

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	
10	
11	
12	
TOTAL	



General Certificate of Secondary Education  
Foundation Tier  
June 2015

## Additional Science

AS2FP

### Unit 6

F

Wednesday 20 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

**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 11(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.



J U N 1 5 A S 2 F P O 1

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

**Biology Questions**

**1** Living things **inherit** some characteristics.

**1 (a)** What does **inherit** mean?

**[2 marks]**

.....

.....

.....

.....

**1 (b)** Cystic fibrosis is an inherited disorder.

Give **one** effect of cystic fibrosis on the body.

**[1 mark]**

Tick (✓) **one** box.

Having extra fingers or toes

Damaged cell membranes

The body is paralysed

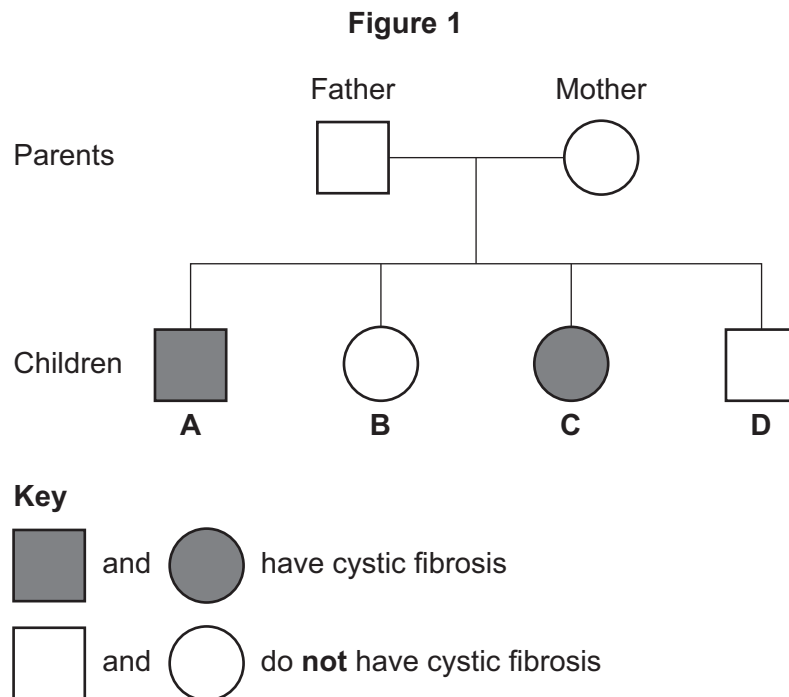


**1 (c)** **Figure 1** is a genetic diagram showing the inheritance of cystic fibrosis in a family.

The parents do **not** have cystic fibrosis.

Children **A** and **C** have cystic fibrosis.

Children **B** and **D** do **not** have cystic fibrosis.



**1 (c) (i)** Which **two** of these statements are correct?

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

**[2 marks]**

Tick (✓) **two** boxes.

Cystic fibrosis is caused by a recessive allele.

Only females can have cystic fibrosis.

Each parent had one cystic fibrosis allele.

The next child in the family will definitely have cystic fibrosis.

**Question 1 continues on the next page**

**Turn over ►**



1 (c) (ii) Scientists can test an embryo to find out if the embryo has cystic fibrosis.

What method would scientists use to test if an embryo has cystic fibrosis?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Embryo division	
Embryo predicting	
Embryo screening	

1 (c) (iii) Some people disagree with embryo testing.

Suggest **one** reason why.

[1 mark]

.....

.....

7
---



2 (a) **Figure 2** shows fossilised dinosaur footprints in rock.

**Figure 2**



2 (a) (i) How could the fossils in **Figure 2** have been formed?

[1 mark]

Tick (✓) **one** box.

The dinosaur was very heavy and made marks in the rock.

The dinosaur walked in mud and the mud turned into rock.

Wet footprints from the dinosaur dried and left marks on the rock.

2 (a) (ii) Fossil footprints are **not** found often.

Give **one** reason why very few are found.

[1 mark]

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.....

**Question 2 continues on the next page**

**Turn over ►**



2 (b) Dinosaurs are extinct.

Give **two** possible causes of extinction.

[2 marks]

1 .....

