Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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8	
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10	
11	
12	
TOTAL	

AQA

General Certificate of Secondary Education
Foundation Tier
June 2015

Additional Science
Unit 5

AS1FP

F

Tuesday 12 May 2015 1.30 pm to 3.00 pm

For this paper you must have:
- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

Time allowed
- 1 hour 30 minutes

A

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 spaces 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 10(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.

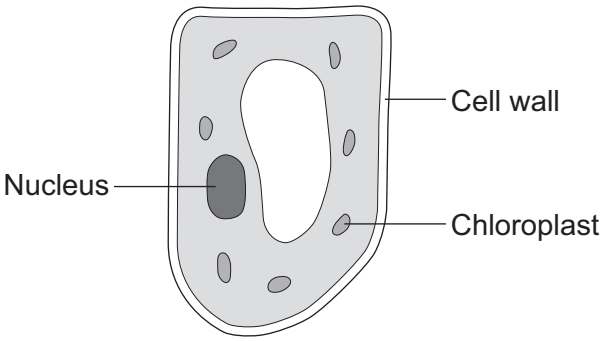
Answer **all** questions in the spaces provided.

Biology Questions

1 This question is about parts of cells.

Figure 1 shows a typical plant cell.

Figure 1



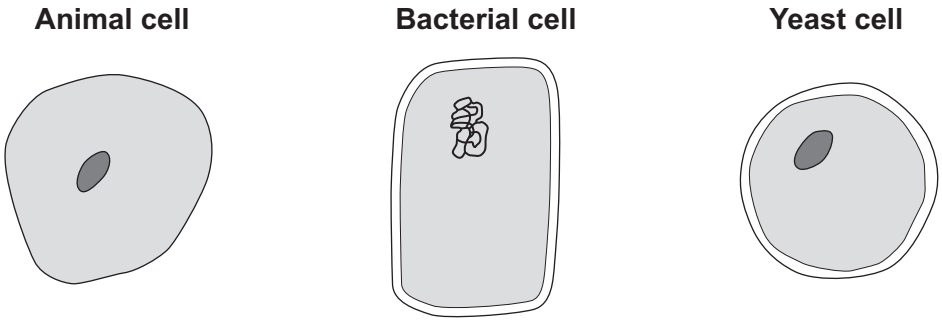
1 (a) Draw **one** line from each part of the cell to the correct function of that part.

[3 marks]

Part of the cell	Function of the part
	controls the activities of the cell
Cell wall	
	absorbs light energy to make food
Chloroplast	
	controls the movement of substances into the cell
Nucleus	
	strengthens the cell

1 (b) **Figure 2** shows an animal cell, a bacterial cell and a yeast cell.

Figure 2



Complete **Table 1**.
Use information from **Figure 2** to help you.

[3 marks]

Put a tick (✓) in the box if the cell has the part.
Put a cross (✗) in the box if the cell does **not** have the part.

The plant cell has been done for you.

Table 1

Type of cell	Has a cell wall	Has chloroplasts	Has a nucleus
Plant cell	✓	✓	✓
Animal cell			
Bacterial cell			
Yeast cell			

6

2 *Pleurococcus* is a simple plant. *Pleurococcus* lives on the surface of trees.

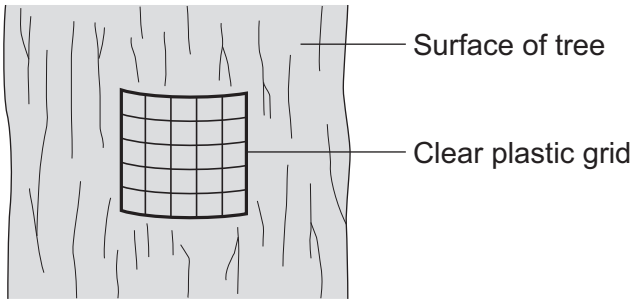
Students investigated the distribution of *Pleurococcus* on different sides of a tree.

The students:

- found the north side of a tree
- put a clear plastic grid onto the tree 1.5 metres up from the ground
- estimated the amount of *Pleurococcus* in the grid.

Figure 3 shows how this was done.

Figure 3



2 (a) Which scientific word is used to describe the clear plastic grid used to sample the plants?

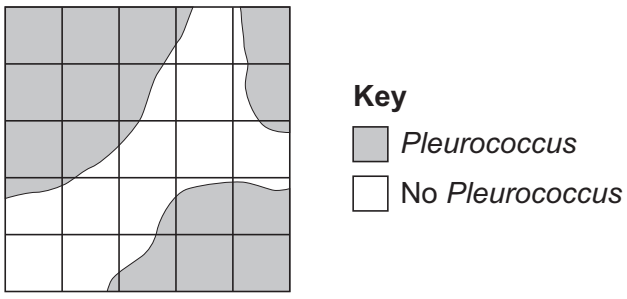
[1 mark]

Draw a ring around the correct answer.

habitat **transect** **quadrat**

2 (b) **Figure 4** shows the students' result for the north side of the tree.

