GCSE
ADDITIONAL SCIENCE

F

Foundation Tier   Unit 6

Friday 17 June 2016   Morning   Time allowed: 1 hour 30 minutes

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

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(c) 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   Some rocks contain fossils.

Figure 1 shows a fossil of an ammonite.

Figure 2 shows what scientists think living ammonites looked like.

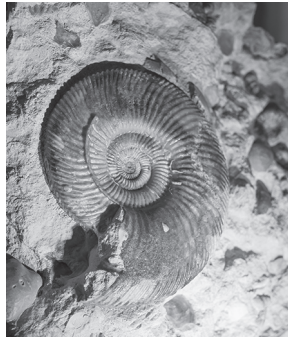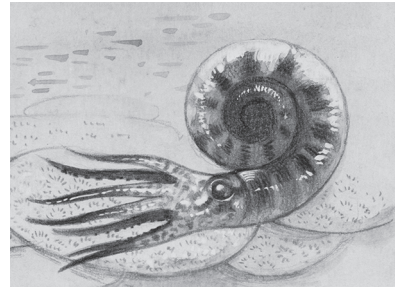| **Figure 1**	**Figure 2**
Fossil of an ammonite	**What scientists think living ammonites looked like**

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

[1 mark]

decayed	grew again	melted

When the ammonite died some parts of the body _____ .

1 (b)   Ammonites are extinct.

Give **two** reasons why animals might become extinct.

[2 marks]

1 _____

_____

2 _____

_____

1 (c)   Some modern animals have evolved from ammonites.

Use evidence from **Figure 1** and **Figure 2** to answer this question.

1 (c) (i)   Which type of modern animal may have evolved from ammonites?

Draw a ring around the correct answer.

[1 mark]

fish   **insects**   **snails**

1 (c) (ii)   Give a reason for your answer to part **(c)(i)**.

[1 mark]

_____

_____

1 (d)   Fossils of many different types of ammonite have been found in different parts of the world.

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

[1 mark]

embryos	**organisms**	**species**

Scientists think different populations of ammonites became separated from one another

and so formed different _____ .

Turn over for the next question

6

2 In humans, respiration may be aerobic or anaerobic.

2 (a) Complete **Table 1** to compare aerobic respiration with anaerobic respiration in humans.

Write **Yes** or **No** in each box.

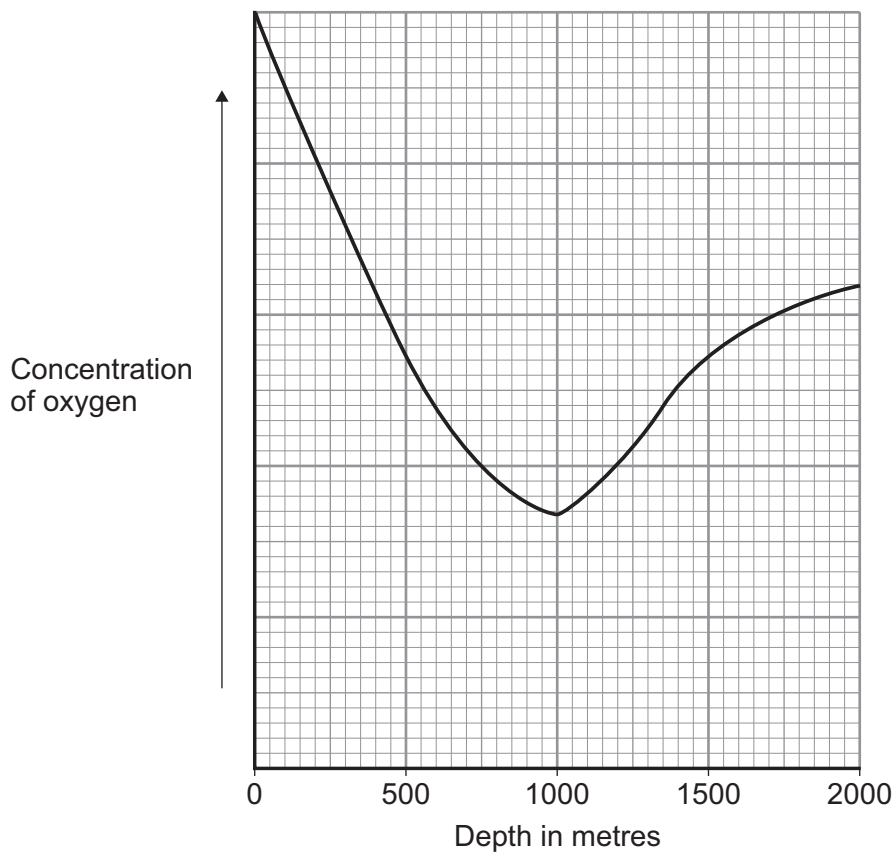The first one has been done for you.

