Specimen paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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11	
12	
13	
14	
15	
TOTAL	

General Certificate of Secondary Education
Higher Tier

Additional Science 1
Unit 5

H

For this paper you must have:
- a ruler
- the Chemistry Data Sheet (enclosed)
- the Physics Equation Sheet (enclosed).

You may use a calculator.

Time allowed
- 90 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

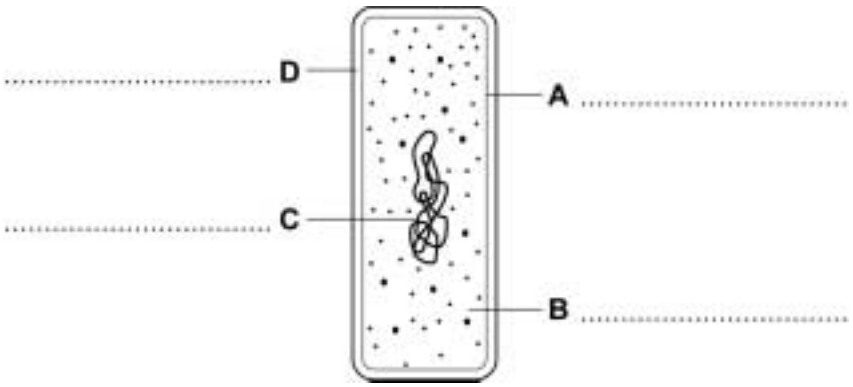
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 6(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  –use good English
  –organise information clearly
  –use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

Biology questions

1 The diagram shows a bacterium.



On the drawing, name the structures labelled **A**, **B**, **C** and **D**.

(4 marks)

4

2 Describe the uses made by plants and algae of the glucose produced during photosynthesis.

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(4 marks)

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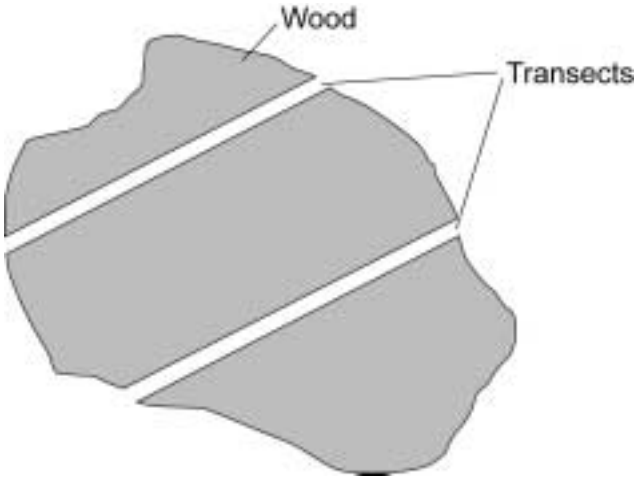
3 Red squirrels live in trees. They eat seeds from the cones of conifer trees. Squirrels store cones in 'larders' on the ground. These larders provide food through the winter. Each red squirrel makes and defends one larder.

Scientists monitor squirrel numbers to find the best habitats for the squirrels' survival. In one investigation, scientists estimated the numbers of squirrels in different types of woodland. Each woodland contains a different species of conifer tree.

Here is their method.

- Ten woods of each type of woodland were surveyed.
- In each wood scientists measured out two transects (strips), each 600 m long and 10 m wide.
- A scientist walked slowly down the centre of each transect, recording the number of squirrel larders he could see.



3 (a) Name **one** variable that was controlled in this investigation.

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(1 mark)

3 (b) (i) The scientists recorded the number of larders instead of the number of squirrels they saw.

How could this have increased the accuracy of the investigation?

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(1 mark)

Question 3 continues on the next page

Turn over ▶

3 (b) (ii) This method of counting the number of larders could have led to an inaccurate estimate of the number of squirrels.

Explain how.

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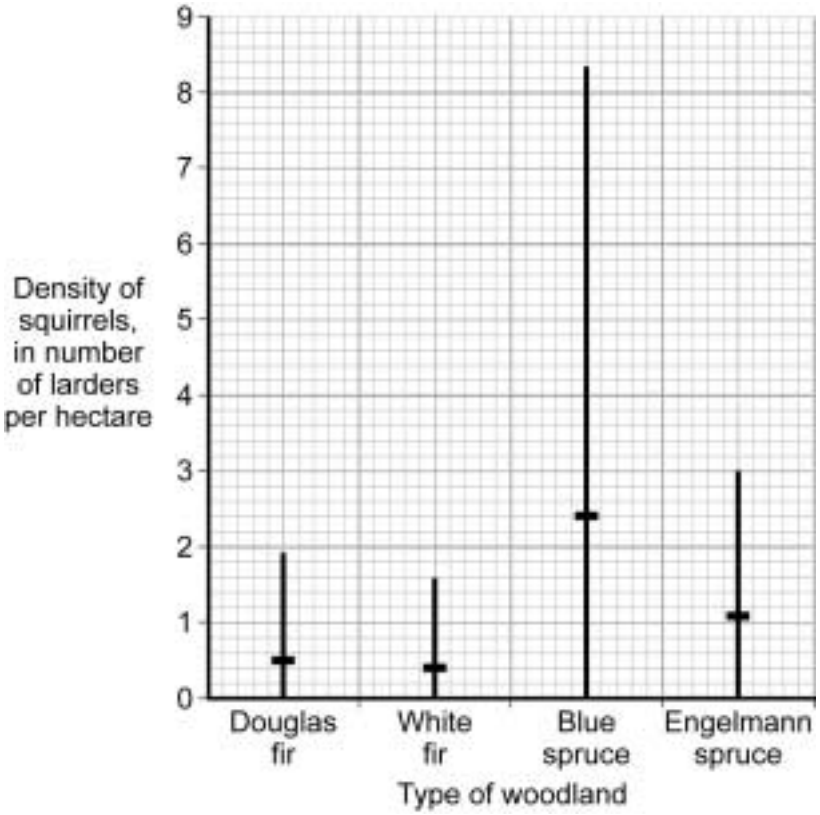
(2 marks)