Figure 4



2 (b) (i) Estimate the number of squares of the grid covered by *Pleurococcus*.

[1 mark]

.....

Number of squares = ...

2 (b) (ii) What fraction of the grid does *Pleurococcus* cover?

[1 mark]

.....

.....

Fraction = ...

2 (b) (iii) Use your answer to part **(b)(ii)** to calculate the percentage (%) cover of *Pleurococcus* on the north side of the tree.

[1 mark]

.....

.....

Percentage cover of *Pleurococcus* = ... %

2 (c) The students repeated their investigation on the east, south and west sides of the tree. The students' results for the east, south and west sides of the tree are shown in **Table 2**.

Table 2

Side of the tree	**Percentage cover of *Pleurococcus***
East	48
South	16
West	12

2 (c) (i) Name **one** physical factor that might affect the distribution of *Pleurococcus* on the tree.

[1 mark]

.....

2 (c) (ii) Suggest an instrument the students could use to measure the factor you gave in part **(c)(i)**.

[1 mark]

.....

6

3 Students investigated photosynthesis.

3 (a) (i) Use the correct answers from the box to complete the word equation for photosynthesis.

[2 marks]

chlorophyll	**glucose**	**mineral ions**	**water**

carbon dioxide + ... $\xrightarrow{\text{energy}}$ ..... + oxygen

3 (a) (ii) Plants need energy for photosynthesis.
Where do plants get the energy from?

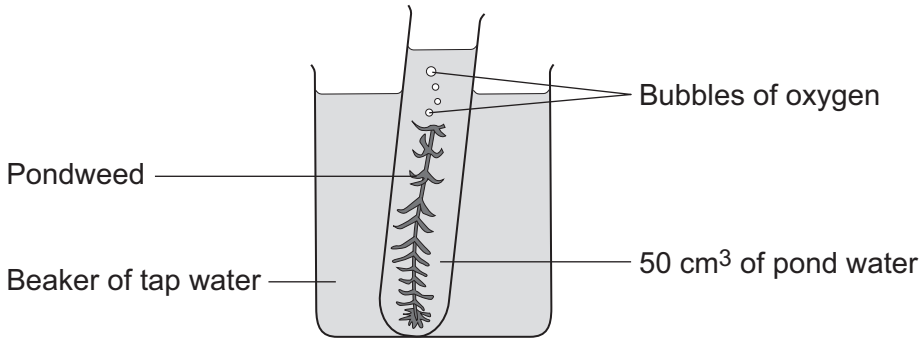
[1 mark]

.....

3 (b) Students used pondweed to investigate how changing the carbon dioxide concentration affected photosynthesis.

Each student set up the apparatus shown in **Figure 5**.
The students counted the number of bubbles of oxygen given off in one minute.

Figure 5



The beaker of tap water helps to keep one control variable constant.
Name this control variable.

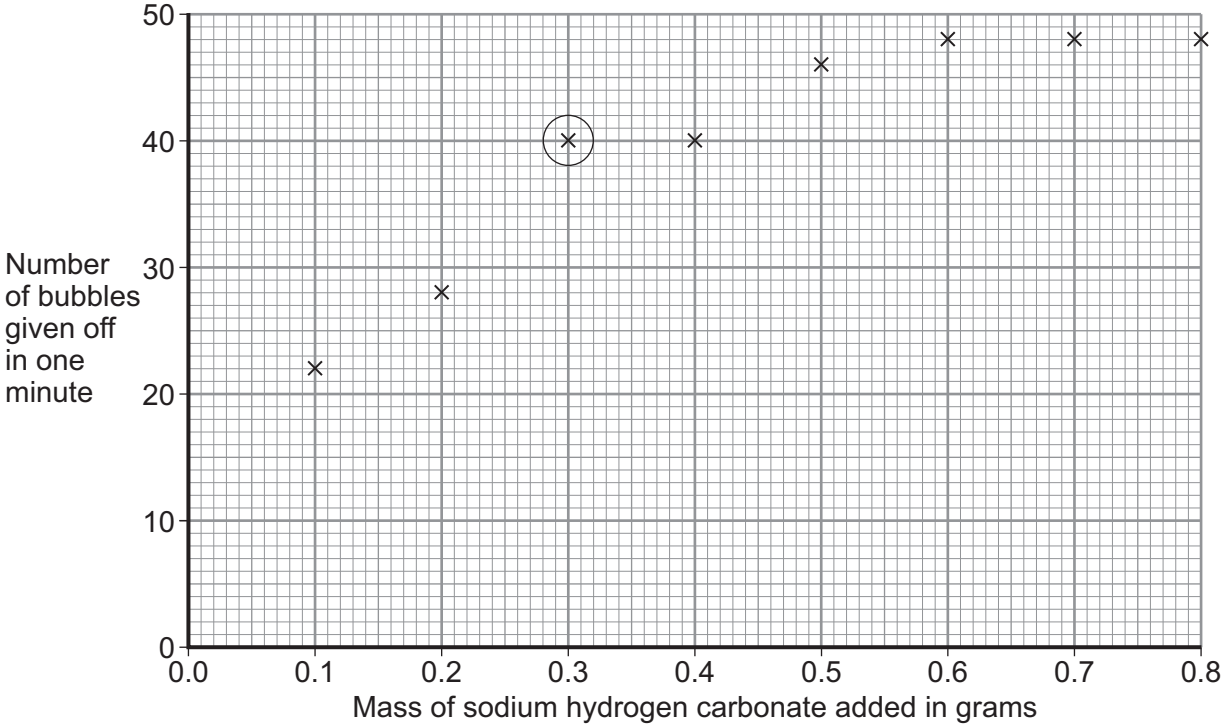
[1 mark]