[2 marks]

Table 1

	Aerobic respiration	**Anaerobic respiration**
Does it use oxygen?	Yes	No
Does it release energy?		
Does it produce lactic acid?		

2 (b) **Figure 3** shows the concentration of oxygen at different depths in the sea.

Figure 3

Concentration of oxygen

Depth in metres

2 (b) (i) At what depth in the sea is the concentration of oxygen the lowest?

[1 mark]

Depth = _____ metres

2 (b) (ii) **Figure 4** shows a tuna fish.

Figure 4

Tuna are very active fish.

Suggest reasons why tuna spend most of their lives in the top 100 metres of the sea.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

Question 2 continues on the next page

Turn over ▶

2 (b) (iii) Three different types of organism, **A**, **B** and **C**, live in a cold sea.
Table 2 shows the percentage of energy from food used in different ways
by **A**, **B** and **C**.

Table 2

Organism	Use of energy as percentage (%)			
	Movement	**Keeping warm**	**Growth**	**Lost as waste**
A	7.0	0.1	2.9	90.0
B	5.0	4.0	1.0	90.0
C	1.5	0.0	8.5	90.0

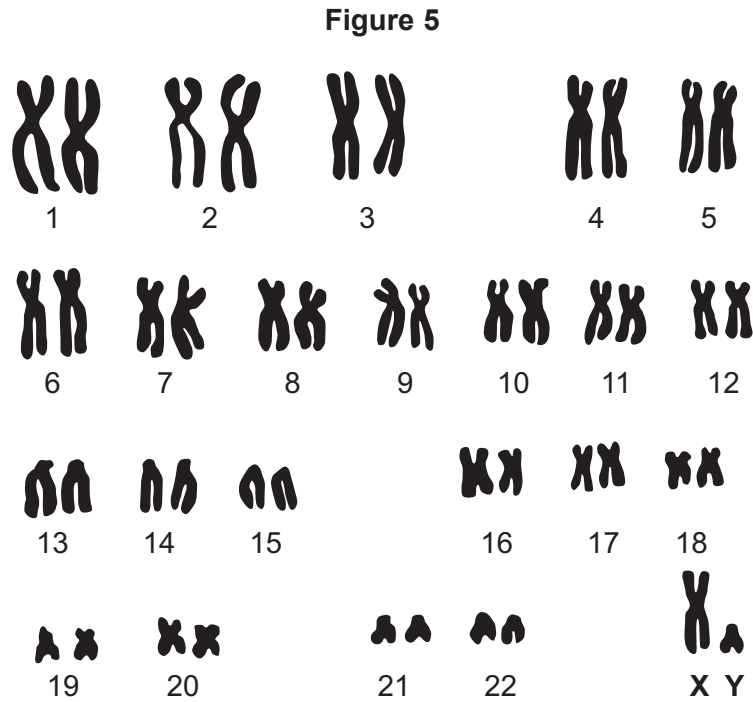Which organism, **A**, **B** or **C**, is a tuna fish?

[1 mark]

Write the correct answer in the box.

7

3   **Figure 5** shows a set of chromosomes from one cell.

Figure 5

3 (a) (i)   Evidence in **Figure 5** shows that the chromosomes are from a human male body cell.

[2 marks]

Draw **one** line from each statement to the correct evidence.

Statement   **Evidence**

There are 46 chromosomes
in the cell

The cell was taken
from a human

The chromosomes are
in pairs

The cell was taken
from a male

The cell has a Y
chromosome

Question 3 continues on the next page

Turn over ▶

3 (a) (ii) How many chromosomes would you expect to find in a human sperm cell (male gamete)?

[1 mark]

_____

3 (b) Scientists did a breeding investigation with mice.