3 (c) The results of the investigation are shown on the graph.



Each bar represents the range of the number of larders in each type of woodland.

The horizontal mark on each bar represents the mean number of larders per hectare of woodland.

3 (c) A student concluded '*You will always find more squirrels in spruce woodland than in fir woodland.'*

Is the student's conclusion justified by the data in the graph?

Explain the reasons for your answer.

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(2 marks)

6

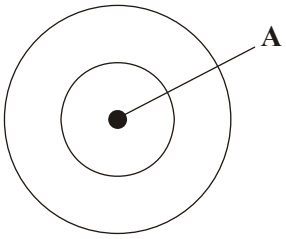
Turn over for the next question

Chemistry questions

4 This question is about oxygen atoms.

4 (a) (i) Oxygen atoms have 8 electrons.

Complete the diagram to represent the arrangement of electrons in an oxygen atom. Use crosses (×) to represent the electrons.



(1 mark)

4 (a) (ii) Name the part of the oxygen atom that is labelled **A** on the diagram.

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(1 mark)

4 (b) Two isotopes of oxygen are oxygen-16 and oxygen-18.

$^{16}_{8}O$ $^{18}_{8}O$

oxygen-16 **oxygen-18**

Describe, in terms of particles, how an oxygen-18 atom is different from an oxygen-16 atom.

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(2 marks)

Turn over for the next question

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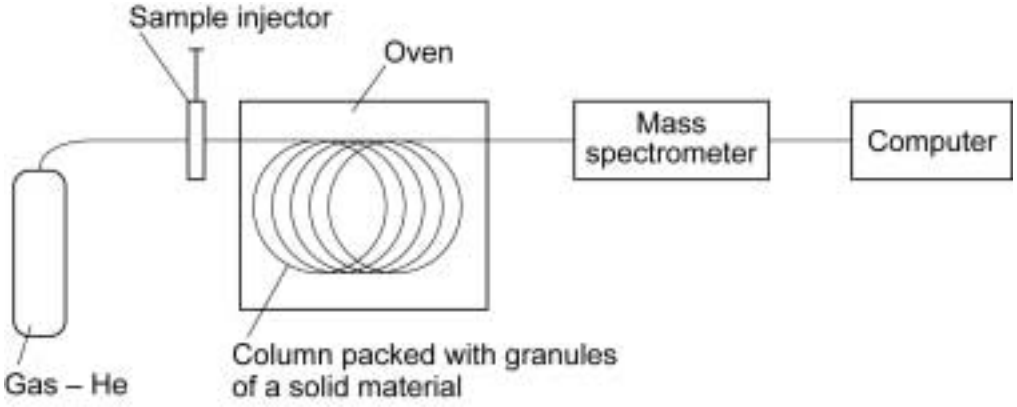
5 The diagram shows the main parts of an instrumental method called gas chromatography linked to mass spectroscopy (GC-MS).



This method separates a mixture of compounds and then helps to identify each of the compounds in the mixture.

5 (a) In which part of the apparatus:

5 (a) (i) is the mixture separated .....

(*1 mark*)

5 (a) (ii) is the relative molecular mass of each of the compounds in the mixture measured?

.....

(*1 mark*)

Question 5 continues on the next page

5 (b) (i) Athletes sometimes take drugs because the drugs improve their performance. One of these drugs is ephedrine.

Ephedrine has the formula:

$C_{10}H_{15}NO$

What relative molecular mass (M_r) would be recorded by GC-MS if ephedrine was present in a blood sample taken from an athlete?

Show clearly how you work out your answer.

Relative atomic masses: H = 1; C = 12; N = 14; O = 16.

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Relative molecular mass = ...

(2 marks)

5 (b) (ii) Another drug is amphetamine which has the formula:

$C_9H_{13}N$

The relative molecular mass (M_r) of amphetamine is 135.

Calculate the percentage by mass of nitrogen in amphetamine.

Relative atomic mass: N = 14

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Percentage of nitrogen = ... %

(2 marks)

5 (c) Athletes are regularly tested for drugs at international athletics events.