.....

3 (c) Sodium hydrogen carbonate can be added to the pond water to provide carbon dioxide for the pondweed.
Each student added a different mass of sodium hydrogen carbonate to the pond water.

Figure 6 shows the students' results.

Figure 6



3 (c) (i) On **Figure 6**, the result in the circle is anomalous.
Suggest a reason for the anomalous result.

[1 mark]

.....

.....

3 (c) (ii) On **Figure 6**, draw a line of best fit for the results.

[1 mark]

3 (c) (iii) Estimate the number of bubbles which should have been given off in one minute when 0.3 g of sodium hydrogen carbonate was added.
Use your answer to part **(c)(ii)** to help you.

[1 mark]

Estimated number of bubbles in one minute = ...

Question 3 continues on the next page

3 (c) (iv) Apart from adding sodium hydrogen carbonate to the water, suggest **one** other source of carbon dioxide for pondweed.

[1 mark]

.....

.....

8

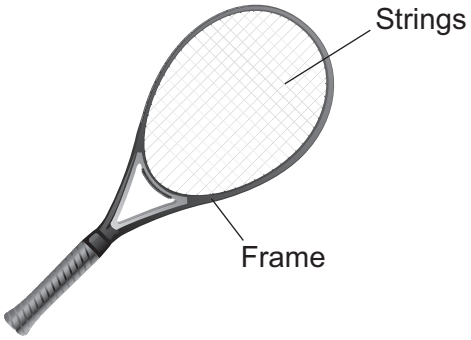
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Chemistry Questions

4 **Figure 7** shows a tennis racket.

Figure 7



Some properties of two materials that can be used to make the frame are shown in **Table 3.**

Table 3

Material	Density in g/cm^3	Relative strength
Aluminium	2.7	0.05
Carbon fibre	2	3

4 (a) (i) Tennis racket frames are now made using carbon fibre instead of aluminium.

Use the information in **Table 3** to suggest **two** reasons why.

[2 marks]

1 .....

.....

2 .....

.....

4 (a) (ii) Suggest **one** other factor a manufacturer should consider when choosing a material to make a tennis racket frame.

[1 mark]

Tick (✓) **one** box.

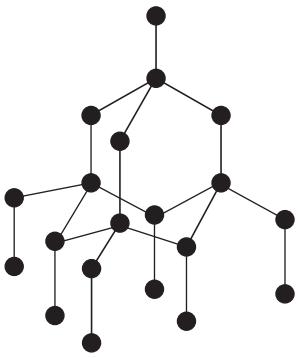
Factor	Tick (✓)
boiling point	
cost	
electrical conductivity	

4 (b) (i) Carbon fibre and graphite are made of carbon atoms.

Which diagram represents the structure of graphite?

[1 mark]

Tick (✓) **one** box.



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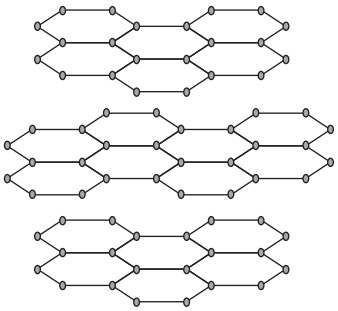

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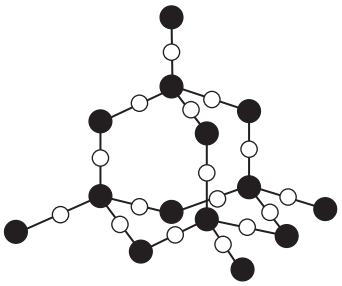


☐

4 (b) (ii) Graphite has a giant structure.

Use the correct answer from the box to complete the sentence.

[1 mark]

diamond	**nitinol**	**silica**

Another form of carbon with a giant structure is ..... .

Question 4 continues on the next page

4 (b) (iii) A carbon fibre is 7000 nm to 8000 nm thick.

How does a carbon fibre compare with a nanoparticle?

[1 mark]

Tick (✓) **one** box.

A carbon fibre is thicker than a nanoparticle. ☐

A carbon fibre is the same thickness as a nanoparticle. ☐

A carbon fibre is thinner than a nanoparticle. ☐

4 (c) (i) Some tennis racket frames are made from an aluminium alloy.