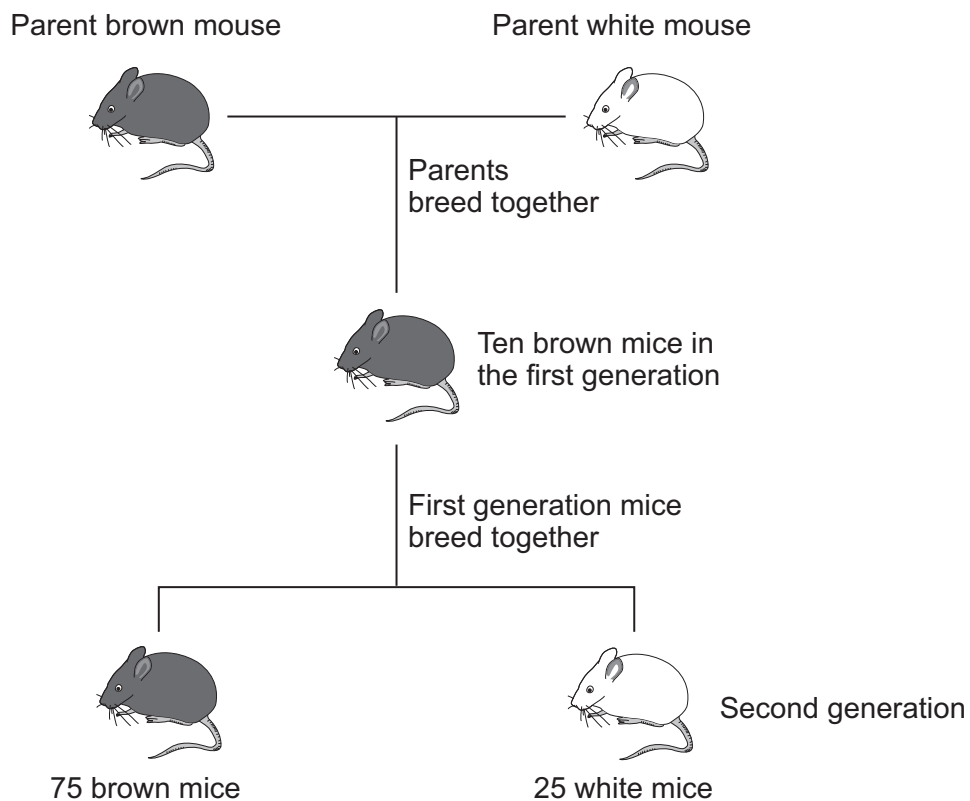The scientists crossed a brown mouse with a white mouse.

There were ten brown mice in the first generation.

The scientists then allowed the ten brown mice in the first generation to breed together.

There were 100 mice in the second generation.

Figure 6 shows the investigation.

Figure 6

Parent brown mouse   Parent white mouse

Parents
breed together

Ten brown mice in
the first generation

First generation mice
breed together

Second generation

75 brown mice   25 white mice

3 (b) (i) What conclusion can you make about the allele for brown fur colour in mice?

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

[2 marks]

Use evidence from **Figure 6**.

dominant	recessive	weak

The allele for brown fur colour in mice is _____ .

Give a reason for your answer.

_____

_____

3 (b) (ii) What is the ratio of fur colour in the second generation of mice?

[1 mark]

Tick (✓) **one** box.

3 brown : 1 white ☐

3 white : 1 brown ☐

1 white : 1 brown ☐

3 (b) (iii) In mice, sex is inherited in the same way as it is in humans.

How many of the first generation of ten mice would you expect to be **male**?

[2 marks]

Number = _____
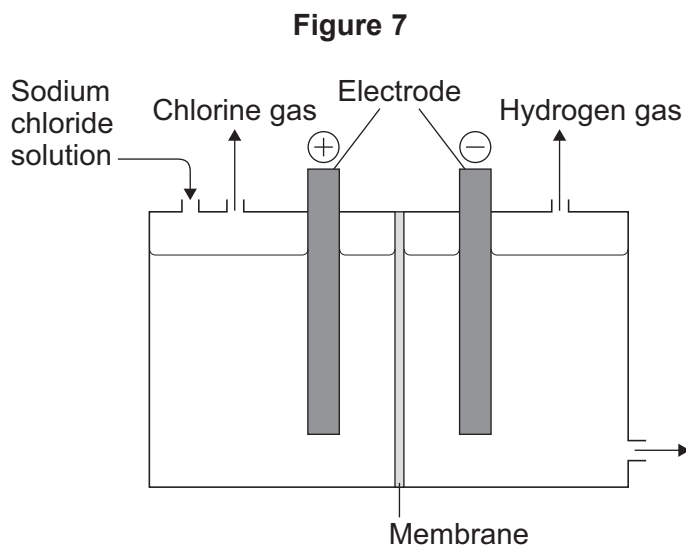
Give a reason for your answer.

_____

_____

8

Chemistry Questions

4   This question is about sodium chloride and sodium hydroxide.

The electrolysis of sodium chloride solution is an industrial process.

Figure 7 shows the electrolysis cell used.

Figure 7

Sodium chloride solution contains sodium ions (Na^+), chloride ions (Cl^-), hydrogen ions (H^+) and hydroxide ions (OH^-).

4 (a) (i)   Chloride ions move to the positive electrode.

Which other ion in the sodium chloride solution moves to the positive electrode?

[1 mark]

_____

4 (a) (ii)   Why do chloride ions move to the positive electrode?

[1 mark]

_____

_____

4 (a) (iii) Suggest **one** reason why the membrane in the cell is porous.

[1 mark]

Tick (✓) **one** box.

To act as the electrolyte ☐

To allow ions to pass through ☐

To collect waste products ☐

4 (b) Hydrogen is produced at the negative electrode.

