

**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 9 June 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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

**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 **28** pages. Any blank pages are indicated.

**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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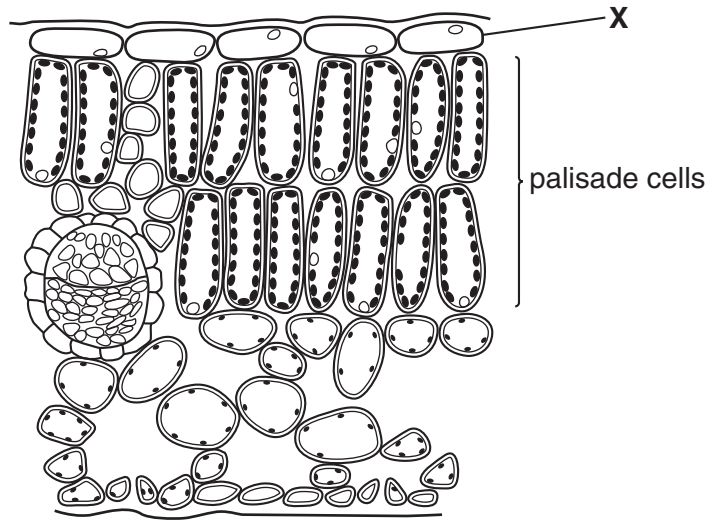
**Question 1 begins on page 4.**

**PLEASE DO NOT WRITE ON THIS PAGE**

Answer **all** the questions.

**Section A – Module B4**

1 Look at the diagram of a section through a leaf.



(a) What is the name of part **X**?

Put a **ring** around the correct answer.

- cuticle    guard cells    lower epidermis    stomata    upper epidermis**

[1]

(b) Palisade cells are labelled on the diagram.

Palisade cells are **more** efficient at photosynthesis than other leaf cells.

Write down **two** reasons why they are more efficient.

1 .....

.....

2 .....

..... [2]

- (c) (i) Water moves through vessels in the leaf during transpiration.  
Write down the name of the vessels that transport water in transpiration.  
Choose from the list.

cuticle

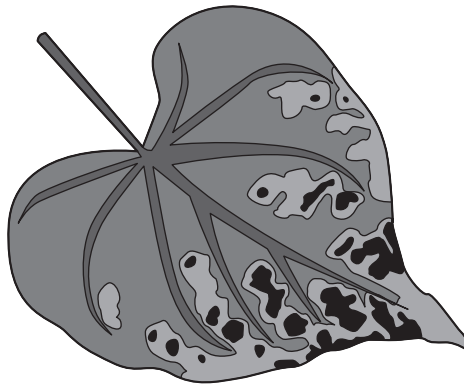
mesophyll

phloem

xylem

..... [1]

- (ii) Look at the leaf in the picture.



This leaf has yellow patches and does not photosynthesise well.  
Magnesium is missing from the soil.  
What substance in plants contains magnesium?

..... [1]

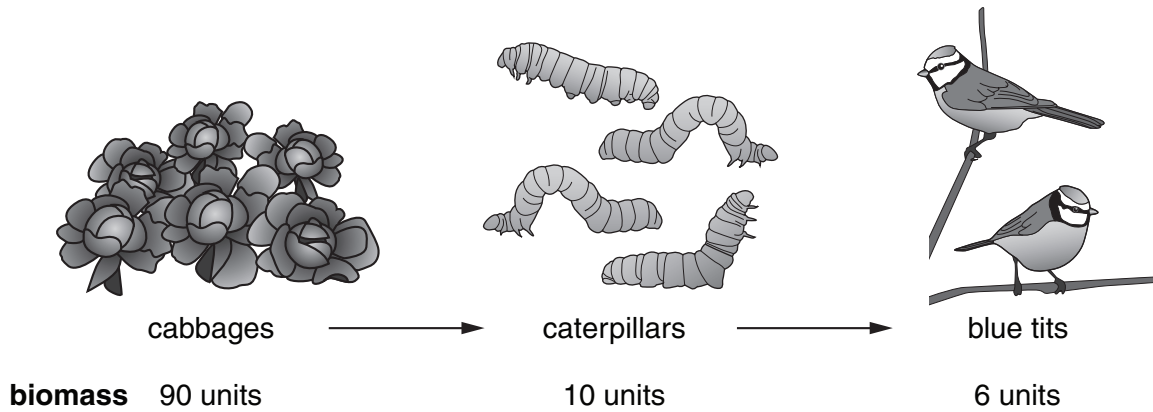
- (iii) Magnesium is usually taken up by plant root hairs from low concentrations in the soil.  
Explain how plants can do this.

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

[Total: 7]

2 (a) Look at the food chain.

It shows the biomass at each stage.