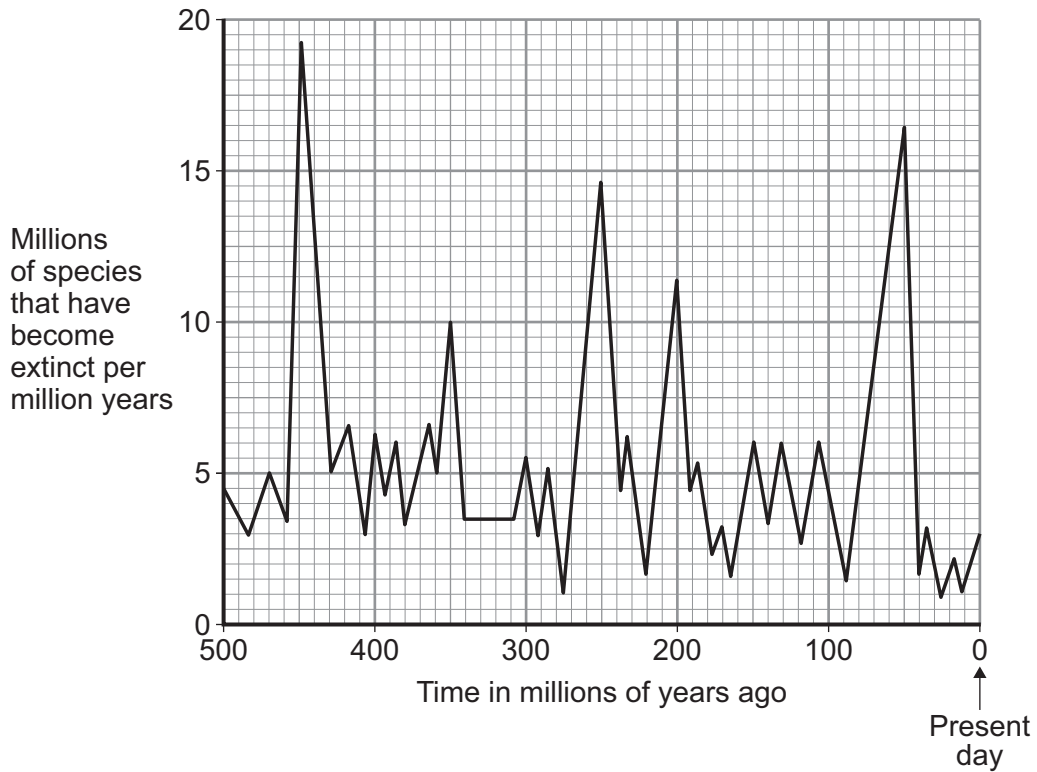
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2 .....

.....

2 (c) **Figure 3** shows the numbers of species that have become extinct over the last 500 million years.

**Figure 3**



2 (c) (i) Scientists describe a mass extinction as ‘more than 7.5 million species becoming extinct in a million years’.

How many mass extinctions have there been in the past 500 million years?

[1 mark]

Number of mass extinctions = .....



**2 (c) (ii)** The last mass extinction happened 50 million years ago.

A student looked at **Figure 3** and stated:

'Mass extinctions happen every 100 million years.'

If the student is correct, when will the next mass extinction happen?

**[1 mark]**

.....  
.....

**2 (c) (iii)** The student's prediction may **not** be accurate.

Suggest **one** reason why.

**[1 mark]**

.....  
.....

7

**Turn over for the next question**

**Turn over ►**



**3** This question is about respiration and exercise.

**3 (a) (i)** When do plants respire?

[1 mark]

Tick (✓) **one** box.

All of the time

Only at night

Only in the daytime

**3 (a) (ii)** When do animals respire?

[1 mark]

Tick (✓) **one** box.

All of the time

Only at night

Only in the daytime

**3 (b)** Where in a cell do most of the reactions of respiration happen?

Draw a ring around the correct answer.

[1 mark]

**cell membrane**

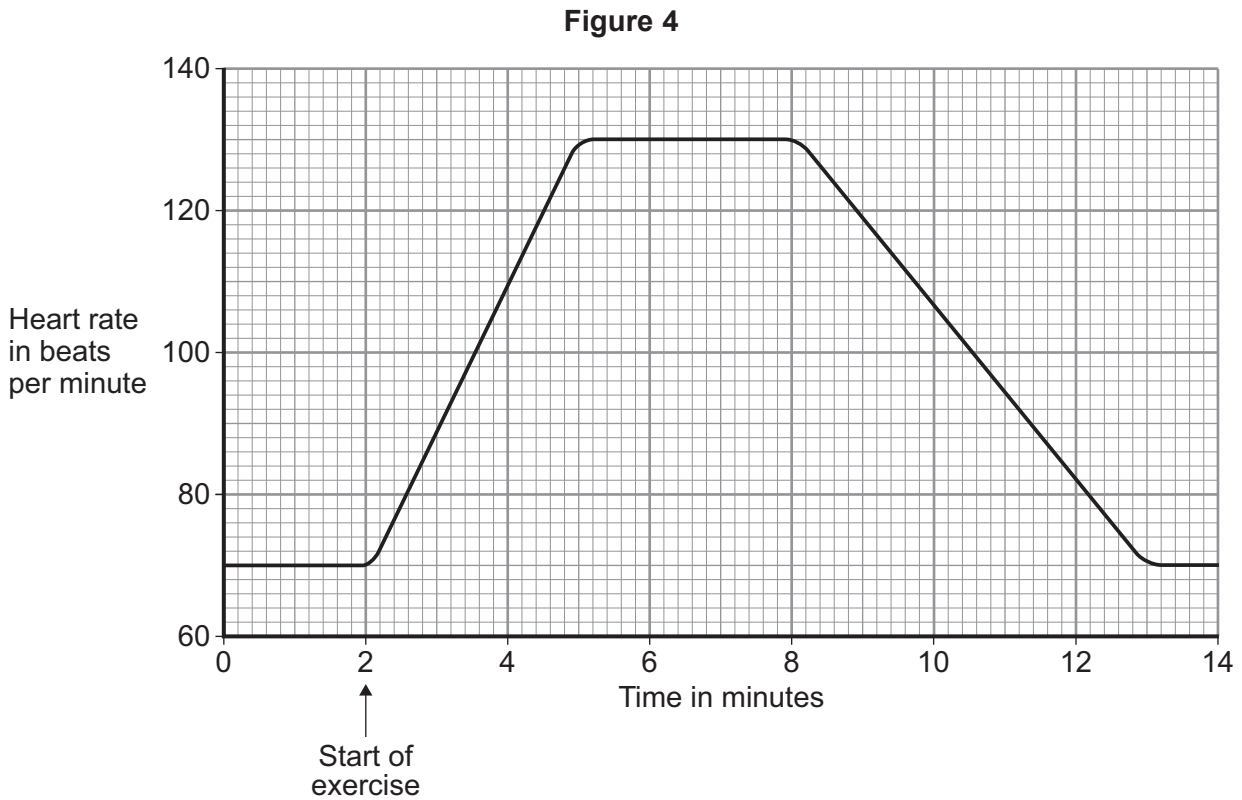
**mitochondria**

**nucleus**





3 (c) Figure 4 shows the heart rate of a student before, during and after exercise.



