

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

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

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

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

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

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

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

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

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

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

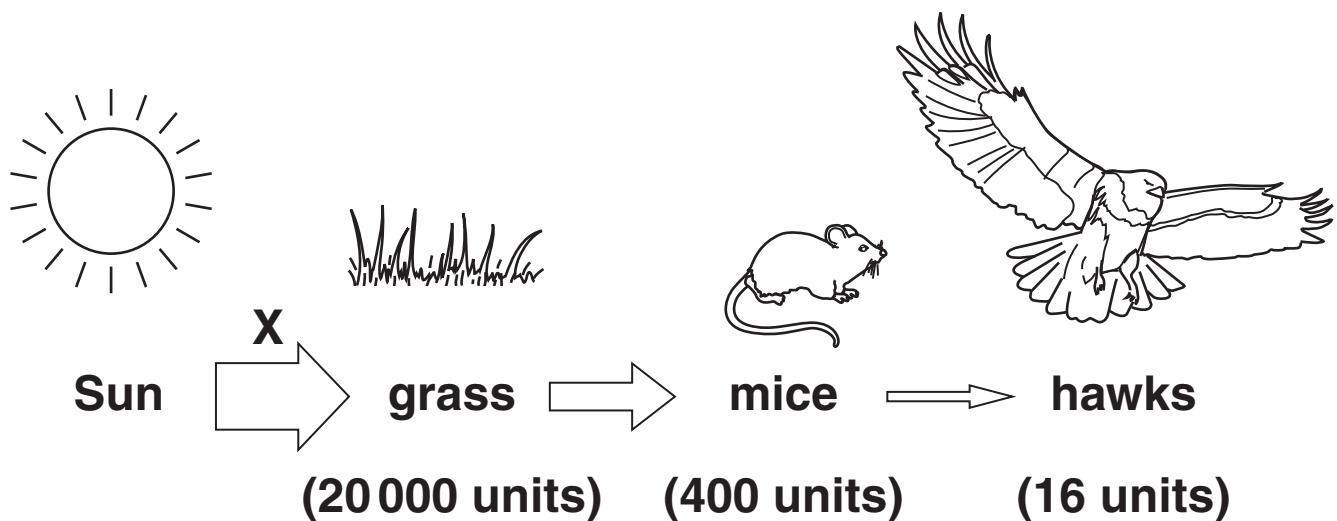
$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

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) 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?

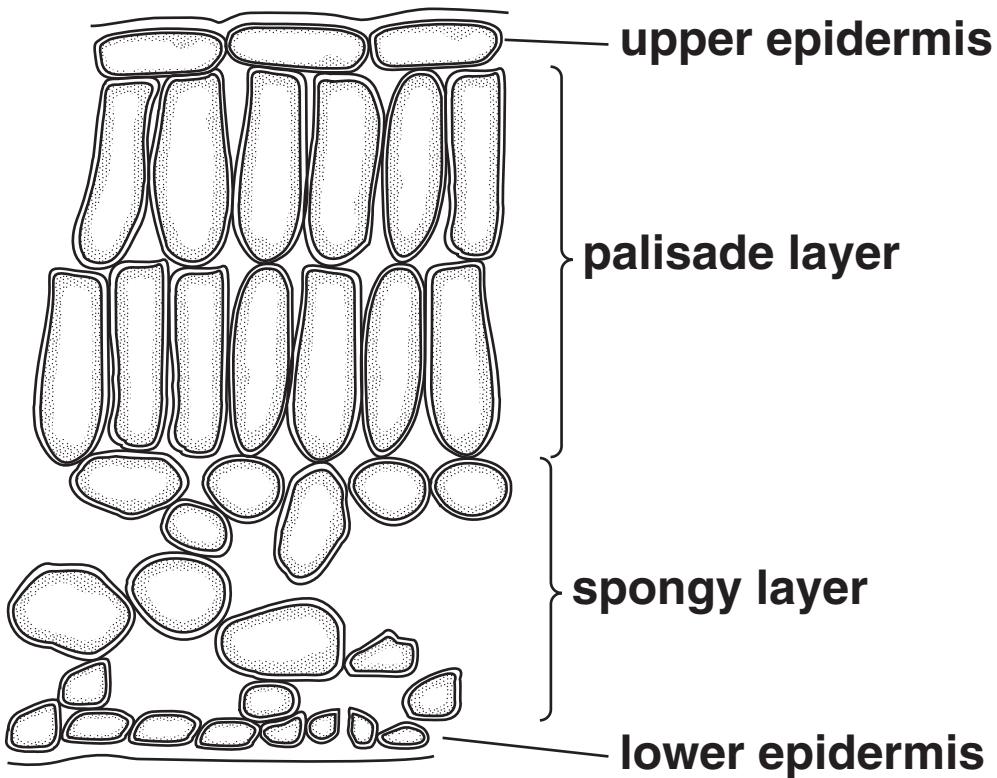
Explain your answer.

