Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
January 2011

Applied Science (Double Award)

APSC/2F

F

Unit 2 Science for the Needs of Society

Written Paper

Thursday 13 January 2011 9.00 am to 10.30 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 1 hour 30 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 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.

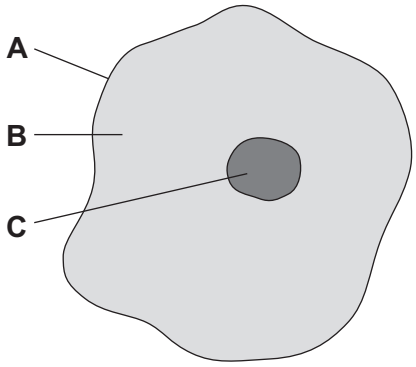
Advice
- In all calculations, show clearly how you work out your answer.

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

1 Medical scientists need to know how living organisms work.

Living organisms are made up of cells.

1 (a) The diagram shows an animal cell.



1 (a) (i) Which label on the diagram, **A**, **B** or **C**, shows the nucleus?

Write your answer in the box. ☐

(1 mark)

1 (a) (ii) Which label on the diagram, **A**, **B** or **C**, shows the cytoplasm?

Write your answer in the box. ☐

(1 mark)

1 (b) All living organisms respire.

Use words from the box to complete the word equation for respiration.

Carbon dioxide	**Hydrogen**	**Oxygen**	**Salt**	**Water**

Glucose + ... → ..... + ...

(3 marks)

1 (c) Complete the sentences by drawing a ring around the correct line in each box.

1 (c) (i) Living organisms respire to release

cells.

energy.

waste.

(1 mark)

1 (c) (ii) The substances needed for respiration move into the cells by

diffusion.

active transport.

breathing.

(1 mark)

1 (d) One substance moves in and out of cells by osmosis.

Use words from the box to complete the sentence.

glucose	**high**	**low**	**water**

Osmosis is the movement of ..... from an area of

..... solute concentration to an area of .....

solute concentration through a semi-permeable membrane.

(3 marks)

10

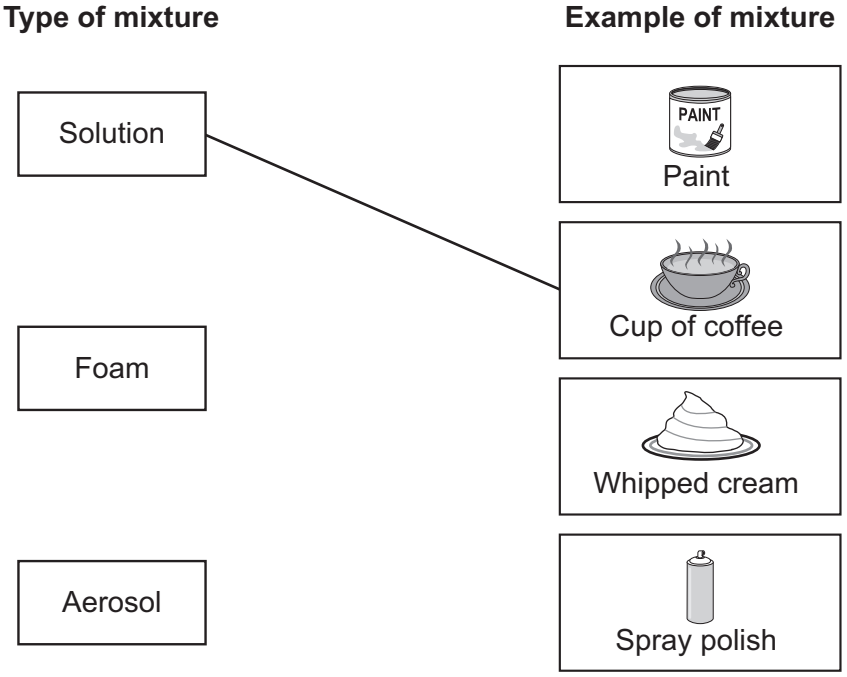
Turn over for the next question

2 A nursery nurse is tidying up the play area of a nursery.

2 (a) There are many different types of mixture in the nursery.

2 (a) (i) Draw a line from the name of each type of mixture to an example of that mixture.