3 (c) (i) The student started to exercise after 2 minutes.

How long did the student exercise for?

[1 mark]

Draw a ring around the correct answer.

**3 minutes**

**6 minutes**

**11 minutes**

3 (c) (ii) Aerobic respiration uses oxygen.

To take in extra oxygen during the exercise, the student's breathing changed.

Give **two** ways breathing changes during exercise.

[2 marks]

1 .....

.....

2 .....

.....

Question 3 continues on the next page

Turn over ►



**3 (c) (iii)** When a person is exercising hard, oxygen **cannot** reach the muscles fast enough.

This means aerobic respiration **cannot** provide all the energy needed.

Complete the sentence.

**[1 mark]**

During hard exercise, extra energy is released by using .....  
respiration.

7



**Turn over for the next question**

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

**Turn over ►**



**Chemistry Questions**

4 Sodium hydroxide is used in the production of soap.

4 (a) Sodium hydroxide is produced from sodium chloride solution.

What is the name of the process used to produce sodium hydroxide?

[1 mark]

Draw a ring around the correct answer.

**distillation**

**electrolysis**

**neutralisation**

4 (b) (i) When sodium hydroxide dissolves in water an alkaline solution is formed.

Which ion causes the solution to be alkaline?

[1 mark]

Draw a ring around the correct answer.

**Cl<sup>-</sup>**

**Na<sup>+</sup>**

**OH<sup>-</sup>**

4 (b) (ii) What is the pH value of sodium hydroxide solution?

[1 mark]

Draw a ring around the correct answer.

**1**

**7**

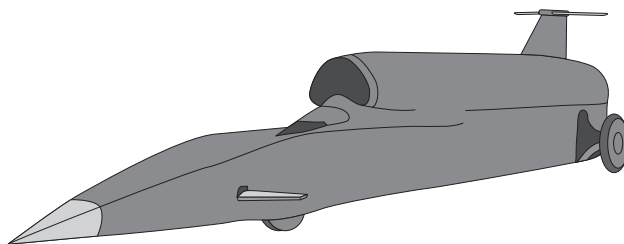
**13**

<b>3</b>



5 (a) Figure 5 shows a rocket-powered car.

Figure 5



5 (a) (i) The car uses hydrogen peroxide to power the rocket.  
Hydrogen peroxide decomposes to produce water and oxygen.  
Complete the word equation for the reaction.

[1 mark]

hydrogen peroxide  $\longrightarrow$  .....

5 (a) (ii) Hydrogen peroxide is passed over a silver catalyst.

Why?

[1 mark]

Tick (✓) **one** box.

To boil the hydrogen peroxide

To increase the concentration of hydrogen peroxide

To increase the rate of reaction

Question 5 continues on the next page

Turn over ►

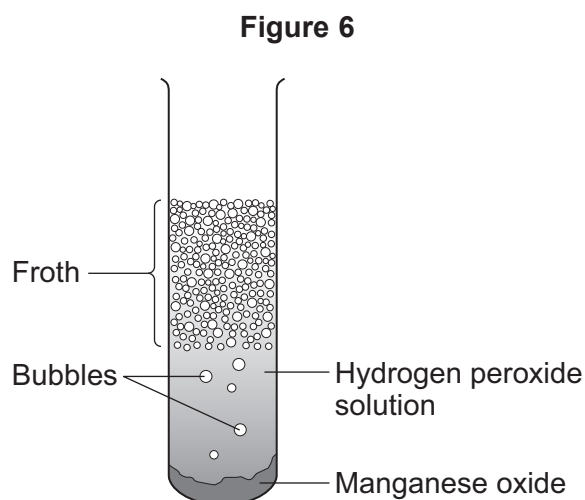


- 5 (b)** A student investigated the rate of decomposition of hydrogen peroxide using manganese oxide as a catalyst.

The student began by using Method A.

**Figure 6** shows the apparatus the student used for Method A.

The student measured the height of the froth after 10 seconds.



- 5 (b) (i)** Name the gas in the froth.

[1 mark]

.....

- 5 (b) (ii)** The reaction is exothermic.

What happens to the temperature of the reaction mixture?

[1 mark]

.....

.....

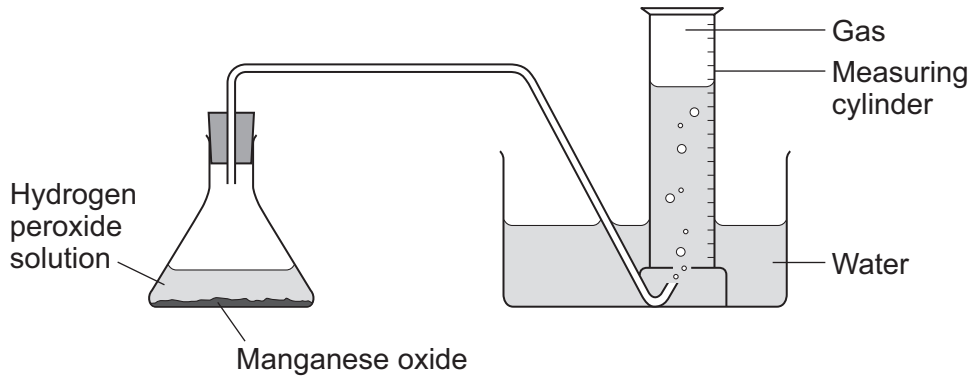


5 (c) The student then used Method **B**.

**Figure 7** shows the apparatus the student used for Method **B**.

The student measured the volume of gas produced every 10 seconds.

**Figure 7**



Method **B** was an improvement on Method **A**.

Suggest **two** reasons why.

**[2 marks]**

- 1 .....
- .....
- 2 .....
- .....

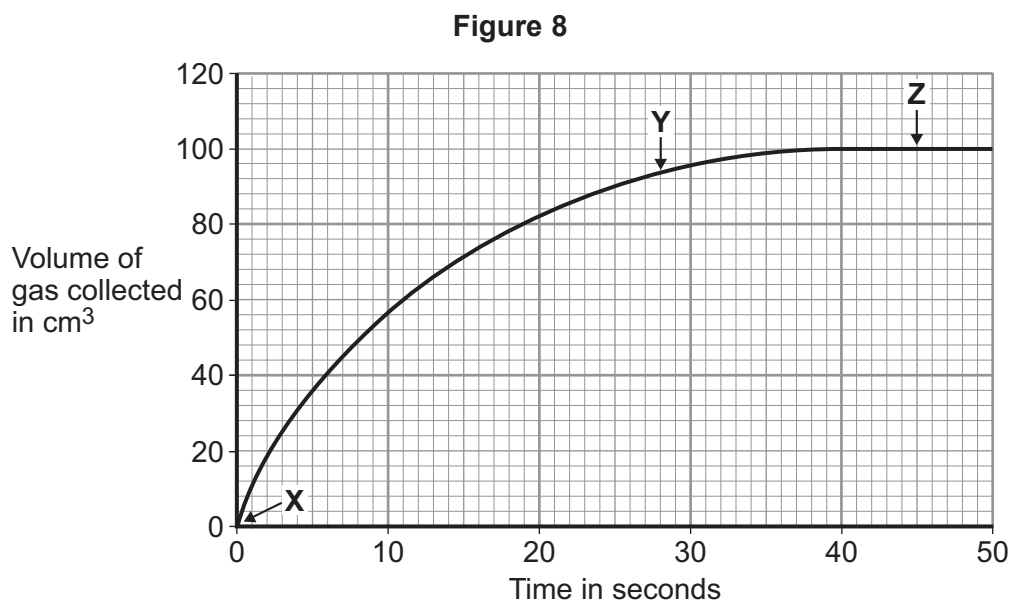
**Question 5 continues on the next page**

**Turn over ▶**



5 (d) The student used the results from Method **B** to draw a graph.

The graph is shown in **Figure 8**.



5 (d) (i) X, Y and Z show different stages in the reaction.

Draw **one** line from each stage to the description of what is happening, at that stage, on the graph shown in **Figure 8**.

[3 marks]

Stage	Description
X	The catalyst is used up
Y	The rate of reaction is decreasing
Z	The rate of reaction is fastest
	The reaction has finished

5 (d) (ii) What is the total volume of gas produced during the reaction?

[1 mark]

Total volume = ..... cm<sup>3</sup>

10





**Turn over for the next question**

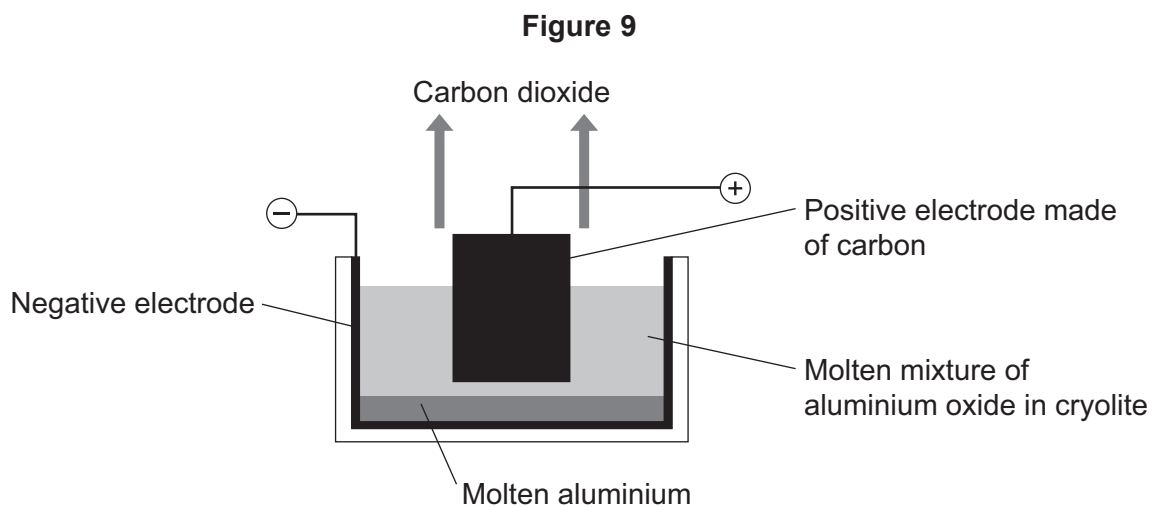
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ANSWER IN THE SPACES PROVIDED**

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6 Aluminium metal is extracted from aluminium oxide using electrolysis.

