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| For Examiner's Use | |
| Examiner's Initials | |
| Question | Mark |
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| 14 | |
| TOTAL | |



General Certificate of Secondary Education
Foundation Tier
June 2014

Additional Science

AS2FP

Unit 6

F

Monday 19 May 2014 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

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 14(d) 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.



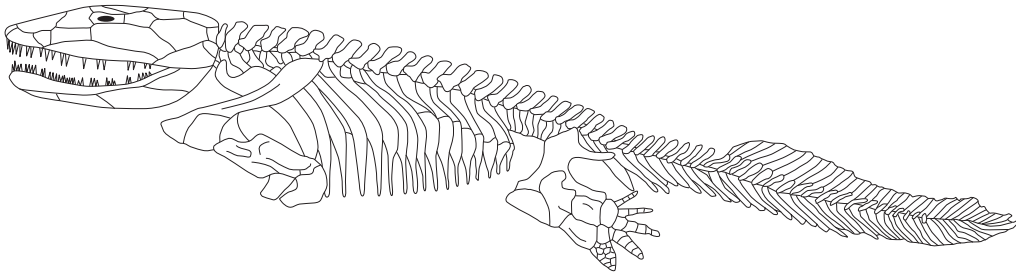
J U N 1 4 A S 2 F P O 1

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

Biology Questions

- 1 **Figure 1** shows a fossil of an animal called *Ichthyostega*.

Figure 1



- 1 (a) (i) What is a fossil?

[2 marks]

.....

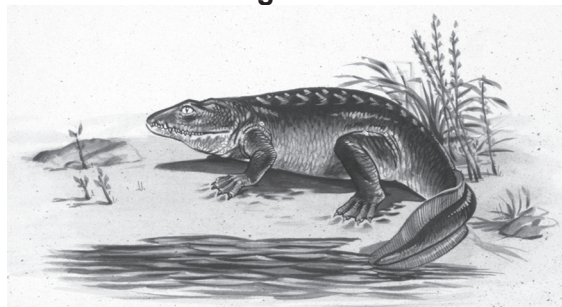
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- 1 (a) (ii) **Figure 2** shows what scientists think *Ichthyostega* looked like.

Figure 2



Scientists think that *Ichthyostega* might have had brown skin.

Why are scientists **not** sure about the skin colour of *Ichthyostega*?

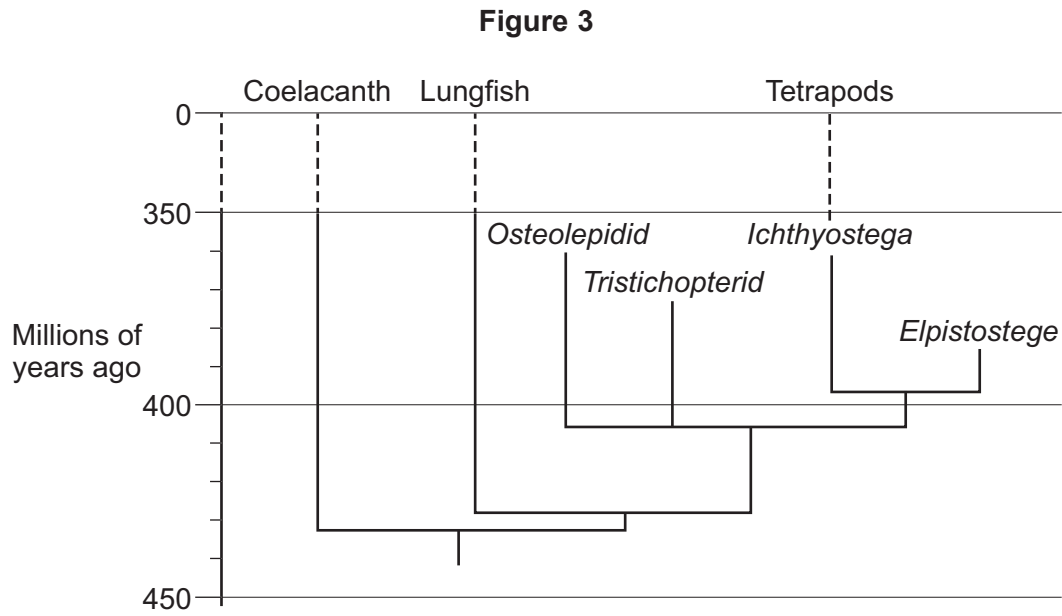
[1 mark]

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1 (b) Figure 3 shows an evolutionary tree.



1 (b) (i) Which living animals have evolved from *Ichthyostega*?

[1 mark]

.....

1 (b) (ii) How long ago did *Ichthyostega* first appear on Earth?

[1 mark]

..... millions of years.

1 (b) (iii) Which extinct animals are the closest relatives of *Ichthyostega*?

Draw a ring around the correct answer.

[1 mark]

Osteolepidid

Tristichopterid

Elpistostege

| |
|---|
| 6 |
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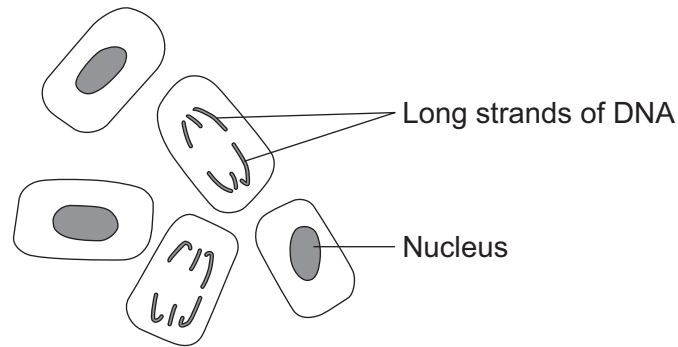
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2 A student used a microscope to look at cells from a root tip.