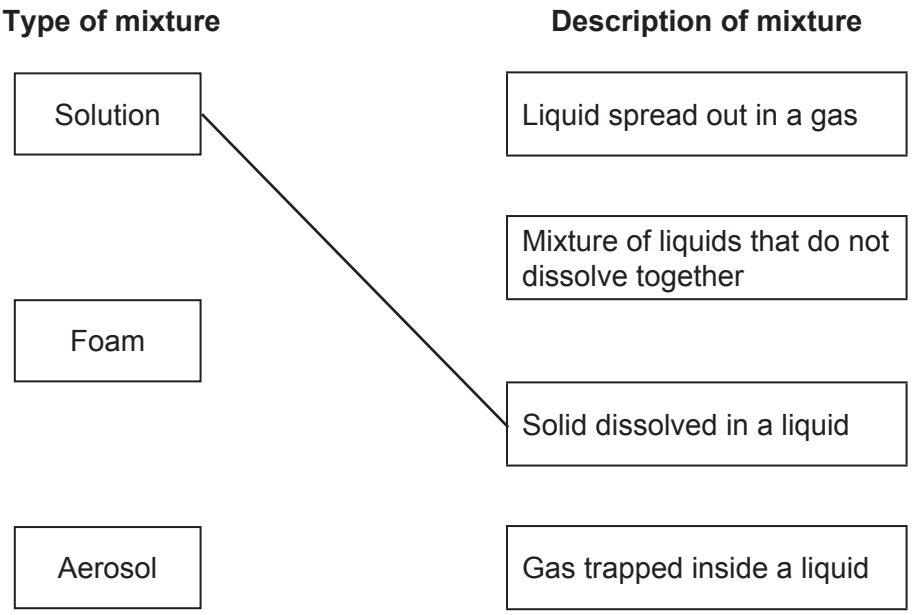
One line has been drawn for you.



(2 marks)

2 (a) (ii) Draw a line from the name of each type of mixture to its description.

One line has been drawn for you.



(2 marks)

2 (b) The nursery nurse wanted to separate some mixtures that the children had made.

Name the method that the nursery nurse could use to separate each of these mixtures:

2 (b) (i) salt and water .....

(1 mark)

2 (b) (ii) sand and beads .....

(1 mark)

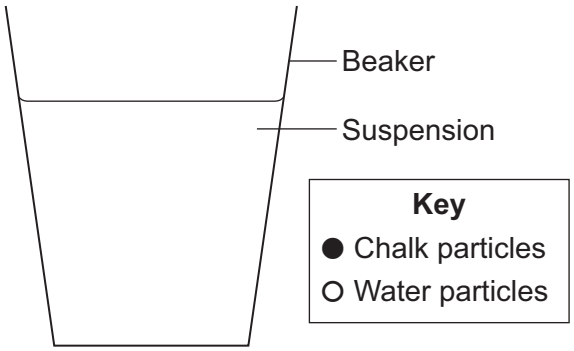
2 (b) (iii) sand and water. .....

(1 mark)

2 (c) Chalk and water is another type of mixture, called a suspension.

On the diagram, draw circles to represent the position of the particles in a suspension after it has been left to stand overnight.

Use (O) to represent the water particles and (●) to represent the chalk particles.



(2 marks)

2 (d) A solution of sugar dissolved in water changes if it is left out for several days.

2 (d) (i) What would happen to the amount of solution after several days?

.....

.....

(1 mark)

2 (d) (ii) Give **one** reason why this would happen.

.....

.....

(1 mark)