Why is hydrogen, and **not** sodium, produced at the negative electrode?

[1 mark]

Tick (✓) **one** box.

Hydrogen has a greater charge than sodium ☐

Hydrogen is a gas at room temperature ☐

Hydrogen is less reactive than sodium ☐

4 (c) Sodium hydroxide is produced in the process.

Sodium hydroxide solution is alkaline.

4 (c) (i) Suggest a pH value for sodium hydroxide solution.

[1 mark]

_____

4 (c) (ii) Sodium hydroxide is neutralised by hydrochloric acid to make sodium chloride and another product.

Complete the word equation for the reaction.

[1 mark]

sodium hydroxide + hydrochloric acid ⟶ sodium chloride + _____

Question 4 continues on the next page

Turn over ▶

4 (c) (iii) Which ion causes hydrochloric acid to be acidic?

[1 mark]

Draw a ring around the correct answer.

Cl^- H^+ OH^-

4 (d) A student made sodium chloride crystals from sodium hydroxide solution and hydrochloric acid.

The student used the following processes.

Give the reason for using each process.

Draw **one** line from each process to the reason the process was used.

[3 marks]

Process	Reason
	To allow crystals to form
Added an indicator	
	To evaporate water
Heated the solution	
	To show when the mixture was neutralised
Left the solution to cool	
	To start the reaction

10

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ▶

5 A student investigated copper sulfate.

The student measured the mass of some blue hydrated copper sulfate.

The student heated the hydrated copper sulfate in a test tube.

The student measured the mass of solid left in the test tube after heating.

Table 3 shows the student's measurements.

Table 3

Substance	Mass in g
Hydrated copper sulfate	2.5
Solid left in test tube	1.6

5 (a) Anhydrous copper sulfate and water were produced by heating hydrated copper sulfate.

What was the mass of each product?

[2 marks]

Mass of anhydrous copper sulfate = _____ g

Mass of water = _____ g

5 (b) What is the chemical formula of anhydrous copper sulfate?

[1 mark]

Draw a ring around the correct answer.

CuS4O $CuSO_4$ CuSO^4

5 (c) The reaction between water and anhydrous copper sulfate is reversible.

5 (c) (i) Draw the symbol used in an equation for a reversible reaction.

[1 mark]

5 (c) (ii) Complete the following sentence.

[1 mark]

The colour change seen when water is added to anhydrous copper sulfate is from

white to _____ .

5 (c) (iii) Energy is released during this reaction.

Complete the sentence.

[1 mark]

Reactions that release energy are called _____ reactions.

6

Turn over for the next question

Turn over ▶

6 Silver iodide is an insoluble salt.

Insoluble salts can be made from two soluble salts.

Figure 8 shows how silver iodide is made from silver nitrate solution and sodium iodide solution.

Figure 8

Silver nitrate solution

Beaker

Sodium iodide solution
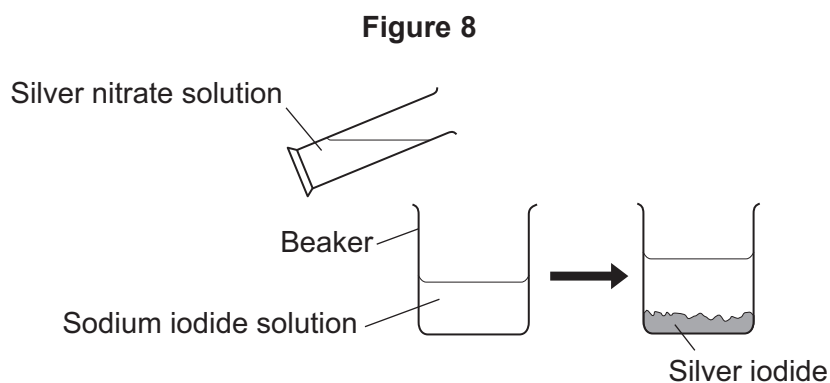
Silver iodide

6 (a) (i) Silver iodide is produced as a solid.

What name is given to this type of reaction?

[1 mark]

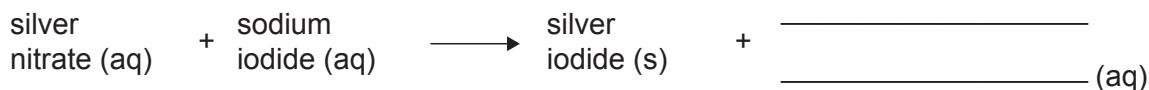Draw a ring around the correct answer.

decomposition   neutralisation   precipitation

6 (a) (ii) Suggest how you could obtain solid silver iodide from the mixture in the beaker.

[1 mark]

_____

_____

6 (b) (i) Complete the word equation for the reaction to produce silver iodide.