Figure 9 is a diagram of the process.



6 (a) Aluminium oxide melts at 2072 °C. Electrolysis uses a molten mixture of aluminium oxide dissolved in cryolite. Electrolysis takes place at about 1000 °C.

Explain why aluminium oxide is dissolved in cryolite.

[2 marks]

.....

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.....



**6 (b)** Extracting aluminium from aluminium oxide uses a lot of energy.

Give **two** ways energy is used in this process.

**[2 marks]**

1 .....

.....

2 .....

.....

**6 (c) (i)** Aluminium oxide is composed of aluminium ( $\text{Al}^{3+}$ ) ions and oxide ( $\text{O}^{2-}$ ) ions.

Explain why aluminium ions move to the negative electrode.

**[2 marks]**

.....

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**6 (c) (ii)** Oxygen is formed at the positive electrode.

Carbon dioxide is then produced.

Use **Figure 9** to help you explain why carbon dioxide is produced at the positive electrode.

**[2 marks]**

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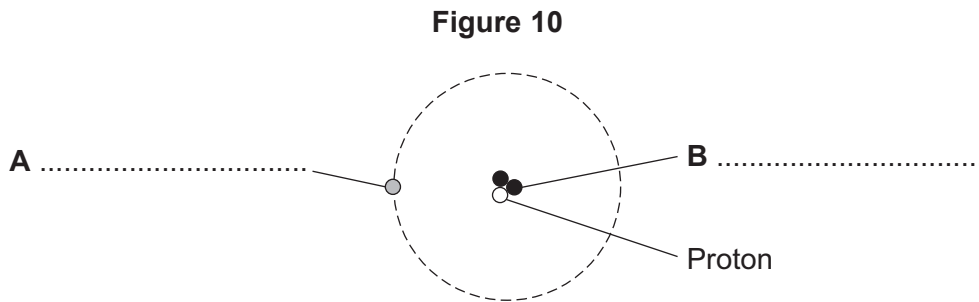
8
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Turn over ►



### Physics Questions

7 **Figure 10** shows an atom of hydrogen.



7 (a) (i) Use words from the box below to label the parts of the atom **A** and **B** on **Figure 10**. [2 marks]

Electron	Ion	Neutron
----------	-----	---------

7 (a) (ii) Complete the following sentence. [1 mark]

Different isotopes of hydrogen have different numbers of .....  
in the nucleus.

7 (b) The relative charge of a nucleus of hydrogen is +1.

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

[1 mark]

electron	neutron	proton
----------	---------	--------

The particle giving the nucleus a positive charge is the .....

4
---



**8** The Sun is a main sequence star.

**8 (a) (i)** Eventually the Sun will run out of fuel and nuclear fusion will stop.

How long is this expected to take?

**[1 mark]**

Tick (✓) **one** box.

Less than one hundred years

Between one hundred and one thousand years

More than one million years

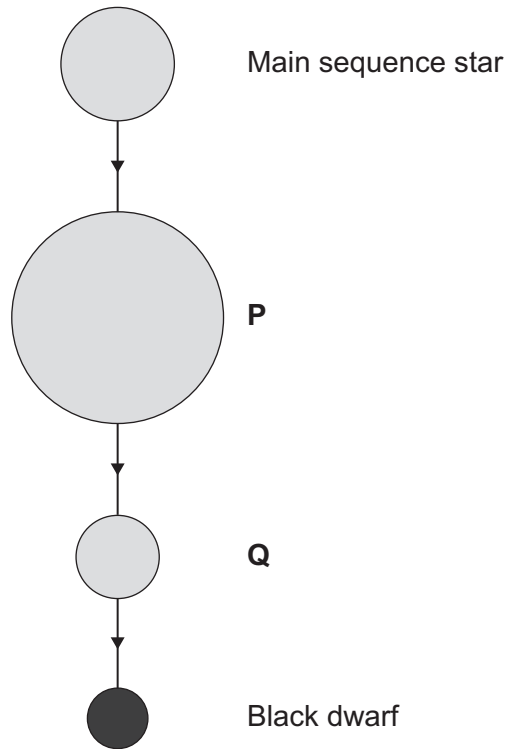
**Question 8 continues on the next page**

**Turn over ►**



8 (a) (ii) Figure 11 shows the life cycle of the Sun from being a main sequence star to becoming a black dwarf.

Figure 11



What are the names given to the stages of the life cycle labelled **P** and **Q** on Figure 11?

Use the correct answers from the box.

[2 marks]

neutron star	red giant	supernova	white dwarf
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**P** .....

**Q** .....



8 (b) Read the following section taken from a textbook.

The fusion processes in a star produce new elements. Elements heavier than iron are only formed in a supernova. Elements heavier than iron are found in the Earth.

What conclusion can you make from this information about how the Earth was formed? **[1 mark]**

.....  
.....