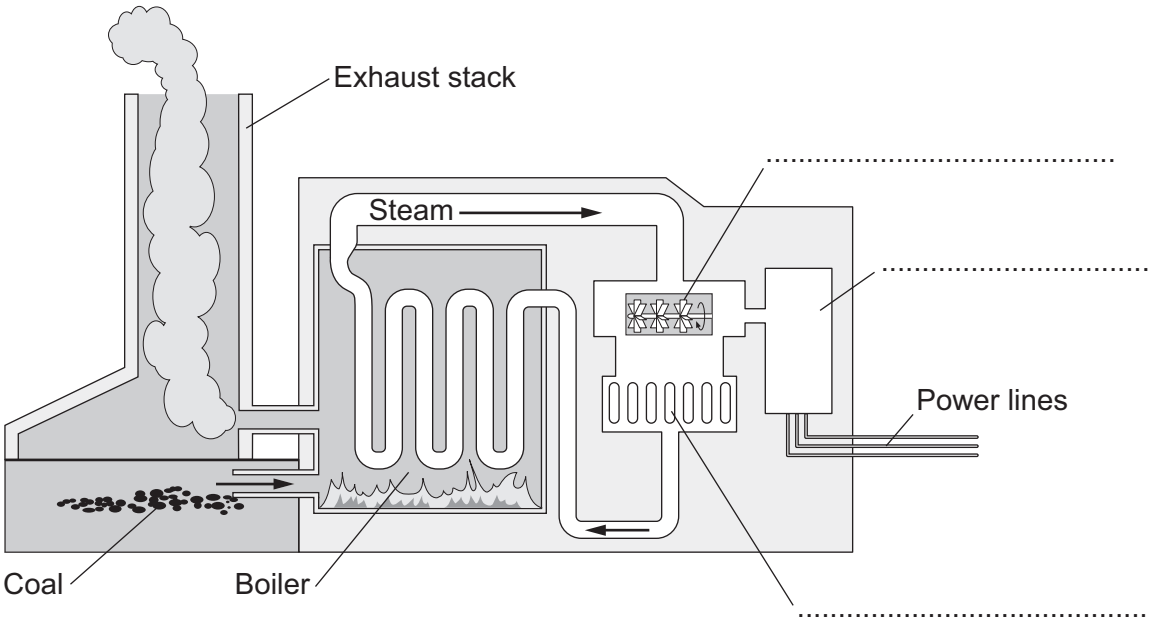
11

3 In Britain, we get about 30 % of our electrical energy from coal-burning power stations.

3 (a) The diagram shows how electricity is produced in a coal-burning power station.

Use the words from the box to complete the labels on the diagram.

Condenser	**Generator**	**Turbine**



(2 marks)

3 (b) Coal-burning power stations work by heating water.

3 (b) (i) Describe what happens to the water after it is heated in the boiler by putting the sentences, **A**, **B**, **C** and **D**, in the correct order.

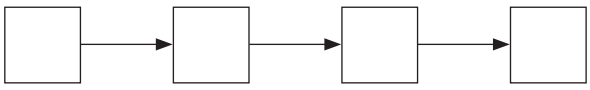
A Cools in the condenser.

B Spins the turbine.

C Returns to the boiler.

D Turns to steam in the boiler.

Write your answers in the boxes.



(2 marks)

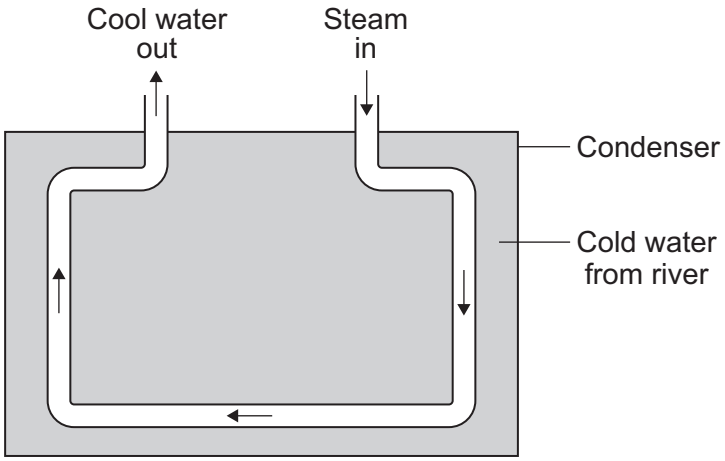
3 (b) (ii) What other fuel could be used to heat the water in a power station?

.....

(1 mark)

3 (c) The diagram below shows a condenser.

In the condenser, the steam flows through brass pipes that are surrounded by water from a local river.



3 (c) (i) Give **one** reason why the pipes are made out of brass.

.....

.....

(1 mark)

3 (c) (ii) The river water has to be cooled before it is returned to the river.

Suggest **one** reason why the water has to be cooled before it goes back to the river.

.....

.....

(1 mark)

3 (d) Why might we **not** be using coal-burning power stations to produce electricity in 200 years' time?

.....

.....

(1 mark)

Question 3 continues on the next page

3 (e) Some electricity generators do **not** use fuels to heat water.

What else could be used to make a turbine spin instead of steam?

.....

.....

(1 mark)

3 (f) A coal-burning power station is not very efficient.

Every kilogram of coal contains 219 kJ of chemical energy.

In a power station, only 68 kJ of this energy is converted to electrical energy.