[1 mark]

silver
nitrate (aq)   +   sodium
iodide (aq)   ⟶   silver
iodide (s)   +   _____

_____ (aq)

6 (b) (ii) What do the state symbols (aq) and (s) in the equation represent?

[2 marks]
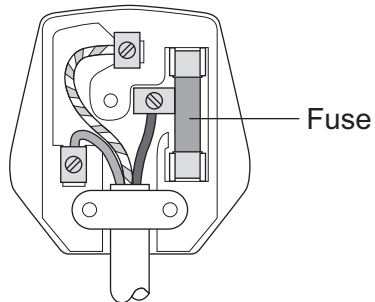
(aq) _____

(s) _____

Physics Questions

7 **Figure 9** shows the inside of a plug.

Figure 9

Fuse

7 (a) What colour is the covering of the wire connected to the fuse in a plug?

[1 mark]

Tick (✓) **one** box.

Blue ☐

Brown ☐

Green and Yellow ☐

Question 7 continues on the next page

Turn over ▶

7 (b) **Figure 10** shows a washing machine.

Figure 10

7 (b) (i) The potential difference of the UK mains electricity supply is 230 V.

The current flowing through the washing machine is 3.5 A.

Calculate the power of the washing machine.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Power = _____ W

7 (b) (ii) Which is the correct fuse for this washing machine?

[1 mark]

Tick (✓) **one** box.

3 A ☐

5 A ☐

13 A ☐

7 (c) When there is an electric current in the human body there is a risk of harm.

The risk of harm depends on the current and the time for which there is a current.

Table 4 shows how the current affects the time before a person is harmed.

Table 4

Current in milliamps	Time before a person is harmed in seconds
50	6.0
100	2.0
150	0.6
200	0.2

Describe the relationship between current and time before a person is harmed.

Use information from **Table 4**.

[1 mark]

_____

_____

5

Turn over for the next question

Turn over ▶

8 In 2011 there was an explosion at a nuclear power station in Japan.

The explosion caused radioactive material to be scattered into the surrounding area.

8 (a) Which **two** of the following are **man-made** sources of background radiation?

[2 marks]

Tick (✓) **two** boxes.
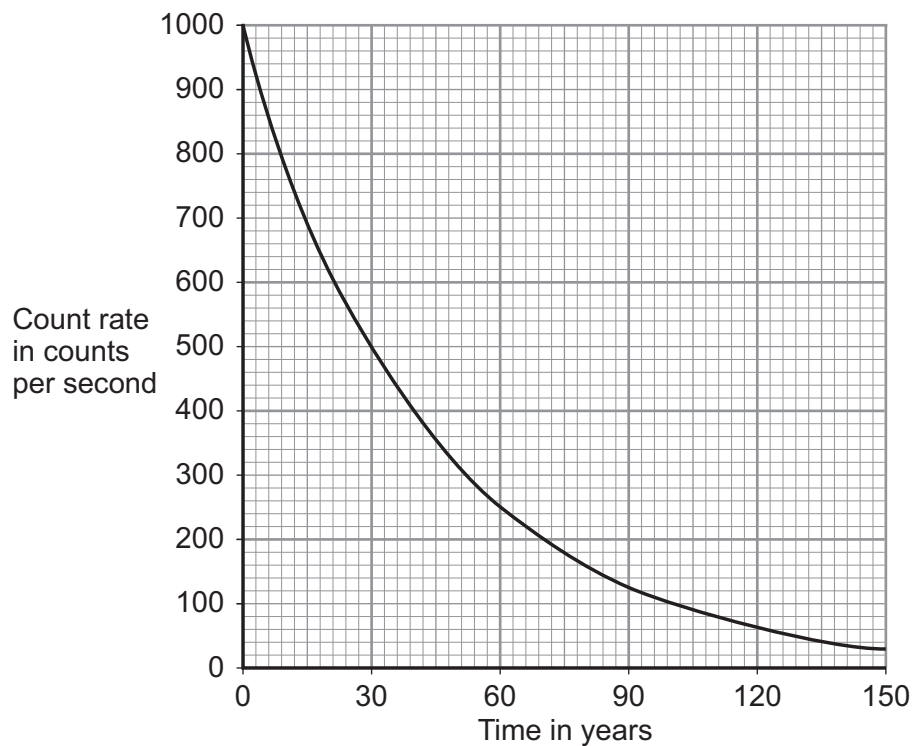
Cosmic rays ☐

Fallout from nuclear weapons tests ☐

Medical X-rays ☐

Rocks ☐

8 (b) One of the radioactive isotopes that was scattered into the surrounding area was caesium-137.

Figure 11 shows how the count rate from a sample of caesium-137 decreases over time.

Figure 11

8 (b) (i) The count rate for caesium-137 falls from 1000 counts per second to 500 counts per second.

How many years would this take?