Figure 4 shows the student's drawing of some of the cells.

Figure 4



2 (a) The cells that have no nucleus are dividing.

2 (a) (i) Why do the cells in roots need to divide?

Give **one** reason.

[1 mark]

.....

.....

2 (a) (ii) The long strands seen in some of the cells are made of DNA.

What are the long strands of DNA called?

[1 mark]

.....

2 (a) (iii) What process is happening in the cells that are dividing?

Draw a ring around the correct answer.

[1 mark]

differentiation

inheritance

mitosis



2 (b) When plants reproduce, the offspring may show genetic variation.

2 (b) (i) What does **variation** mean?

[1 mark]

.....

.....

2 (b) (ii) Draw a ring around the correct answer to complete each sentence.

[4 marks]

Genetic variation happens during

asexual reproduction
cloning
sexual reproduction

when sex cells called

chromosomes

gametes

genes

fuse together.

The fusion of these cells is called

respiration.
fertilisation.
separation.

One of each pair of alleles in the offspring comes from each

clone.
embryo.
parent.

8

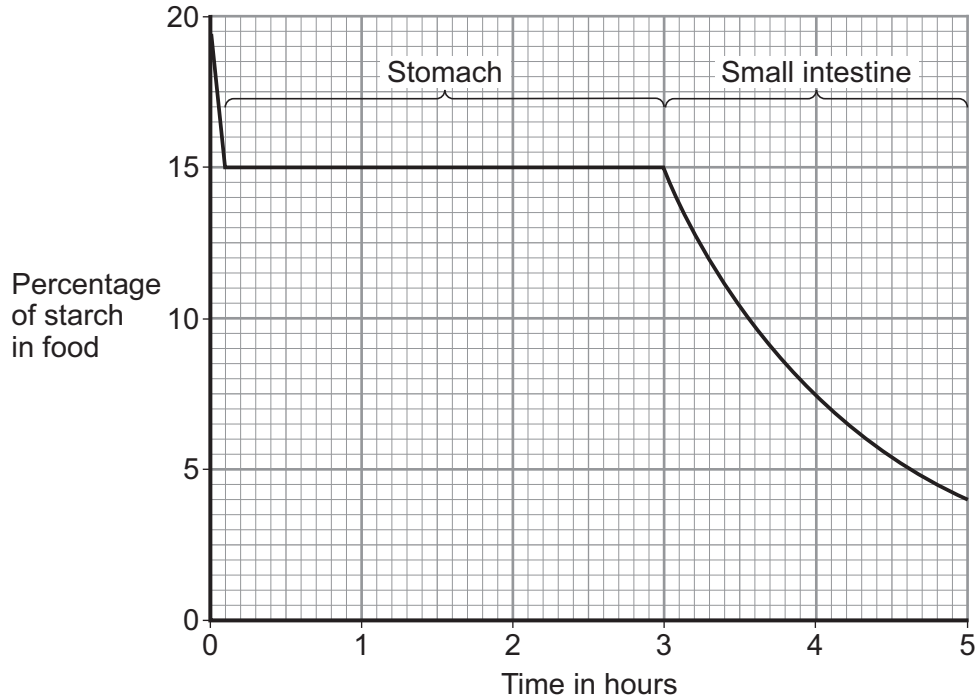
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3 Scientists measured the percentage of starch in food as it passed through part of the digestive system.

Figure 5 shows the results.

Figure 5



3 (a) (i) An enzyme that digests starch is made in the small intestine.

How does Figure 5 show this?

[1 mark]

.....

.....

3 (a) (ii) An enzyme that digests starch is also found in the mouth.

Where is the enzyme found in the mouth made?

Draw a ring around the correct answer.

[1 mark]

- liver** **pancreas** **salivary glands**

3 (a) (iii) Complete the sentence.

[1 mark]

When starch is digested, is produced.



3 (b) Some enzymes are used in industry.

3 (b) (i) Glucose is changed into fructose by enzyme **X**.

The word equation shows this reaction.



What is the name of enzyme **X**?

Draw a ring around the correct answer.

[1 mark]

isomerase

lipase

protease

3 (b) (ii) Fructose is used in slimming foods.

Table 1 shows information about 1 g of glucose and 1 g of fructose.

Table 1

| | 1 g of glucose | 1 g of fructose |
|------------------------------|-------------------|--------------------|
| Energy in kJ | 15.9 | 15.9 |
| Sweetness in arbitrary units | 74 | 173 |

Suggest why fructose, **not** glucose, is used in slimming foods.

Use information from **Table 1** to help you.

[3 marks]

.....

.....

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Chemistry Questions

4 Ammonium nitrate is made from ammonia solution and an acid.

4 (a) Draw a ring around the correct answer to complete each sentence.

[3 marks]

Ammonium nitrate is made by reacting ammonia solution with

hydrochloric acid.

nitric acid.

sulfuric acid.

Ammonia solution is

acidic.

alkaline.

neutral.

An important use for ammonium nitrate is in

bleach.