The alloy is made from aluminium mixed with other metals.

The percentages of the other metals in the alloy are shown in **Table 4**.

Table 4

Chemical symbol of metal	Percentage (%) of metal in the alloy
Cr	1
Cu	2
Mg	3
Zn	6

Calculate the percentage of aluminium in the alloy.

[2 marks]

.....

.....

.....

Percentage of aluminium in the alloy = ... %

4 (c) (ii) Name **one** metal mixed with aluminium in the alloy.

Use **Table 4** and the Chemistry Data Sheet to help you answer the question.

[1 mark]

.....

4 (d) (i) The strings in some tennis rackets are made from nylon.

Nylon is a thermosoftening plastic.

Describe the structure of a thermosoftening plastic.

[1 mark]

Tick (✓) **one** box.

Hexagonal layers ☐

Ionic lattice ☐

Tangled polymer chains ☐

4 (d) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

dissolve	**harden**	**melt**

When a thermosoftening plastic is heated, the plastic will ..... .

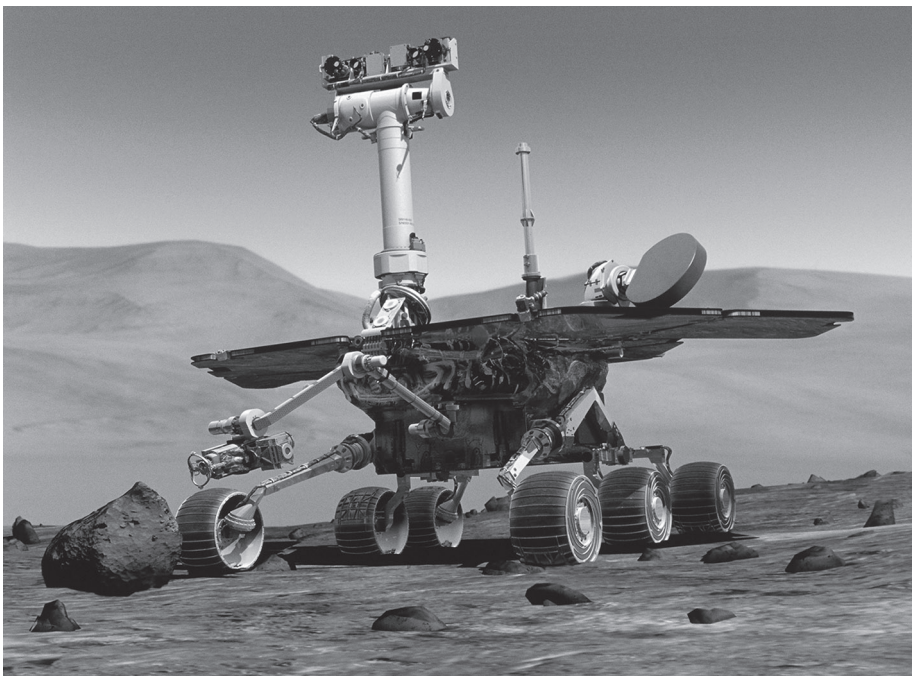
11

Turn over for the next question

5 Space probes have been sent to investigate the atmosphere of Mars.

Figure 8 shows a space probe.

Figure 8



5 (a) The space probes analysed the atmosphere of Mars using an instrumental method called GC-MS.

Give **two** reasons why an instrumental method is used.

[2 marks]

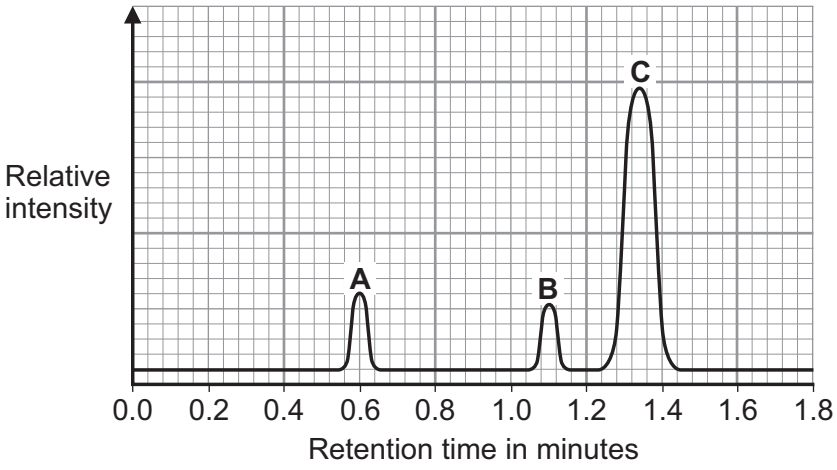
Tick (✓) **two** boxes.

Reason	**Tick (✓) two**
Accurate	
Detects small quantities	
Low sensitivity	
Slow process	

5 (b) **Figure 9** shows a gas chromatogram (GC) of the atmosphere of Mars.