An instrumental method such as GC-MS is better than methods such as titration.

Suggest **two** reasons why.

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(2 marks)

5 (d) When a blood sample is taken from an athlete the sample is often split into two portions. Each portion is tested at a different laboratory.

Suggest **two** reasons why.

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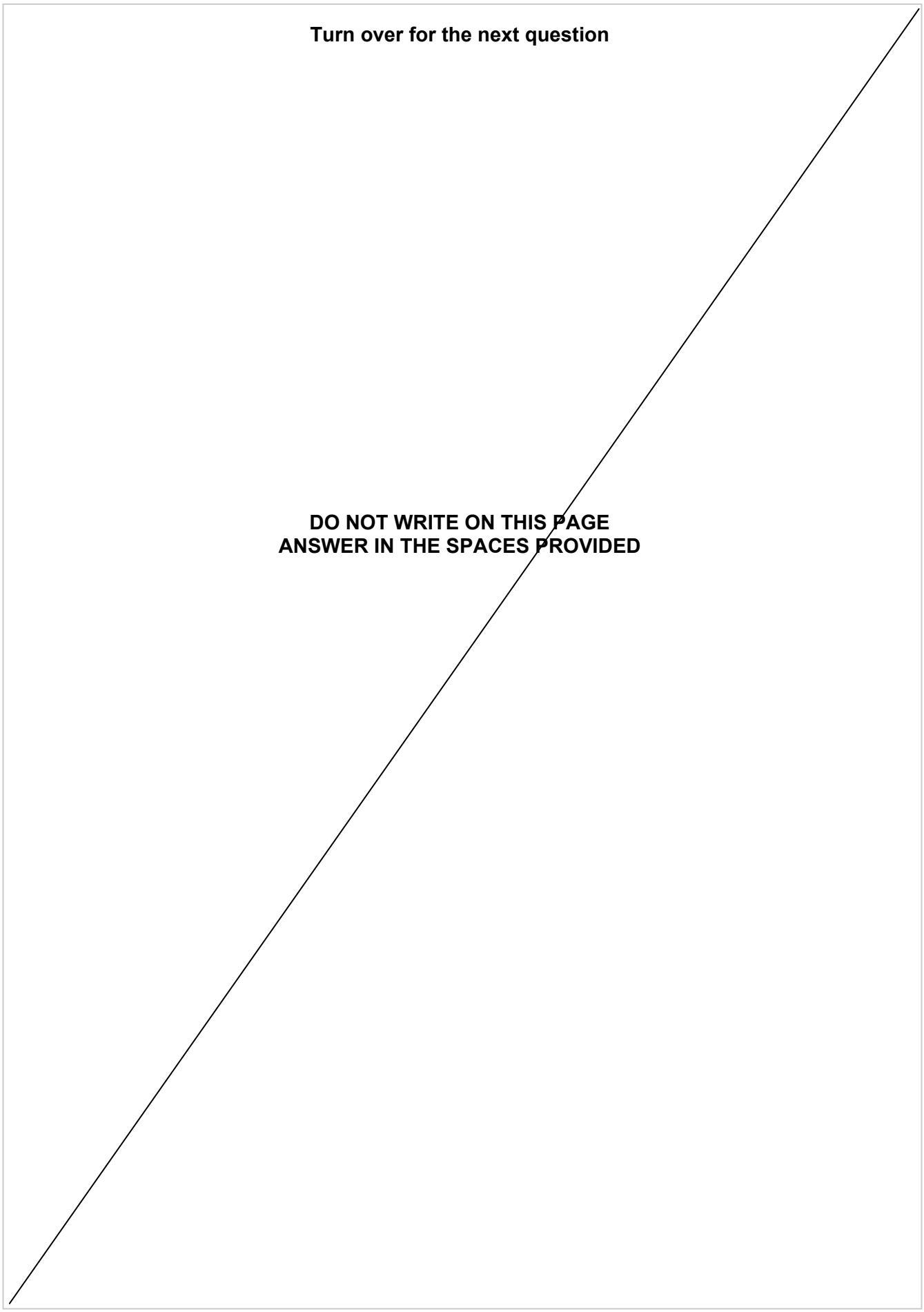
(2 marks)

10

Turn over for the next question

Turn over for the next question



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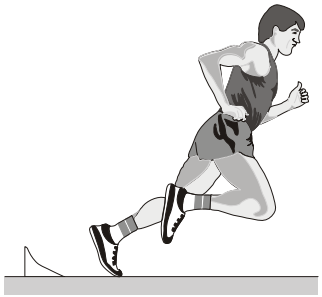
ANSWER IN THE SPACES PROVIDED

Physics questions

6 The diagram shows an athlete at the start of a race. The race is along a straight track.



In the first 2 seconds, the athlete accelerates constantly and reaches a speed of 9 m/s.

6 (a) (i) Calculate the acceleration of the athlete.

Write down the equation you use.

Show clearly how you work out your answer.

Give the unit.

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Acceleration = ...