[1 mark]

Time = _____ years

8 (b) (ii) What is the half-life of caesium-137?

[1 mark]

Half-life = _____ years

8 (c) (i) State **one** possible effect on the human body of being exposed to nuclear radiation.

[1 mark]

_____

_____

8 (c) (ii) Suggest **one** way that people living in the surrounding area can reduce their exposure to the radiation.

[1 mark]

Tick (✓) **one** box.

Stay indoors ☐

Eat locally grown food ☐

Open the window ☐

Question 8 continues on the next page

Turn over ▶

8 (d)   Caesium-137 emits beta particles and gamma rays.

8 (d) (i)   What is a **beta** particle?

[1 mark]

Tick (✓) **one** box.

An electromagnetic wave ☐

The same as a helium nucleus ☐

An electron from the nucleus ☐

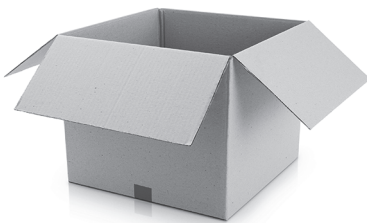**8 (d) (ii)**   Some of the caesium-137 passed into the soil.

The Japanese government has arranged for the top layer of soil to be removed from areas where levels of radiation are high.

The layer of soil that is removed must be safely stored for a long period of time.

Figure 12 shows three possible containers to store the soil.

Figure 12

Cardboard box	Plastic bag	Metal drum

Which container would be the safest one to use?

[2 marks]

Tick (✓) **one** box.

Cardboard box ☐

Plastic bag ☐

Metal drum ☐

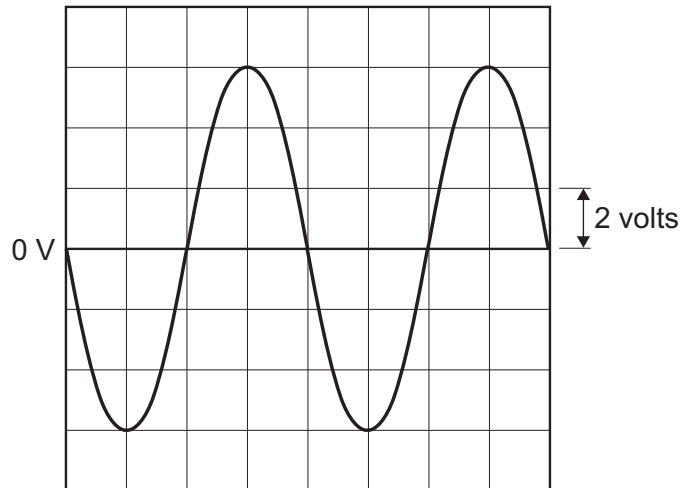Give the reason for your answer.

_____

_____

9

Turn over for the next question

Turn over ▶

9 An oscilloscope can be used to measure potential difference (p.d.).

A student uses an oscilloscope to measure the p.d. across a power supply.

Figure 13 shows the trace that is displayed on the oscilloscope screen.

Each vertical division represents 2 volts.

Figure 13

9 (a) Use **Figure 13** to calculate the peak potential difference of the power supply.

[2 marks]

_____

_____

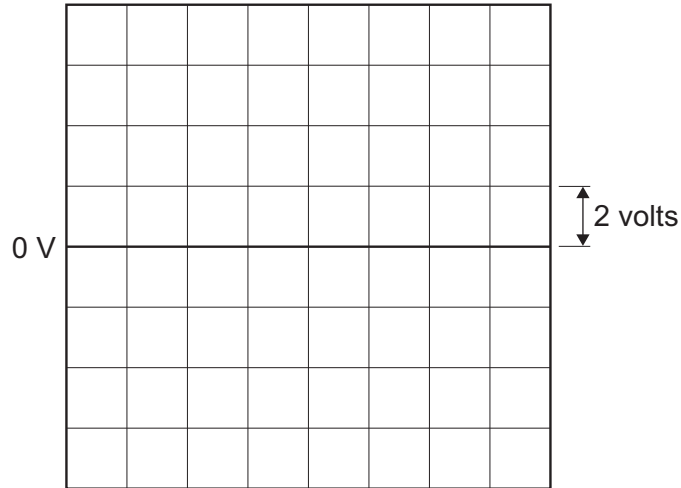Peak potential difference = _____ V

9 (b) The student now connects a 3 V battery to the oscilloscope in place of the original power supply.

The controls on the oscilloscope are **not** changed.

Draw onto **Figure 14** the trace the student would now see.

[2 marks]

Figure 14

0 V

2 volts

Question 9 continues on the next page

Turn over ▶

9 (c)   **Table 5** shows information about two light bulbs.

