

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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MODIFIED LANGUAGE

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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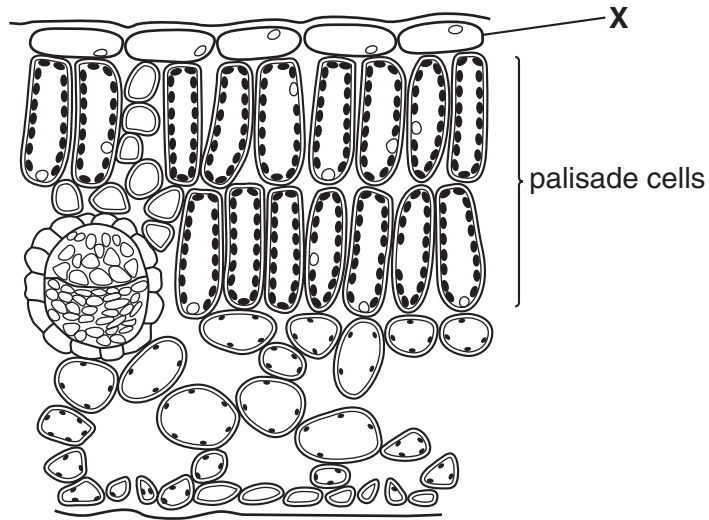
Question 1 begins on page 4.

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) Give 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

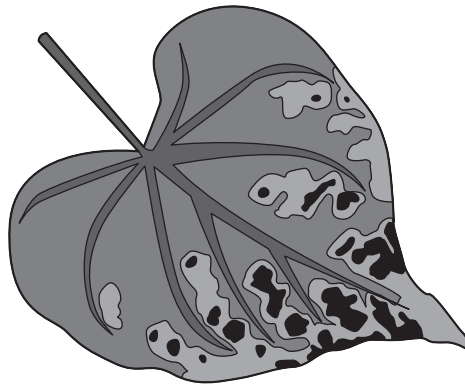
mesophyll

phloem

xylem

..... [1]

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



This leaf has yellow patches. It does not photosynthesise well.
Magnesium is missing from the soil.
Name the substance in plants that contains magnesium.

..... [1]

- (iii) There are usually low concentrations of magnesium in the soil. Magnesium is taken up by root hairs on the plant.

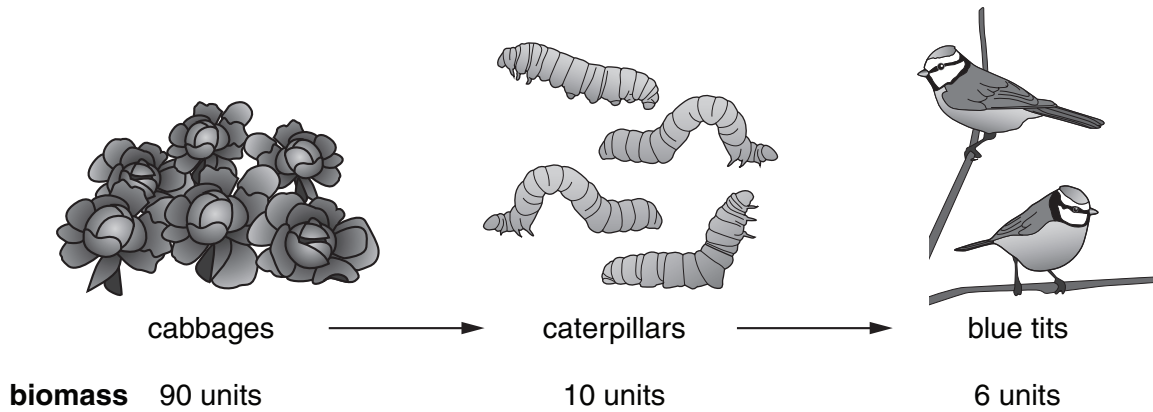
Explain how plants can do this.

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

[Total: 7]

2 (a) Look at the food chain.

It shows the biomass at each stage.

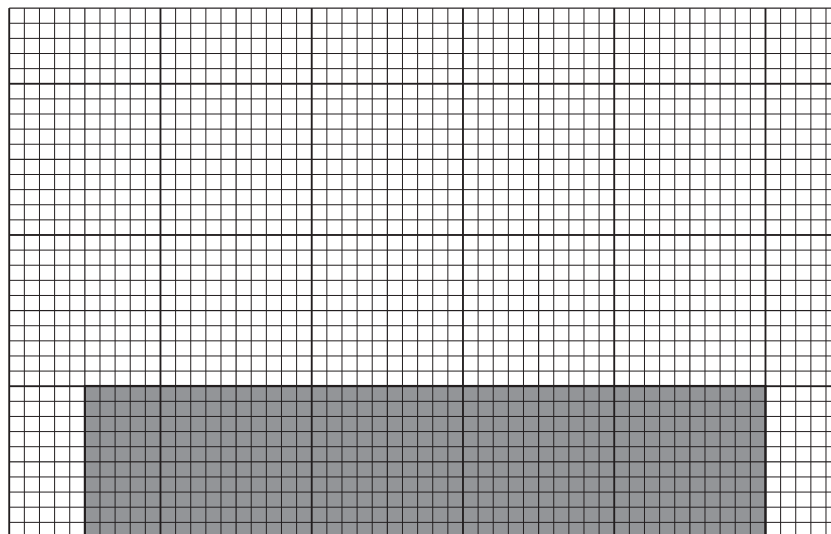


A pyramid of biomass can be drawn to describe this food chain.

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.



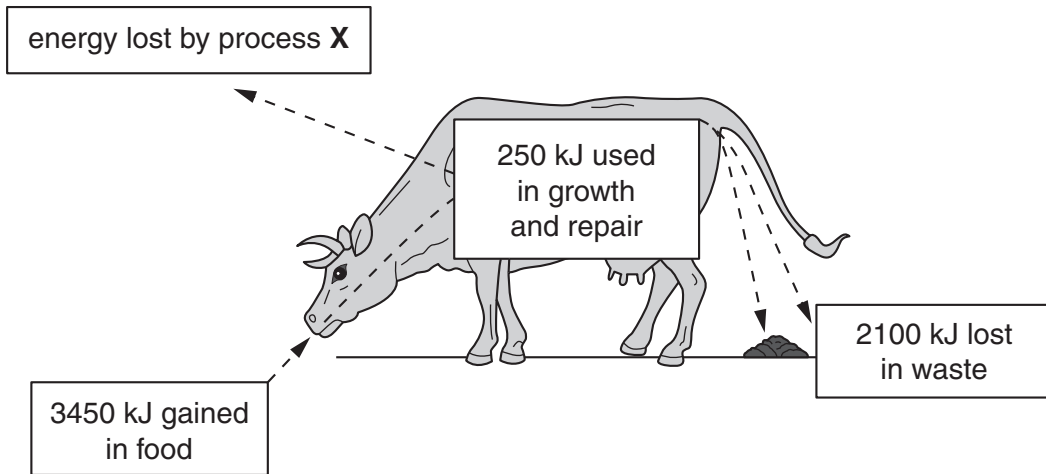
[2]

(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.

Name 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.

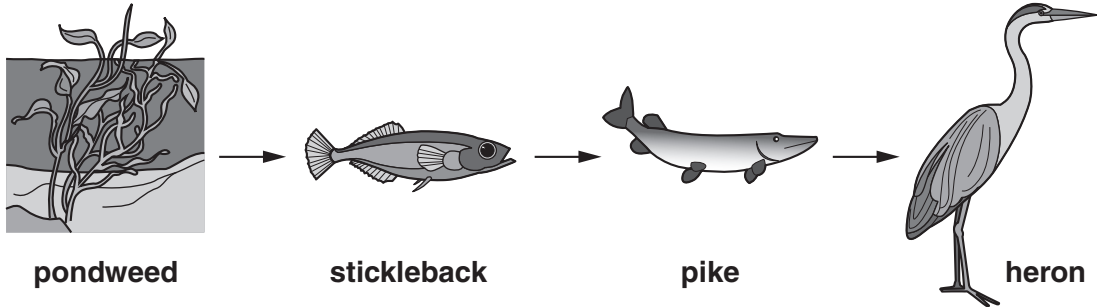
.....