(3 marks)

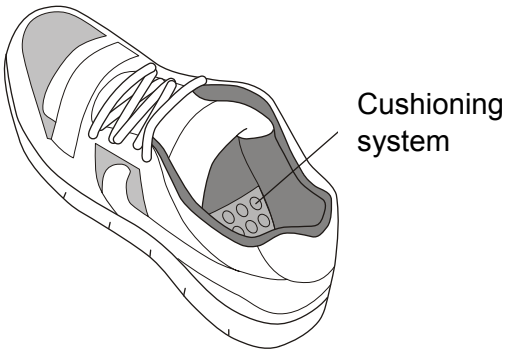
6 (a) (ii) Complete the following sentence.

The velocity of the athlete is the ..... of the athlete in a given direction.

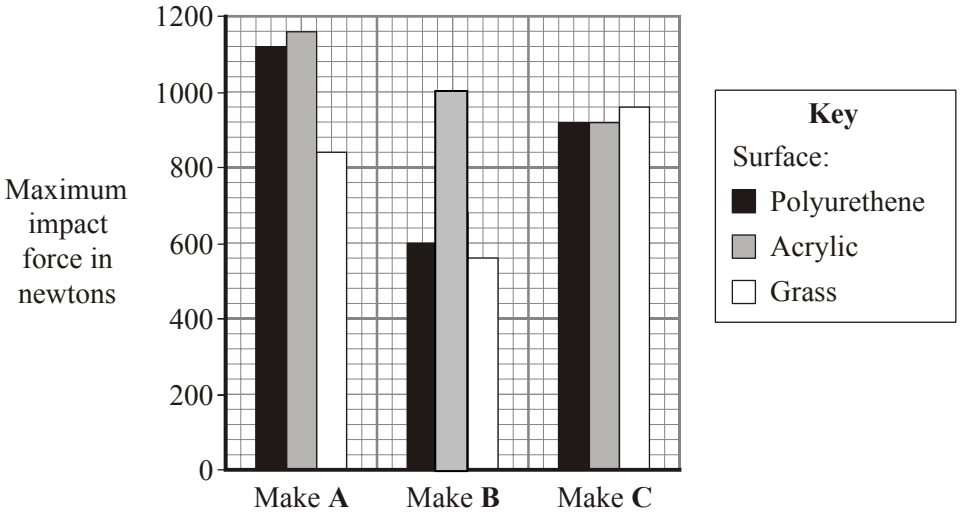
(1 mark)

Question 6 continues on the next page

6 (b) Many running shoes have a cushioning system. This reduces the impact force on the athlete as the heel of the running shoe hits the ground.



The bar chart shows the maximum impact force for three different makes of running shoe used on three different types of surface.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Analyse and evaluate the performance of the running shoes on the three surfaces.

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(6 marks)

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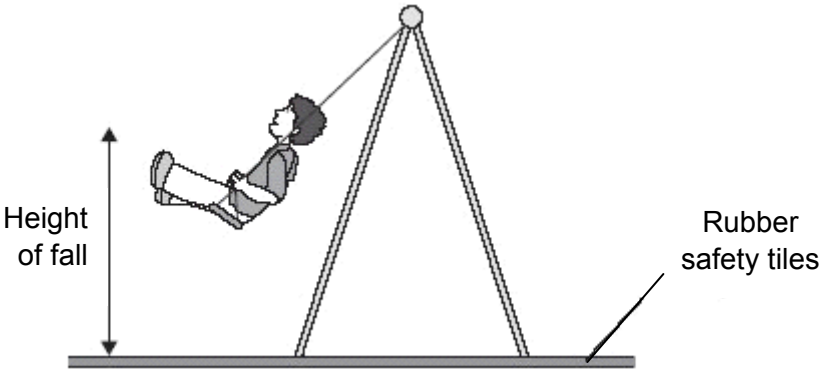
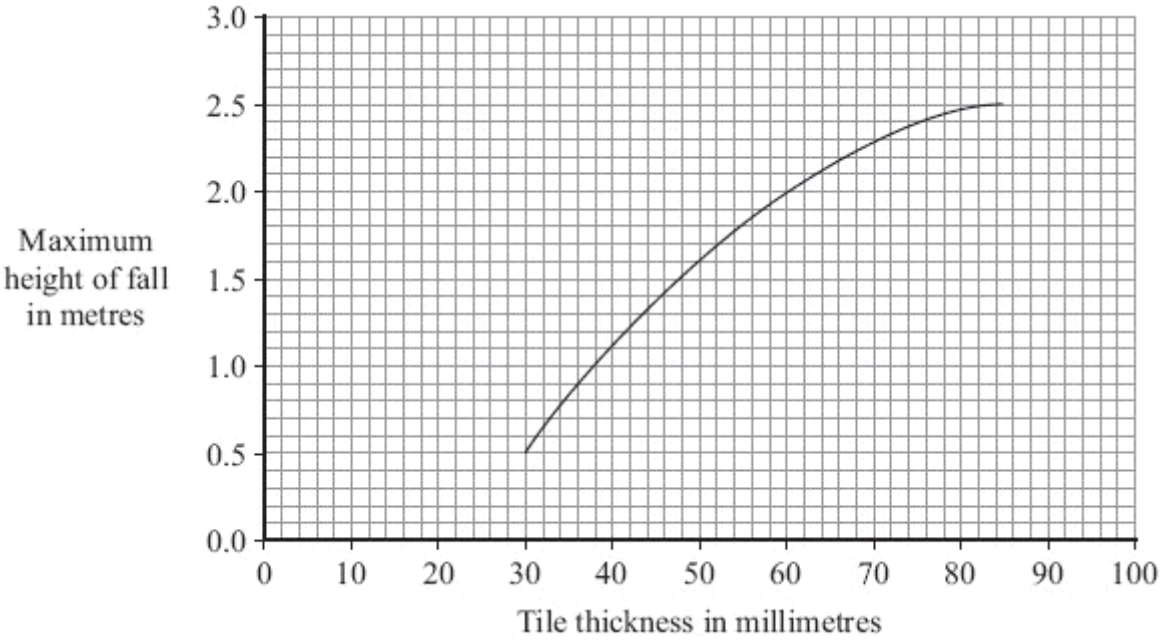
7 The diagram shows a child on a playground swing.