Table 5

	Bulb A	Bulb B
Input power in watts	60	13
Price in a shop	£1.50	£4.50
Estimated annual cost to run	£4.50	£1.20
Life time in years	1	9

9 (c) (i) Suggest the reason why the annual cost to run the bulbs is an estimate.

[1 mark]

_____

_____

9 (c) (ii) A student looks at the information in **Table 5**.

She concludes that bulbs with a lower input power have a higher price in a shop.

Suggest what additional information the student needs to have in order to be more confident about her conclusion.

[1 mark]

_____

_____

9 (c) (iii) When **Bulb A** and **Bulb B** are connected to the same mains supply they are equally bright.

Bulb B is more efficient than **Bulb A**.

Use data from **Table 5** to state why **Bulb B** is more efficient than **Bulb A**.

[1 mark]

_____

_____

Turn over for the next question

7

Turn over ▶

Biology Questions

10 Enzymes are important chemicals in living things.

10 (a) What type of molecule are enzymes made from?

[1 mark]

_____

10 (b) The enzyme isomerase is used in industry to convert glucose into fructose.

10 (b) (i) Why is glucose converted into fructose by industry?

[1 mark]

_____

10 (b) (ii) **Table 6** shows the effect of pH on the rate of the reaction.

Table 6

pH	Rate of reaction in arbitrary units
5	13
7	24
9	17
11	0

Suggest why there is no reaction at pH 11.

[1 mark]

_____

_____

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

Describe how enzymes in the human digestive system break down the chemicals in food.

In your answer you should refer to:

- the names of enzymes
- the food substances the enzymes break down
- the products of the breakdown.

[6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Extra space _____

_____

_____

_____

_____

9

Turn over ▶

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
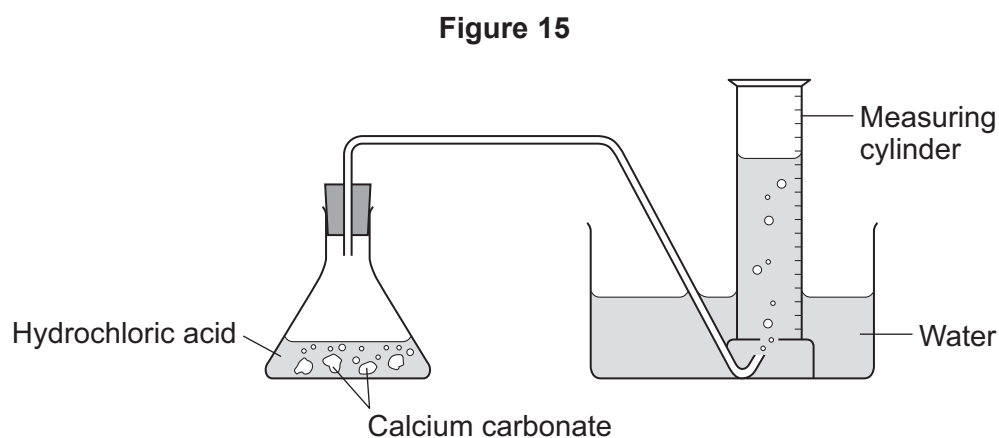ANSWER IN THE SPACES PROVIDED**

Chemistry Questions

11 This question is about rates of reaction.

A student investigated the rate of the reaction between calcium carbonate and hydrochloric acid.

The equation for the reaction is:

$$CaCO_3(s) \ + \ 2HCl\ (aq) \longrightarrow CaCl_2\ (aq) \ + \ CO_2\ (g) \ + \ H_2O\ (l)$$

Figure 15 shows the apparatus the student used.

Figure 15

11 (a) Which equation should the student use to calculate the rate of reaction?

[1 mark]

Tick (✓) **one** box.