Most of the atmosphere of Mars is carbon dioxide.

Figure 9



5 (b) (i) Which substance, **A**, **B** or **C**, is carbon dioxide? .....

[1 mark]

5 (b) (ii) Which substance, **A**, **B** or **C**, travels through the gas chromatography column the fastest? .....

[1 mark]

5 (c) (i) Carbon dioxide can be represented as **O = C = O**

What is the chemical formula of carbon dioxide? .....

[1 mark]

5 (c) (ii) Carbon dioxide is a simple molecule.

Give a property of substances consisting of simple molecules.

[1 mark]

Tick (✓) **one** box.

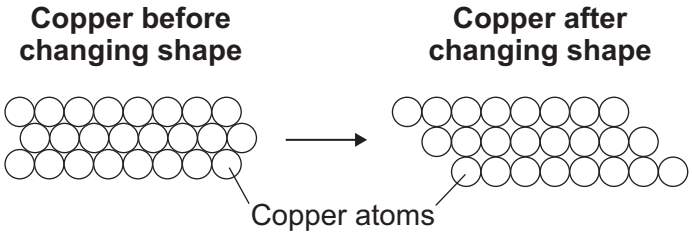
Property	**Tick (✓)**
Do not conduct electricity	
Have giant structures	
Have high boiling points	

6

6 (a) Pure copper is a soft metal.

Figure 10 shows how atoms are arranged in copper metal, before and after the metal has changed shape.

Figure 10



Describe what happens to the arrangement of atoms in copper when the metal changes shape.

[2 marks]

.....

.....

.....

.....

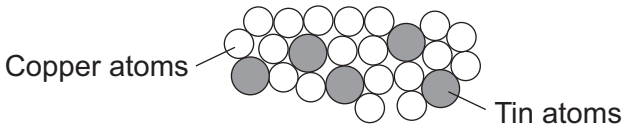
6 (b) Bronze is an alloy made from copper and tin.

Figure 11 shows a statue made from bronze.

Figure 11

Figure 12 shows how the atoms are arranged in bronze.

Figure 12



Bronze is harder than pure copper.

Explain why bronze is harder than pure copper.

Use ideas about the arrangement of atoms in bronze in your answer.

[2 marks]

.....

.....

.....

.....

4

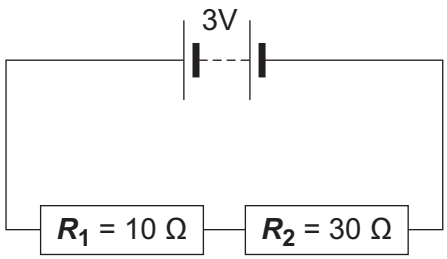
Turn over for the next question

Physics Questions

7 In an electrical circuit, resistors may be connected in series or in parallel.

7 (a) **Figure 13** shows two resistors, R_1 and R_2, connected in a circuit in series.

Figure 13



7 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

less than	equal to	greater than

The current through R_1 is ..... the current through R_2.

7 (a) (ii) Calculate the total resistance of the circuit shown in **Figure 13**.

[1 mark]

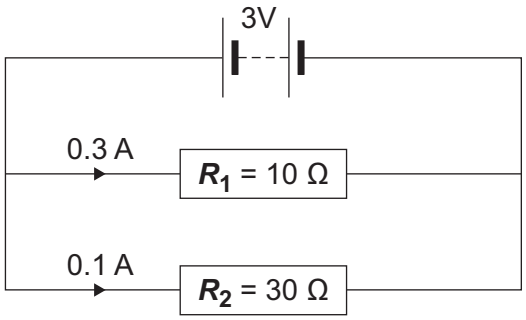
.....

.....

Total resistance = ... Ω

7 (b) **Figure 14** shows two resistors connected in a circuit in parallel and the current through each resistor.

Figure 14



7 (b) (i) On **Figure 14**, show how you would connect a voltmeter to measure the potential difference across the resistor R_2.

Use the correct circuit symbol for a voltmeter.

[2 marks]

7 (b) (ii) What is the potential difference across the resistor R_1?

Draw a ring around the correct answer.

[1 mark]

0 V **1.5 V** **3 V**

7 (b) (iii) How would the current through the battery be calculated?

[1 mark]

Tick (✓) **one** box.

0.3 – 0.1 = 0.2 A ☐

0.3 + 0.1 = 0.4 A ☐

0.3 × 0.1 = 0.03 A ☐

6

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

8 **Figure 15** shows a sprinter on the starting blocks just before the start of a 100 m race.

Figure 15

8 (a) (i) The starting gun is fired.

The sprinter exerts a force on the blocks.

Complete the sentence.

[1 mark]

The blocks exert an equal and ..... force on the sprinter.

8 (a) (ii) After leaving the blocks, the sprinter accelerates at 5.0 m/s^2.

The mass of the sprinter is 94 kg.

Calculate the resultant force needed to accelerate the sprinter. Give the unit.

[3 marks]

Choose the unit from the list below.

kilograms **newtons** **metres**

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Resultant force = ... unit .....

8 (a) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

increases	**decreases**	**stays the same**

As the speed of the sprinter increases, the air resistance acting

on him ..... .

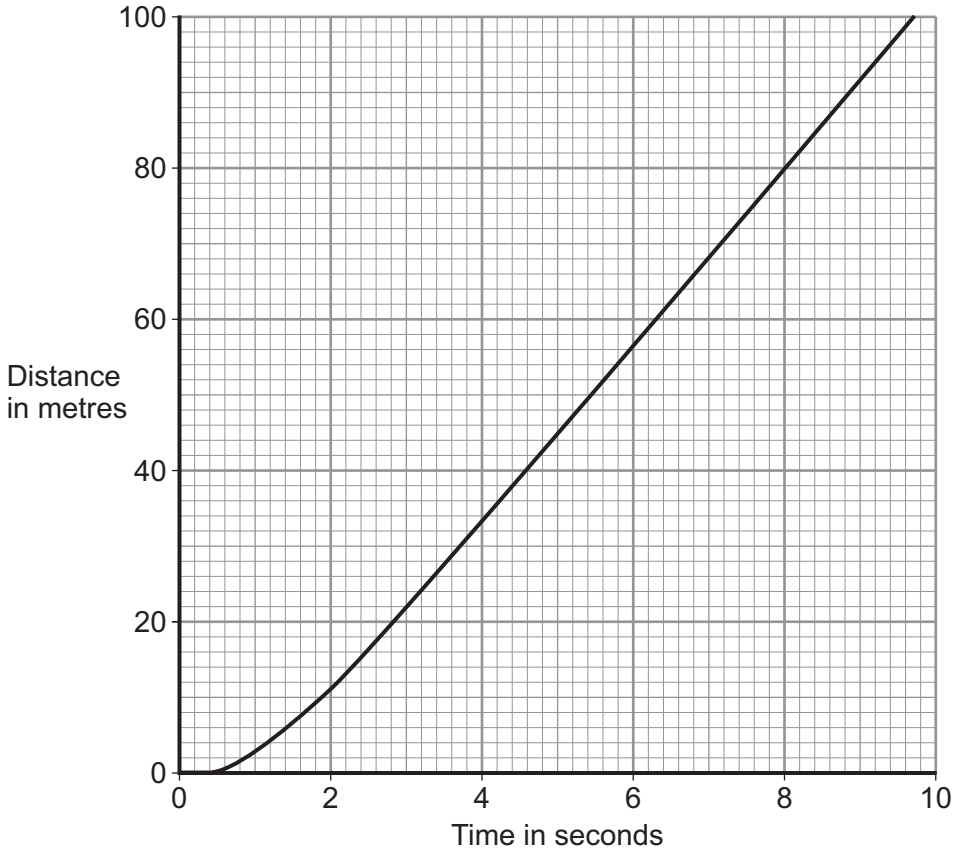
Question 8 continues on the next page

Turn over ▶

8 (a) (iv) **Figure 16** shows the distance–time graph for the sprinter.

The graph starts from when the gun is fired.

Figure 16



What is the reaction time of the sprinter shown in **Figure 16**?

[1 mark]

Tick (✓) **one** box.

0.0 seconds ☐

0.5 seconds ☐

9.7 seconds ☐

8 (a) (v) Use the correct answer from the box to complete the sentence.

[1 mark]

force	speed	acceleration

The gradient of the graph in **Figure 16** represents the ..... of the sprinter.

8 (b) **Table 5** shows the times a sprinter took to run four 100 m runs in a training session.

The sprinter took 10 minutes rest between each run.

The time was measured using a stopwatch.

Table 5

Run	Time in seconds
1	10.46
2	10.44
3	10.42
4	10.41

8 (b) (i) What happens to the sprinter's 100 m time during the training session?

[1 mark]

.....

.....

8 (b) (ii) The sprinter looks at his times and concludes that he will always get faster during every training session.

Suggest **two** reasons why this is **not** a valid conclusion.

[2 marks]

1 .....

.....

2 .....

.....

10

9 **Figure 17** shows an astronaut walking on the Moon.

Figure 17

9 (a) The gravitational field strength on the Moon is 1.6 N/kg.

The mass of the astronaut is 120 kg.

Calculate the weight of the astronaut on the Moon.

[2 marks]

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Weight = ... N

9 (b) When the astronaut walks on the Moon, his clothing becomes electrostatically charged.

This is because negative charges are rubbed off the dusty surface of the Moon onto the astronaut's boots.

9 (b) (i) Which type of particle is transferred from the dusty surface of the Moon to the astronaut's boots?

[1 mark]

Draw a ring around the correct answer.

proton **electron** **neutron**

9 (b) (ii) The dust from the surface where the astronaut has walked becomes positively charged.

Why is this dust attracted to the astronaut's boots?

[1 mark]

.....

