

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

Unit 2 Modules B4 C4 P4 (Higher Tier)

**B624/02**


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)

**Monday 25 January 2010**
**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**

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

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

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

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

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

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

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

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

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

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**Question 1 begins on page 4.**

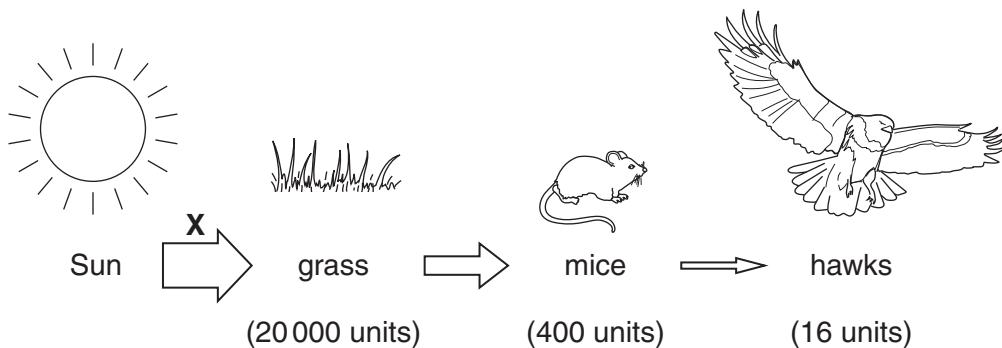
**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

**Section A – Module B4**

1 Look at the food chain.

The numbers show the amount of energy used for growth at each stage of the food chain.



(a) Process X transfers energy from the Sun to the grass.

What is process X?

..... [1]

(b) 2% of the energy in the grass is transferred to the mice.

This is a lower figure than the percentage of energy transferred from the mice to the hawks.

(i) What percentage of the energy in the mice is transferred to the hawks?

answer ..... % [2]

(ii) **Not** all the energy at one stage of a food chain is transferred to the next.

Write down **one** reason why.

..... [1]

(iii) The percentage of the energy transferred from the mice to the hawks is **more** than that transferred from the grass to the mice.

Suggest why.

.....

..... [1]

(c) Look at the food chain.

A disease reduces the number of hawks.

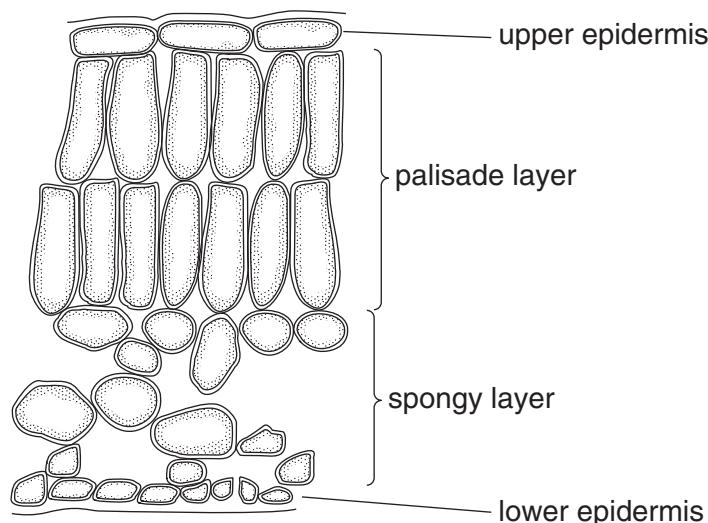
What is likely to happen to the amount of grass? .....

Explain your answer.

.....  
.....

[Total: 6]

2 The diagram shows a section through a leaf.



(a) The spongy layer contains air spaces.

Why are the air spaces important?

.....  
.....

[1]

(b) (i) Which of the four layers labelled in the diagram contains most chloroplasts?

.....

[1]

(ii) Chloroplasts contain chlorophyll.

What element found in minerals is present in chlorophyll?

Put a ring around the correct answer.

calcium

magnesium

phosphorus

potassium

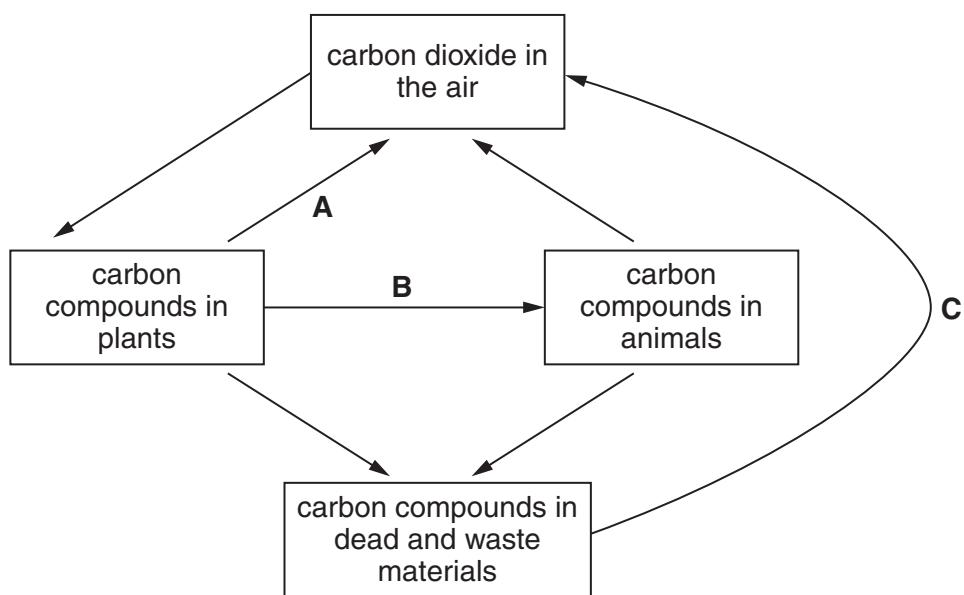
[1]

(iii) By what process do plants absorb minerals?

.....

[Total: 4]

3 The diagram shows part of the carbon cycle.



(a) What process is shown by arrow **A**?

..... [1]

(b) What process is shown by arrow **B**?

..... [1]

(c) What type of organisms are responsible for the process shown by arrow **C**?

..... [1]

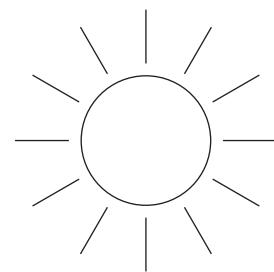
(d) There are other ways carbon dioxide is added to the air that are **not** shown on the diagram.

Write down **one other** way.

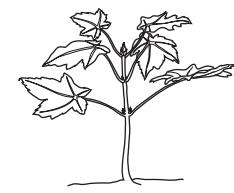
..... [1]

[Total: 4]

4 The diagram shows a plant on two different days.



rainy day



sunny day

(a) Plants lose water from their leaves.

What is this process called?

..... [1]

(b) On the sunny day it is warmer, there is more light and it is less humid.

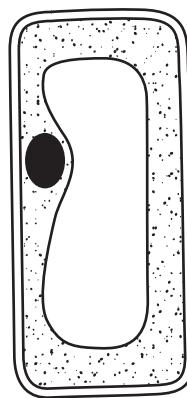
The plant loses water more quickly.

Explain why.

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

(c) The diagram shows a cell from the plant on the rainy day.

The cell is turgid.



On the sunny day the cell becomes plasmolysed.

Draw a diagram to show a plasmolysed cell.

Label your diagram to show the changes.

[2]

[Total: 6]

5 This question is about fertilisers.

Fertilisers can be made by **neutralisation**.

(a) Complete the word equation to show what happens during neutralisation.

acid + base → ..... + ..... [2]

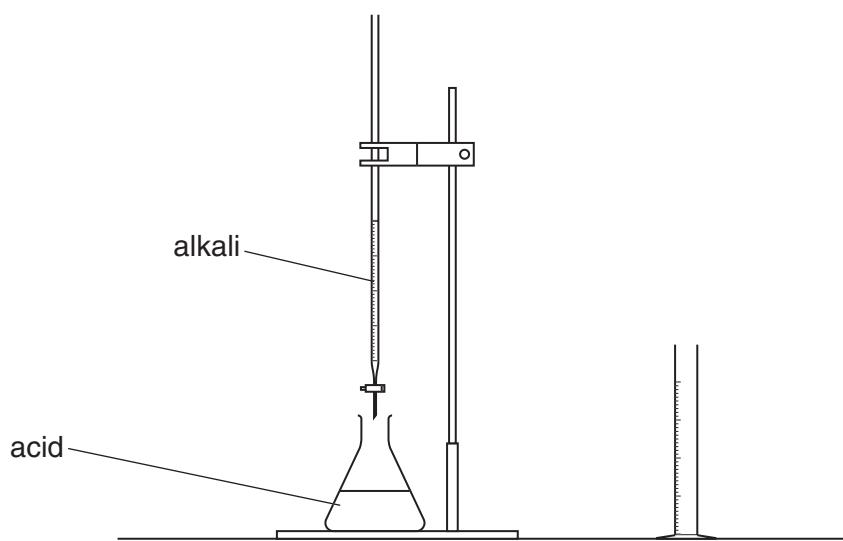
(b) Potassium hydroxide reacts with nitric acid.

What is the name of the fertiliser made?

..... [1]

(c) Acids react with alkalis when fertilisers are made.

Look at the diagram. It shows the equipment used.



Alkali from the burette is added to the acid in the flask.

Jo wants to make ammonium sulfate.

(i) Which acid and which alkali should she use?

acid used .....

alkali used ..... [2]

(ii) Explain how Jo gets a **neutral** solution.

.....

.....

..... [2]

11

(iii) How does Jo get **solid** ammonium sulfate from the neutral solution?

..... [1]

(d) Acids contain hydrogen ions,  $H^+$ . Alkalies contain hydroxide ions,  $OH^-$ .

Write an **ionic** equation for neutralisation.

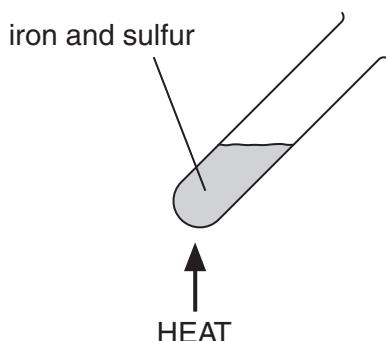
..... [1]

**[Total: 9]**

6 This question is about chemical calculations.

Jake and Monty make iron sulfide.

They heat a mixture of iron and sulfur.



(a) They make a sample of iron sulfide.

They predict that they will make 9.0 g.

They actually make 7.2 g.

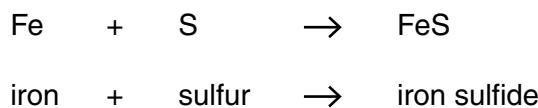
Calculate their percentage yield.

.....  
.....

answer ..... %

[2]

(b) Look at the equation for the reaction.



Jake and Monty use 5.6 g of iron.

How much iron sulfide can they make?

The relative atomic mass of iron is 56 and of sulfur is 32.

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

answer ..... g

How much sulfur must Jake and Monty use?

.....

answer ..... g

[2]

[Total: 4]

13

7 This question is about the manufacture of medicines.

Finchfield Pharmaceuticals make medicines.

Making and developing new medicines is very expensive.

One of the reasons for this is that less automation is possible.

- Write about **other** reasons why making and developing new medicines is very expensive.
- Explain your answers.

.....

.....

.....

.....

.....

.....

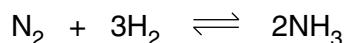
.....

[4]

**[Total: 4]**

8 Ammonia is made in the Haber process.

Look at the equation.



(a) (i) One condition used in the Haber process is an iron catalyst.

Write down one **other** condition used.

..... [1]

(ii) Why is a catalyst used?

..... [1]

(b) Ammonia can be used to make urea,  $\text{CO}(\text{NH}_2)_2$ .

How many atoms are there in one molecule of urea,  $\text{CO}(\text{NH}_2)_2$ ?

..... [1]

[Total: 3]

## Section C – Module P4

9 Radioactive atoms can emit **three** different types of nuclear radiation.

One type is **alpha** ( $\alpha$ ) radiation.

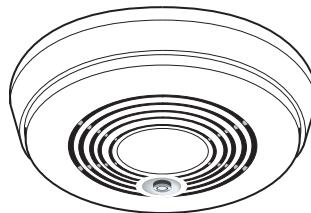
(a) Write down the names of the **other** two types of nuclear radiation.

1 .....

2 ..... [2]

(b) Americium-241 does not occur naturally.

It is a source of alpha radiation. It is used in smoke alarms.



(i) Describe how a smoke detector containing americium-241 works.

Use ideas about **ionisation** to answer the question.

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

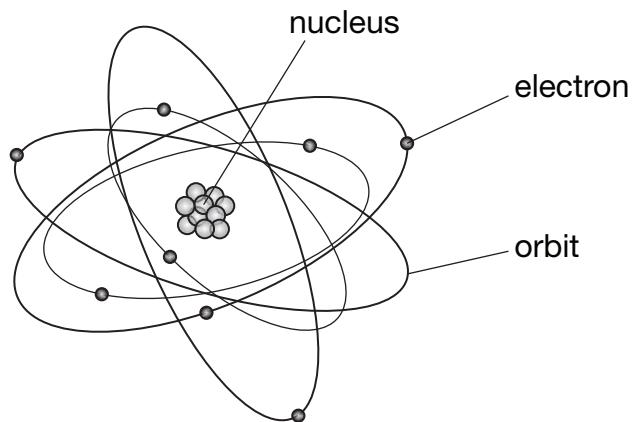
(ii) Americium-241 is made when plutonium-241 decays.

Plutonium-241 is made in a nuclear reactor from plutonium-240.

How does plutonium-240 change into plutonium-241 in a nuclear reactor?

..... [1]  
 [Total: 5]

10 (a) The diagram represents a radioactive atom.



Finish the sentences by choosing the **best** words from this list.

atom

electron

nucleus

orbit

stable

unstable

Radiation comes from the nucleus of the atom.

The radioactive atom is ..... .

The atom may emit an alpha particle.

The alpha particle is the same as a helium ..... .

[2]

(b) This table shows the atomic numbers of some elements.

element	symbol	atomic number
thallium	Tl	81
lead	Pb	82
bismuth	Bi	83
polonium	Po	84
astatine	At	85
radon	Rn	86

(i) Polonium-209 decays by emitting an alpha particle.

Which element is formed when polonium-209 decays?

Use the table to help you.

..... [1]

(ii) Finish and balance the equation to show what happens when polonium-209 decays.



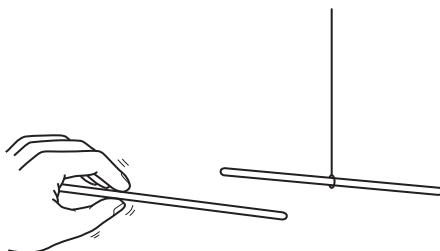
[2]

[Total: 5]

11 This question is about static electricity.

(a) Mel hangs up a charged plastic rod on a cotton thread.

She brings another charged rod towards it.



The rods move apart.

Why do the two rods move apart?

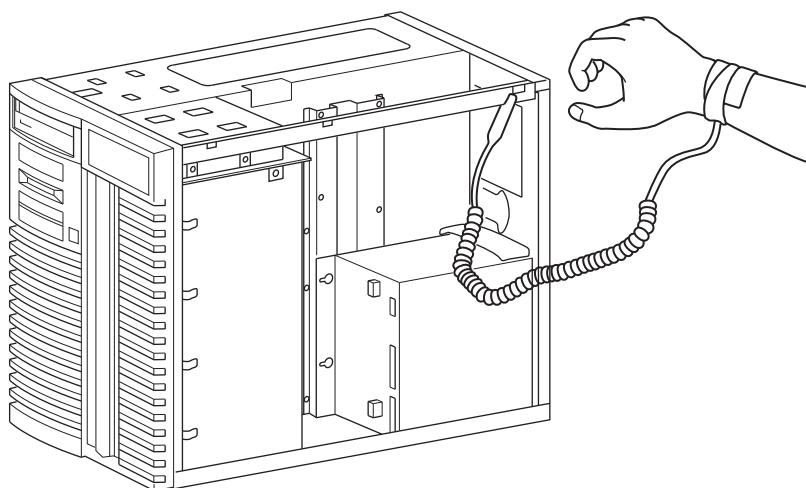
..... [1]

(b) Electronic components can be damaged by static electricity.

Look at the picture.

A technician builds a computer.

She is attached to the computer by an **antistatic strap**.



Write down two **other** examples where static electricity can be dangerous.

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

[2]

(c) Technicians can sometimes get electrostatic shocks when using machines.

How do they avoid this?

.....

[Total: 4]

12 The table shows the hearing ranges of some animals.

animal	frequency range in Hz
bullfrog	100 – 3000
canary	250 – 8000
chicken	125 – 2000
dog	67 – 45 000
elephant	16 – 12 000
goldfish	20 – 3000
horse	55 – 33 500
human	20 – 20 000
owl	200 – 12 000

(a) Which **two** animals can hear ultrasound?

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

(b) Ultrasound is used to scan pregnant women to check on the growth of the unborn baby.

Write down **two** reasons why ultrasound is used instead of X-rays.

1 .....

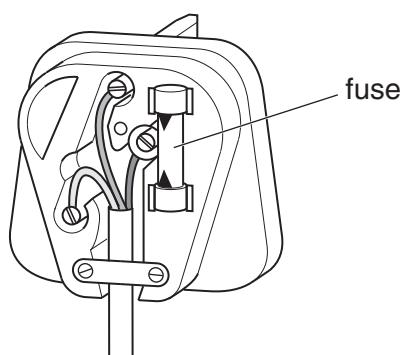
.....

2 .....

..... [2]

[Total: 3]

13 A mains plug contains a fuse.



(a) This plug is connected to a table lamp.

The **fuse** is there for protection. It melts if the current is too large.

Explain **in detail** how this provides protection.

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

[1]

(b) The total resistance of the circuit containing the lamp is  $460\Omega$ .

A fuse is used in the 230V mains plug.

Calculate the current that passes through the fuse.

The equations on page 2 may help you.

.....  
.....

answer ..... amps

[2]

**[Total: 3]**

**END OF QUESTION PAPER**

22

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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	11 <b>B</b> boron 5	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	20 <b>Ne</b> neon 10
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12	27 <b>Al</b> aluminium 13	28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	40 <b>Ar</b> argon 18
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Nb</b> niobium 40	93 <b>Zr</b> zirconium 40	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhodium 75	190 <b>Os</b> osmium 76
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108
[277] <b>Mt</b> meitnerium 109	[277] <b>Ds</b> darmstadtium 110	[271] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated				

**Key**

relative atomic mass
atomic symbol
name
atomic (proton) number

1  
**H**  
hydrogen  
1

\* 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.