

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**GATEWAY SCIENCE**

**B624/02**

**ADDITIONAL SCIENCE B**

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 10 June 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 **24** pages. Any blank pages are indicated.

## 2

### EQUATIONS

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

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

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

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

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

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

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

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

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

**BLANK PAGE**


**Question 1 begins on page 4.**

**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

**Section A – Module B4**

1 Read this newspaper article carefully.

	<p><b>The blue hole</b></p>
	<p>Scientists have just discovered a deep, blue hole in a forest in the Bahamas.</p>
	<p>The hole is full of water and is about 35 metres deep.</p>
	<p>At the surface the water is pure. Deeper into the hole, it becomes more and more salty and contains less oxygen.</p>
	<p>At the bottom of the hole scientists have found the bodies of animals and plants that have not decayed. They are thousands of years old.</p>
	<p>“The plants are so well preserved they still have green chloroplasts” said one scientist.</p>

(a) The decomposers can **not** decay the dead animals and plants at the bottom of the hole.

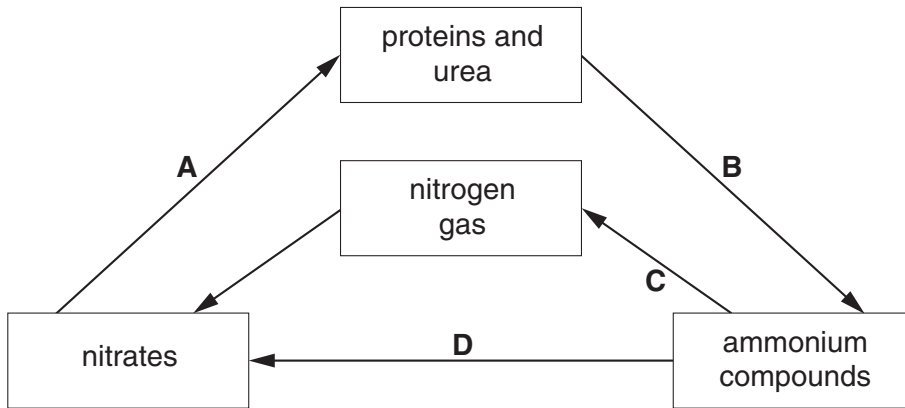
Write down **two** reasons why.

1 .....

2 ..... [2]

(b) The decay of dead plants and animals is an important step in the nitrogen cycle.

The diagram shows part of the cycle.



(i) Which step in the cycle shows decay?

Choose from **A**, **B**, **C** or **D**.

answer .....

[1]

(ii) Nitrogen gas can be converted into nitrogen compounds, such as nitrates.

Write down **two** ways that this can happen.

1 .....

2 ..... [2]

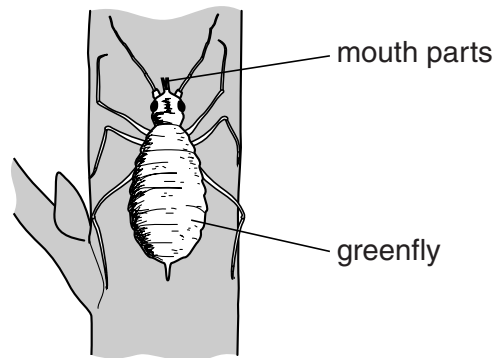
(c) The scientist says that the plants still have green chloroplasts.

Which cells in plant leaves contain most chloroplasts?

..... [1]

[Total: 6]

- 2 The diagram shows a greenfly feeding from the stem of a tomato plant.



The greenfly pushes a hollow tube into one of the tissues in the plant stem.

It can then take sugar from this tissue.

- (a) Suggest which tissue the greenfly is most likely to pierce to get the sugar solution.

Put a **ring** around the answer in this list.

**epidermis      palisade      phloem      xylem**

[1]

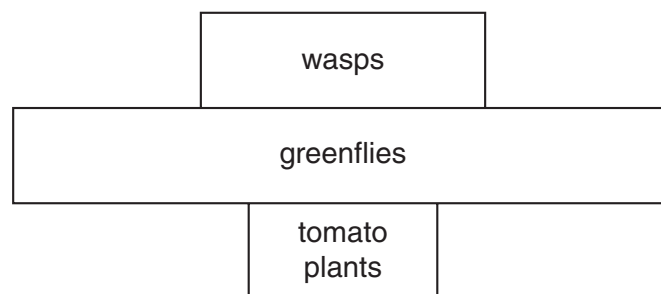
- (b) Tomato plants are often grown in glasshouses.

The plants produce fewer tomatoes when greenflies feed on them.

A gardener releases some wasps into his glasshouse.

The wasps eat the greenflies.

- (i) The following diagram gives information about the food chain in the glasshouse.



Write down the name of this type of diagram.

..... [1]

(ii) Using wasps to eat greenflies is an example of biological control.

Many gardeners prefer to use biological control instead of chemical pesticides.

Write down **two** advantages of using biological control.

1 .....

2 ..... [2]

[Total: 4]

3 Plants need minerals to grow.

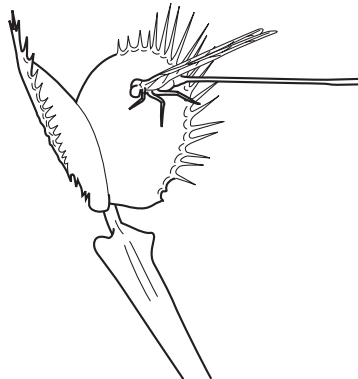
They usually get these minerals from the soil.

(a) Some plants can **not** get enough minerals from the soil.

Their leaves are adapted to trap insects.

They digest the insects to get the minerals they need.

One plant that does this is the venus fly trap.



The venus fly trap does not get enough nitrates from the soil.

Instead it gets nitrogen compounds from the insects.

(i) What do plants look like if they do not get enough nitrates?

..... [1]

(ii) The venus fly trap also needs magnesium compounds.

Write down **one** chemical in the plant that contains magnesium.

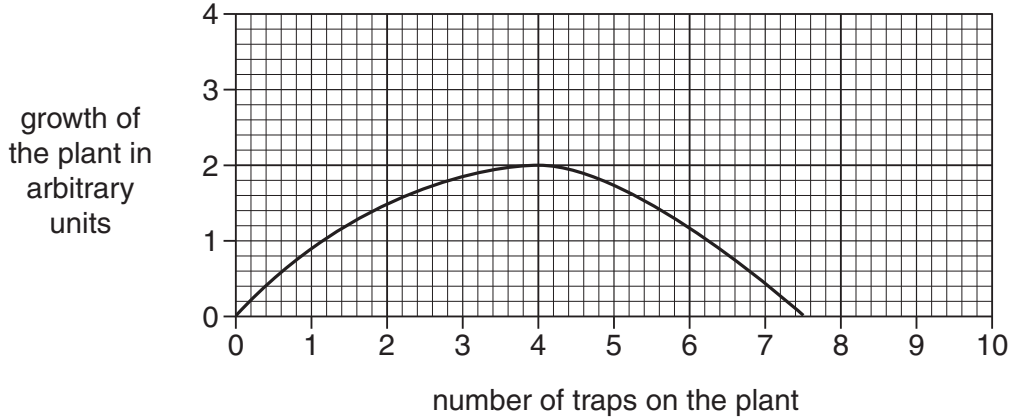
..... [1]



(b) Plants like the venus fly trap use energy to make traps to catch insects.

This energy comes from sugars made in photosynthesis.

The graph shows how different numbers of traps affect the growth of a plant.



(i) Use the graph to predict how many traps a plant should make for maximum growth.

..... [1]

(ii) Suggest why the plant grows **less** well if it makes more or less traps.

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

(iii) Most plant leaves are **not** adapted to catch insects.

The leaves are adapted for photosynthesis by being broad and thin.

Explain how these adaptations help with photosynthesis.

Leaves are broad because .....

Leaves are thin because .....

[Total: 7]

4 Anil is growing some lettuce plants in his garden.

Normally they look like the plants in the first diagram.



Anil goes outside on a hot day to look at the lettuce plants.

They look different.



(a) Anil's lettuce plants have lost water and wilted.

Why does loss of water from the plants cause wilting?

.....

.....

..... [2]

(b) In what conditions would Anil's plants wilt fastest?

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

light and humid

dark and warm

dry and windy

windy and humid

[1]

[Total: 3]

Section B – Module C4

5 This question is about fertilisers.

Look at the diagram. It shows the label on a bag of fertiliser.



(a) Ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , is a fertiliser.

(i) Anna makes some ammonium nitrate crystals.

She uses ammonia solution and an acid.

Write down the **name** of the acid.

..... [1]

(ii) What is the relative formula mass ( $M_r$ ) of ammonium nitrate,  $\text{NH}_4\text{NO}_3$ ?

The relative atomic mass ( $A_r$ ) of H is 1, of N is 14 and of O is 16.

.....  
.....

relative formula mass is ..... [1]

(b) The overuse of fertilisers sometimes causes eutrophication.

Eutrophication may cause living things in the water to die.

Write about what happens during eutrophication.

Include in your answer

- how the fertiliser gets into the water
- what the fertiliser does in the water
- how this affects the living things in the water.

.....  
.....  
.....  
..... [3]

[Total: 5]

6 This question is about washing powders.

(a) Suggest a reason, other than cost, why it is good to wash clothes at **40°C** rather than at **50°C**.

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

(b) A detergent molecule has two ends

- a hydrophilic head
- a hydrophobic tail.



(i) What does the **hydrophilic** head do during cleaning?

..... [1]

(ii) What does the **hydrophobic** tail do during cleaning?

..... [1]

(c) Another way of cleaning clothes is to use a dry cleaning solvent.

(i) What is meant by **dry** cleaning?

..... [1]

(ii) Why is dry cleaning sometimes used instead of normal washing?

..... [1]

[Total: 5]

7 This question is about water.

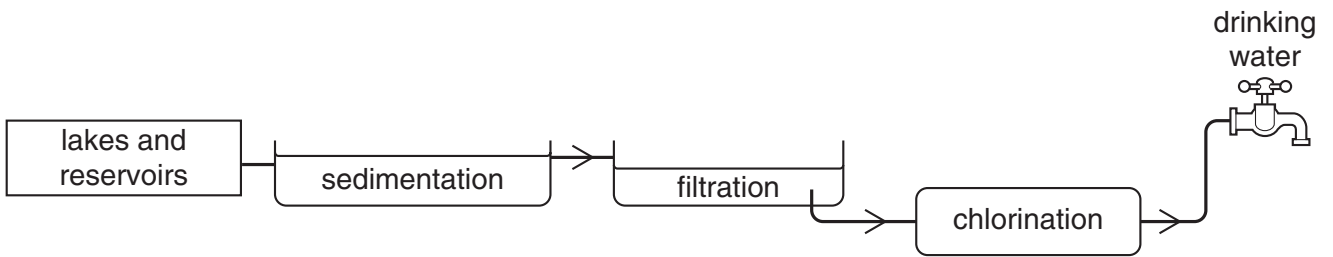
Water is taken from lakes and reservoirs.

The water contains microbes, soluble materials and insoluble materials.

Water is treated to make it safe for drinking.

Look at the diagram.

It shows some of the stages used in treating water.



(a) (i) Explain what happens during sedimentation.

..... [1]

(ii) Explain why the water goes through a chlorination process.

..... [1]

(b) River water may contain many substances before it is purified.

The water may contain **pesticides**.

The pesticides get into the river from the land.

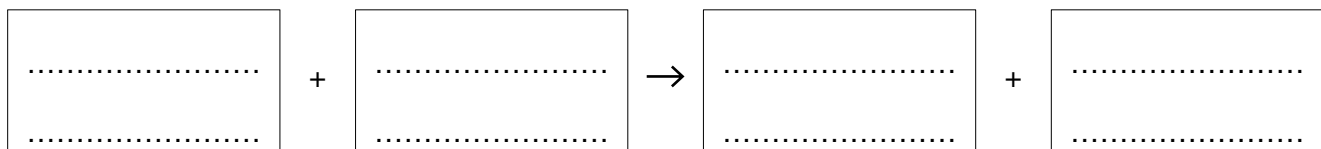
Suggest how pesticides get into the river.

..... [1]

(c) Sodium chloride reacts with silver nitrate.

Sodium nitrate and silver chloride are made.

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



[1]

(d) Barium chloride,  $\text{BaCl}_2$ , reacts with sodium sulfate,  $\text{Na}_2\text{SO}_4$ .

Barium sulfate,  $\text{BaSO}_4$ , and sodium chloride,  $\text{NaCl}$ , are made.

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

..... [2]

[Total: 6]

8 This question is about acids and bases.

An acid and base react together.

A salt and water are made.

(a) Look at the list.

It shows the names of some salts.

**ammonium chloride**

**ammonium nitrate**

**ammonium sulfate**

**potassium sulfate**

**sodium chloride**

**sodium nitrate**

Sodium hydroxide reacts with hydrochloric acid.

Write down the name of the salt made.

Choose from the list.

..... [1]

(b) Calcium nitrate,  $\text{Ca}(\text{NO}_3)_2$ , is another salt.

(i) How many different **elements** are there in this formula?

..... [1]

(ii) John makes some calcium nitrate in the laboratory.

He expects to make 80 g of calcium nitrate.

He only makes 64 g.

Calculate his percentage yield.

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

answer ..... % [2]

[Total: 4]



Section C – Module P4

9 This question is about static electricity.

(a) Static electricity can be dangerous when refuelling an aircraft.

Suggest why.

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

(b) A plastic ruler is rubbed with a cloth.

The ruler becomes **positively** charged.

Explain how the ruler becomes positively charged.

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

(c) Static electricity can also be useful.

It is used in hospitals.



A doctor can **restart** a patient's **heart**.

He puts the paddles on the patient's chest.

The paddles are charged.

Describe what happens next.

In your answer write about

- how the heart restarts
- the precautions taken.

.....

.....

.....

..... [2]

[Total: 5]

10 A hair dryer is an electrical appliance.

(a) The hair dryer is **double insulated**.



It is not earthed.

Explain why the hair dryer is not earthed.

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

(b) The hair dryer is connected to a 230V mains supply.

The current through the hair dryer is 5 A.

Calculate the **resistance** of the hair dryer.

The equations on page 2 may help you.

.....  
.....

answer ..... ohms [2]

[Total: 3]

11 **Ultrasound** scans are used in hospitals.



(a) Ultrasound waves are used to build up a picture of an unborn baby.

Explain how the waves build up this picture.

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

(b) X-rays are **not** used for scanning unborn babies.

One reason is that X-rays can damage living cells.

Write down **one other** reason why X-rays are not used.

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

[Total: 3]

12 Gamma rays and X-rays are used to treat cancer.

(a) Gamma rays come from the nucleus of some radioactive materials.

How are X-rays made?

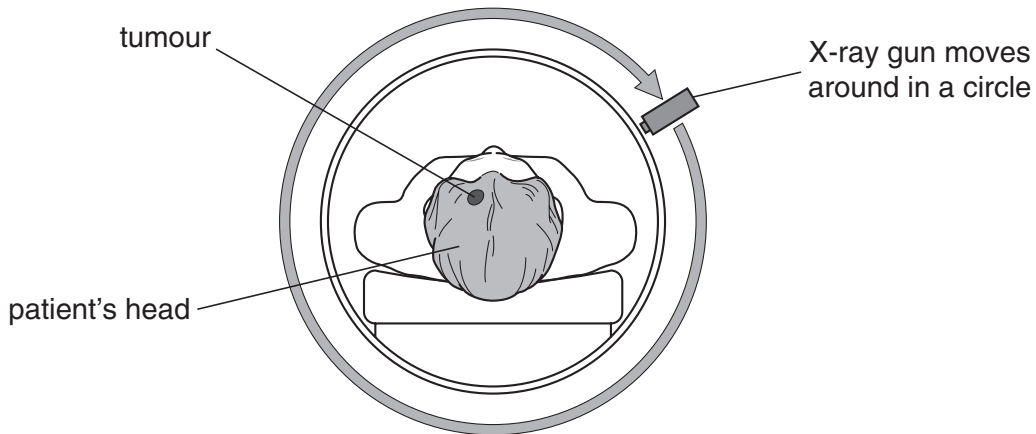
.....  
..... [1]

(b) (i) X-rays are often better than gamma rays for cancer treatment.

Suggest why.

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

(ii) An X-ray gun is rotated around a cancer patient's head.



The X-rays are always aimed at the tumour.

This kills the cancer cells from all directions.

Give **one other** reason why the X-ray gun is moved around the cancer patient's head.

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

[Total: 3]

13 There are three types of nuclear radiation.

These are alpha, beta and gamma.

Look at the table.

type of radiation	description
alpha	${}^4_2\text{He}$
beta	${}^0_{-1}\beta$
gamma	electromagnetic wave

(a) The nucleus of a radioactive atom decays and emits alpha, beta or gamma radiation.

What is special about a radioactive nucleus?

Finish the sentence.

A radioactive atom decays because its nucleus is ..... [1]

(b) An alpha particle is a helium nucleus.

What is a beta particle?

Finish the sentence.

A beta particle is a high speed ..... [1]

(c) Background radiation is always present in the environment.

Where does background radiation come from?

Write down **two** sources of background radiation.

1 .....

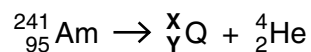
2 ..... [2]

(d) An americium nucleus, Am, decays.

It emits an alpha particle.

A new element, Q, is produced.

Look at the equation.



(i) What is the **mass number (X)** of Q?

..... [1]

(ii) What is the **atomic number (Y)** of Q?

..... [1]

[Total: 6]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

1 2 3 4 5 6 7 0

7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4							4 <b>He</b> helium 2			
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12							20 <b>Ne</b> neon 10			
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20							40 <b>Ar</b> argon 18			
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38							84 <b>Kr</b> krypton 36			
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56							131 <b>Xe</b> xenon 54			
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88							[222] <b>Rn</b> radon 86			
<table border="1" style="margin: auto;"> <tr> <td>1 <b>H</b> hydrogen 1</td> </tr> </table>								1 <b>H</b> hydrogen 1			
1 <b>H</b> hydrogen 1											
<table border="1" style="margin: auto;"> <tr> <td>relative atomic mass</td> </tr> <tr> <td>atomic symbol</td> </tr> <tr> <td>name</td> </tr> <tr> <td>atomic (proton) number</td> </tr> </table>								relative atomic mass	atomic symbol	name	atomic (proton) number
relative atomic mass											
atomic symbol											
name											
atomic (proton) number											
56 <b>Fe</b> iron 26	55 <b>Mn</b> manganese 25	59 <b>Co</b> cobalt 27	59 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36
101 <b>Ru</b> ruthenium 44	[98] <b>Tc</b> technetium 43	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54
190 <b>Os</b> osmium 76	186 <b>Re</b> rhenium 75	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86
[277] <b>Hs</b> hassium 108	[264] <b>Bh</b> bohrium 107	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> 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.