4

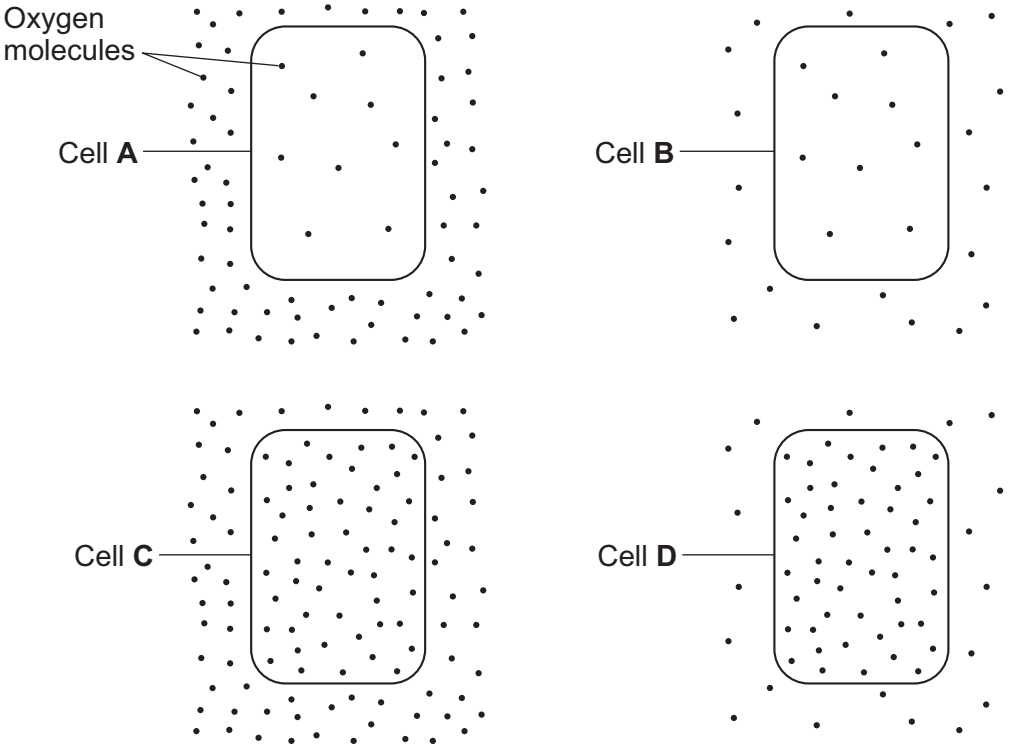
Turn over for the next question

Biology Questions

10 (a) **Figure 18** shows four cells, **A**, **B**, **C** and **D**. Each cell is surrounded by oxygen molecules.

Oxygen molecules can move into cells or out of cells.

Figure 18



10 (a) (i) Name the process by which oxygen moves into cells or out of cells.

[1 mark]

.....

10 (a) (ii) Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest?

[1 mark]

Cell .....

10 (a) (iii) Give the reason for your answer to part **(a)(ii)**.

[1 mark]

.....

.....

10 (a) (iv) Why do cells need oxygen?

[1 mark]

.....

.....

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

The cells in large plants and animals are organised into tissues, organs and organ systems.

Describe each level of organisation of cells and give examples of these in plants and animals.

Do **not** refer to the parts of cells.

[6 marks]

.....

.....

.....

.....

.....

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.....

.....

.....

.....

.....

.....

Extra space .....

.....

.....

.....

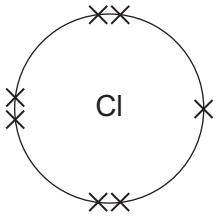
10

Chemistry Questions

11 This question is about chlorine and compounds of chlorine.

Figure 19 represents the outer shell electrons in an atom of chlorine.

Figure 19



11 (a) (i) A chlorine atom contains three different types of particle.

Complete **Table 6** to show the relative mass of each particle.

[2 marks]

Table 6

Name of particle	Relative mass of particle
proton	
neutron	1
electron	

11 (a) (ii) Atoms of chlorine can have different numbers of neutrons.

Complete the sentence.

[1 mark]

Atoms of chlorine with different numbers of neutrons are called ..... .

11 (a) (iii) Calculate the number of neutrons in an atom of $^{35}_{17}Cl$

[1 mark]

.....

Number of neutrons = ...

11 (b) Two chlorine atoms combine to form a chlorine molecule.

11 (b) (i) Name the type of bonding in a chlorine molecule.

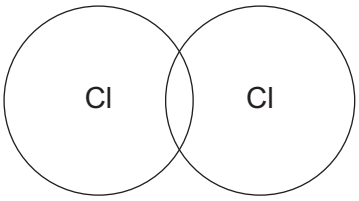
[1 mark]

.....

11 (b) (ii) Complete **Figure 20** to show the arrangement of the outer shell electrons in a chlorine molecule.

[2 marks]

Figure 20



11 (c) Chlorine reacts with sodium to produce sodium chloride.