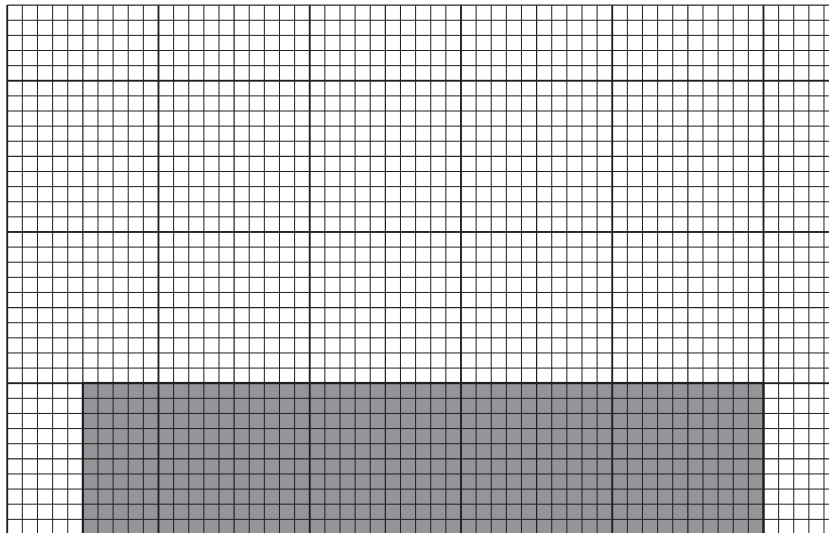


A pyramid of biomass can be drawn to describe this food chain.

Finish the pyramid of biomass to include the caterpillars and the blue tits.

Make sure the bars are drawn to scale and **labelled**.

The bar for the cabbages has been drawn for you.



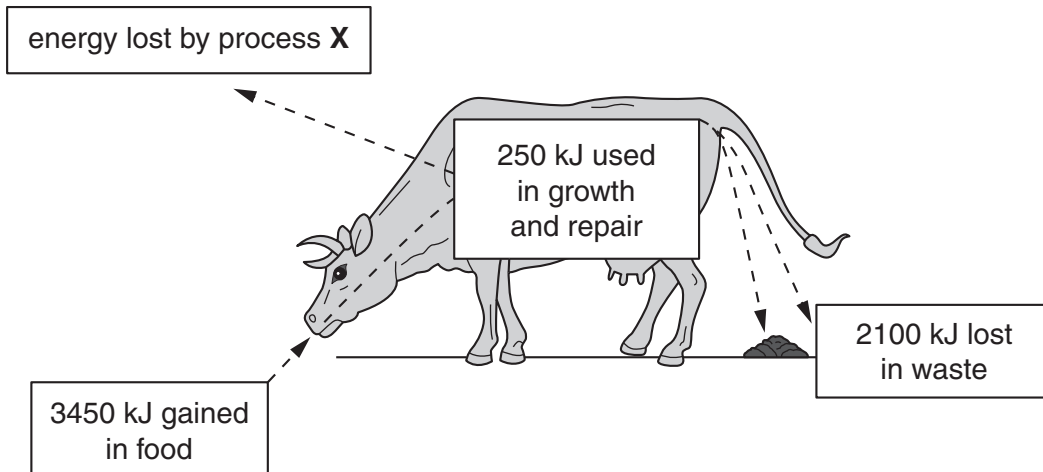
[2]

(b) Farmers grow crops and produce large amounts of biomass.

This biomass is fed to cows.

Look at the diagram.

It shows all the energy transferred to and from a cow.



(i) Look at the diagram.

What is process X?

..... [1]

(ii) Calculate the amount of energy lost by process X.

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

answer ..... kJ [1]

(iii) Some of the energy gained in food is transferred to growth and repair.

Calculate the **efficiency** of this energy transfer.

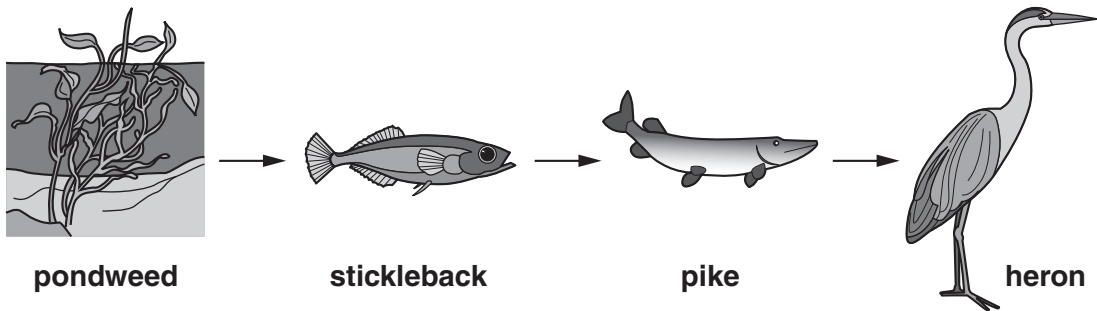
.....  
 .....  
 .....

answer ..... % [2]

(c) Some farmers use intensive farming methods to improve the yield of their crops.