8 (c) Deuterium and tritium are isotopes of hydrogen and can be obtained from water.

Scientists are trying to fuse deuterium and tritium in laboratories.

Some people are worried that a fusion experiment could cause a massive explosion.

Suggest **two** reasons why scientists are continuing to do these experiments. **[2 marks]**

1 .....

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2 .....

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6

**Turn over for the next question**

**Turn over ►**

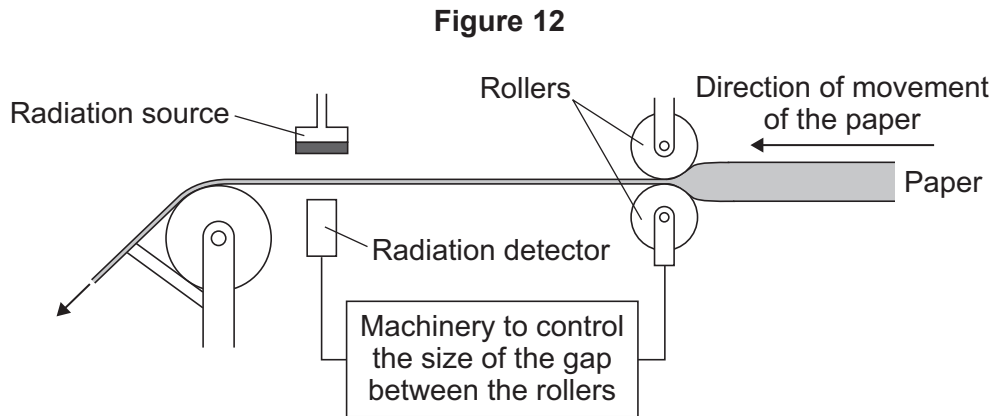


9 **Figure 12** shows a system used in factories making paper.

The system is used to control the thickness of the paper and includes a source of beta radiation and a detector.

The detector measures the amount of beta radiation each second.

Machinery uses information from the detector to adjust the size of the gap between the rollers.



**Table 1** shows how the paper thickness affects the amount of beta radiation detected each second.

**Table 1**

Paper thickness in mm	Beta radiation detected in counts per second
0.08	2400
0.09	2200
0.10	2000
0.11	1800

9 (a) Using information from **Table 1**, state what happens to the amount of beta radiation detected each second as the paper thickness increases.

[1 mark]

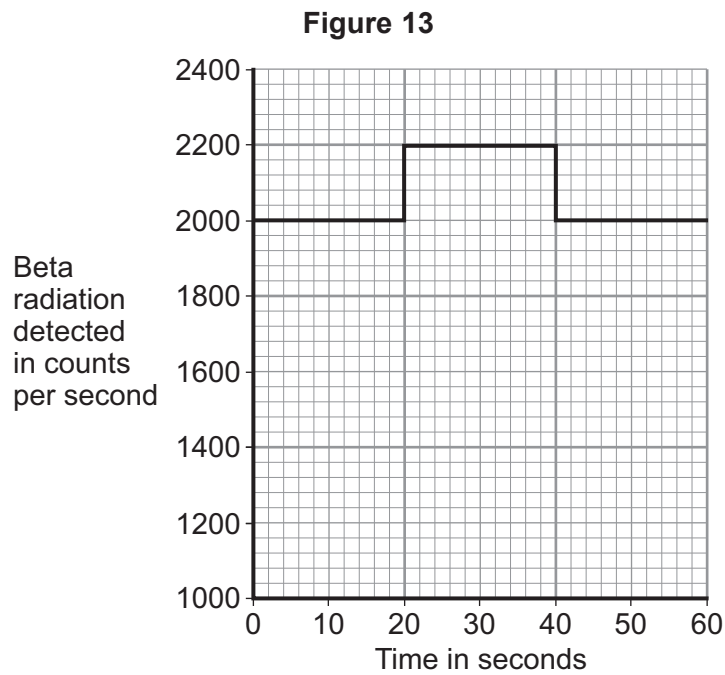
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9 (b) Figure 13 shows data from the detector obtained during sixty seconds.



9 (b) (i) Describe how the amount of beta radiation detected each second varies during sixty seconds. [3 marks]

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9 (b) (ii) What conclusion can be made about the thickness of the paper **between** 20 and 40 seconds? [1 mark]

Tick (✓) **one** box.

- The thickness of the paper decreased.
- The thickness of the paper increased.
- The thickness of the paper stayed the same.

**Question 9 continues on the next page**

**Turn over ►**



**9 (c)** Why does the beta radiation source used in this system need to have a long half-life? **[1 mark]**

Tick (✓) **one** box.

So that a large amount of radiation is emitted per second.

So that the mean count from the source is constant.

So that very thin paper can be produced.

**9 (d)** Explain why working **near** the radioactive source in the system may be a health risk. **[2 marks]**

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.....

**9 (e)** Some of the radiation detected is called background radiation.  
Which **two** of the following are **natural** sources of background radiation? **[2 marks]**

Tick (✓) **two** boxes.

cosmic rays

fallout from nuclear weapons tests

medical imaging

nuclear power stations

rocks

**10**



**Turn over for the next question**

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ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



### Biology Questions

**10** Protease enzymes digest proteins.

**10 (a)** What type of substance is produced when protein is digested?

[1 mark]

.....

**10 (b)** A student investigated the digestion of protein by protease.

Egg white is a protein.

Boiling changes egg white from a clear liquid to a white solid.

The student:

**Step 1** put 10 cm<sup>3</sup> of liquid egg white into a measuring cylinder

**Step 2** put the measuring cylinder in boiling water until the egg white went solid

**Step 3** put 5 cm<sup>3</sup> of protease solution into a test tube

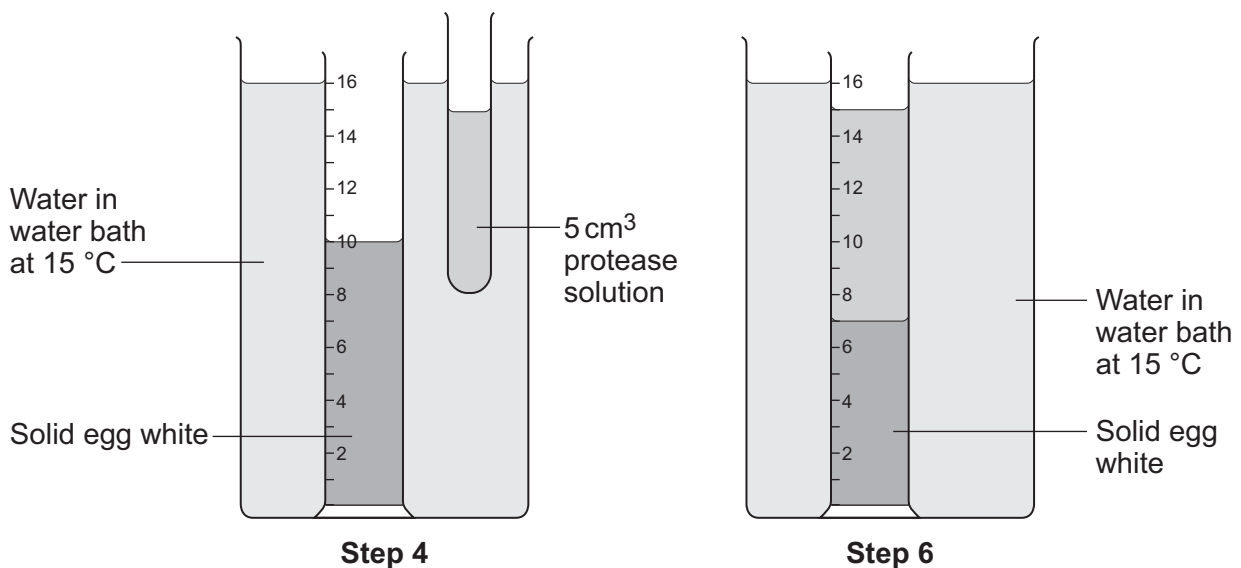
**Step 4** put both the measuring cylinder and the test tube into a water bath at 15 °C for ten minutes

**Step 5** added the protease to the solid egg white in the measuring cylinder

**Step 6** recorded the volume of solid egg white in the measuring cylinder after 24 hours.

**Figure 14** shows **Step 4** and **Step 6** of the investigation.

**Figure 14**



**10 (b) (i)** In **Step 4**, why were the solid egg white and protease solution put into the water bath for 10 minutes before being added together?

[1 mark]

.....  
.....

**10 (b) (ii)** Calculate the volume of solid egg white digested after 24 hours at 15 °C.

Use **Figure 14** to work out your answer.

[1 mark]

.....  
.....

Volume of solid egg white digested = ..... cm<sup>3</sup>

**Question 10 continues on the next page**

**Turn over ►**



**10 (c)** Other students repeated the investigation at different temperatures using 20 cm<sup>3</sup> of liquid egg white.

The students used the same concentration of protease solution for each temperature.

**Table 2** shows the results.

**Table 2**

Temperature in °C	Volume of egg white that had been digested in 24 hours in cm <sup>3</sup>
10	2
20	4
30	8
40	16
50	0

**10 (c) (i)** Describe the relationship between temperature and the volume of egg white digested at temperatures from 10 °C to 40 °C.

**[2 marks]**

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.....



**10 (c) (ii) Student 1** wrote a conclusion:

“Protease works best at 40 °C.”

This conclusion may not be accurate.

Suggest how the investigation should be changed so that **Student 1** could find a more accurate value for the best temperature.

**[2 marks]**

.....

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**10 (c) (iii) Student 2** wrote a different conclusion:

“At 50 °C protease is killed by the high temperature.”

Why is the conclusion written by **Student 2 not** correct?

**[2 marks]**

.....

.....

How should **Student 2** correct the conclusion?

.....

.....

9
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**Turn over for the next question**

**Turn over ►**



### Chemistry Questions

**11** Magnesium sulfate is a salt.

Magnesium sulfate solution is produced from magnesium oxide (MgO) and sulfuric acid (H<sub>2</sub>SO<sub>4</sub>).

**11 (a)** Magnesium oxide is insoluble.

What type of substance is magnesium oxide?

**[1 mark]**

Draw a ring around the correct answer.

**acid**

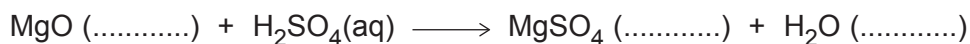
**alkali**

**base**

**11 (b)** The equation represents the reaction between magnesium oxide and sulfuric acid.

Complete the equation by writing the correct state symbol in each space.

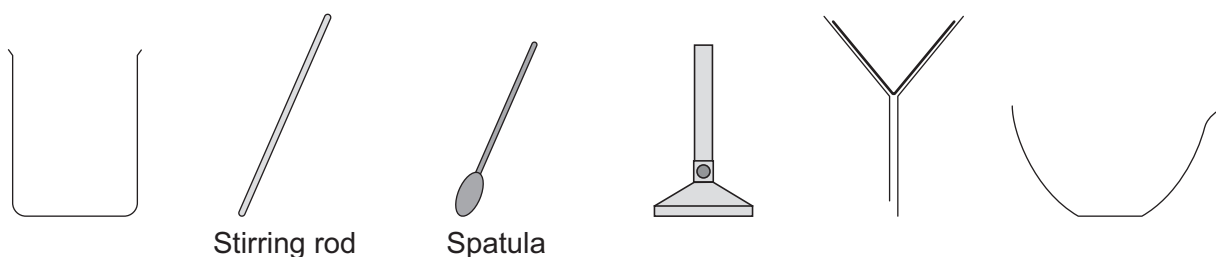
**[2 marks]**



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

**Figure 15** shows **some** of the equipment which is used to make magnesium sulfate crystals.

**Figure 15**





Describe how you would make crystals of magnesium sulfate from magnesium oxide and sulfuric acid.

Include in your answer:

- how you would use the equipment
- how to separate the solution
- how to produce magnesium sulfate crystals from the solution.

**[6 marks]**

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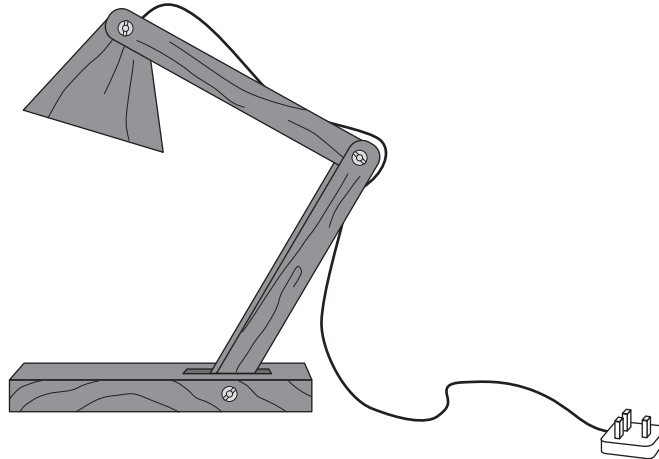
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### Physics Questions

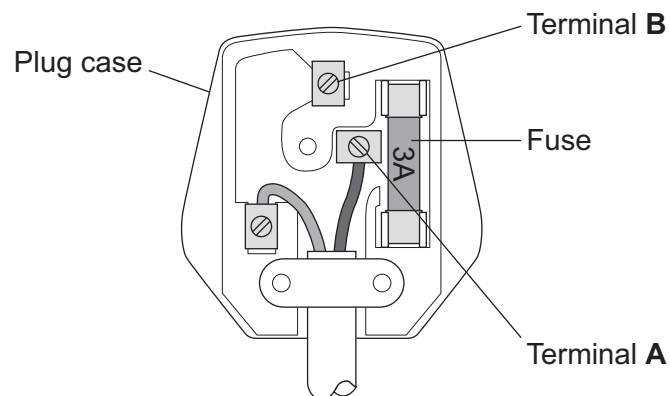
- 12** **Figure 16** shows a wooden desk lamp.  
The lamp is connected to a three-pin plug using two-core cable.

**Figure 16**



- 12 (a)** **Figure 17** shows the inside of the three-pin plug.

**Figure 17**



- 12 (a) (i)** What is the name of the wire connected to the fuse at Terminal A?

[1 mark]

.....



**12 (a) (ii)** The desk lamp does **not** need a wire connected to Terminal **B**.

Why?

[1 mark]

.....  
.....

**12 (a) (iii)** Why is plastic a suitable material for the plug case?

[1 mark]

.....

**12 (a) (iv)** The fuse has a current rating of 3 A. What does this mean?

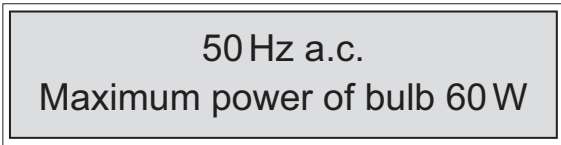
[2 marks]

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**12 (b)** The desk lamp has been made for use in the UK.

**Figure 18** shows part of the label from the lamp.

**Figure 18**



What information does the label give about the UK mains electricity supply?

[2 marks]

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**Question 12 continues on the next page**

**Turn over ►**



12 (c) The potential difference of the UK mains electricity supply is 230 V.  
The current flowing through the bulb in the desk lamp is 0.13 A.

Calculate the power of the bulb.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....  
.....  
.....  
.....

Power = ..... W

12 (d) Table 3 gives information about three different bulbs, A, B and C.

Table 3

Bulb	Electrical power input in watts	Light power output in watts
A	22	14
B	28	14
C	60	14

A person is going to buy one of the bulbs A, B or C. The bulbs cost the same.

Use Table 3 to decide which one of the bulbs, A, B or C, the person should buy.

Give a reason for your answer.

[1 mark]

.....  
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.....

10

END OF QUESTIONS

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