11 (c) (i) Write the word equation for the reaction to produce sodium chloride.

[1 mark]

.....

11 (c) (ii) Sodium chloride has the formula NaCl.

How does this formula show that sodium chloride is a compound?

[1 mark]

.....

.....

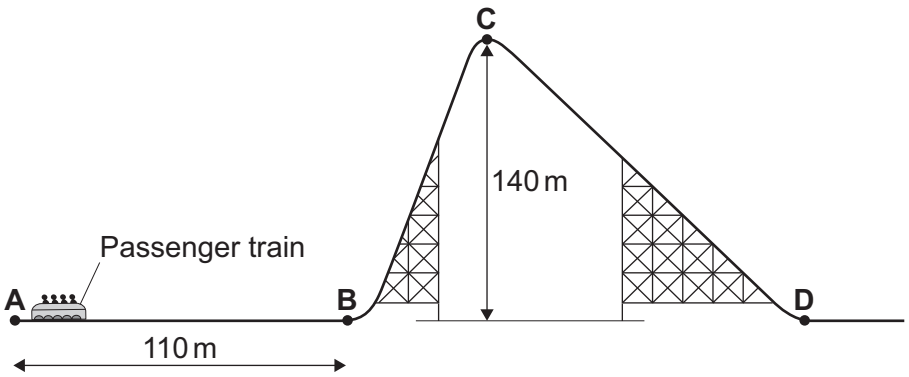
9

Turn over for the next question

Physics Questions

12 **Figure 21** shows the first part of a roller-coaster ride.

Figure 21



12 (a) The passenger train accelerates from point **A** to point **B**, a distance of 110 m.

A constant force of 141 kN acts to accelerate the passenger train between point **A** and point **B**.

12 (a) (i) Calculate the work done to accelerate the passenger train between point **A** and point **B**.
[3 marks]

Use the correct equation from the Physics Equations Sheet. Give the unit.

.....

.....

Work done = ... unit .....

12 (a) (ii) Use the correct answer from the box to complete the sentence.
[1 mark]

chemical	**gravitational potential**	**kinetic**

The work done to accelerate the passenger train from point **A** to point **B** increases the

..... energy of the passenger train.

12 (b) (i) From point **B** to point **C**, shown in **Figure 21**, the passenger train climbs a vertical height of 140 m.

Calculate the increase in gravitational potential energy of the passenger train as it climbs from point **B** to point **C**.

[2 marks]

The mass of the passenger train is 8325 kg.

The gravitational field strength is 10 N/kg.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Increase in gravitational potential energy = ... J

12 (b) (ii) The passenger train stops at point **C** and then falls, due to gravity, towards point **D**.

State the maximum increase in kinetic energy of the passenger train as it moves from point **C** to point **D**.

[1 mark]

Maximum increase in kinetic energy = ... J

12 (b) (iii) The actual increase in kinetic energy of the passenger train as it falls from point **C** to point **D** is less than your answer to part **(b)(ii)**.

Why?

[1 mark]

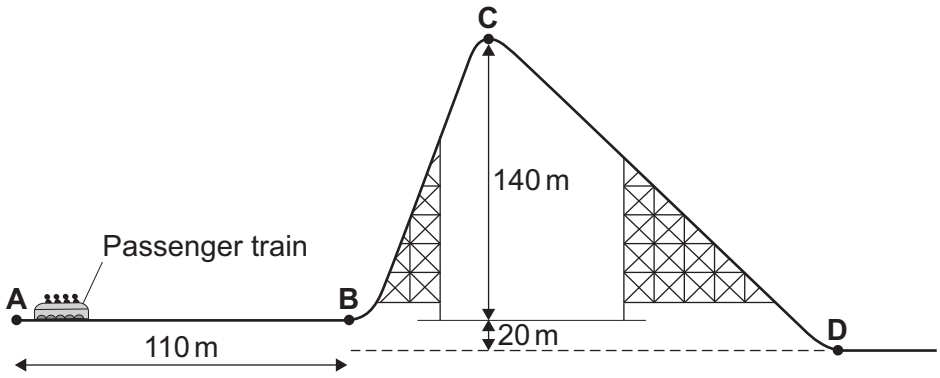
.....

.....

Question 12 continues on the next page

12 (c) **Figure 22** shows a different roller-coaster design.

Figure 22



What effect will the change in design have on the velocity of the passenger train at point **D**?

[1 mark]

.....

.....

12 (d) On many roller-coaster rides the passengers feel the effect of large accelerations on their bodies.

Table 7 shows some of the effects that can occur.

Table 7

Acceleration in m/s^2	Possible effect
10	Feeling of heaviness
20	Difficulty in moving arms and legs
30	Limited eyesight
40	Unconsciousness

In the United Kingdom there is no legal limit on the maximum acceleration a passenger should experience during a roller-coaster ride.

Do you think there should be a legal limit?

Give a reason for your answer.

[1 mark]

.....

.....

.....

10

END OF QUESTIONS

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