Sometimes **pesticides** are used.

This is a food chain found in rivers.



Pesticides sprayed on fields can decrease the number of herons in rivers.

Write about how this happens.

.....

.....

.....

..... [2]

[Total: 8]

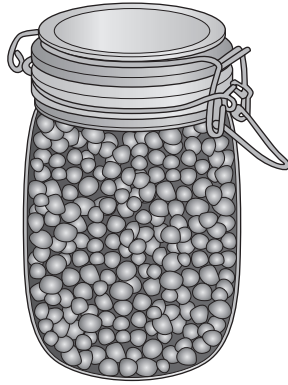


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**Question 3 begins on page 10.**

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3 Peas can be preserved by storing them in a strong salt solution.



(a) The peas are soaked in a strong salt solution.

Look at the statements below.

Which statement describes the way the salt solution helps preserve the peas from decay?

Put a tick (✓) in the correct box.

high temperature kills microorganisms

the solution prevents microorganisms getting oxygen

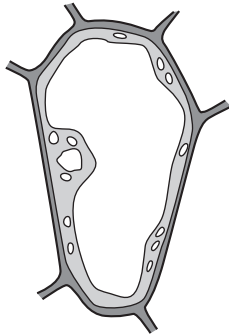
the solution causes microorganisms to lose water

the solution is too acidic for microorganisms

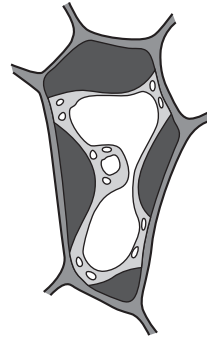
[1]

(b) Preserving peas in strong salt solution can affect their texture.

This is because the pea cells change shape.



normal pea cell



pea cell in strong salt solution

(i) Write down the name of the process that causes the cell to change shape in the strong salt solution.

..... [1]

(ii) Write down the word used to describe the appearance of the cell in the strong salt solution.

..... [1]

(c) (i) **Turgor pressure** provides support for a pea plant.

Explain what is meant by turgor pressure.

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

(ii) Turgor pressure occurs in plant cells.

Turgor pressure does **not** occur in animal cells.

Explain why.

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

[Total: 5]

## Section B – Module C4

4 Mr Hills is a farmer.

He grows vegetables on his farm.

(a) Mr Hills adds fertilisers to his fields.



Potassium nitrate,  $\text{KNO}_3$ , is a fertiliser.

Calculate the relative formula mass,  $M_r$ , of potassium nitrate.

The relative atomic mass of K is 39, of N is 14 and of O is 16.

.....

.....

.....

answer ..... [1]

(b) Potassium nitrate is made when potassium hydroxide reacts with an acid.

(i) Write down the name of this acid.

..... [1]

(ii) An acid reacts with a base.

What is the name of this **type** of reaction?

Choose from:

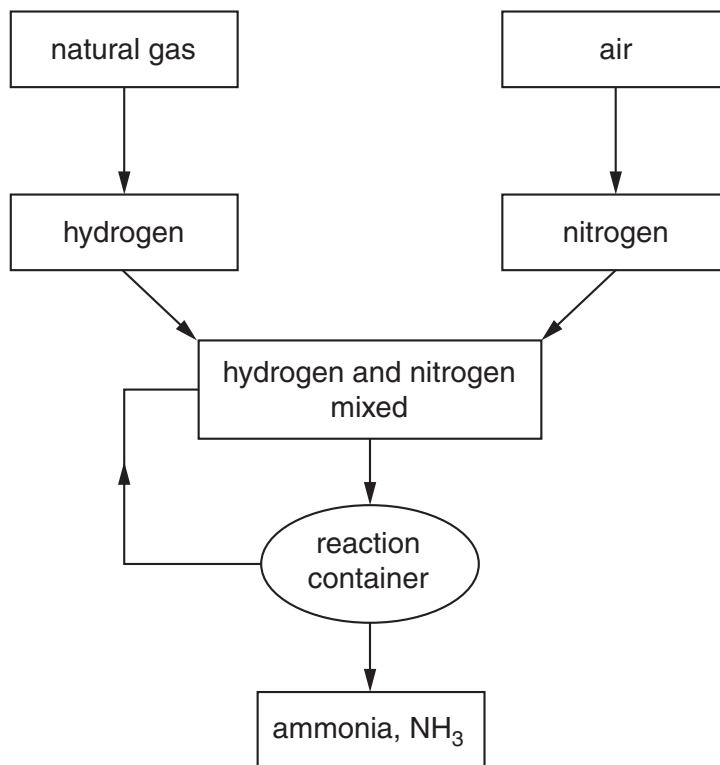
**chromatography    distillation    neutralisation    precipitation**

answer ..... [1]



5 This question is about the manufacture of ammonia, NH<sub>3</sub>.

Look at the flow chart. It shows the steps in the process.



