii) 5 m/s
or 5

gets 2 marks

or correct unit

gets 1 mark mark

3

(c) (i) 50 s or 50

gets 2 marks

or $t = d/v$

gets 1 mark

3

(ii) Line correct (of gradient 4 and spans 30 consecutive seconds)

1

(d) (i) 0.04 or 6/15

gets 2 marks

or $a = v/t$

gets 1 mark

3

[15]

16

- (a) (i) 3km [allow 2.9 to 3.1]
for 1 mark 1
- (ii) 6.6 min [allow 6.5 to 6.8]
for 1 mark 1
- (b) can be in any units, 1.5 km/min, 1500 m/min, 25 m/s, 90 km/h
 $Sp = d/t$
 $=12/8$
 $=1.5$
 km/min
for 1 mark each (see marking of calculations) 4

[6]

17

- (a) (i) air resistance/drag/friction (or upthrust)
weight/gravitational pull/gravity
for 1 mark each 1
- (ii) air resistance/friction acts in opposite direction to motion 1
- (iii) Y 1
- (iv) the sky-diver accelerates/his speed increases
in downward direction/towards the Earth/falls
for 1 mark each 2
- (b) force X has increased force Y has stayed the same the speed of the sky-diver
will stay the same
for 1 mark each 3
- (c) (i) CD 1
- (ii) 500 }
(iii) 50 } (but apply e.c.f. from (i)) 3

(iv) 10 (but apply e.c.f. from (ii) and (iii))

gets 2 marks

or 500/50 or d/t

gets 1 mark

2

[14]

18

(a) (i) 9400(m)

for 1 mark

1

(ii) 26.5(hours)

for 1 mark

1

(b) (i) F

for 1 mark

1

(ii) D

for 1 mark

1

(iii) B

for 1 mark

1

[5]

19

(a) (i) **E-F** (ticked)

1

(ii) **B-C or D-E**

accept both answers

1

- (b) fast(er) *accept downhill* 1
- slow(er) 1
- force *do not accept distance* 1

[5]

20

- (a) (i) walking at constant speed 1
- (ii) standing still 1
- (b) is higher **or** faster
accept less time to walk more distance (both time and distance must be mentioned) 1
- the slope of graph is steeper
accept slope is more 1
- (c) speed = $\frac{\text{distance}}{\text{time}}$
accept suitable symbols used in correct formula
do not accept a triangle 1

[5]

21

(a) A = speeding up
[Accept 'accelerating / acceleration / going faster']

B = moving at a steady speed
[Accept 'constant speed']

C = slowing down
[Accept 'going slower' / decelerating]
each for 1 mark

3

(b) acceleration = $\frac{\text{change in speed/velocity}}{\text{time taken}}$

NB if formula given must be correct

or $\frac{10}{4}$
gains 1 mark

but 2.5
gains 2 marks

unit m/s^2 **or** metres per second squared
or metres per second per second
for 1 mark

or m/s^{-2}
[Credit even if no / an incorrect numerical answer is given]

3

[6]

22

(a) evidence of

$$\text{speed} = \frac{\text{distance}}{\text{time}} \text{ (travelled) or } \frac{100}{20} \text{ or } \frac{40}{20}$$

gains 1 mark

but or any correct calculation of gradient

(except when zero) gains 2 marks

$$\frac{140}{70} \text{ or } 2$$

gains 1 mark

units metres per second **or** m/s **or** ms⁻¹

(not mps)

for 1 mark

3

(b) *evidence of* calculating the two speeds

$$\left(\frac{100}{20} \text{ and } \frac{40}{20} \text{ or } 5 \text{ and } 2 \right) \quad (\text{evidence of this may be in (a)})$$

or

noting distances travelled in same time (20 secs) i.e. 100m and 40m **but** 2.5

gains 2 marks

2

[5]