7 (a) The playground surface is covered in rubber safety tiles. The tiles reduce the risk of serious injury to children who fall off the swing.

The graph gives the maximum height that a child can fall onto rubber safety tiles of different thicknesses and be unlikely to get a serious head injury.



7 (a) (i) Describe how the maximum height of fall relates to the thickness of the rubber safety tile.

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(1 mark)

7 (a)(ii) The maximum height of any of the playground rides is 2 metres.

What tile thickness should be used in the playground?

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Give a reason for your answer.

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(2 marks)

7 (b) Use phrases from the box to complete the following sentences.

the force on	**the work done to stop**	**the time taken to stop**

7 (b) (i) Falling onto a rubber surface compared to a hard surface increases

..... the child.

(1 mark)

7 (b) (ii) Momentum is lost more slowly falling onto a rubber surface than onto a hard surface.

This reduces ..... the child.

(1 mark)

5

Turn over for the next question

Biology Questions

8 The human stomach is an organ.

Describe how the tissues in the stomach enable the stomach to function.

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(6 marks)

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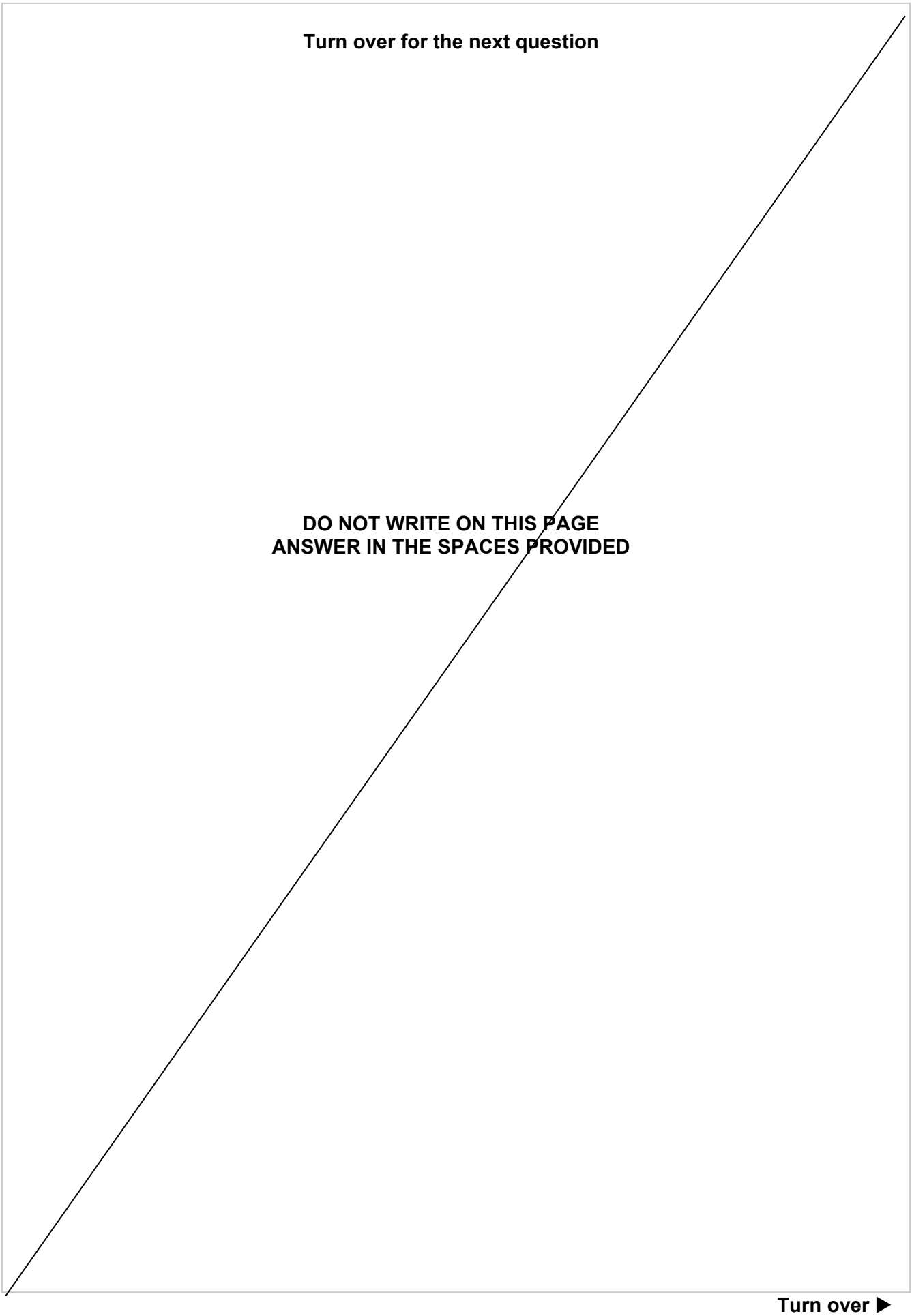
Turn over for the next question