(a) In this reaction, nitrogen, N<sub>2</sub>, reacts with hydrogen, H<sub>2</sub>, to make ammonia.

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

..... [2]

(b) An iron catalyst is used in this process.

What is the effect of using a catalyst on the rate of reaction and the percentage yield of ammonia?

Effect on rate of reaction .....

Effect on percentage yield ..... [1]

(c) Ammonia is a very important chemical.

Explain why.

.....

..... [1]

(d) Look at the table.

It shows the percentage yield of ammonia at different temperatures and pressures.

pressure in atmospheres	percentage yield at 200 °C	percentage yield at 400 °C	percentage yield at 600 °C
100	80	22	8
200	92	40	14
300	95	56	18
400	96	67	22

(i) How does increasing the **temperature** change the percentage yield?

..... [1]

(ii) How does increasing the **pressure** change the percentage yield?

..... [1]

[Total: 6]

**16**  
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6 This question is about water supplies.

Water purification has three stages.

(a) Complete the table to show the processes and why they are used.

process	why it is used
filtration	<p>.....</p> <p>.....</p>
<p>.....</p>	allows very small solid particles to settle out
chlorination	kills microbes

[2]

(b) One of the pollutants sometimes found in water is lead compounds.

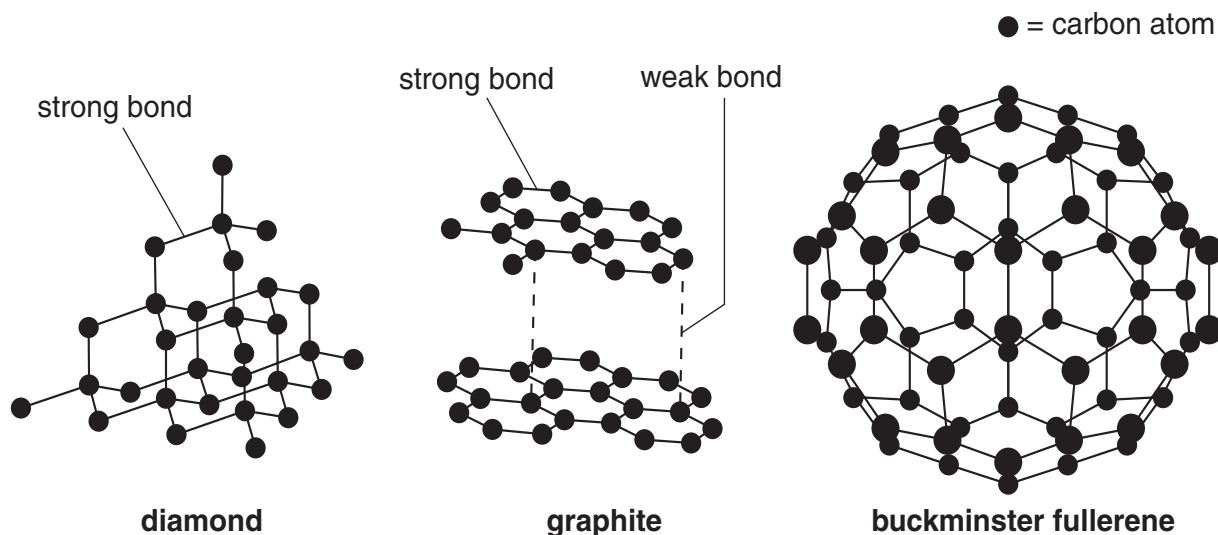
Explain how lead compounds get into water supplies.

.....

.....[1]

[Total: 3]

7 Carbon can exist in different solid forms.



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

Choose from:

**allotrope**

**isotope**

**nanotube**

**precipitate**

answer ..... [1]

(b) Graphite is slippery.

Explain why.

Use ideas about its structure.

The diagram may help you.

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

(c) Graphite is a good conductor of electricity.

Explain how graphite conducts electricity.

..... [1]

(d) Diamond is used to make cutting tools.



Write down **two** reasons why.

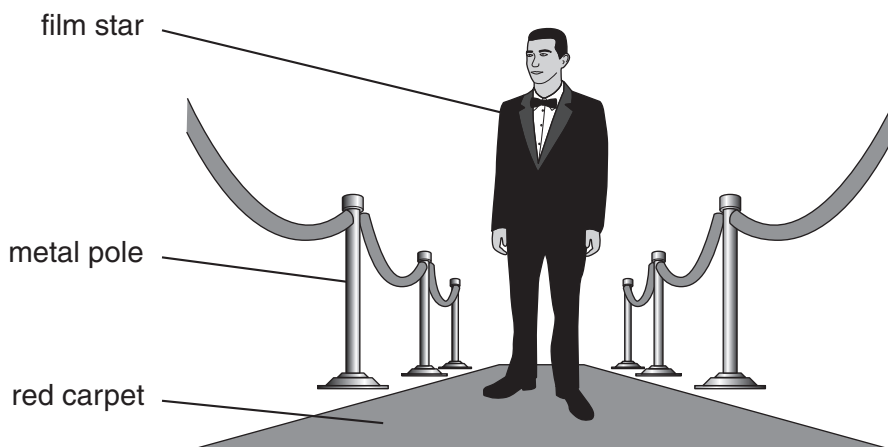
1 .....

2 ..... [2]

[Total: 5]

Section C – Module P4

8 A film star walks down the red carpet.



He becomes charged.

He touches a metal pole.

The charged particles move to earth and he gets an electrostatic shock.

(a) What are these charged particles called?

Choose from:

- alpha    beta    electrons    neutrons    protons

..... [1]

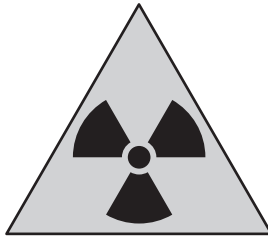
(b) Static electricity can cause shocks.

Write down one other **disadvantage** of static electricity.

..... [1]

[Total: 2]

9 This question is about radioactivity.



(a) The three types of nuclear radiation are **alpha**, **beta** and **gamma**.

Complete the table.

type of radiation	speed	description
alpha	slow moving	helium nucleus
beta		
gamma	very fast	electromagnetic wave

[2]

(b) Most elements do **not** contain radioactive atoms.

We can place these elements in a **nuclear reactor**.

They absorb **particles** in the reactor.

This makes the atoms radioactive.

(i) What is the name of the particles that are absorbed by the atoms?

..... [1]

(ii) Alpha radiation comes from the **nucleus** of a radioactive atom.

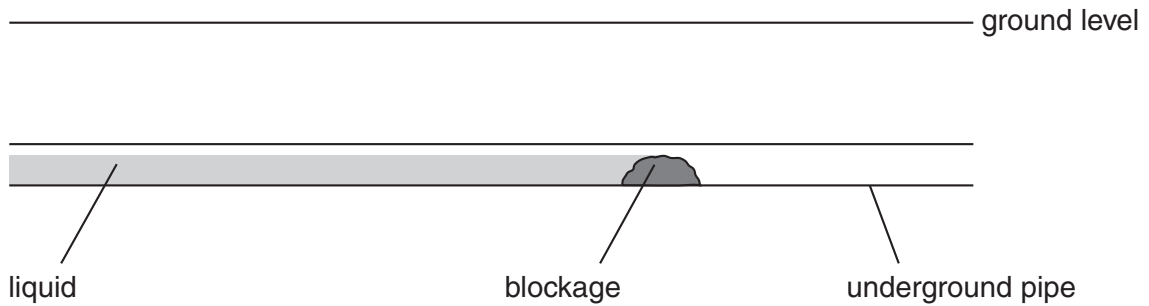
What is special about the nucleus of a **radioactive** atom?

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

(c) Some underground pipes carry liquids.

Sometimes they become blocked.

Look at the diagram.



Radioactive tracers can be used to find the blockage in the pipe.

Explain how.

Your answer should include

- the **type** of tracer used
- **why** this tracer is used
- how the radiation is **detected**
- **how** the blockage is found.

.....

.....

.....