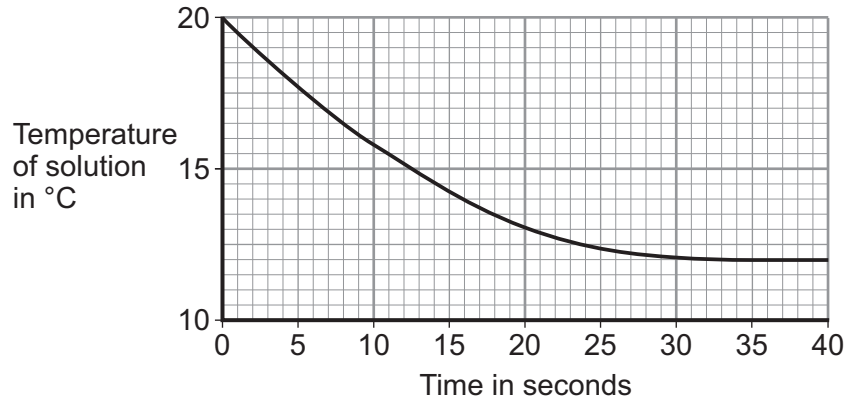
fertilisers.

soap.



- 4 (b)** A student added ammonium nitrate to water and stirred the mixture. The temperature of the solution was measured every 5 seconds. **Figure 6** shows the results.

Figure 6



- 4 (b) (i)** Describe how the temperature of the solution changed.

[2 marks]

.....

.....

.....

.....

- 4 (b) (ii)** Use information from **Figure 6** to help you answer this question.

A sports injury pack uses the reaction between ammonium nitrate and water.

The sports injury pack starts to work and is put on a person's leg.

Suggest how the area of skin under the pack will now feel.

[2 marks]

.....

.....

Give **one** reason for your answer in terms of energy change.

.....

.....

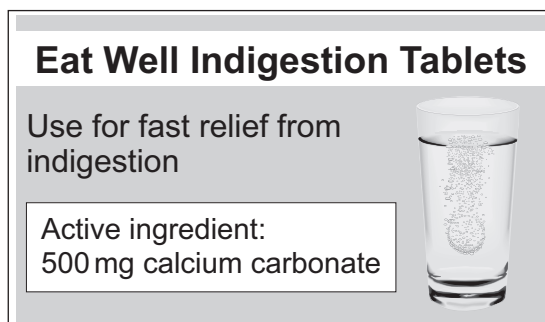
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5 Indigestion tablets are used to neutralise excess acid in the stomach.

Figure 7 shows a label from a packet of indigestion tablets.

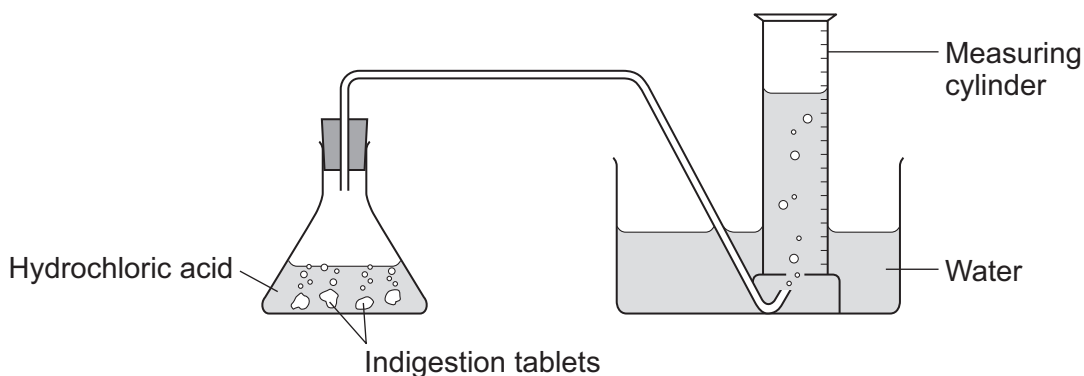
Figure 7



A student investigated the reaction of indigestion tablets with excess hydrochloric acid.

The student used the apparatus shown in Figure 8.

Figure 8



The word equation for the reaction is:

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

5 (a) Calcium chloride dissolves in water to form a solution.

Which state symbol represents a solution?

Draw a ring around the correct answer.

[1 mark]

(aq)

(l)

(s)