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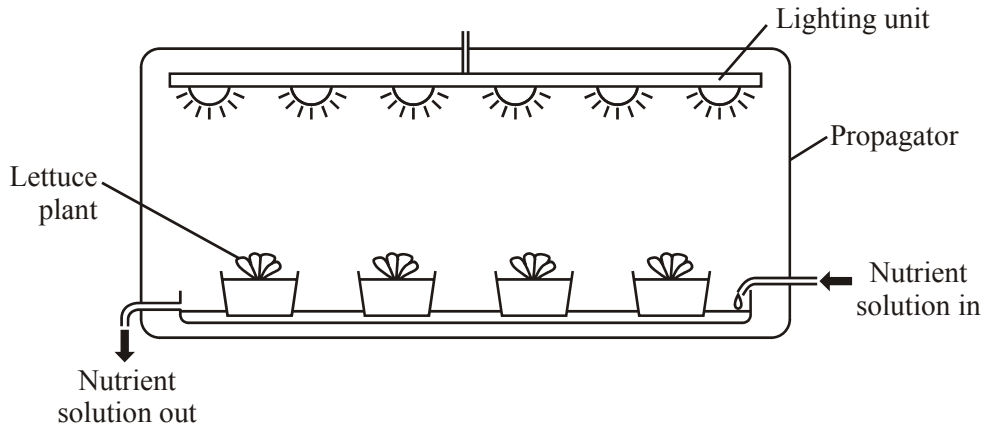
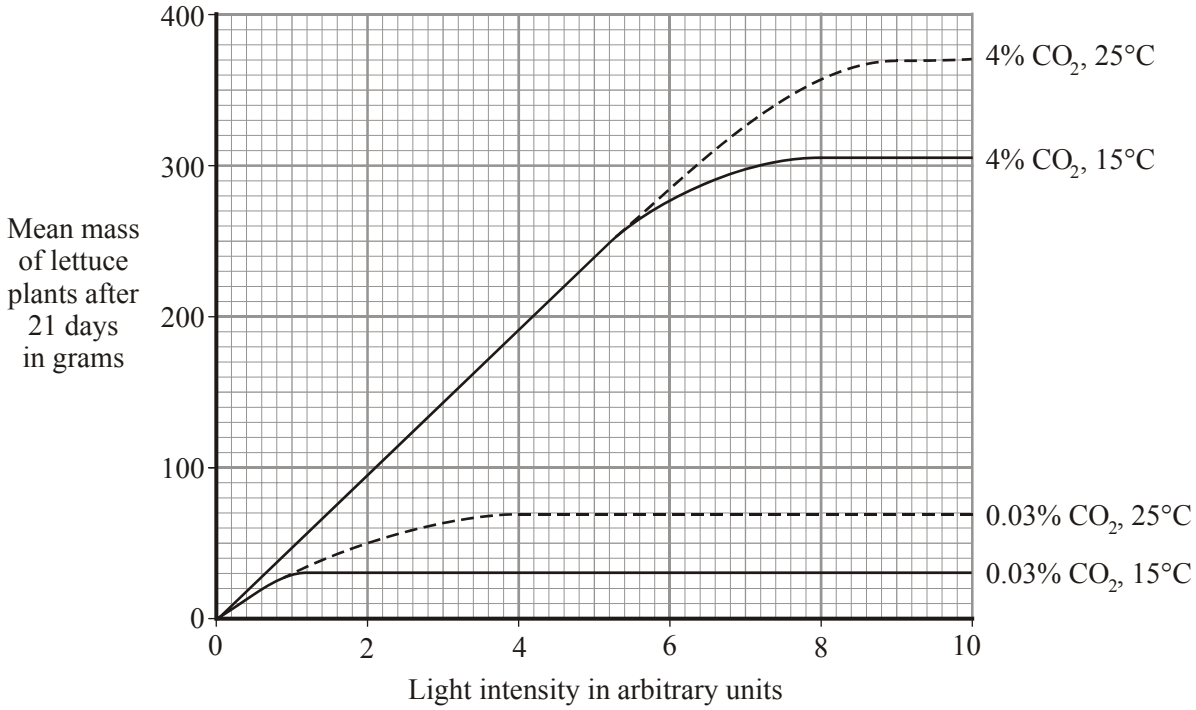
ANSWER IN THE SPACES PROVIDED

9 Changing the conditions in which plants grow affects how fast they grow.

The diagram shows a propagator in which scientists can control temperature, light intensity and carbon dioxide concentration.