Rate of reaction = $\dfrac{\text{Time}}{\text{Volume of gas produced}}$ ☐

Rate of reaction = Volume of gas produced × time ☐

Rate of reaction = $\dfrac{\text{Volume of gas produced}}{\text{Time}}$ ☐

Question 11 continues on the next page

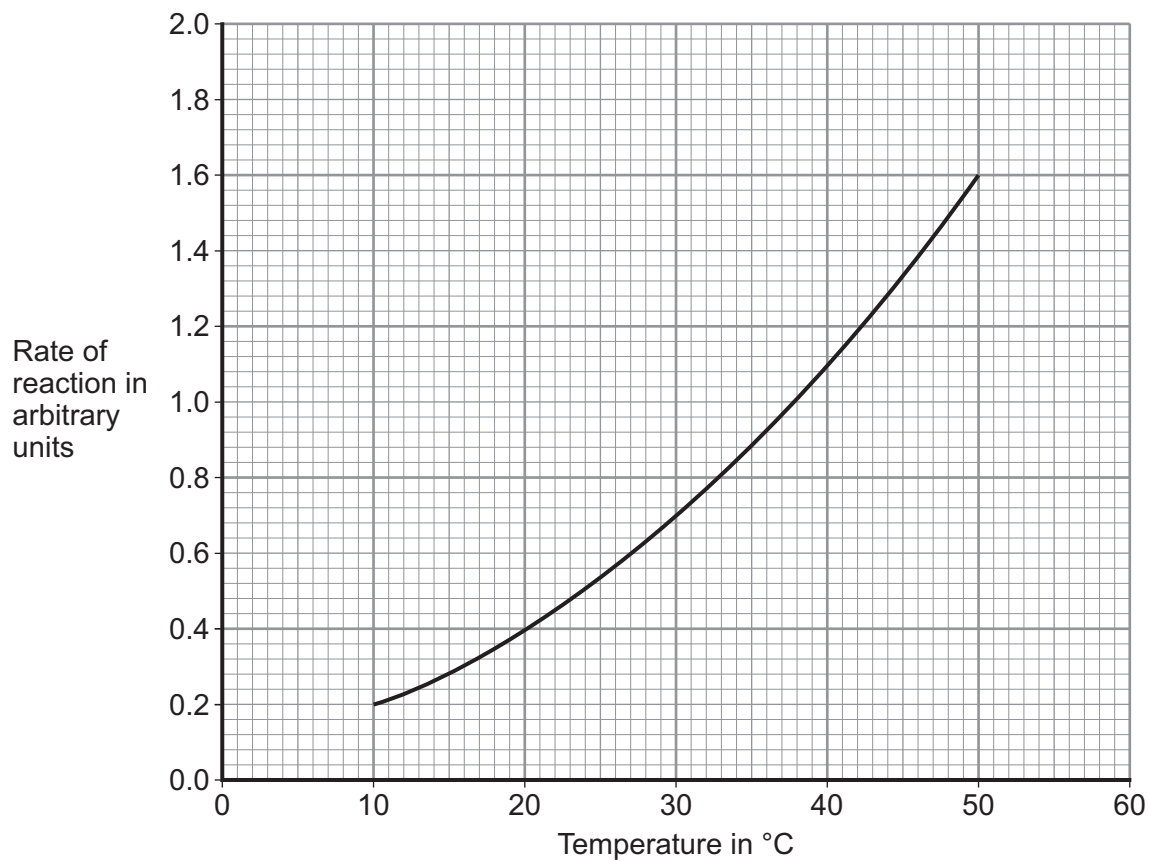**Turn over ▶**

11 (b) The student plotted a graph of the rate of reaction against temperature.

Figure 16 shows the graph.

Figure 16

11 (b) (i) What is the rate of reaction at 15 °C?

[1 mark]

Rate of reaction at 15 °C = _____ arbitrary units

11 (b) (ii) The student concluded:

'The rate of reaction doubles for every 10 °C increase in temperature.'

Figure 16 shows the student's conclusion is **not** correct for the whole of the temperature range.

Describe how data from **Figure 16** supports and does **not** support the student's conclusion.

[3 marks]

Supports _____

_____

_____

_____

Does not support _____

_____

_____

_____

11 (c) (i) Explain, in terms of particles, why an increase in temperature increases the rate of reaction.

[2 marks]

_____

_____

_____

_____

11 (c) (ii) Give **two** other ways of increasing the rate of reaction between calcium carbonate and hydrochloric acid.

[2 marks]

_____

_____

_____

_____

9

Physics Questions

12 The Sun is a star and releases energy by the process of nuclear fusion.

12 (a) What is meant by nuclear fusion?

[1 mark]

_____

_____

12 (b) The age of the Sun is estimated to be 4.5 billion years.
It is thought that the Sun will continue to release energy for another 5 billion years.

Why is the Sun able to maintain its energy output for such a long time?

[1 mark]

_____

_____

12 (c) The first stage in the life cycle of a star is the formation of a protostar.

12 (c) (i) Describe how a protostar is formed.

[2 marks]

_____

_____

_____

_____

12 (c) (ii) Name the stage of the life cycle that the Sun is currently in.

[1 mark]

_____

12 (d) **Table 7** shows information about the Sun and two other stars.

Table 7

Star	Temperature in °C	Mass compared to the Sun
Tau Ceti	5 000	0.8
Sun	6 000	1.0
Rigel	11 000	18

12 (d) (i) The star Rigel will become a supernova.

What is a supernova?

[1 mark]

_____

_____

12 (d) (ii) State **one** stage of the life cycle of a star that could happen to Rigel after the supernova stage.

[1 mark]

_____

_____

12 (d) (iii) Complete the sentence.

[1 mark]

Elements heavier than _____ are only formed in a supernova.

12 (d) (iv) The star Tau Ceti will **not** become a supernova.

Give the reason why.

[1 mark]

_____

_____

9

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED