Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

B624/02

GATEWAY SCIENCE

ADDITIONAL SCIENCE B

Unit 2 Modules B4 C4 P4
(Higher Tier)

MONDAY 25 JANUARY 2010: Afternoon
DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (CW/SW) MEP10246 24483/1

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- 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.
- 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 three.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is 60.

EQUATIONS

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

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

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

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

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

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

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

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

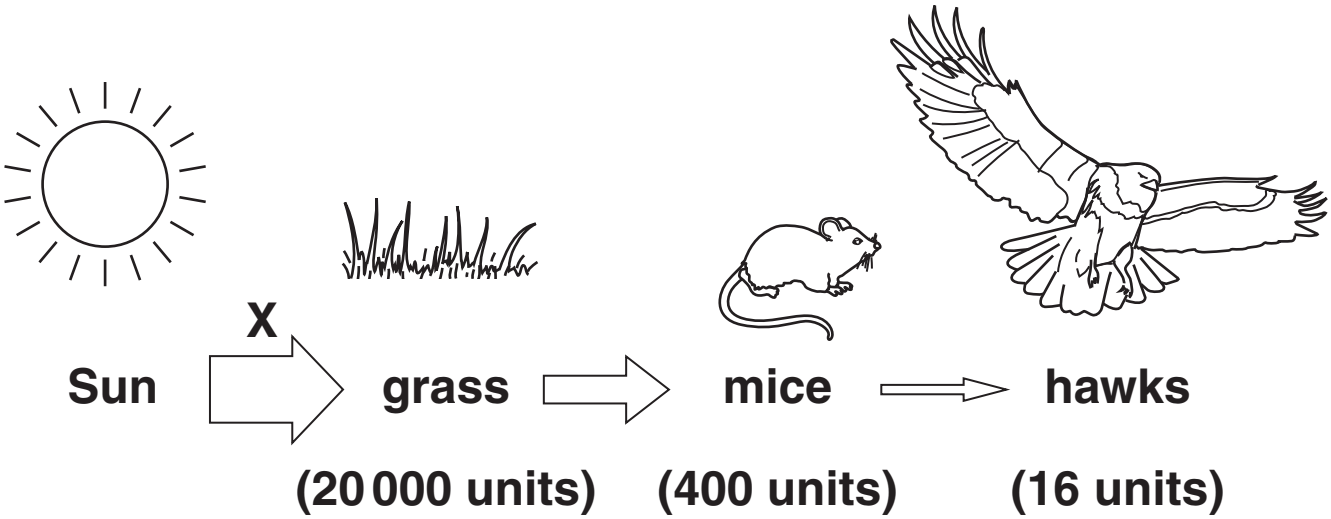
$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

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) <u>NOT</u> all the energy at one stage of a food chain is transferred to the next.

Write down <u>ONE</u> reason why.

_____ [1]

(iii) The percentage of the energy transferred from the mice to the hawks is <u>MORE</u> 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.

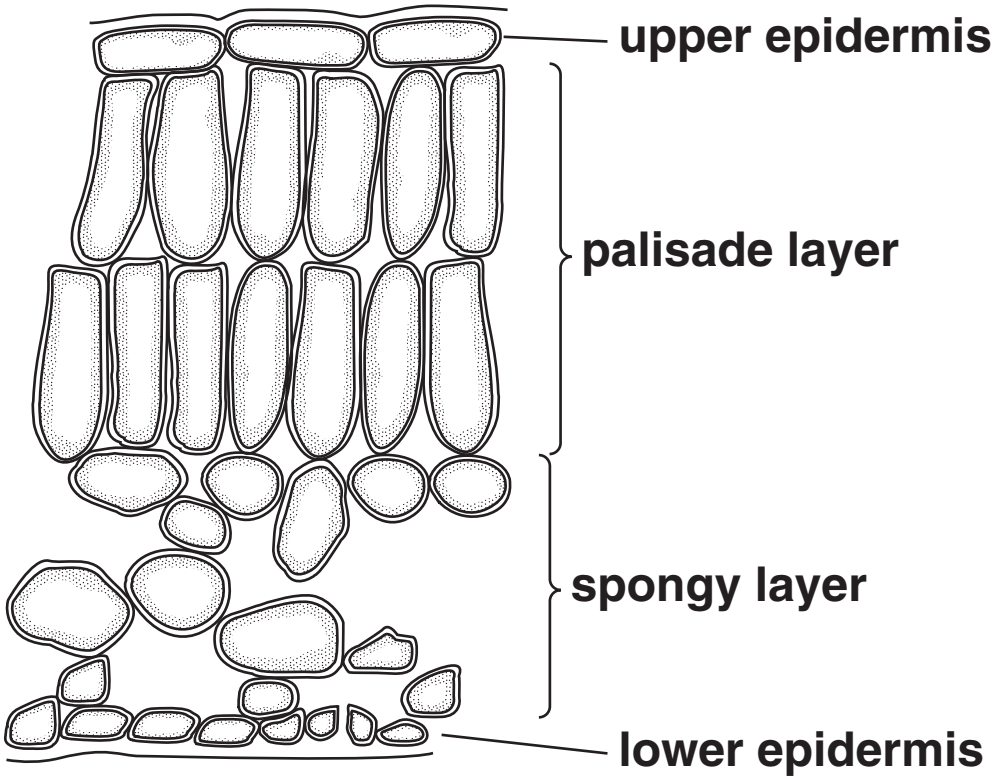
_____

_____ **[1]**

[Total: 6]

BLANK PAGE

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

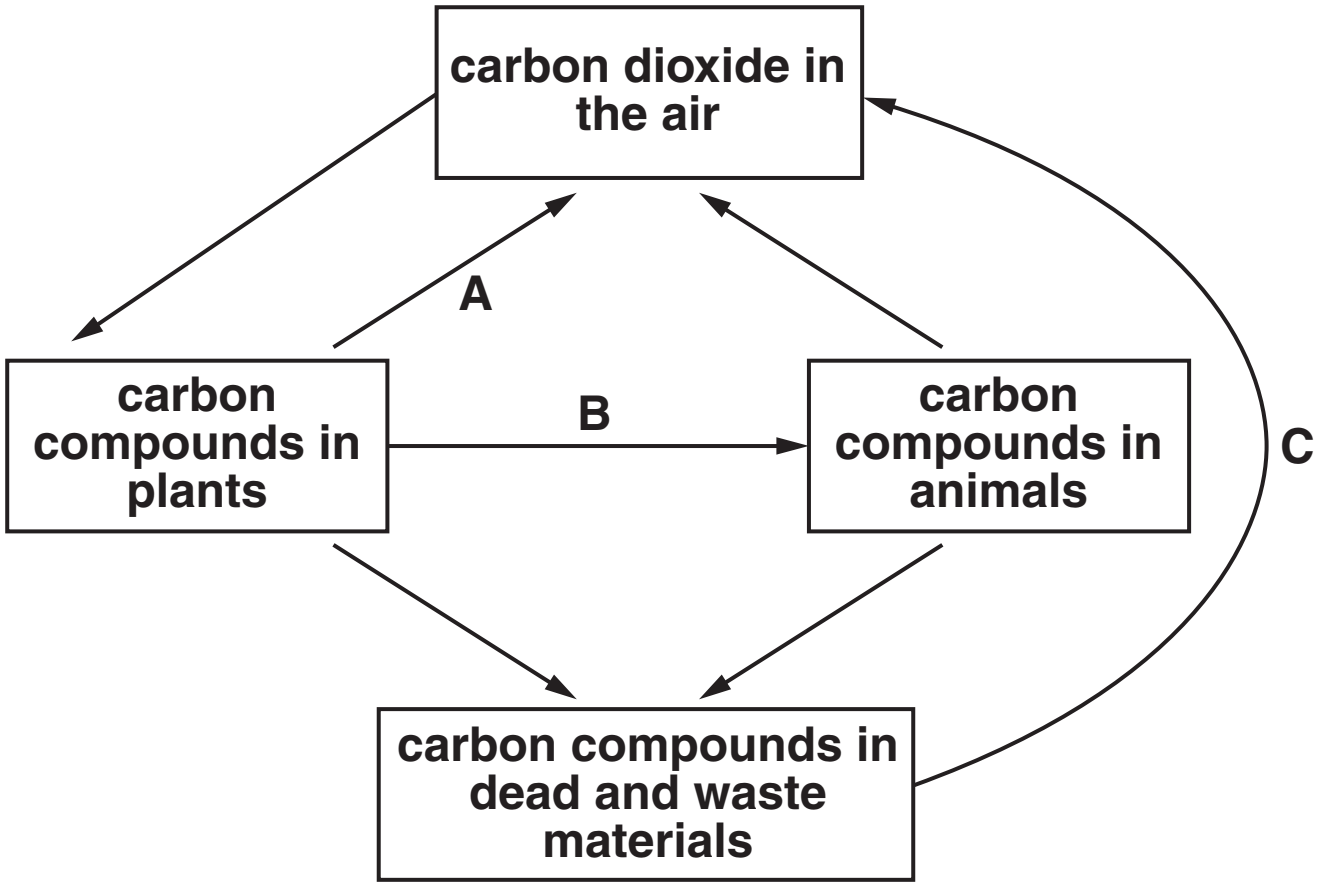
PHOSPHORUS POTASSIUM [1]

(iii) By what process do plants absorb minerals?

_____ [1]

[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]

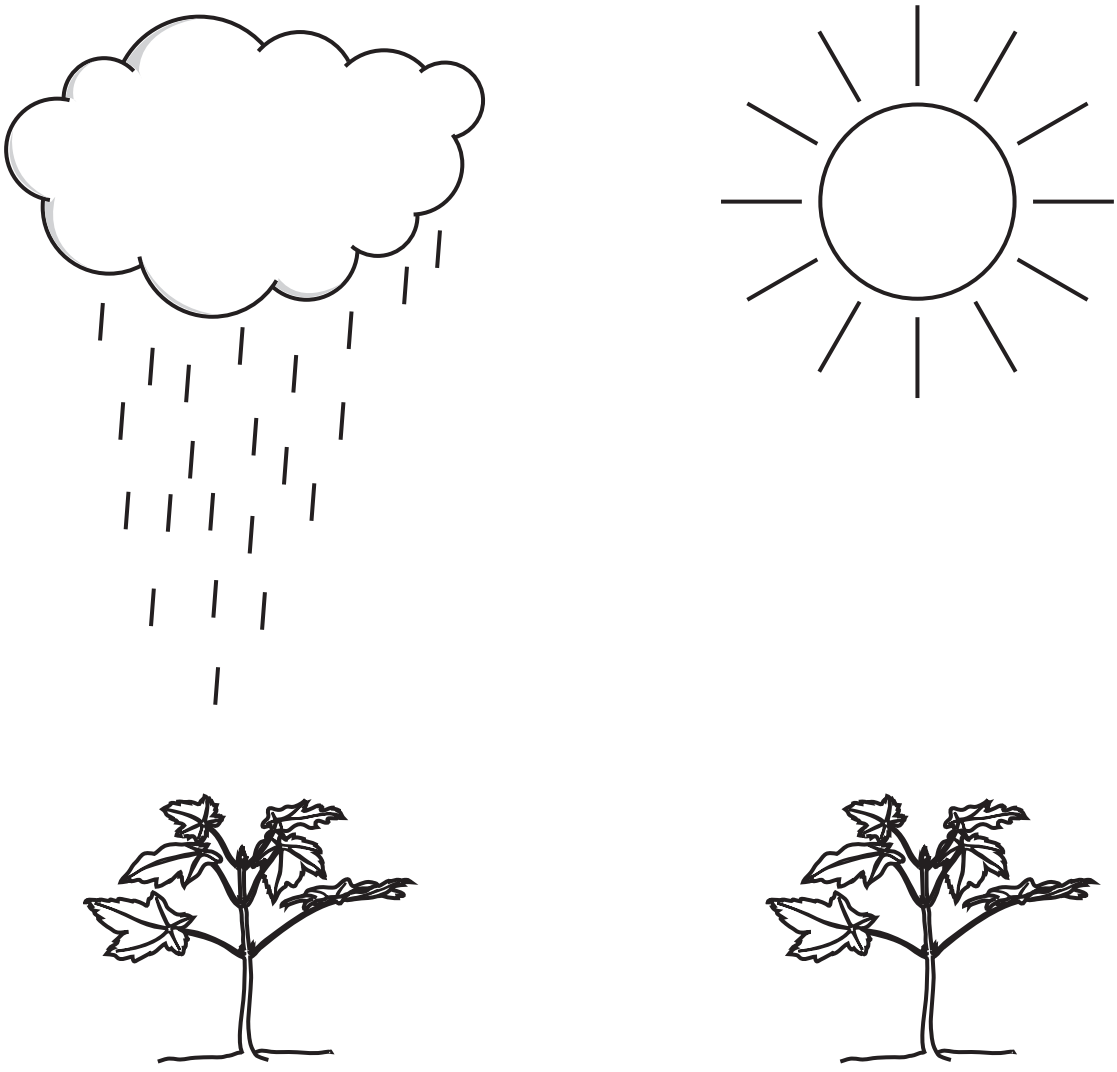
(d) There are other ways carbon dioxide is added to the air that are <u>NOT</u> shown on the diagram.

Write down <u>ONE OTHER</u> 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.

_____

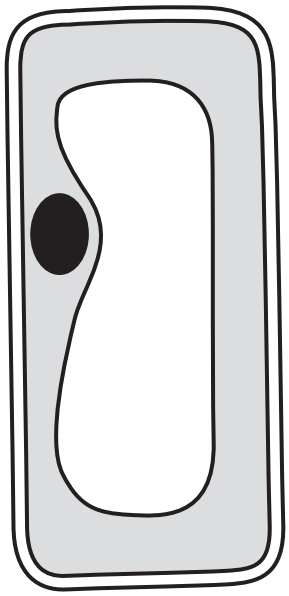
_____

_____

_____ **[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.

If you are unable to draw the diagram describe clearly the changes that will occur inside the cell as it becomes plasmolysed.

[2]

[Total: 6]

SECTION B – MODULE C4

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]

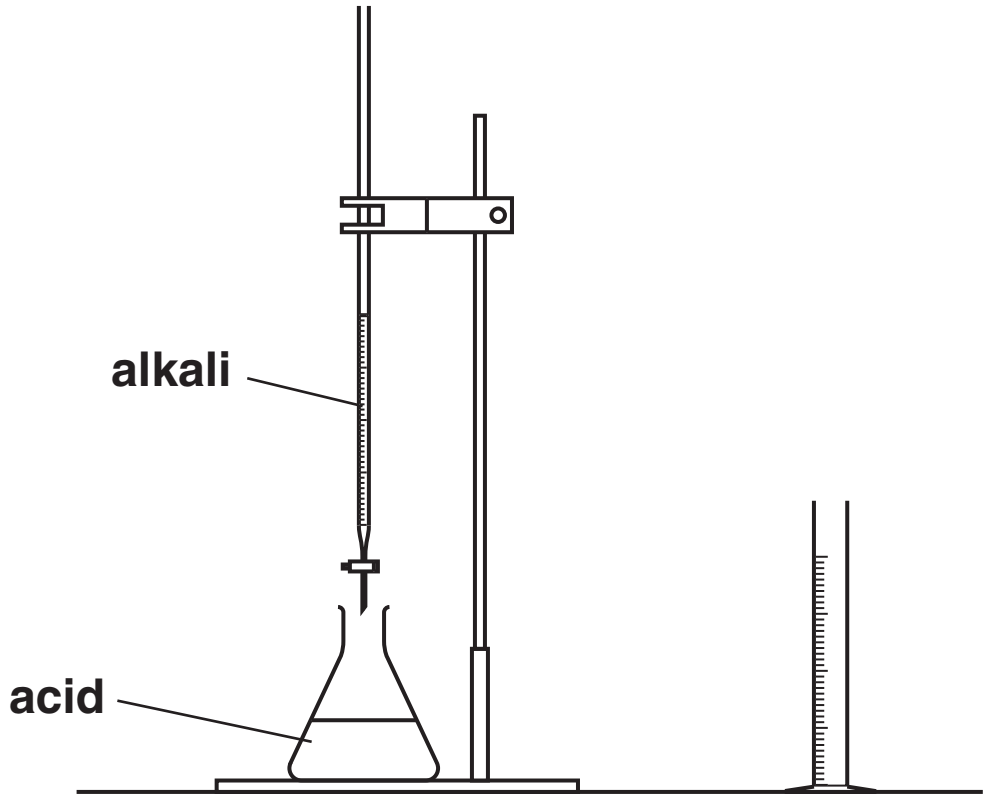
(b) Potassium hydroxide reacts with nitric acid.

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]

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

_____ [1]

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

Write an IONIC equation for neutralisation.

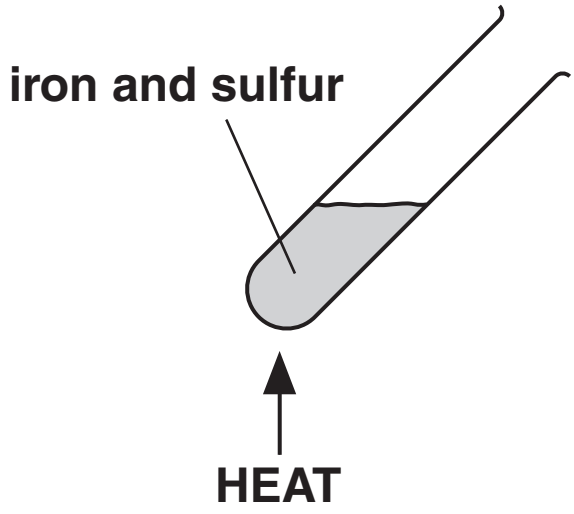
_____ [1]

[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.

Fe	+	S	→	FeS
iron	+	sulfur	→	iron sulfide

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]

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 <u>OTHER</u> 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.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

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

Write down one <u>OTHER</u> condition used.

_____ **[1]**

(ii) Why is a catalyst used?

_____ **[1]**

(b) Ammonia can be used to make urea, $CO(NH_2)_2$.

How many atoms are there in one molecule of urea, $CO(NH_2)_2$?

_____ **[1]**

[Total: 3]

SECTION C – MODULE P4

9 Radioactive atoms can emit THREE different types of nuclear radiation.

One type is ALPHA (α) 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.**

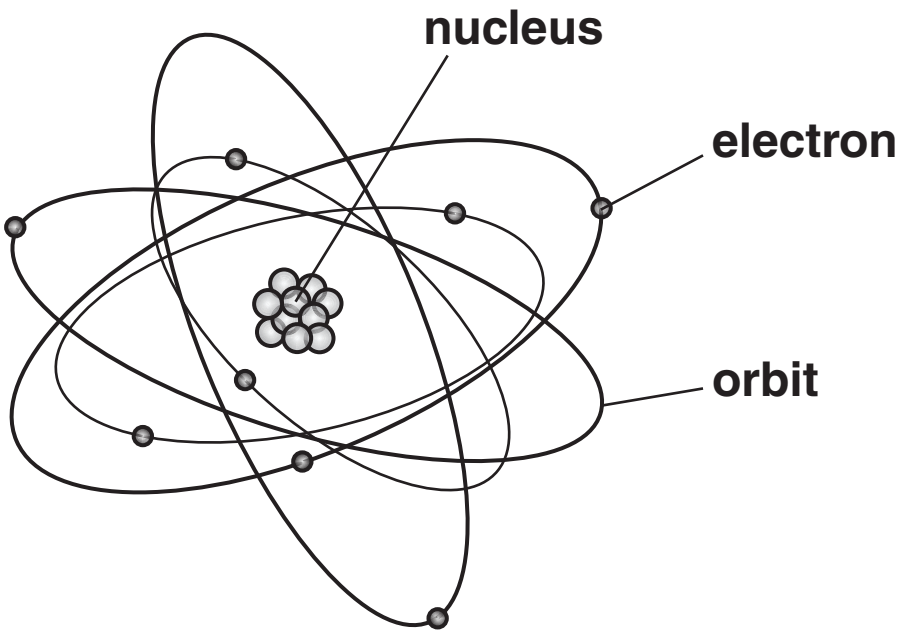
Plutonium-241 is made in a nuclear reactor from plutonium-240.

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.

$^{209}_{84}Po \longrightarrow$ _____ + _____

[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.

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?

_____ **[1]**

[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 _____

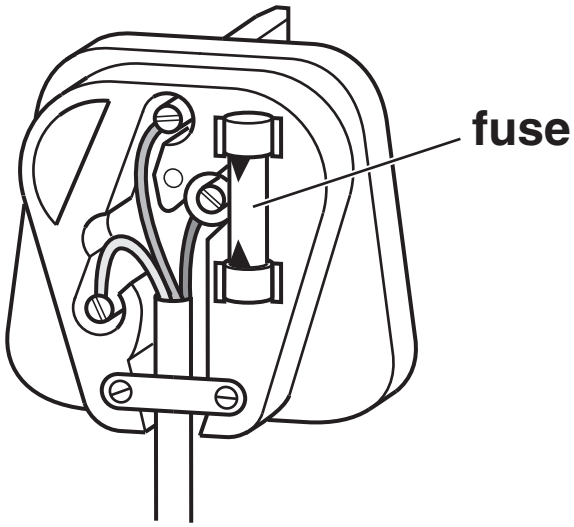
_____

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 Ω.

A fuse is used in the 230 V mains plug.

Calculate the current that passes through the fuse.

The equations on page 3 may help you.

_____

_____

answer _____ amps [2]

[Total: 3]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
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						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.