The graph shows the effects of changing the temperature, light intensity and carbon dioxide concentration on the growth of lettuce plants.



9 (a) Describe and explain the effect of increasing light intensity on the mean mass of lettuce plants at 4 % carbon dioxide and 15 ˚C.

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(4 marks)

Question 9 continues on the next page

9 (b) In Britain, many tomato growers use artificial lights to increase the yield of tomato crops.

The table shows the amount of natural daylight and artificial lamplight received by a tomato crop grown in a greenhouse.

Month	Natural daylight received by tomato plant		Artificial lamplight given to tomato plant		Total light energy received by plant per day in J/cm^2	Percentage increase in growth resulting from artificial light
	Day length in hours	Light energy received by plant per day in J/cm^2	Hours of light given per day	Light energy received by plant per day in J/cm^2		
January	8.1	239	18	492	731	206
February	9.9	492	18	492	984	100
March	11.9	848	12	328	1176	39
April	13.9	1401	2	55	1456	4
May	15.5	1786	0	0	1786	0
June	16.6	1960	0	0	1960	0
July	16.2	1849	0	0	1849	0
August	14.7	1561	0	0	1561	0
September	12.8	1064	2	55	1119	5
October	10.6	614	11	301	915	49
November	8.8	288	18	492	780	171
December	7.6	183	18	492	675	269

9 (b) (i) Describe the pattern for the amount of light energy received from natural daylight by a tomato plant during the day.

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(3 marks)

9 (b) (ii) A tomato plant needs 600 J of light energy per cm^2 each day to grow and produce tomatoes.

Use this information and data from the table to suggest an explanation for the pattern of the artificial light given to the tomato plants.

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(2 marks)

9

Turn over for the next question

Chemistry Questions

10 Ammonia has the formula NH_3

The diagrams show how electrons are arranged in nitrogen and hydrogen atoms.

Nitrogen atom

Hydrogen atom

10 (a) Draw a diagram to show how the electrons are arranged in an ammonia molecule.

You need only show the electrons in the highest energy level.

(2 marks)

10 (b) Ammonia is a gas at room temperature.

Explain why ammonia has a low boiling point.

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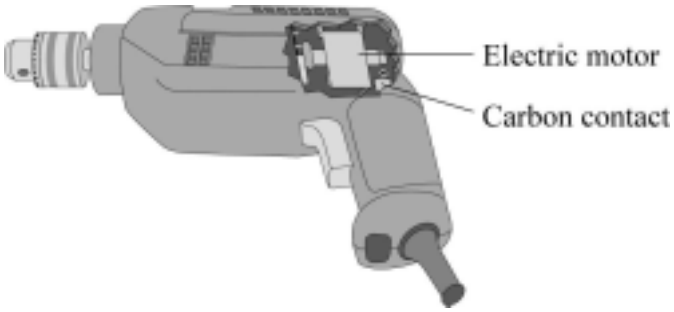
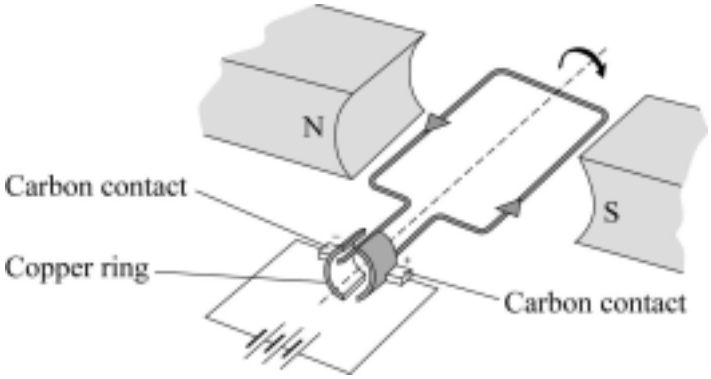
(2 marks)

4

11 This drill contains an electric motor.



The diagram below shows the main parts of an electric motor.



The carbon contacts are made of graphite. Springs push the contacts against the copper ring.
The contacts conduct electricity to the copper ring. The copper ring rotates rapidly but does not stick or become worn because the graphite is soft and slippery.

Graphite has properties which are ideal for making the contacts in an electric motor.
Explain, in terms of structure and bonding, why graphite has these properties.

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(4 marks)

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Turn over ▶

12 This drinks bottle is made of thermosoftening plastic.

Drinks bottles of this type can be recycled.

Describe and explain how these used plastic bottles can be changed into new plastic objects.

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(4 marks)

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13 Aspirin tablets have important medical uses.

13 (a) Aspirin is made when salicylic acid reacts with ethanoic anhydride.

The equation for this reaction is:

$$\underset{\text{salicylic acid}}{C_7H_6O_3} + C_4H_6O_3 \rightarrow \underset{\text{aspirin}}{C_9H_8O_4} + CH_3COOH$$

Calculate the maximum mass of aspirin that could be made from 100 g of salicylic acid.