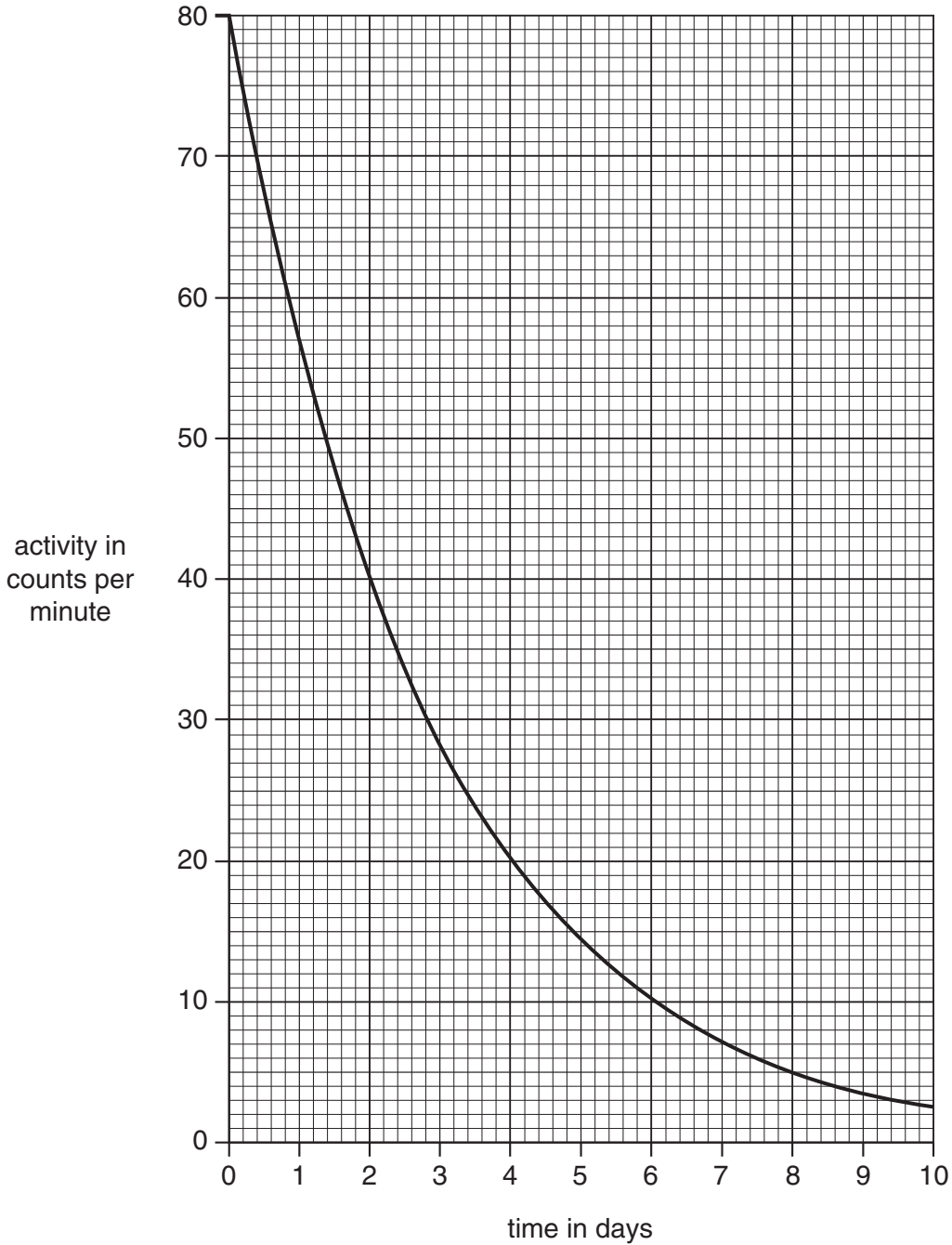
.....

.....

..... [4]

(d) Radioactive materials become less active with time.

Look at the graph of the activity of radioactive material X.



(i) Radioactive material X has an activity of 80 counts per minute.

Its activity decreases over time.

Look at the decay curve for material X.

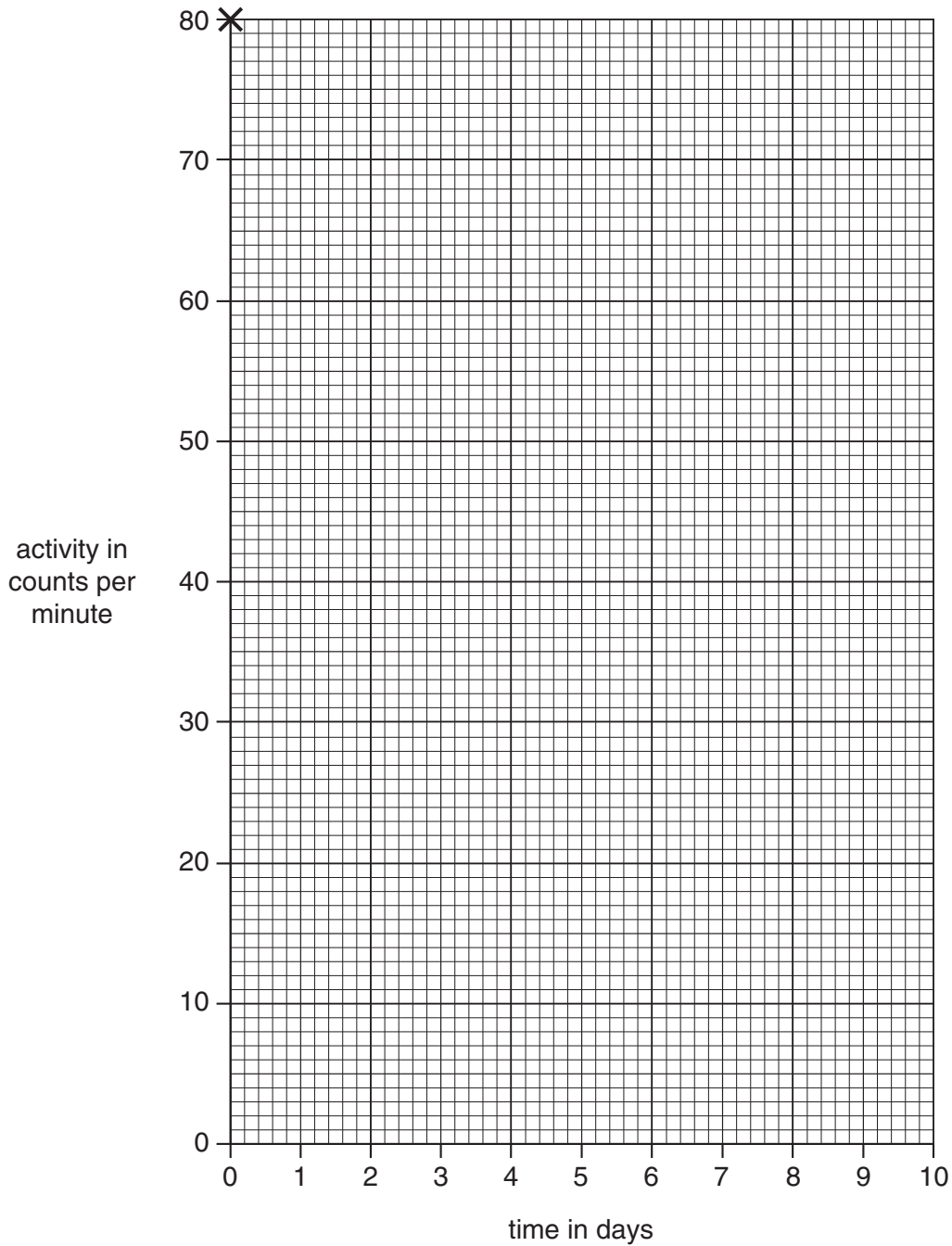
What is the **half life** of radioactive material X?

answer ..... days

[1]

- (ii) Material **Y** has a half life of **3 days**. It starts with an activity of 80 counts per minute.  
Complete the graph.

Draw the decay curve for material **Y** for the first 6 days.



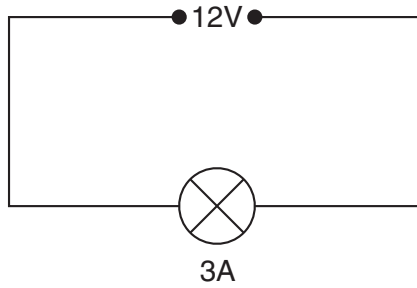
[1]

[Total: 10]



10 Amy builds an electric circuit.

(a) Look at the circuit diagram.



The current in the lamp is 3A.

The voltage across the lamp is 12V.

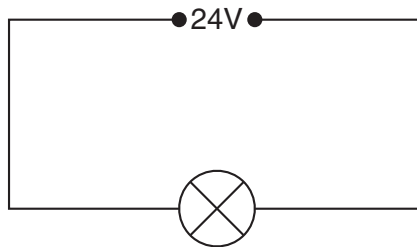
Calculate the **resistance** of the lamp.

The equations on page 2 may help you.

.....  
.....

answer.....  $\Omega$  [2]

(b) Amy **increases** the voltage across the lamp to 24V.



What happens to the size of the **current** in the lamp?

..... [1]

[Total: 3]

11 **Ultrasound** is a longitudinal wave.

(a) Humans **cannot** hear ultrasound. Explain why.

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

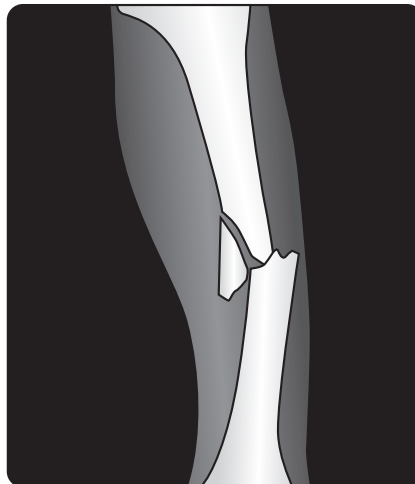
(b) Ultrasound is used in hospitals for scanning.

It can detect the different layers inside the body.

Explain how.

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

(c) X-rays are used in hospitals.



X-rays can show broken bones.

It is safer to scan unborn babies with **ultrasound**.

Suggest why ultrasound is used rather than X-rays.

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

(d) How are X-rays made in an X-ray machine?

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

[Total: 5]

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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0
	1 <b>H</b> hydrogen 1							4 <b>He</b> helium 2
		9 <b>Be</b> beryllium 4						20 <b>Ne</b> neon 10
	7 <b>Li</b> lithium 3	24 <b>Mg</b> magnesium 12					19 <b>F</b> fluorine 9	35.5 <b>Cl</b> chlorine 17
	23 <b>Na</b> sodium 11					16 <b>O</b> oxygen 8		40 <b>Ar</b> argon 18
	39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20				32 <b>S</b> sulfur 16		84 <b>Kr</b> krypton 36
	85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38				79 <b>Se</b> selenium 34		131 <b>Xe</b> xenon 54
	133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56				128 <b>Te</b> tellurium 52		[222] <b>Rn</b> radon 86
	[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88				[209] <b>Po</b> polonium 84		[210] <b>At</b> astatine 85
						209 <b>Bi</b> bismuth 83		
						207 <b>Pb</b> lead 82		
						204 <b>Tl</b> thallium 81		
						201 <b>Hg</b> mercury 80		
						112 <b>Cd</b> cadmium 48		
						108 <b>Ag</b> silver 47		
						106 <b>Pd</b> palladium 46		
						103 <b>Rh</b> rhodium 45		
						101 <b>Ru</b> ruthenium 44		
						100 <b>Tc</b> technetium 43		
						96 <b>Mo</b> molybdenum 42		
						93 <b>Nb</b> niobium 41		
						91 <b>Zr</b> zirconium 40		
						89 <b>Y</b> yttrium 39		
						87 <b>La*</b> lanthanum 57		
						86 <b>Re</b> rhenium 75		
						84 <b>W</b> tungsten 74		
						81 <b>Ta</b> tantalum 73		
						79 <b>Ir</b> iridium 77		
						78 <b>Pt</b> platinum 78		
						77 <b>Au</b> gold 79		
						76 <b>Os</b> osmium 76		
						75 <b>Rh</b> rhodium 45		
						74 <b>Pd</b> palladium 46		
						73 <b>Cu</b> copper 29		
						72 <b>Hf</b> hafnium 72		
						71 <b>Ta</b> tantalum 73		
						70 <b>Zn</b> zinc 30		
						69 <b>Ag</b> silver 47		
						68 <b>Cd</b> cadmium 48		
						67 <b>Co</b> cobalt 27		
						65 <b>Ni</b> nickel 28		
						63.5 <b>Cu</b> copper 29		
						62 <b>Ni</b> nickel 28		
						61 <b>Co</b> cobalt 27		
						60 <b>Ni</b> nickel 28		
						59 <b>Co</b> cobalt 27		
						58 <b>Ni</b> nickel 28		
						57 <b>Co</b> cobalt 27		
						56 <b>Fe</b> iron 26		
						55 <b>Mn</b> manganese 25		
						54 <b>Cr</b> chromium 24		
						53 <b>V</b> vanadium 23		
						52 <b>Cr</b> chromium 24		
						51 <b>V</b> vanadium 23		
						50 <b>Ti</b> titanium 22		
						49 <b>Sc</b> scandium 21		
						48 <b>Ti</b> titanium 22		
						47 <b>Sc</b> scandium 21		
						46 <b>Ti</b> titanium 22		
						45 <b>Sc</b> scandium 21		
						44 <b>Ti</b> titanium 22		
						43 <b>Sc</b> scandium 21		
						42 <b>Ti</b> titanium 22		
						41 <b>Sc</b> scandium 21		
						40 <b>Ca</b> calcium 20		
						39 <b>K</b> potassium 19		
						38 <b>Sr</b> strontium 38		
						37 <b>Rb</b> rubidium 37		
						36 <b>Kr</b> krypton 36		
						35 <b>Br</b> bromine 35		
						34 <b>Se</b> selenium 34		
						33 <b>As</b> arsenic 33		
						32 <b>S</b> sulfur 16		
						31 <b>P</b> phosphorus 15		
						30 <b>Si</b> silicon 14		
						29 <b>Al</b> aluminum 13		
						28 <b>Si</b> silicon 14		
						27 <b>Al</b> aluminum 13		
						26 <b>Fe</b> iron 26		
						25 <b>Mn</b> manganese 25		
						24 <b>Cr</b> chromium 24		
						23 <b>V</b> vanadium 23		
						22 <b>Ti</b> titanium 22		
						21 <b>Sc</b> scandium 21		
						20 <b>Ca</b> calcium 20		
						19 <b>K</b> potassium 19		
						18 <b>Ar</b> argon 18		
						17 <b>Cl</b> chlorine 17		
						16 <b>O</b> oxygen 8		
						15 <b>P</b> phosphorus 15		
						14 <b>N</b> nitrogen 7		
						13 <b>Si</b> silicon 14		
						12 <b>C</b> carbon 6		
						11 <b>B</b> boron 5		
						10 <b>Ne</b> neon 10		
						9 <b>F</b> fluorine 9		
						8 <b>O</b> oxygen 8		
						7 <b>N</b> nitrogen 7		
						6 <b>C</b> carbon 6		
						5 <b>B</b> boron 5		
						4 <b>He</b> helium 2		
						3 <b>Li</b> lithium 3		
						2 <b>Be</b> beryllium 4		
						1 <b>H</b> hydrogen 1		

**Key**  
relative atomic mass  
atomic symbol  
name  
atomic (proton) number

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.