[1]

[Total: 6]

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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

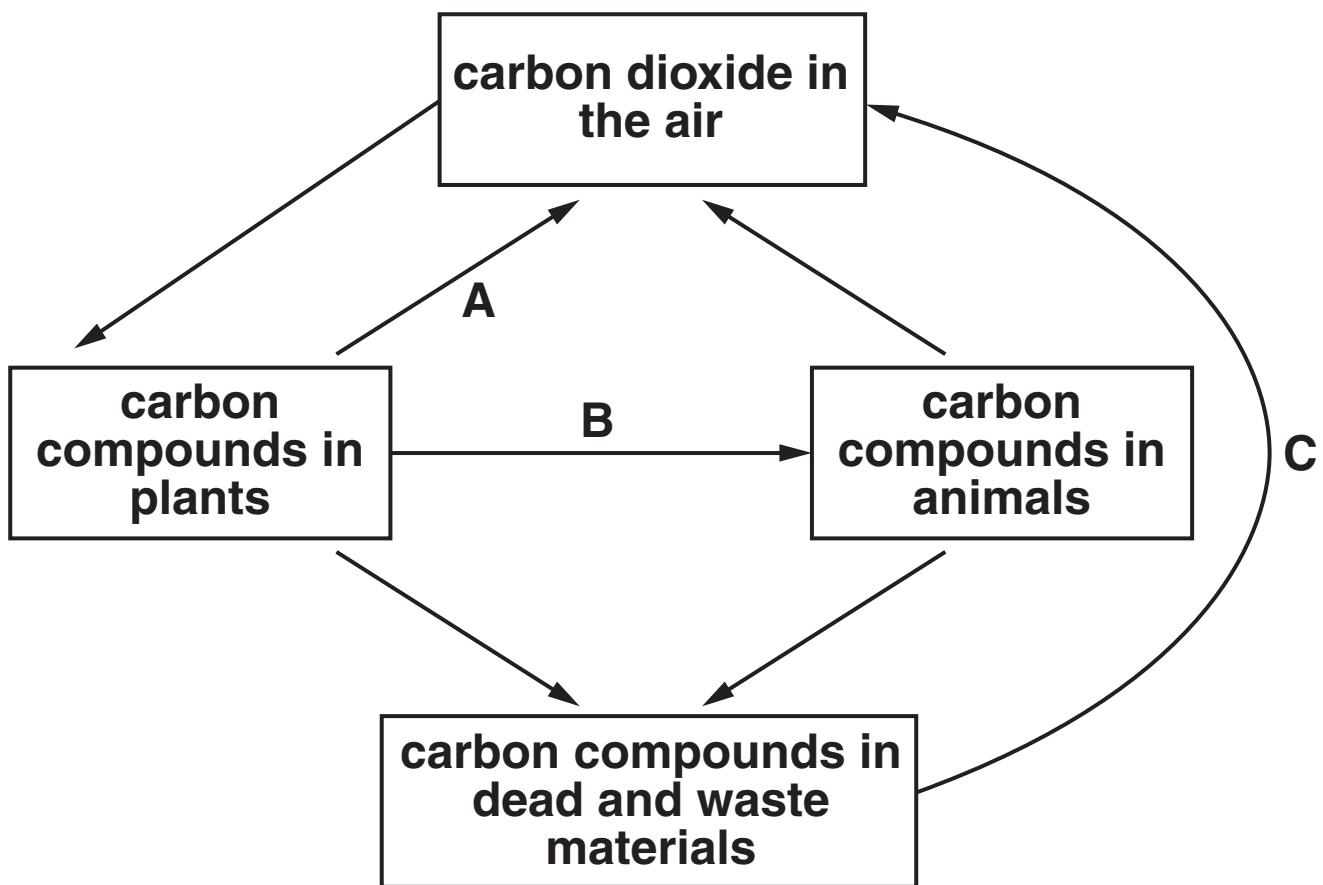
[1]

(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]

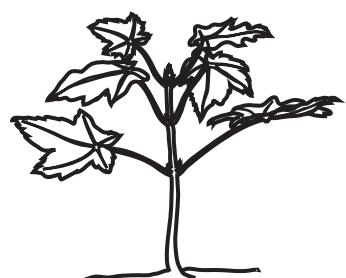
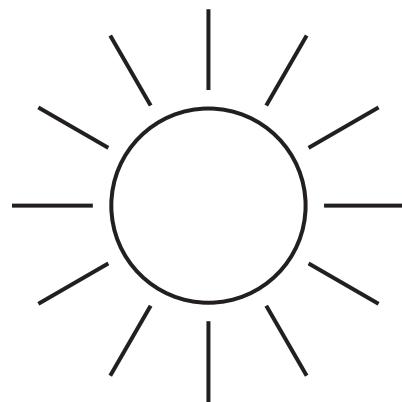
(d) There are other ways carbon dioxide is added to the air that are NOT shown on the diagram.

Write down ONE OTHER way.

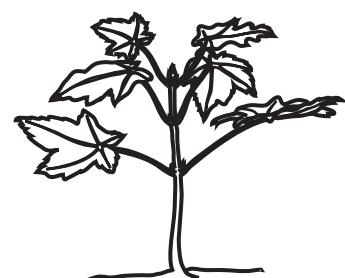
[1]

[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.

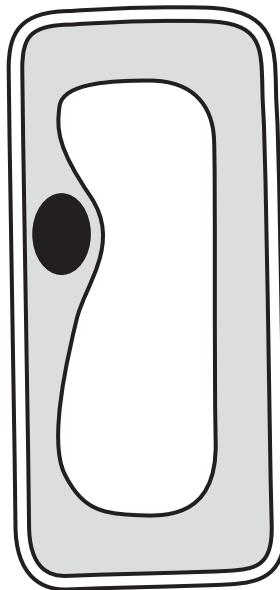
The plant loses water more quickly.

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.

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]

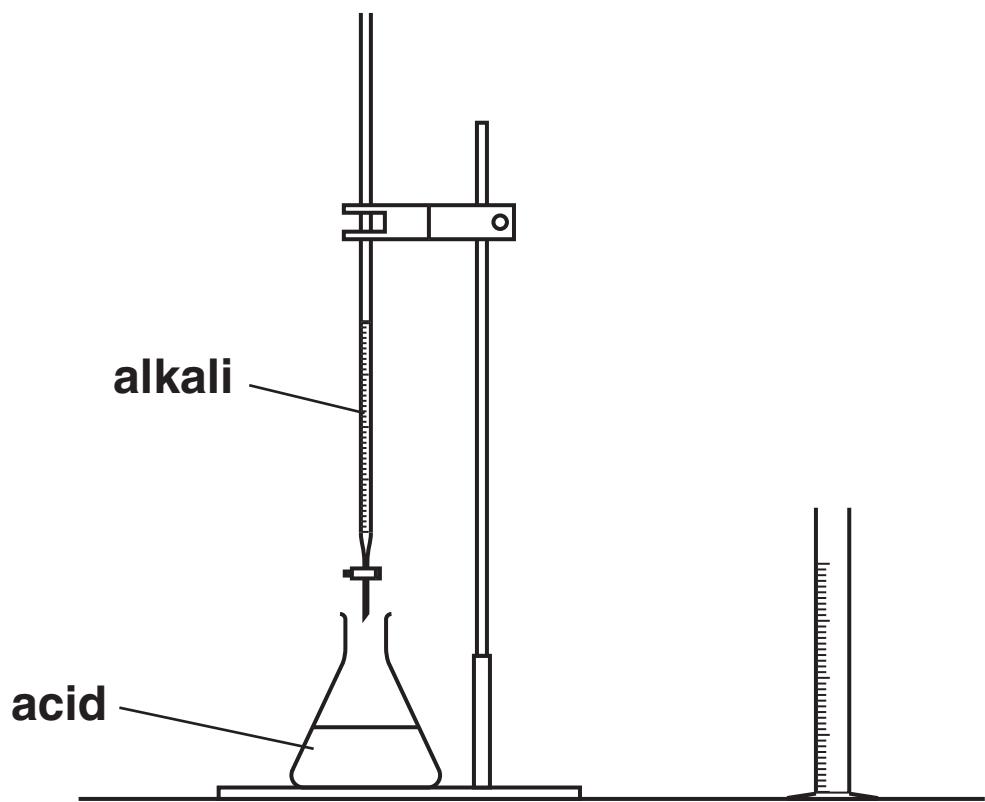
- (b) Potassium hydroxide reacts with nitric acid.**

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^+ . Alkalies contain hydroxide ions, OH^- .

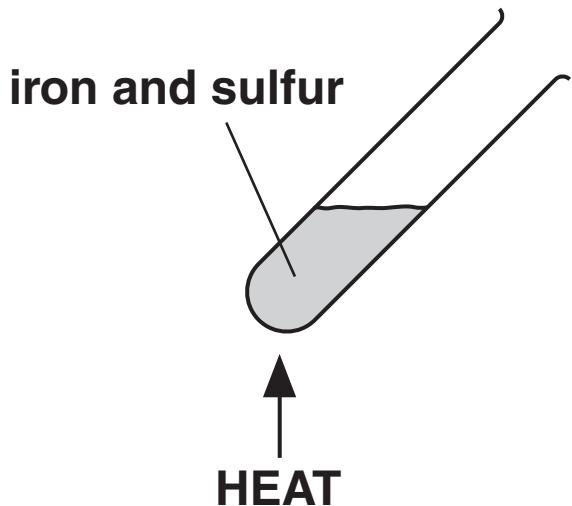
Write an IONIC equation for neutralisation.

[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]

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 (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.**

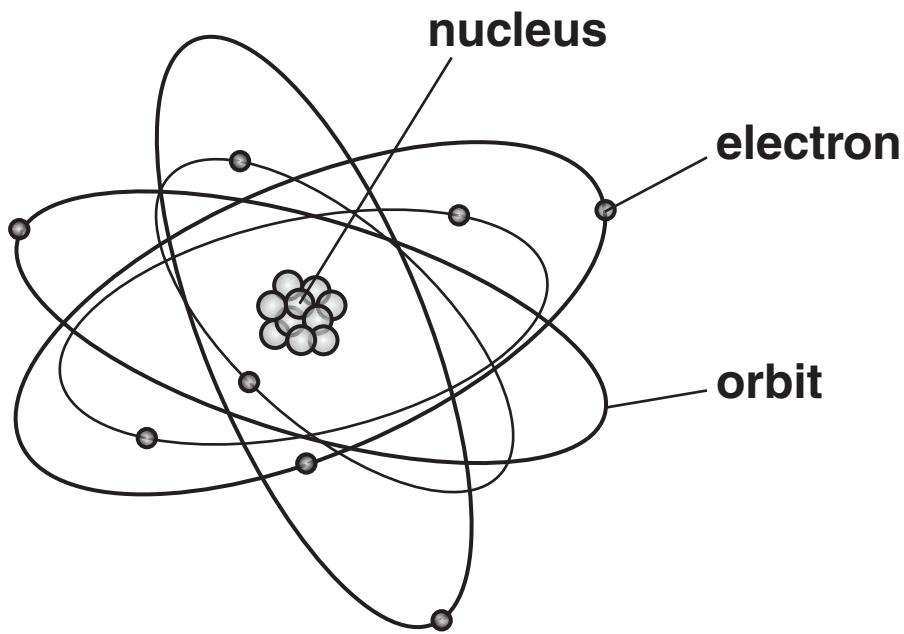
Plutonium-241 is made in a nuclear reactor from plutonium-240.

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

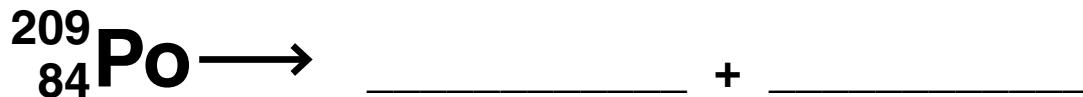
- (i) Polonium-209 decays by emitting an alpha particle.

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.



[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.

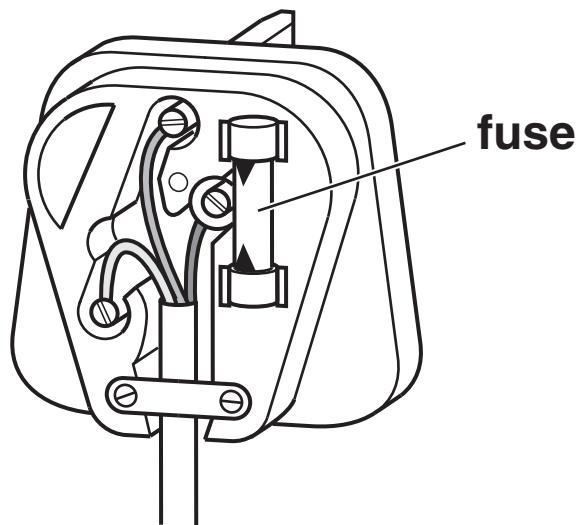
Write down TWO reasons why ultrasound is used instead of X-rays.

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 460Ω .

A fuse is used in the 230V 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



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The Periodic Table of the Elements

1	2	3	4	5	6	7	0
Li lithium 3	Be beryllium 4	9	11	12	14	16	20
K potassium 19	Ca calcium 20	Sc scandium 21	Ti titanium 22	Cr chromium 24	Mn manganese 25	Fe iron 26	N nitrogen 7
Rb rubidium 37	Sr strontium 38	Y yttrium 39	Zr zirconium 40	Nb niobium 41	Mo molybdenum 42	Ru ruthenium 44	Te technetium 43
Cs caesium 55	Ba barium 56	La* lanthanum 57	Hf hafnium 72	Ta tantalum 73	W tungsten 74	Re rhenium 75	O oxygen 8
[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	[268] Mt meitnerium 109
Key	relative atomic mass atomic symbol <small>name</small> atomic (proton) number	Ds darmstadtium 110	Rg roentgenium 111	[271]	[272]	[209] Po polonium 84	[210] At astatine 85
1 H hydrogen 1	2 He helium 2	3 Li lithium 3	4 Be beryllium 4	5 B boron 5	6 C carbon 6	7 N nitrogen 7	0 F fluorine 9
11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10	21 Cl chlorine 17	22 Ar argon 18
27 Al aluminum 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Se selenium 34	36 Te tellurium 52	37 Br bromine 35	38 Kr krypton 36
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 Co cobalt 27
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
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
139 Cs caesium 55	140 Ba barium 56	141 La* lanthanum 57	179 Hf hafnium 72	182 Ta tantalum 73	185 W tungsten 74	191 Re rhenium 75	192 Ir iridium 77
140 Fr francium 87	141 Ra radium 88	142 Ac* actinium 89	143 Rf rutherfordium 104	144 Db dubnium 105	145 Sg seaborgium 106	146 Bh bohrium 107	147 Mt meitnerium 109
148 Fr francium 87	149 Ra radium 88	150 Ac* actinium 89	151 Rf rutherfordium 104	152 Db dubnium 105	153 Sg seaborgium 106	154 Bh bohrium 107	155 Mt meitnerium 109
156 Fr francium 87	157 Ra radium 88	158 Ac* actinium 89	159 Rf rutherfordium 104	160 Db dubnium 105	161 Sg seaborgium 106	162 Bh bohrium 107	163 Mt meitnerium 109
164 Fr francium 87	165 Ra radium 88	166 Ac* actinium 89	167 Rf rutherfordium 104	168 Db dubnium 105	169 Sg seaborgium 106	170 Bh bohrium 107	171 Mt meitnerium 109
172 Fr francium 87	173 Ra radium 88	174 Ac* actinium 89	175 Rf rutherfordium 104	176 Db dubnium 105	177 Sg seaborgium 106	178 Bh bohrium 107	179 Mt meitnerium 109
180 Fr francium 87	181 Ra radium 88	182 Ac* actinium 89	183 Rf rutherfordium 104	184 Db dubnium 105	185 Sg seaborgium 106	186 Bh bohrium 107	187 Mt meitnerium 109
188 Fr francium 87	189 Ra radium 88	190 Ac* actinium 89	191 Rf rutherfordium 104	192 Db dubnium 105	193 Sg seaborgium 106	194 Bh bohrium 107	195 Mt meitnerium 109
196 Fr francium 87	197 Ra radium 88	198 Ac* actinium 89	199 Rf rutherfordium 104	200 Db dubnium 105	201 Sg seaborgium 106	202 Bh bohrium 107	203 Mt meitnerium 109
204 Fr francium 87	205 Ra radium 88	206 Ac* actinium 89	207 Rf rutherfordium 104	208 Db dubnium 105	209 Sg seaborgium 106	210 Bh bohrium 107	211 Mt meitnerium 109
212 Fr francium 87	213 Ra radium 88	214 Ac* actinium 89	215 Rf rutherfordium 104	216 Db dubnium 105	217 Sg seaborgium 106	218 Bh bohrium 107	219 Mt meitnerium 109
220 Fr francium 87	221 Ra radium 88	222 Ac* actinium 89	223 Rf rutherfordium 104	224 Db dubnium 105	225 Sg seaborgium 106	226 Bh bohrium 107	227 Mt meitnerium 109
228 Fr francium 87	229 Ra radium 88	230 Ac* actinium 89	231 Rf rutherfordium 104	232 Db dubnium 105	233 Sg seaborgium 106	234 Bh bohrium 107	235 Mt meitnerium 109
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268 Fr francium 87	269 Ra radium 88	270 Ac* actinium 89	271 Rf rutherfordium 104	272 Db dubnium 105	273 Sg seaborgium 106	274 Bh bohrium 107	275 Mt meitnerium 109
276 Fr francium 87	277 Ra radium 88	278 Ac* actinium 89	279 Rf rutherfordium 104	280 Db dubnium 105	281 Sg seaborgium 106	282 Bh bohrium 107	283 Mt meitnerium 109
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296 Fr francium 87	297 Ra radium 88	298 Ac* actinium 89	299 Rf rutherfordium 104	300 Db dubnium 105	301 Sg seaborgium 106	302 Bh bohrium 107	303 Mt meitnerium 109
304 Fr francium 87	305 Ra radium 88	306 Ac* actinium 89	307 Rf rutherfordium 104	308 Db dubnium 105	309 Sg seaborgium 106	310 Bh bohrium 107	311 Mt meitnerium 109
312 Fr francium 87	313 Ra radium 88	314 Ac* actinium 89	315 Rf rutherfordium 104	316 Db dubnium 105	317 Sg seaborgium 106	318 Bh bohrium 107	319 Mt meitnerium 109
320 Fr francium 87	321 Ra radium 88	322 Ac* actinium 89	323 Rf rutherfordium 104	324 Db dubnium 105	325 Sg seaborgium 106	326 Bh bohrium 107	327 Mt meitnerium 109
328 Fr francium 87	329 Ra radium 88	330 Ac* actinium 89	331 Rf rutherfordium 104	332 Db dubnium 105	333 Sg seaborgium 106	334 Bh bohrium 107	335 Mt meitnerium 109
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360 Fr francium 87	361 Ra radium 88	362 Ac* actinium 89	363 Rf rutherfordium 104	364 Db dubnium 105	365 Sg seaborgium 106	366 Bh bohrium 107	367 Mt meitnerium 109
368 Fr francium 87	369 Ra radium 88	370 Ac* actinium 89	371 Rf rutherfordium 104	372 Db dubnium 105	373 Sg seaborgium 106	374 Bh bohrium 107	375 Mt meitnerium 109
376 Fr francium 87	377 Ra radium 88	378 Ac* actinium 89	379 Rf rutherfordium 104	380 Db dubnium 105	381 Sg seaborgium 106	382 Bh bohrium 107	383 Mt meitnerium 109
384 Fr francium 87	385 Ra radium 88	386 Ac* actinium 89	387 Rf rutherfordium 104	388 Db dubnium 105	389 Sg seaborgium 106	390 Bh bohrium 107	391 Mt meitnerium 109
392 Fr francium 87	393 Ra radium 88	394 Ac* actinium 89	395 Rf rutherfordium 104	396 Db dubnium 105	397 Sg seaborgium 106	398 Bh bohrium 107	399 Mt meitnerium 109
396 Fr francium 87	397 Ra radium 88	398 Ac* actinium 89	399 Rf rutherfordium 104	400 Db dubnium 105	401 Sg seaborgium 106	402 Bh bohrium 107	403 Mt meitnerium 109
404 Fr francium 87	405 Ra radium 88	406 Ac* actinium 89	407 Rf rutherfordium 104	408 Db dubnium 105	409 Sg seaborgium 106	410 Bh bohrium 107	411 Mt meitnerium 109
412 Fr francium 87	413 Ra radium 88	414 Ac* actinium 89	415 Rf rutherfordium 104	416 Db dubnium 105	417 Sg seaborgium 106	418 Bh bohrium 107	419 Mt meitnerium 109
420 Fr francium 87	421 Ra radium 88	422 Ac* actinium 89	423 Rf rutherfordium 104	424 Db dubnium 105	425 Sg seaborgium 106	426 Bh bohrium 107	427 Mt meitnerium 109
428 Fr francium 87	429 Ra radium 88	430 Ac* actinium 89	431 Rf rutherfordium 104	432 Db dubnium 105	433 Sg seaborgium 106	434 Bh bohrium 107	435 Mt meitnerium 109
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536 Fr francium 87	537 Ra radium 88	538 Ac* actinium 89	539 Rf rutherfordium 104	540 Db dubnium 105	541 Sg seaborgium 106	542 Bh bohrium 107	543 Mt meitnerium 109
544 Fr francium 87	545 Ra radium 88	546 Ac* actinium 89	547 Rf rutherfordium 104	548 Db dubnium 105	549 Sg seaborgium 106	550 Bh bohrium 107	551 Mt meitnerium 109
552 Fr francium 87	553 Ra radium 88	554 Ac* actinium 89	555 Rf rutherfordium 104	556 Db dubnium 105	557 Sg seaborgium 106	558 Bh bohrium 107	559 Mt meitnerium 109
560 Fr francium 87	561 Ra radium 88	562 Ac* actinium 89	563 Rf rutherfordium 104	564 Db dubnium 105	565 Sg seaborgium 106	566 Bh bohrium 107	567 Mt meitnerium 109
568 Fr francium 87	569 Ra radium 88	570 Ac* actinium 89	571 Rf rutherfordium 104	572 Db dubnium 105	573 Sg seaborgium 106	574 Bh bohrium 107	575 Mt meitnerium 109
576 Fr francium 87	577 Ra radium 88	578 Ac* actinium 89	579 Rf rutherfordium 104	580 Db dubnium 105	581 Sg seaborgium 106	582 Bh bohrium 107	583 Mt meitnerium 109
584 Fr francium 87	585 Ra radium 88	586 Ac* actinium 89	587 Rf rutherfordium 104	588 Db dubnium 105	589 Sg seaborgium 106	590 Bh bohrium 107	591 Mt meitnerium 109
592 Fr francium 87	593 Ra radium 88	594 Ac* actinium 89	595 Rf rutherfordium 104				

* 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.