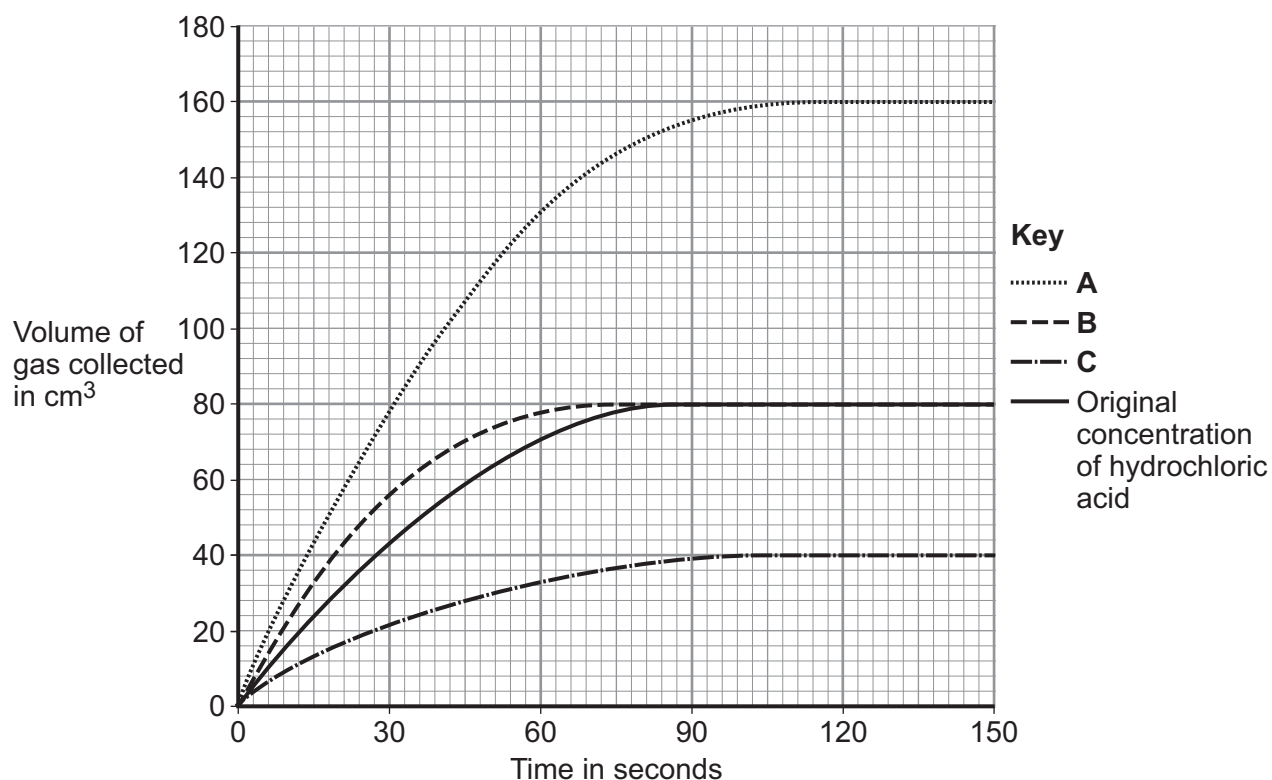


5 (b) The student measured the volume of gas produced every 30 seconds.

The student repeated the investigation using the same volume of hydrochloric acid, but with a greater concentration.

The student used the results to draw a graph, as shown in **Figure 9**.

Figure 9



Which curve, **A**, **B** or **C**, correctly shows the results the student would obtain using the same volume of hydrochloric acid, but with a greater concentration?

Write your answer in the box.

[1 mark]

5 (c) State **one** variable the student needed to keep the same in the investigation.

[1 mark]

.....

.....

Question 5 continues on the next page

Turn over ►



5 (d) The instructions on the packet of indigestion tablets state, 'for faster relief chew the tablets'.

Suggest why.

Tick (✓) **two** boxes which would correctly complete the sentence.

[2 marks]

| The tablets are chewed for faster relief because the tablets will ... | Tick (✓) |
|--|-----------------|
| be in smaller pieces. | |
| have a larger surface area. | |
| have more energy. | |
| last longer. | |

5



6 In industry, sulfuric acid is made using the Contact Process.
One step in the process produces the gas sulfur trioxide.
Two gases, sulfur dioxide and oxygen, are reacted together to make sulfur trioxide.
The word equation for this reaction is:



6 (a) What will happen to the rate of the reaction if the pressure of the gases is increased? **[1 mark]**

.....

6 (b) Catalysts are used in industrial processes.
Tick (✓) **two** boxes which would correctly complete the sentence. **[2 marks]**

| Catalysts are used in industrial processes to ... | Tick (✓) |
|--|-----------------|
| increase the rate of reaction. | |
| make more reactants. | |
| make the product look better. | |
| reduce costs. | |

6 (c) Either platinum or vanadium oxide can be used as the catalyst in the Contact Process. Platinum is 'poisoned' by impurities in the gases and stops working as a catalyst after two years.

Vanadium oxide does not produce sulfur trioxide as quickly.
The vanadium oxide catalyst is replaced every five years.

Suggest **one** advantage and **one** disadvantage of using platinum as a catalyst compared with vanadium oxide.

[2 marks]

Advantage

.....

Disadvantage

.....

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7 Many trophies are silver plated.

Figure 10 shows a silver-plated trophy.

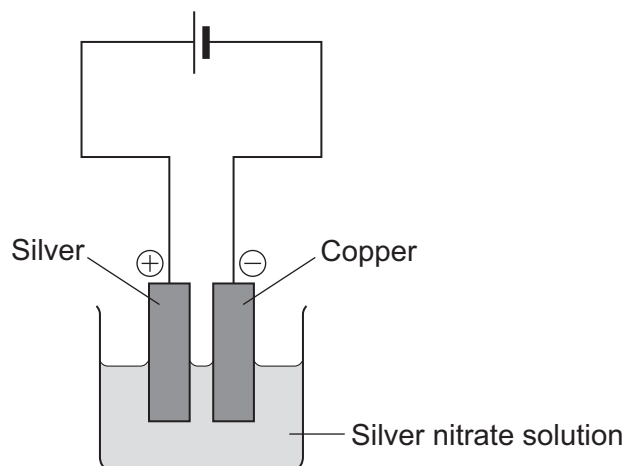
Figure 10



The trophies are made of copper and then silver plated by electrolysis.

A student used the apparatus shown in **Figure 11** to investigate silver plating onto copper by electrolysis.

Figure 11



7 (a) (i) Draw a ring around the correct answer to complete the sentence.

[1 mark]

Silver nitrate is used in solution so that the silver ions are

free to move.

at the correct temperature.

solid particles.

7 (a) (ii) Why do silver ions move to the negative electrode?

[1 mark]

.....

.....

7 (a) (iii) Draw a ring around the correct answer to complete the sentence.

[1 mark]

At the negative electrode the silver ions

gain

lose

share

electrons.

7 (b) The student recorded the mass of the electrodes at the start and at the end of the investigation.

Table 2 shows some of the results.

Complete Table 2.

[1 mark]

Table 2

| | At start | At end |
|-------------------------------------|----------|--------|
| Mass of positive (+) electrode in g | 26 | 24 |
| Mass of negative (-) electrode in g | 50 | |

4

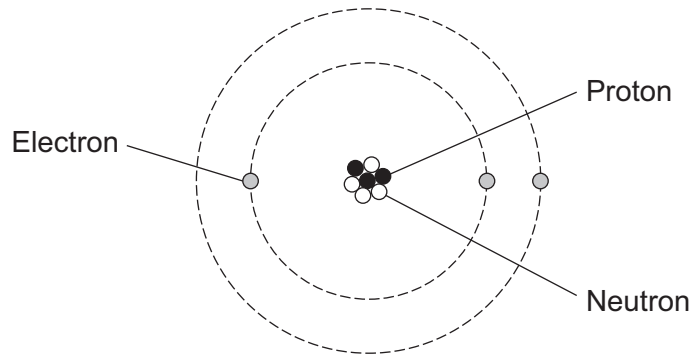
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Physics Questions

8 **Figure 12** shows the structure of a lithium atom.

Figure 12



8 (a) (i) **Table 3** gives information about the particles in an atom.

Complete **Table 3** by adding the names of the particles.

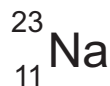
Use information from **Figure 12**.

[2 marks]

Table 3

| Particle | Relative charge | Relative mass |
|----------|-----------------|---------------|
| | +1 | 1 |
| | -1 | Very small |
| | 0 | 1 |

8 (a) (ii) An atom of sodium has a mass number of 23 and an atomic number of 11.



How many protons are in an atom of sodium?

How many electrons are in an atom of sodium?

[2 marks]

8 (b) Complete the sentence.

[1 mark]

An ion is an atom which has lost or gained

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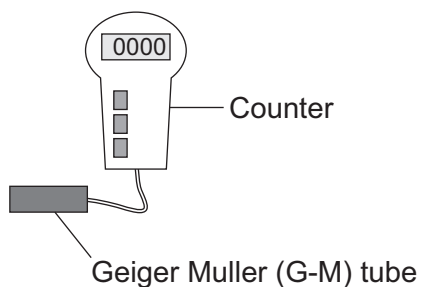
**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Turn over ►



- 9 **Figure 13** shows the apparatus a teacher used to demonstrate nuclear radiation to her class.

Figure 13

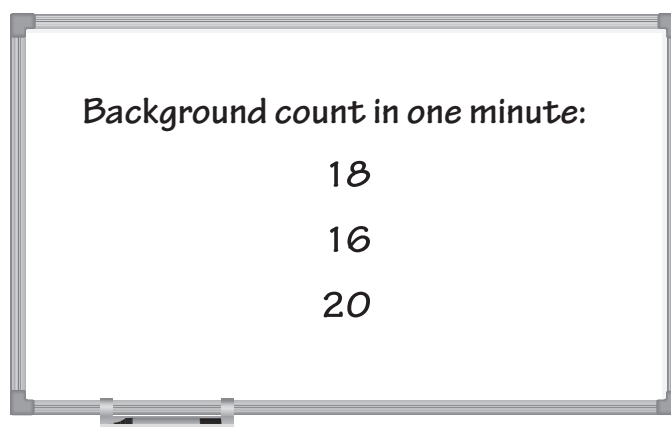


- 9 (a) (i) The teacher started by measuring the background radiation.

She used the G-M tube to measure the number of counts in one minute.

She did this three times and wrote her results on the board, as shown in **Figure 14**.

Figure 14



The three results were different.

What is the most likely reason for this?

Tick (✓) **one** box.

[1 mark]

Radioactive decay is a random process.

The temperature in the room changed.

The teacher forgot to reset the counter.



9 (a) (ii) Calculate the mean value of the three results shown in **Figure 14**.

[1 mark]

.....

.....

Mean value =

9 (b) The teacher used plutonium-239 as the source of the nuclear radiation.

9 (b) (i) The teacher should use the source safely.

Which are the **two** most important laboratory safety precautions when using the source of nuclear radiation?

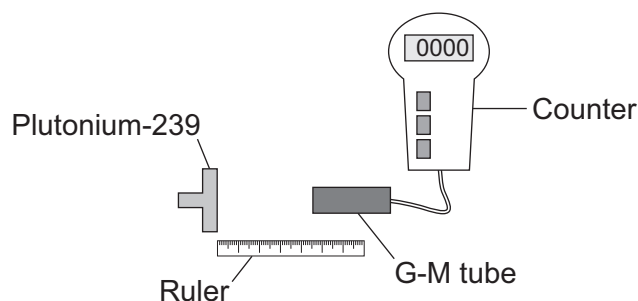
Tick (✓) **two** boxes.

[2 marks]

| Laboratory safety precaution | Tick (✓) |
|--|----------|
| Wear safety goggles | |
| Use tongs to pick up the source | |
| Tie back long hair | |
| Replace the source in a lead-lined box after use | |

9 (b) (ii) **Figure 15** shows the apparatus the teacher used to show the range of the nuclear radiation in air.

Figure 15



The G-M tube was placed at different distances from the source. The number of counts in one minute was measured each time.

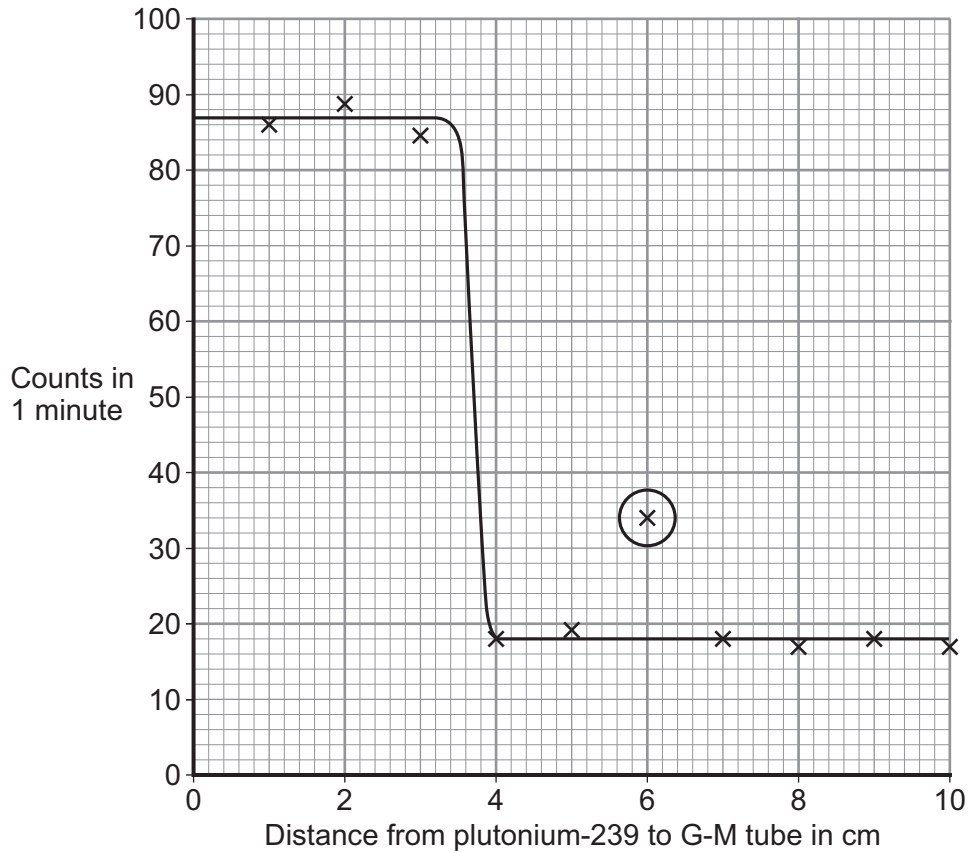
Question 9 continues on the next page

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Figure 16 shows the results.

Figure 16



On **Figure 16** the circled result is anomalous.

What is the most likely reason for the anomalous result?

Tick (✓) **one** box.

[1 mark]

Radioactive decay is a random process.

The teacher did not reset the counter to zero.

The G-M tube moved as the counts were measured.

9 (b) (iii) What is the maximum range in air of the nuclear radiation?

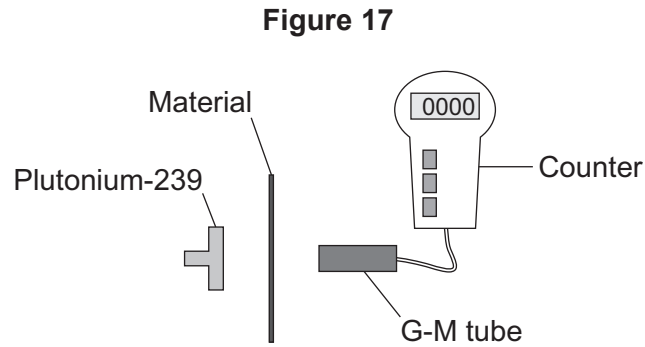
Use information from **Figure 16**.

[1 mark]

Maximum range in air = cm



- 9 (c) **Figure 17** shows the apparatus the teacher used to show the penetration of the nuclear radiation through different materials.



Different materials were placed between the G-M tube and the source. The number of counts in one minute was measured each time.

The teacher wrote the results on the board, as shown in **Figure 18**.

Figure 18

| | |
|------------------------------|----|
| <i>Counts in one minute:</i> | |
| No material - | 86 |
| Paper - | 18 |
| Aluminium - | 16 |

What type of nuclear radiation is emitted by plutonium-239?

Draw a ring around the correct answer.

alpha

beta

gamma

Give **one** reason for your answer.

[2 marks]

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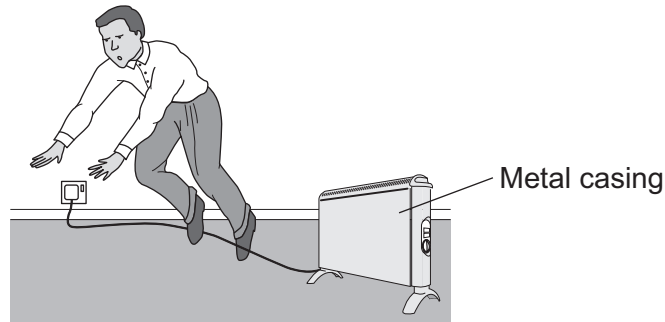
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10 (a) Some household appliances must have an earth wire.

Figure 19 shows a man tripping over the electrical cable connected to a heater. The live wire inside the heater becomes loose and touches the metal casing of the heater.

Figure 19



A larger current now flows in the live wire and exceeds the rating of the fuse in the plug.

10 (a) (i) What happens to the fuse wire inside the fuse?

[1 mark]

.....

10 (a) (ii) What happens to the circuit?

[1 mark]

.....

10 (a) (iii) The man now touches the heater.

Why does he **not** get an electric shock?

[1 mark]

.....

.....



10 (b) (i) Figure 20 shows some pictures of common household appliances and the materials their casings are made from.

Which **two** appliances must have an earth wire?

Tick (✓) **two** boxes under the correct pictures.

[2 marks]

Figure 20



Plastic kettle



Wooden lamp



Aluminium toaster



Steel washing machine

10 (b) (ii) Choose the correct answer from the box to complete the sentence.

[1 mark]

| | | |
|-------|------|---------|
| earth | live | neutral |
|-------|------|---------|

Some appliances are double insulated and therefore have **no** wire.

10 (c) Some circuits are protected with Residual Current Circuit Breakers (RCCBs).

State **one** advantage of using an RCCB instead of a fuse.

[1 mark]

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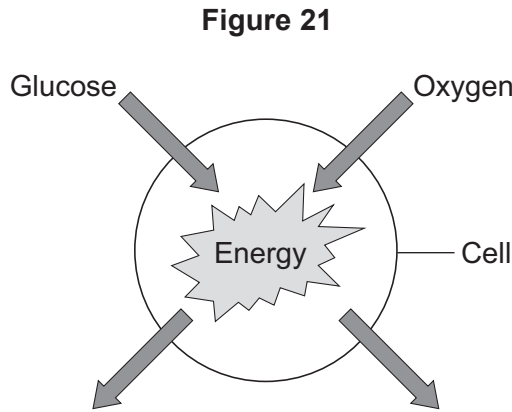
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Biology Questions

11 Respiration releases energy.

11 (a) **Figure 21** shows what happens during aerobic respiration in a cell.



Write the names of the two products of respiration in the spaces on **Figure 21**.

[2 marks]

11 (b) Cardiac output is the volume of blood that can be pumped out of the heart each minute.

$$\text{Cardiac output} = \text{stroke volume} \times \text{heart rate}$$

- Stroke volume is the volume of blood pumped by the heart each beat.
- Heart rate is the number of heart beats per minute.

Free-divers stay under water for as long as they can with no air supply. They cannot breathe until they get back to the surface.

Table 4 shows information about one free-diver at rest and during a free-dive.

Table 4

| | Stroke volume in cm ³ | Heart rate in beats per minute | Cardiac output in cm ³ per minute |
|--------------------|-------------------------------------|-----------------------------------|---|
| At rest | 70 | 65 | 4550 |
| During a free-dive | 160 | 15 | |

11 (b) (i) Calculate the free-diver's cardiac output during the free-dive.

[1 mark]

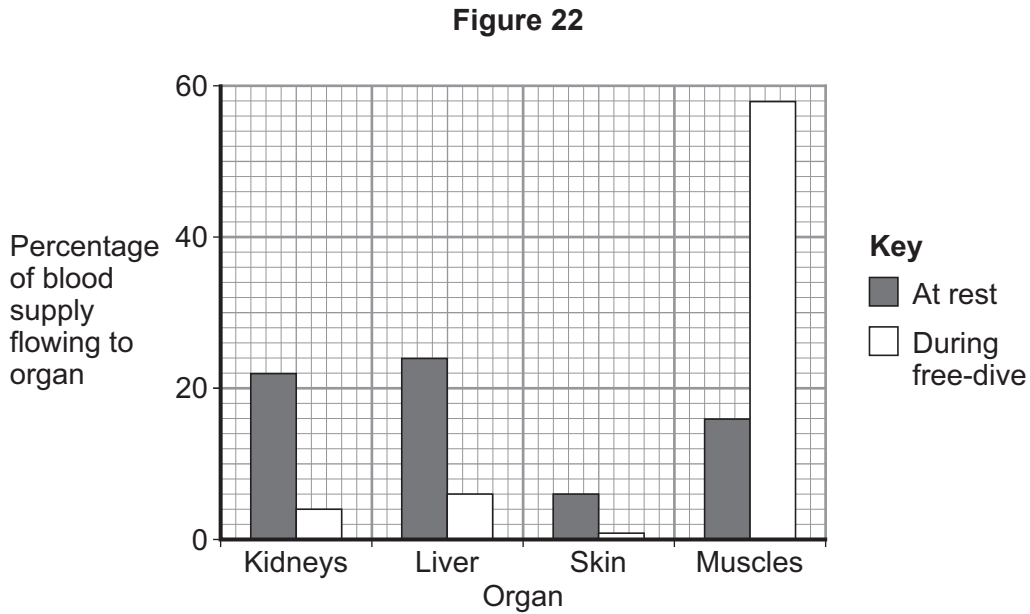
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Cardiac output = cm³ per minute



11 (b) (ii) Figure 22 shows the percentages of blood flowing to some of the free-diver's organs at rest and during a free-dive.



The volume of blood flowing to the free-diver's muscles at rest was 728 cm³ per minute.

Calculate the volume of blood flowing to the free-diver's muscles per minute during a free-dive.

Use the formula:

$$\text{volume of blood flowing to organ per minute} = \text{cardiac output} \times \frac{\% \text{ of blood flowing to organ}}{100}$$

Use your answer to part 11(b)(i) in your calculation.

[2 marks]

.....

.....

.....

.....

Volume of blood = cm³ per minute

Question 11 continues on the next page

Turn over ▶



11 (b) (iii) Free-divers may have a lung volume of more than twice the normal lung volume.

A free-diver has set a world record of 23 minutes under water.

Training makes free-divers tolerant of high lactic acid concentrations.

The equation for anaerobic respiration is:

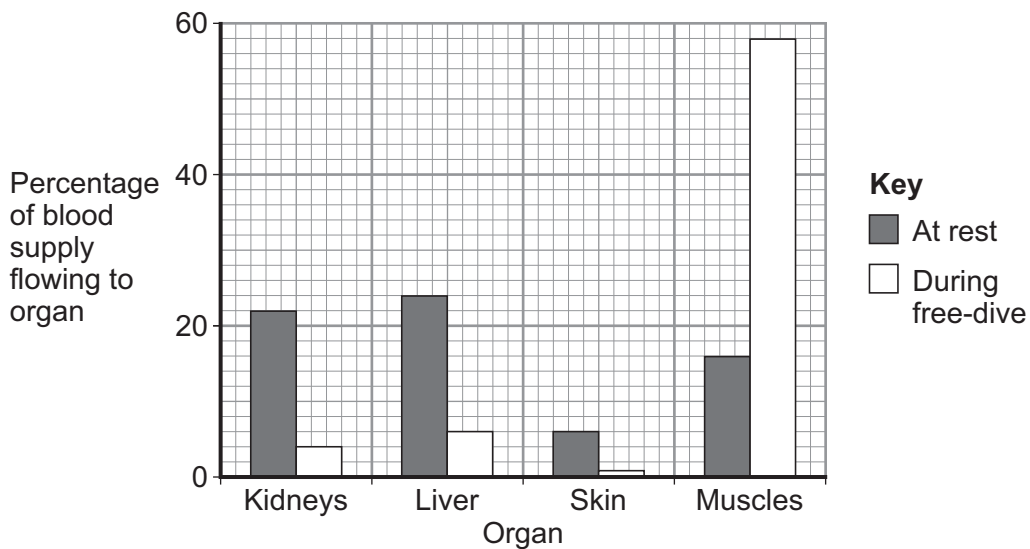


How can free-divers stay under water for such a long time without breathing?

In your answer you should refer to respiration and blood flow to the free-diver's organs.

[4 marks]

Figure 22 is repeated below to help you.



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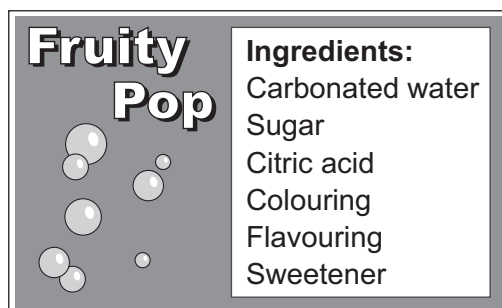
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Chemistry Questions

12 **Figure 23** is a label showing the ingredients in a fizzy fruit drink.

Figure 23



12 (a) Carbonated water is made by dissolving carbon dioxide in water.

Aqueous carbonic acid is produced. This is a reversible reaction.

Write the word equation for the reaction.

[1 mark]

..... + \rightleftharpoons

12 (b) (i) The pH of Fruity Pop is 4.1.

Name the **two** ingredients which give Fruity Pop a pH of 4.1.

[2 marks]

.....

12 (b) (ii) Which ion will cause Fruity Pop to have a pH of 4.1?

[1 mark]

.....



13 A student makes copper sulfate crystals by reacting copper oxide with an acid.

13 (a) (i) What type of substance is copper oxide?
Draw a ring around the correct answer to complete the sentence.

[1 mark]

Copper oxide is an insoluble

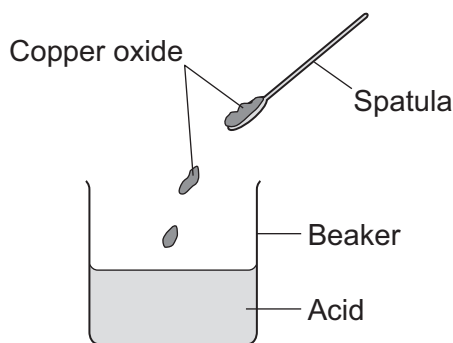
| |
|---------|
| alkali. |
| base. |
| salt. |

13 (a) (ii) Name the acid used to make copper sulfate.

[1 mark]

13 (b) A student puts the acid into a beaker.
The student adds copper oxide to the acid, as shown in **Figure 24**, until a black solid remains in a blue solution.

Figure 24



13 (b) (i) Why does the black solid remain in the solution?

[1 mark]

.....
.....

13 (b) (ii) Describe how the student can produce copper sulfate crystals from the mixture of black solid and blue solution.

[2 marks]

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Physics Questions

14 Nuclear fusion and nuclear fission are both processes that release energy.

14 (a) Energy is released in stars by the process of nuclear fusion.

What is nuclear fusion?

[1 mark]

.....

.....

14 (b) Stars go through a life cycle.

Elements lighter than iron are formed by fusion processes during the main sequence part of the life cycle.

Name the part of the life cycle during which elements heavier than iron are formed.

[1 mark]

.....

14 (c) The life cycle depends on the size of the star.

Table 5 gives information about three stars, **J**, **K** and **L**.

Table 5

| Star | Relative mass of the star compared to the Sun | Estimated time to complete the life cycle of the star in millions of years |
|----------|---|--|
| J | 0.1 | 100 000 000 |
| K | 1.0 | 13 000 |
| L | 10.0 | 100 |

14 (c) (i) What conclusion can be made from the data shown in **Table 5**?

[1 mark]

.....

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14 (c) (ii) Why is the time to complete the life cycle of a star only an estimate?

[1 mark]

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Question 14 continues on the next page

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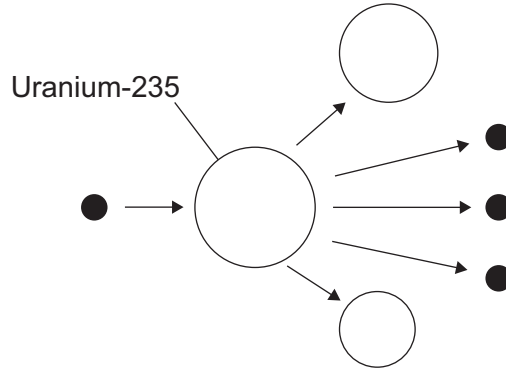


14 (d) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Uranium-235 is a fissionable substance used in nuclear reactors to release energy.

Figure 25 shows a simplified nuclear fission reaction.

Figure 25



- Describe the process of nuclear fission.
- How is the energy released in nuclear fission used in a nuclear power station to generate electricity?

[6 marks]

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END OF QUESTIONS



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