Calculate the efficiency of this power station using the equation in the box.

$$\text{efficiency} = \frac{\text{useful electrical energy produced by power station}}{\text{total energy supplied to power station}} \times 100$$

Show clearly how you work out your answer.

.....

.....

.....

Efficiency = ... %

(2 marks)

11

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

4 Humans use other living organisms to make many useful products.

4 (a) The table lists some products that are made from living organisms.

Use the words in the box to complete the table.

bacteria	**fungus**	**plant**

Product	**Organism used to make product**
Penicillin	
Cotton wool	
Yoghurt	

(2 marks)

4 (b) Some living organisms are used to make drugs that treat medical conditions.

Diabetes is a condition where the human body cannot make insulin.

4 (b) (i) Name the organ that produces insulin.

.....

(1 mark)

4 (b) (ii) Name the substance in the blood that is controlled by insulin.

.....

(1 mark)

4 (b) (iii) How does insulin control the substance that you named in **4(b)(ii)**?

.....

.....

(1 mark)

4 (b) (iv) Scientists have genetically engineered a living organism to produce insulin that people with diabetes can use.

The sentences in the table below show the process of genetic engineering.

Put the sentences in the correct order by writing the numbers, **2**, **3** and **4**, in the correct boxes.

The first sentence has been labelled for you.

	The bacteria are grown in large numbers and will now make human insulin.
	Every time the bacteria reproduce, the human gene will also be copied into the offspring.
1	The insulin gene is taken from human DNA.
	The human gene for insulin is put into bacterial cells.

(2 marks)

4 (b) (v) Before human insulin was produced using genetic engineering, diabetics were treated with insulin from pigs.

Suggest **one** disadvantage of using insulin from pigs to treat humans with diabetes.

.....

.....

(1 mark)

4 (c) Hormones are carried around the body by blood within the circulatory system.

Give the function of each of the following components of the circulatory system.

4 (c) (i) The heart:

.....

(1 mark)

4 (c) (ii) Red blood cells:

.....

(1 mark)

4 (c) (iii) Platelets:

.....

(1 mark)

11

5 Scientists have discovered that the Earth's atmosphere is very different from what it was 4500 million years ago.

5 (a) The Earth's atmosphere contains a mixture of gases.

Complete the table which shows some of these gases.

Gas	Formula
	CH_4
Ammonia	NH_3
Steam	H_2O
Carbon dioxide	

(2 marks)

5 (b) There is very little steam in the Earth's atmosphere now because the steam cooled down and became liquid water.

5 (b) (i) Suggest where most of the water went.

.....

.....

(1 mark)

5 (b) (ii) Oxygen can be made by breaking up water molecules.

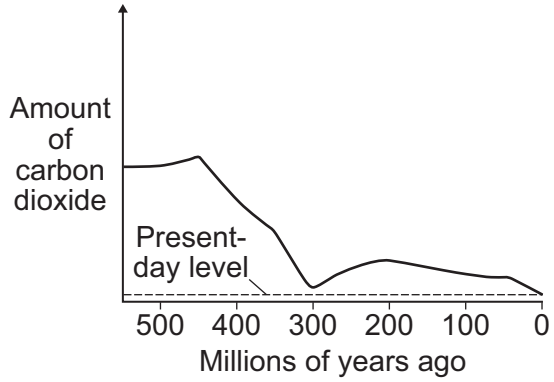
Complete the chemical equation for this process.

$2H_2O \rightarrow$ ..... + 2 .....
Water Oxygen Hydrogen

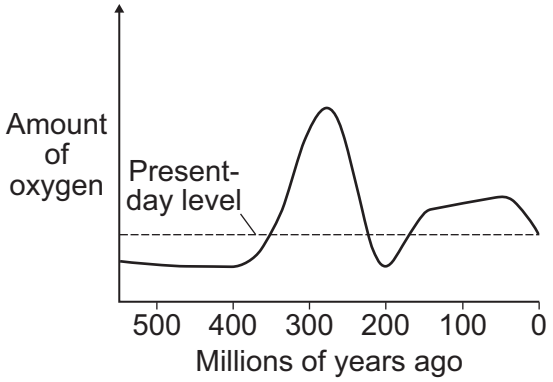
(2 marks)

5 (c) The graphs show that around 400 million years ago the levels of carbon dioxide and oxygen in the Earth's atmosphere changed.

Carbon dioxide in the Earth's atmosphere



Oxygen in the Earth's atmosphere



5 (c) (i) Complete the sentences to explain what happened to the amount of carbon dioxide between 400 and 300 million years ago.

The amount of carbon dioxide ..... .

This was because plants use it for ..... .

(2 marks)

5 (c) (ii) What was happening to the amount of oxygen between 400 and 300 million years ago?

.....

.....

(1 mark)

5 (c) (iii) Explain why the amount of oxygen changed at this time.

.....

.....

.....

(2 marks)

10

6 Doctors can diagnose and treat certain diseases using radioactive substances.

The main types of nuclear radiation given out by radioactive substances are alpha, beta and gamma.

Information about alpha, beta and gamma radiation is given in the table.

Radiation	Charge	Stopped by	Shielding material
Alpha	+2	Thin sheet of paper	Paper, skin, clothes
Beta	–1	Thin sheet of aluminium	Thick plastic, glass, light metals
Gamma	0	Many centimetres of lead	Dense material, concrete, earth

6 (a) Use the words in the box to complete the sentences about the main types of radiation.

Alpha	**Beta**	**Gamma**

..... radiation is not a particle, but an electromagnetic wave.

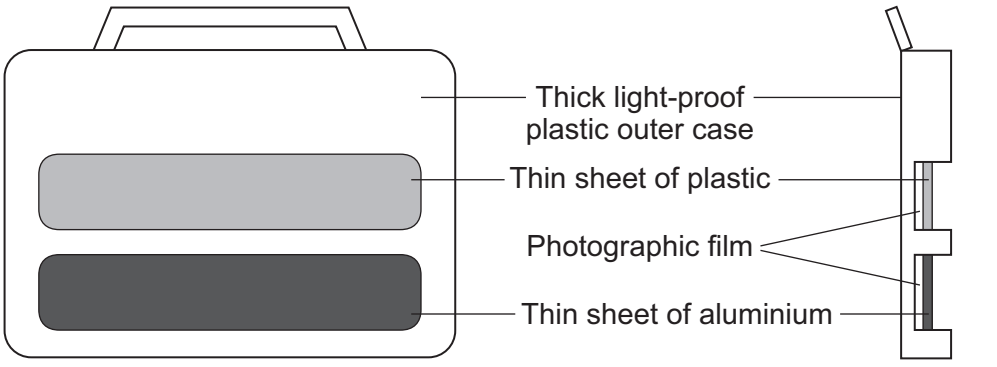
..... particles are the same as a helium nucleus.

..... particles are high-speed electrons.

(2 marks)

6 (b) People who work with radioactive substances wear a film badge to monitor their exposure to radiation.

The diagram shows a film badge.



Use the information in the table to help you to complete the sentences that describe how a film badge works.

Film badges contain two photographic films. One film is under a thin sheet of aluminium,

and this only detects ..... radiation.

The other film is under a thin sheet of plastic, and detects .....

and ..... radiation.

..... radiation cannot be detected by this type of badge.

(4 marks)

6 (c) Gamma radiation is used to sterilise plastic medical equipment.

6 (c) (i) What does *sterilise* mean?

.....

.....

(1 mark)

6 (c) (ii) Give **one** reason why gamma radiation can be used for sterilising plastic medical equipment.

.....

.....

(1 mark)

6 (c) (iii) Give **one** reason why heat **cannot** be used to sterilise plastic medical equipment.

.....

.....

(1 mark)

6 (c) (iv) Suggest why some people might be worried by the use of gamma radiation to sterilise medical equipment.

.....

.....

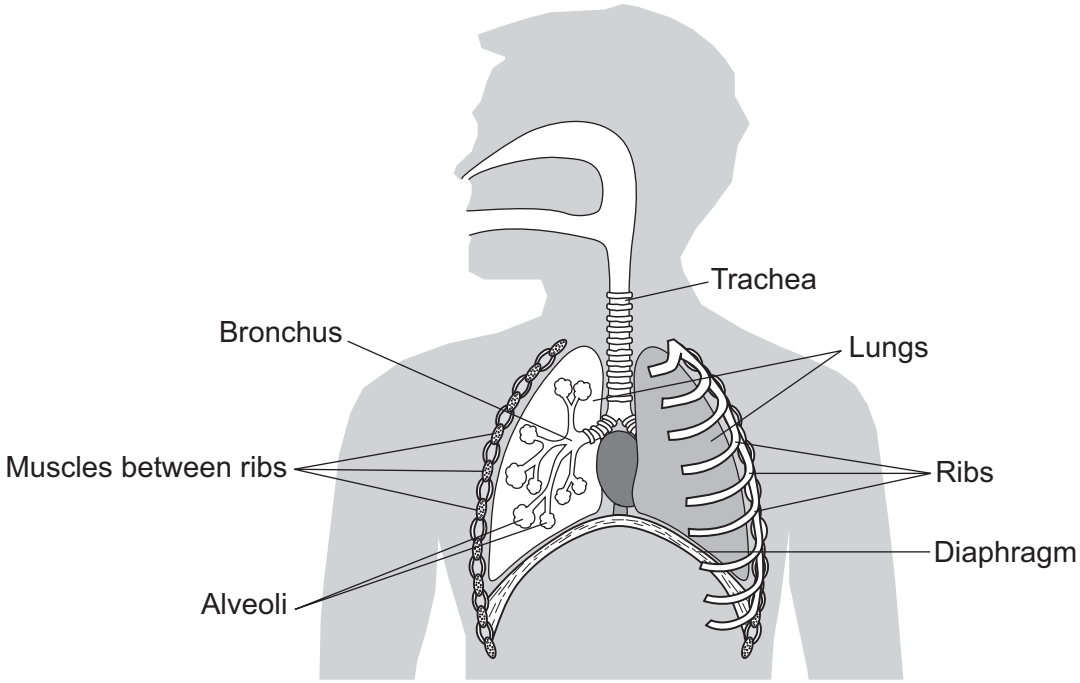
(1 mark)

10

7 Sports scientists help athletes to improve their performance.

One way they do this is by monitoring the athlete's breathing rate.

7 (a) The diagram shows the human breathing system.



Use the diagram to describe how we breathe in.

.....

.....

.....

.....

.....

.....

(3 marks)

7 (b) A sports scientist monitored an athlete's breathing rate during a training course.

The data collected is shown in the table.

Breathing rate	Start of training	After 1 week of training	After 2 weeks of training	After 4 weeks of training	End of training
At rest	12	12	12	10	10
After 10 minutes of exercise	55	53	49	46	40

7 (b) (i) Suggest appropriate units for recording breathing rate.

.....

(1 mark)

7 (b) (ii) The athlete's breathing rate after 10 minutes of exercise was lower at the end of training than at the start of training.

What was the percentage decrease?

.....

.....

.....

.....

Breathing rate decrease = ... %

(3 marks)

7 (b) (iii) Explain how the data in the table could show that the training programme improved the athlete's fitness.

.....

.....

.....

.....

(2 marks)

9

8 Limestone is used to make slaked lime. Farmers use slaked lime on their fields to neutralise acids in rainwater.

8 (a) Limestone is made of calcium carbonate.

What is the chemical formula for calcium carbonate?

.....

(1 mark)

8 (b) Limestone is converted to quicklime in a lime kiln.

8 (b) (i) What process is used to convert limestone to quicklime?

.....

.....

(1 mark)

8 (b) (ii) Name the gas that is given off when limestone is converted to quicklime.

.....

(1 mark)

8 (b) (iii) What environmental problem is caused by this gas?

.....

(1 mark)

8 (c) Quicklime is converted into slaked lime by adding water.

An exothermic reaction takes place.

8 (c) (i) Complete the symbol equation for the conversion of quicklime to slaked lime.

..... + H_2O → .....

(2 marks)

8 (c) (ii) What is an *exothermic* reaction?

.....

.....

(1 mark)

8 (d) Limestone can also be used in the manufacture of glass.

What **two** ingredients are added to limestone to make glass?

1 .....

2 .....

(2 marks)

9

Turn over for the next question

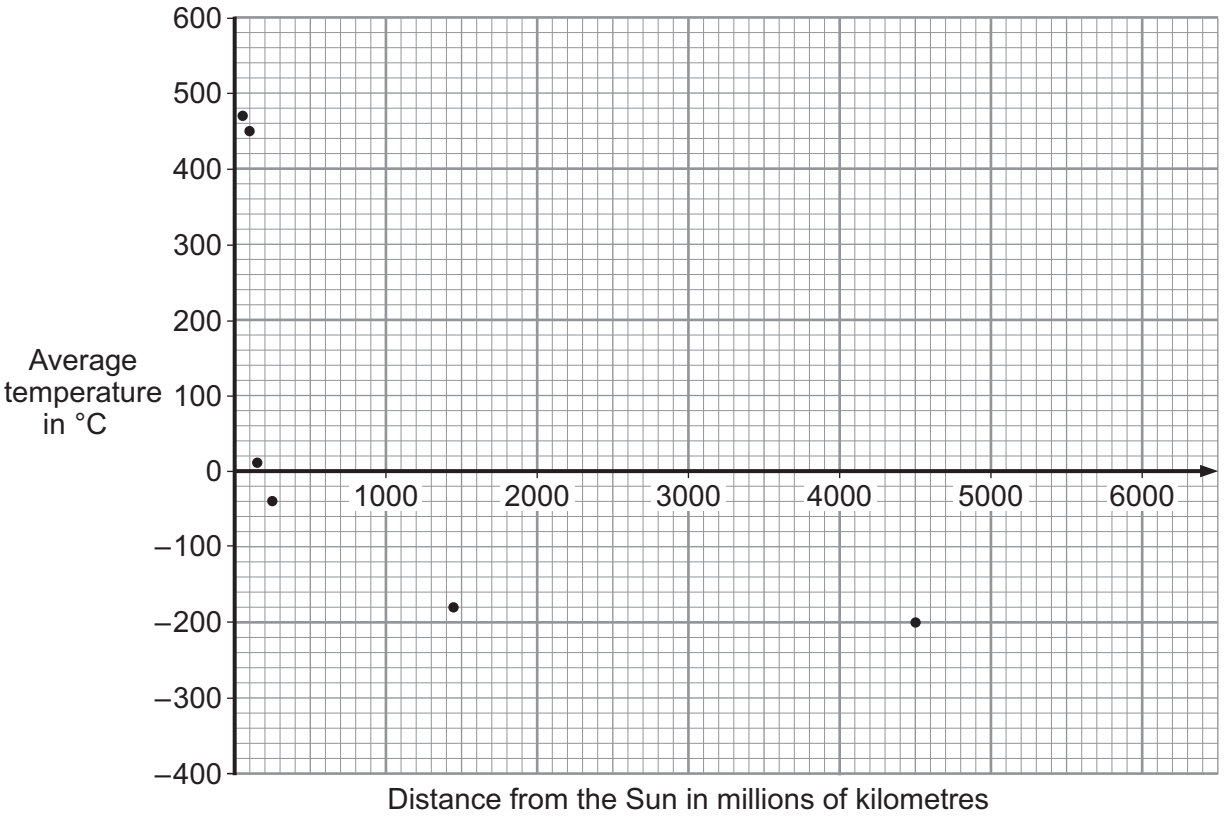
9 Astronomers are looking to see if there could be life on other objects in the Solar System.

9 (a) Astronomers use infrared telescopes to measure the temperatures of objects in space because they want to know if the temperature is right for liquid water to be present.

The table shows information about some objects in the Solar System.

Object	Distance from the Sun in millions of kilometres	Average temperature in °C
Mercury	60	470
Venus	110	450
Earth	150	10
Mars	230	–40
Jupiter	780	–150
Saturn	1430	–180
Uranus	2870	
Neptune	4500	–200
Pluto	5910	–220

The graph shows the relationship between the distance of objects from the Sun and average temperature.



9 (a) (i) On the graph, plot the data for Jupiter and Pluto.

(2 marks)

9 (a) (ii) Use the information in the table and on the graph to predict the average temperature for Uranus.

..... °C

(1 mark)

9 (a) (iii) Why is it hotter on Venus than it is on Earth?

.....

.....

(1 mark)

9 (a) (iv) Why might the average temperature on Mars suggest that there is no life on Mars?

.....

.....

(1 mark)

Question 9 continues on the next page

Turn over ▶

9 (b) Infrared telescopes are usually in space on satellites above the Earth.

Give **two** advantages of using a telescope on a satellite rather than on the surface of the Earth.

1 .....

.....

2 .....

.....

(2 marks)

9 (c) Astronomers have noticed that the frequency of infrared waves coming from the stars is lower than expected.

9 (c) (i) Why is the frequency of infrared waves lower than expected?

.....

.....

(1 mark)

9 (c) (ii) What has this evidence led astronomers to believe is happening to the Universe?

.....

.....

(1 mark)

9

END OF QUESTIONS

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