Show clearly how you work out your answer.

The relative formula mass (M_r) of salicylic acid ($C_7H_6O_3$) is 138.
The relative formula mass (M_r) of aspirin ($C_9H_8O_4$) is 180.

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Maximum mass of aspirin = ...g

(2 marks)

13 (b) In an experiment a chemist calculated that the maximum yield of aspirin is 400 g.

The chemist did the experiment but only made 250 g of aspirin.

Calculate the percentage yield of aspirin for this experiment.

Show clearly how you work out your answer.

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Percentage yield of aspirin = ... %

(2 marks)

4

Turn over▶

Physics questions

14 The diagram shows the horizontal forces acting on a car of mass 1200 kg.

14 (a) Calculate the acceleration of the car at the instant shown in the diagram.

Write down the equation you use, and then show clearly how you work out your answer and give the unit.

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Acceleration = ...

(4 marks)

14 (b) Explain why the car reaches a top speed even though the thrust force remains constant at 3500 N.

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(3 marks)

14 (c) The diagram shows a car and a van.

The two vehicles have the same mass and identical engines.

Explain why the top speed of the car is greater than the top speed of the van.

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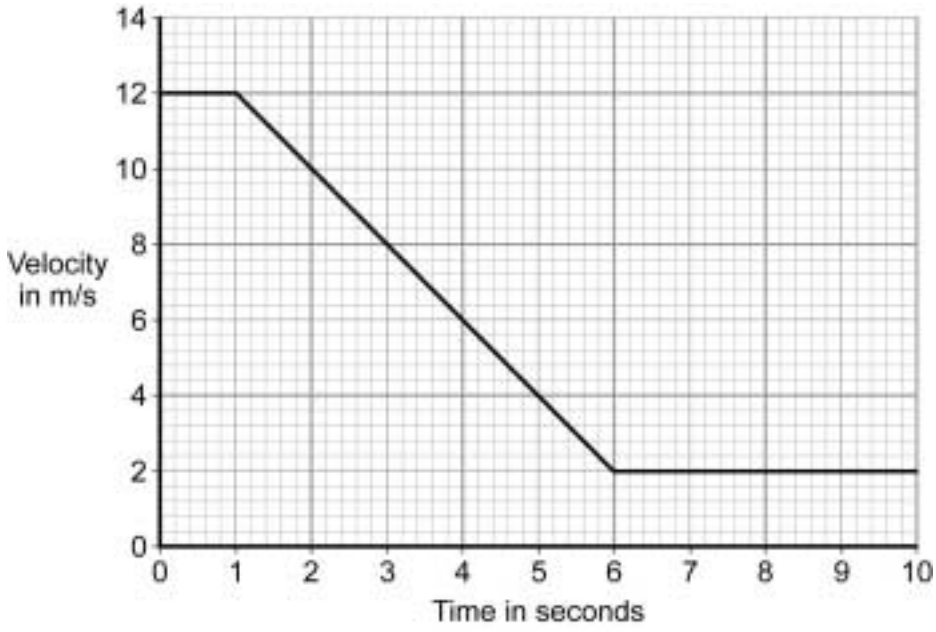
(4 marks)

Turn over▶

11

15 A car is driven along a straight, snow covered, road. The graph shows how the velocity of the car changes from the moment the driver sees a very slow moving queue of traffic ahead.



15 (a) Use the graph to calculate the distance the car travels while it is slowing down.

Show clearly how you work out your answer.

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Distance = ...m

(3 marks)

15 (b) The car has a mass of 1200 kg.

Calculate the kinetic energy of the car when it travels at a speed of 12 m/s.

Write down the equation you use, and then show clearly how you work out your answer.

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Kinetic energy = ... J

(2 marks)

5

END OF QUESTIONS

AQA

GCSE Physics Equations Sheet

Unit 5 F and H

$a = \frac{F}{m}$ or $F = m \times a$	F resultant force m mass a acceleration
$a = \frac{v - u}{t}$	a acceleration v final velocity u initial velocity t time taken
$W = m \times g$	W weight m mass g gravitational field strength
$F = k \times e$	F force k spring constant e extension
$W = F \times d$	W work done F force applied d distance moved in the direction of the force
$P = \frac{E}{t}$	P power E energy transferred t time taken
$E_p = m \times g \times h$	E_p change in gravitational potential energy m mass g gravitational field strength h change in height
$E_k = {}^1/_2 \times m \times v^2$	E_k kinetic energy m mass v speed

$p = m \times v$	*p* momentum *m* mass *v* velocity
$I = \frac{Q}{t}$	*I* current *Q* charge *t* time
$V = \frac{W}{Q}$	*V* potential difference *W* work done *Q* charge
$V = I \times R$	*V* potential difference *I* current *R* resistance
$P = \frac{E}{t}$	*P* power *E* energy *t* time
$P = I \times V$	*P* power *I* current *V* potential difference
$E = V \times Q$	*E* energy *V* potential difference *Q* charge