

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
GATEWAY SCIENCE  
ADDITIONAL SCIENCE B**

**B624/02**

Unit 2 Modules B4 C4 P4  
(Higher Tier)

Candidates answer on the question paper  
A calculator may be used for this paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)

**Wednesday 21 January 2009  
Afternoon**

**Duration: 1 hour**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

**FOR EXAMINER'S USE**

Section	Max.	Mark
A	20	
B	20	
C	20	
<b>TOTAL</b>	<b>60</b>	

## 2

## EQUATIONS

$$\text{speed} = \frac{\text{distance}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2} mv^2$$

$$\text{potential energy} = mgh$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

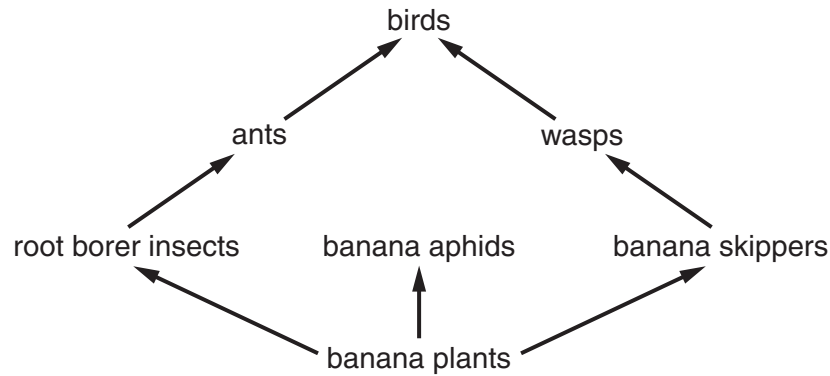
3

Answer **all** the questions.**Section A – Module B4**

**1** This question is about bananas.

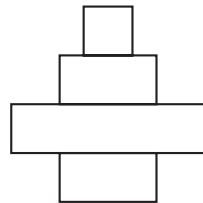
**(a)** Banana plants are grown in large fields called plantations.

They are producers for a food web.



The diagram shows the shape of a pyramid of numbers for this food web.

pyramid of numbers



pyramid of biomass

Describe how a pyramid of biomass would look different to this pyramid of numbers.

You may draw a diagram in the space above if you wish.

.....

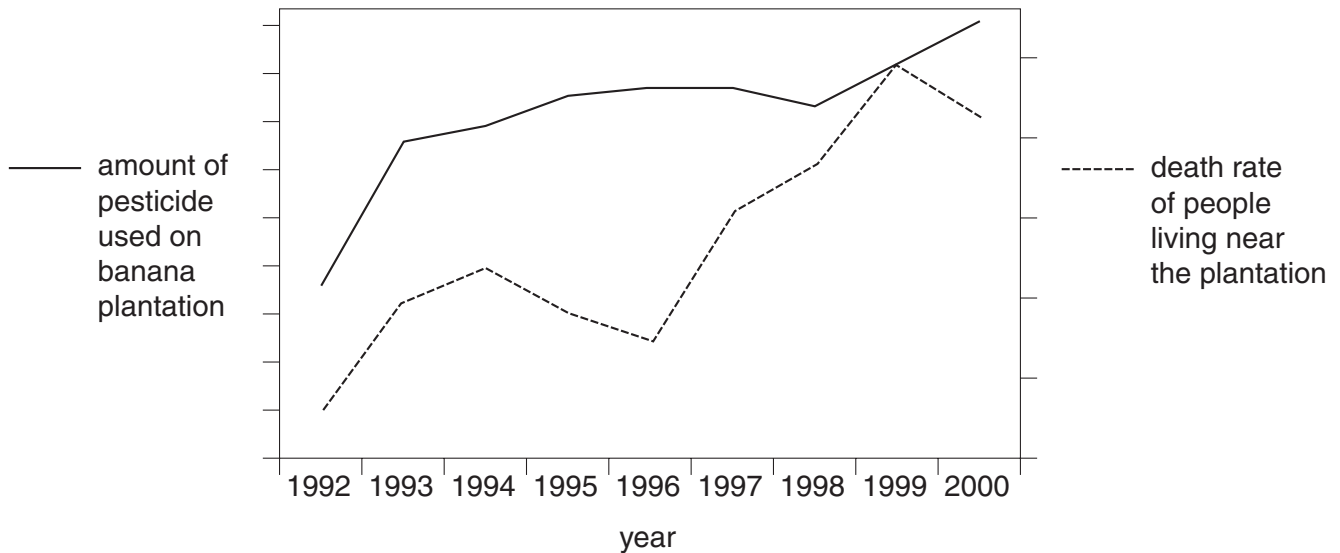
..... **[1]**

4

(b) Some banana farmers use pesticides to kill insect pests.

People who live near the plantations are worried that the pesticides might be harming them.

Look at this graph.



(i) How does the graph suggest that the people might be correct?

.....  
 ..... [1]

(ii) How does the graph suggest that the people might **not** be correct?

.....  
 ..... [1]

(iii) Some farmers decide not to use pesticides.

They use biological control instead.

Biological control will not harm people.

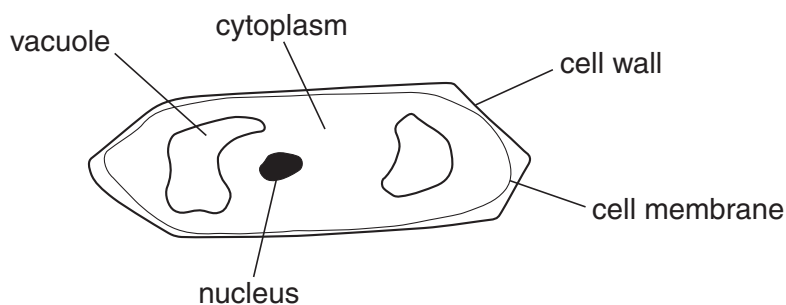
Explain one **other** advantage of using biological control instead of pesticides.

.....  
 ..... [1]

[Total: 4]

5

2 The diagram shows a plant cell from a root.



(a) The cell is placed in a dilute solution.

Water moves from the solution into the vacuole.

(i) What is the name of the process that causes water to move into the cell?

..... [1]

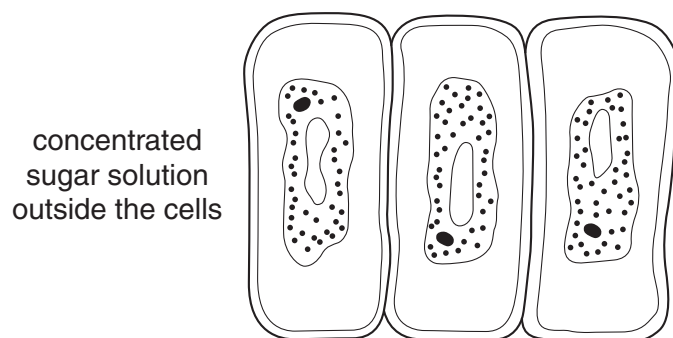
(ii) The cell membrane is partially permeable.

What is meant by the term **partially permeable**?

.....

..... [1]

(b) These cells have been placed in a concentrated sugar solution.



Finish the following sentences about the cells.

The cells have lost water.

Therefore the cell contents are not pushing against the cell wall and so their

..... pressure has dropped.

The cell becomes flaccid and then the cell membrane comes away from the cell wall.

The cell has become .....

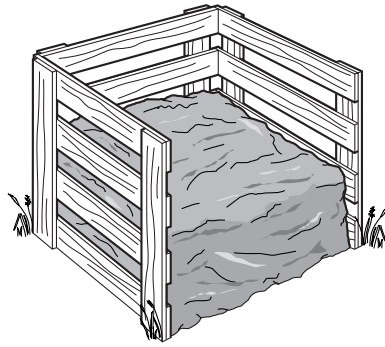
[2]

[Total: 4]

Turn over

6

- 3 Percy builds a compost heap in his garden.



- (a) Percy builds the compost heap on the ground to let detritivores such as earthworms into the heap.

What do detritivores do?

.....

Explain why this increases the rate of decomposition.

.....

.....

[2]

- (b) Percy buys a box of compost maker to make the waste decay faster.



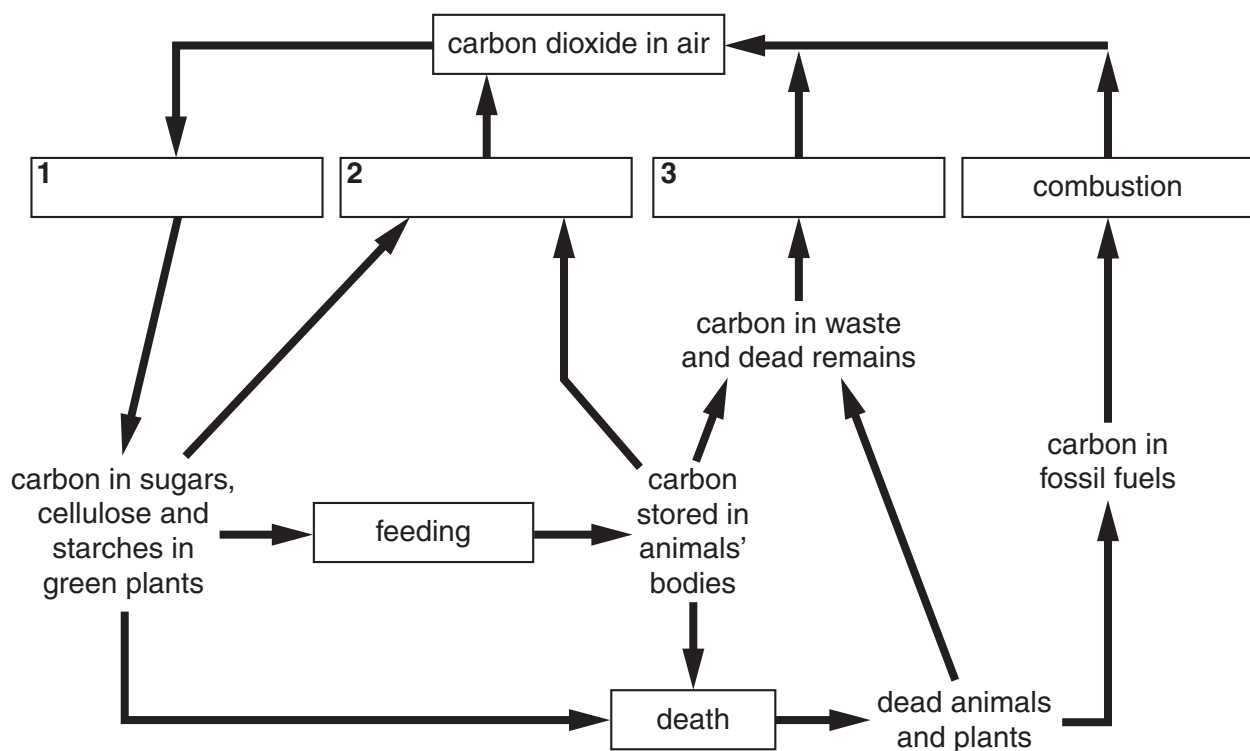
Explain why the powder is likely to have more effect in the summer.

.....

..... [2]

[Total: 4]

- 4 The diagram shows the carbon cycle.



- (a) Finish the diagram by writing the best words in the boxes 1, 2 and 3.

Choose your words from this list.

**decomposition**

**photosynthesis**

**respiration**

[2]

- (b) Both the carbon cycle and the nitrogen cycle involve bacteria acting as decomposers (saprophytes).

The nitrogen cycle also involves three other types of bacteria.

Write down **one** of these **other** types of bacteria and explain what they do in the cycle.

type of bacteria .....

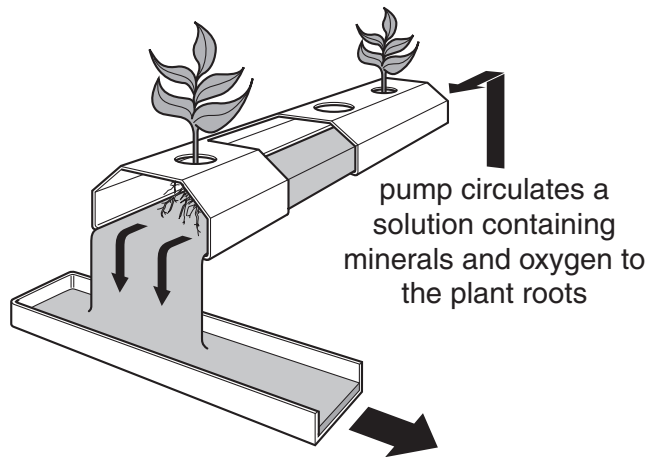
what they do in the nitrogen cycle .....

.....

..... [3]

[Total: 5]

- 5 The diagram shows some plants being grown using hydroponics.



- (a) The roots need oxygen in order to absorb the minerals from the solution.

Explain why.

.....

.....

..... [2]

- (b) The plants are supplied with a constant supply of minerals and oxygen by the pump.

Write down **one other** advantage of growing plants using hydroponics.

.....

..... [1]

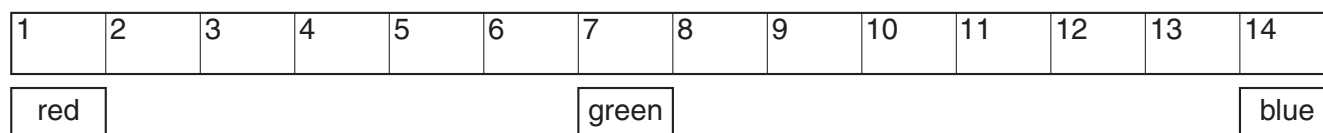
[Total: 3]



## Section B – Module C4

6 This question is about acids and bases.

Look at the diagram. It shows the pH scale.



(a) John wants to measure the pH of a solution of hydrochloric acid.

Describe how he can do this.

.....  
.....  
..... [2]

(b) John makes some sodium chloride.

He uses sodium hydroxide and an acid.

Write down the name of the acid.

Choose from the list.

hydrochloric acid

nitric acid

phosphoric acid

sulfuric acid

answer ..... [1]

10

(c) An acid reacts with a carbonate.

A salt and water are made.

A gas is also made.

Write down the name of the gas.

Choose from the list.

**ammonia**

**carbon dioxide**

**hydrogen**

**nitrogen**

**oxygen**

answer ..... [1]

(d) Copper oxide is a base. It reacts with sulfuric acid to make copper sulfate and water.

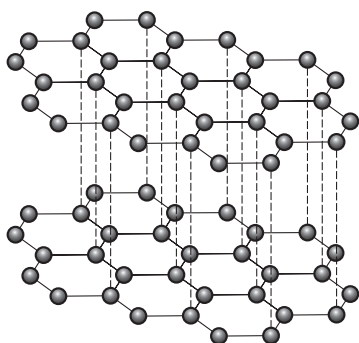
Write a **word** equation for this reaction.

..... [1]

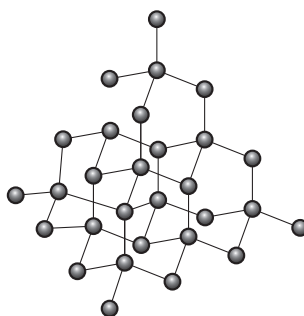
[Total: 5]

7 This question is about forms of carbon.

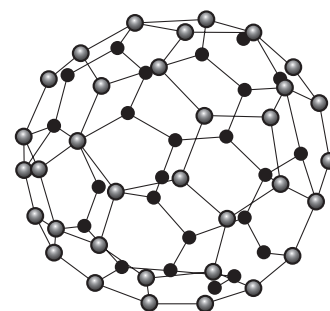
Carbon occurs in three forms.



**graphite**



**diamond**



**buckminster fullerene**

(a) Graphite is used in electrodes because it conducts electricity and has a high melting point.

(i) Explain why graphite conducts electricity.

..... [1]

(ii) Explain why graphite has a high melting point.

Use ideas about structure and bonding.

..... [1]

(b) (i) Buckminster fullerene is made from a large number of carbon atoms.

What is its formula? Choose from the list.

$C_{40}$

$C_{60}$

$C_{80}$

$C_{100}$

answer ..... [1]

(ii) Fullerenes can be made into nanotubes.

Write down **one** use of nanotubes.

..... [1]

(c) Diamond, graphite and buckminster fullerene are all different solid forms of carbon.

What name is given to different solid forms of the same element?

..... [1]

**[Total: 5]**

12

- 8 (a) Paul reacts some potassium hydroxide, KOH, solution with some nitric acid, HNO<sub>3</sub>.

Potassium nitrate, KNO<sub>3</sub>, and water are formed.

Write a balanced **symbol** equation for this reaction.

..... [1]

- (b) Paul expects to make 6.0 g of potassium nitrate.

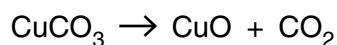
He actually makes 4.8 g.

Calculate his percentage yield.

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

answer ..... % [2]

- (c) Look at this chemical equation.



Paul starts with 50 g of copper carbonate.

He makes 50 g of copper oxide and carbon dioxide altogether.

Explain why the mass of the starting materials is the same as the mass of the products.

.....  
..... [1]

[Total: 4]

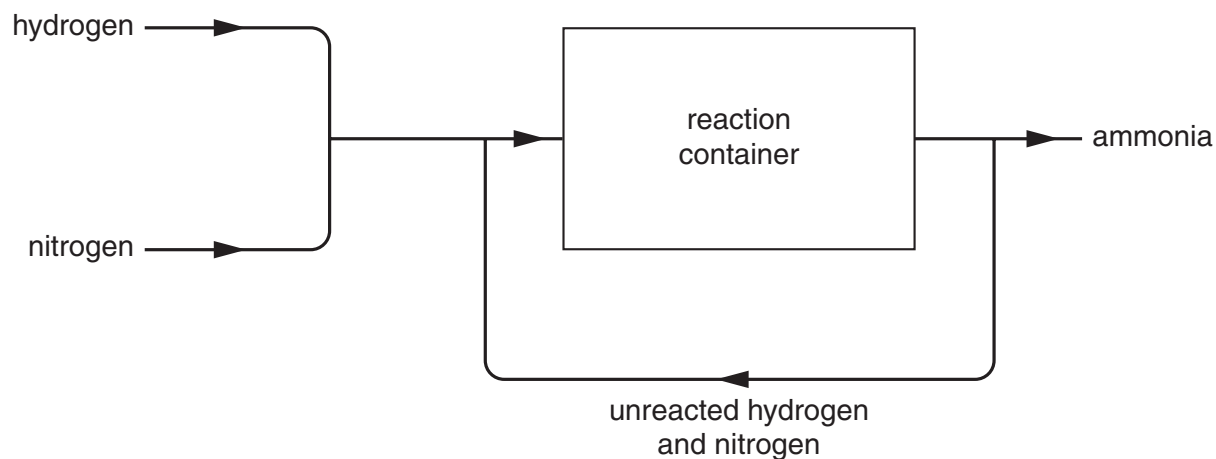
13

- 9 This question is about ammonia and fertilisers.

Ammonia is manufactured by reacting nitrogen with hydrogen.

Look at the diagram.

It shows a flow chart for this reaction.



- (a) (i) An iron catalyst is used in this reaction.

Explain why.

..... [1]

- (ii) The process takes place at 450 °C. This is the optimum temperature.

Explain why this temperature is used.

Your answer should refer to

- percentage yield
- rate of reaction.

.....  
.....  
..... [2]

14

- (iii) Higher pressures give higher yields of ammonia.

Write down **one** disadvantage of using higher pressures.

..... [1]

- (b) Ammonia is used to make fertilisers.

Why do farmers use fertilisers?

..... [1]

- (c) Most fertilisers are added to soil as small lumps.

What must happen to the fertiliser before it is absorbed by a plant?

..... [1]

[Total: 6]

## Section C – Module P4

- 10 (a) Jamie rubs a plastic rod with a piece of silk.

The teacher tells him that the plastic has become positively charged.

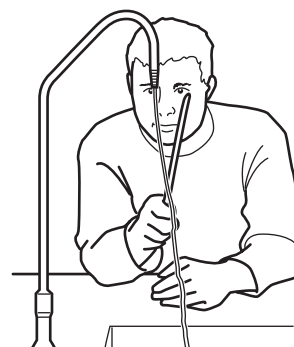
- (i) The rod has become **positively** charged by friction.

Explain why.

..... [1]

- (ii) Jamie holds the rod near to a stream of water from the tap.

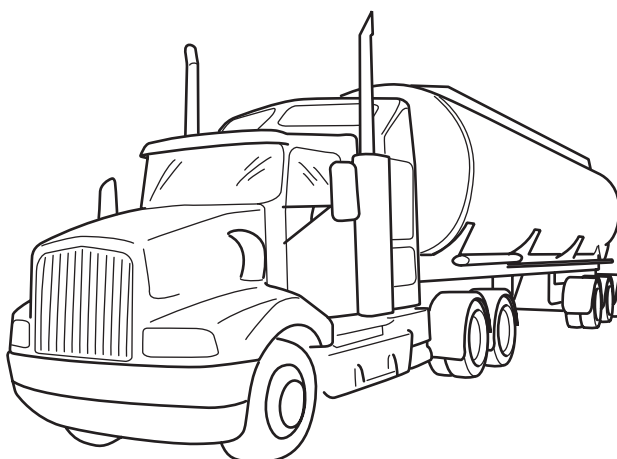
The water moves towards the rod.



Suggest a reason why.

..... [1]

- (b) Flour tankers must be earthed before the flour is unloaded through a plastic pipe.



- (i) What happens to the flour as it flows through the plastic pipe?

..... [1]

- (ii) Why is the tanker earthed?

..... [1]

[Total: 4]

16

- 11 Mandy buys an electric drill at a car boot sale.

It has this symbol on it.



This means the drill is **double insulated**.

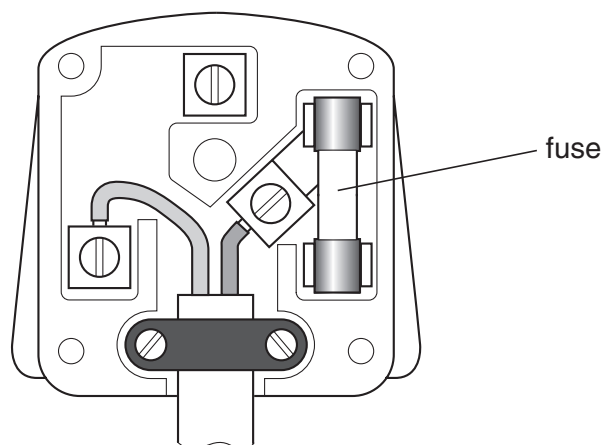
Mandy checks the wiring of its plug.

- (a) Explain why the electric drill does not need an earth wire connected to it.

.....

.....

..... [2]



- (b) The plug has a fuse in it for safety.

Describe how the fuse works.

.....

..... [2]

- (c) The drill is designed to operate at 230V.

The resistance of the circuit is  $46\Omega$ .

Calculate the current in the circuit.

The equations on page 2 may help you.

.....

.....

answer ..... A

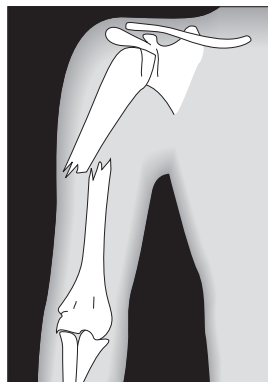
[2]

[Total: 6]



12 Trevor has broken his arm.

He has it X-rayed at the hospital.



(a) How are X-rays produced in an X-ray machine?

.....  
 ..... [1]

(b) How are **gamma rays** similar to X-rays?

Put a tick (✓) in the box next to the correct answer.

Gamma rays and X-rays are both easily absorbed by skin.

☐

Gamma rays and X-rays are both longitudinal waves.

☐

Gamma rays and X-rays are both produced in the same way.

☐

Gamma rays and X-rays have similar wavelengths.

☐

[1]

(c) X-rays are often used instead of gamma rays.

Suggest why.

..... [1]

(d) Write down **one** use of gamma radiation in a hospital.

..... [1]

(e) **Ultrasound** is used in hospitals as well.

Describe **one** use of ultrasound in hospital.

..... [1]

[Total: 5]

Turn over

13 Hinkley Point is a nuclear power station.



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(a) Electricity is generated in a **nuclear** power station.

(i) How is heat produced in the nuclear power station?

..... [1]

(ii) The heat produced boils water.

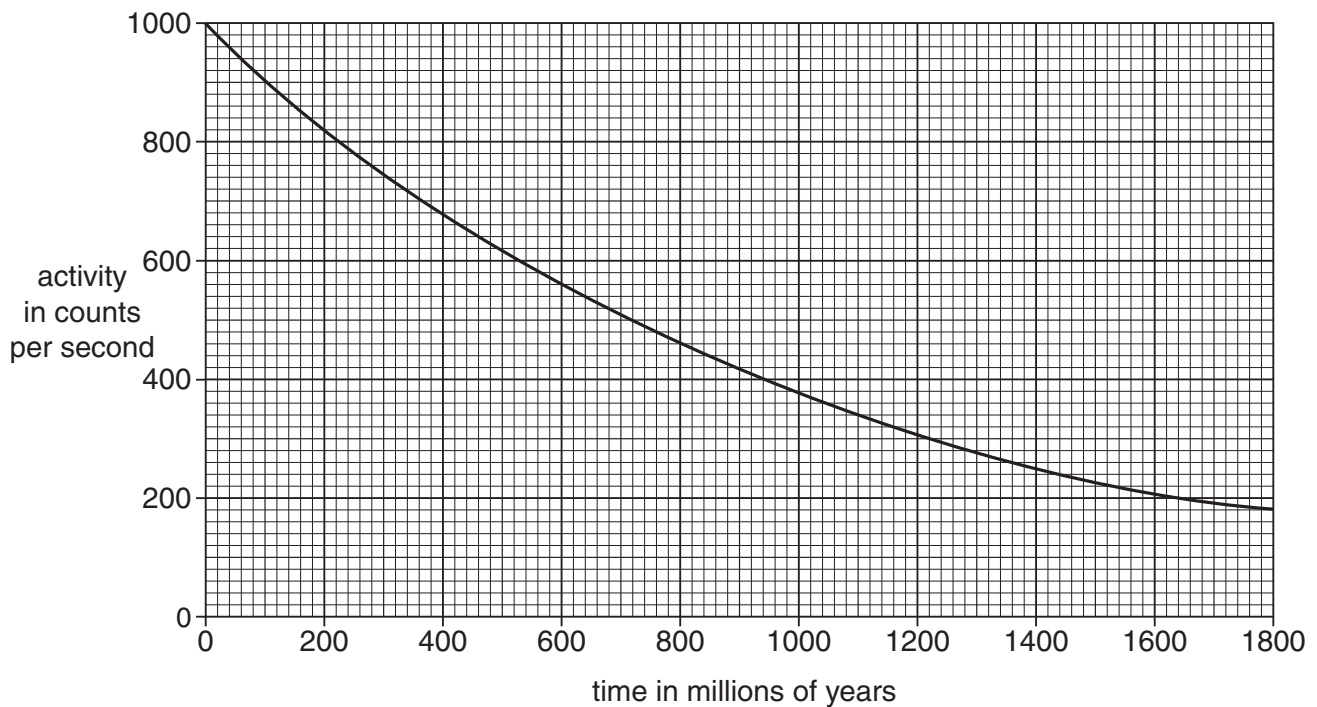
This makes steam.

What makes the generator turn?

..... [1]

- (b) The nuclear power station uses uranium-235. Its activity decreases with time.

The graph shows how the activity of uranium-235 varies with time.



Use the graph to work out the half-life of uranium-235.

.....  
 .....

Half-life of uranium-235 = ..... million years [2]

- (c) Lead-208 is not radioactive.

Lead-209 is radioactive.

How are lead-208 atoms different from lead-209 atoms?

.....  
 ..... [1]

[Total: 5]

**END OF QUESTION PAPER**

# The Periodic Table of the Elements

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20

1	2	Key										3	4	5	6	7	0	
		relative atomic mass atomic symbol name atomic (proton) number																
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10	
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18	
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36	
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54	
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86	
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated							

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.