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]

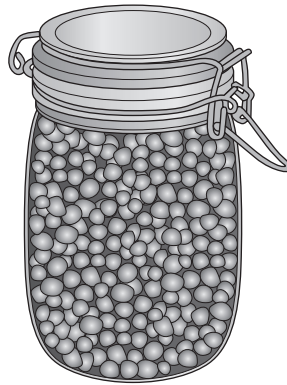
[Total: 8]

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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.

One of these statements describes the way the salt solution helps preserve the peas from decay.

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

high temperature kills microorganisms

the solution prevents microorganisms getting oxygen

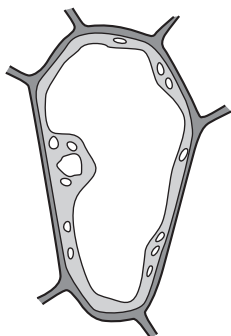
the solution causes microorganisms to lose water

the solution is too acidic for microorganisms

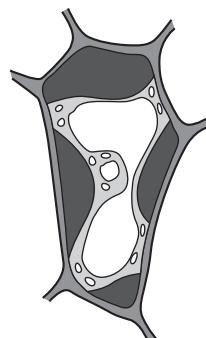
[1]

(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, 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.

Give the name of this **type** of reaction.

Choose from:

chromatography distillation neutralisation precipitation

answer [1]

(c) One disadvantage of using too much fertiliser is that some of it runs off into rivers and lakes.

This causes **eutrophication**.

Write about eutrophication.

Your answer should include

- what happens during eutrophication
- the effects on living organisms.

.....

.....

.....

.....

.....

.....

.....

.....

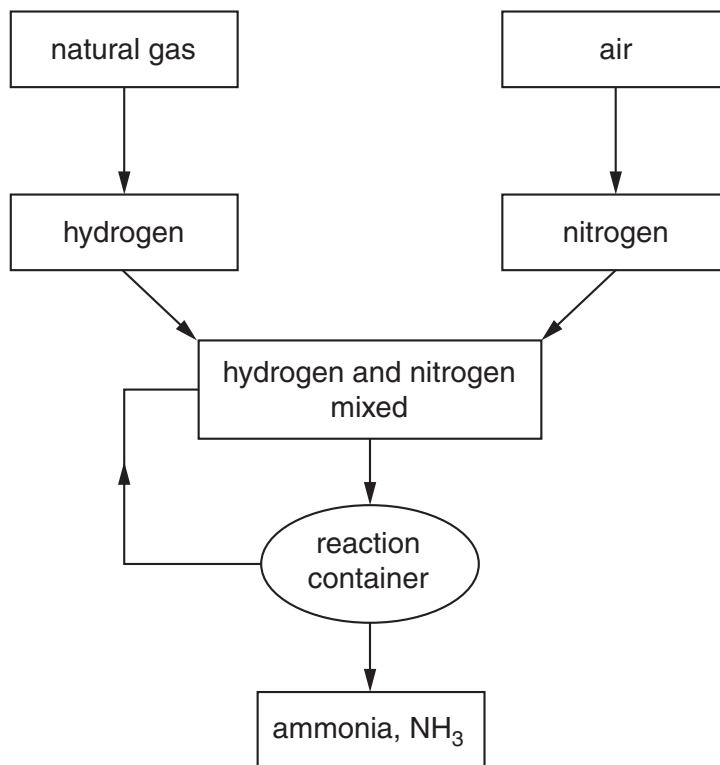
.....

..... [3]

[Total: 6]

5 This question is about the manufacture of ammonia, NH₃.

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



(a) In this reaction, nitrogen, N₂, reacts with hydrogen, H₂, to make ammonia.

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

..... [2]

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

Describe 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) Describe how increasing the **temperature** changes the percentage yield.

..... [1]

(ii) Describe how increasing the **pressure** changes 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.

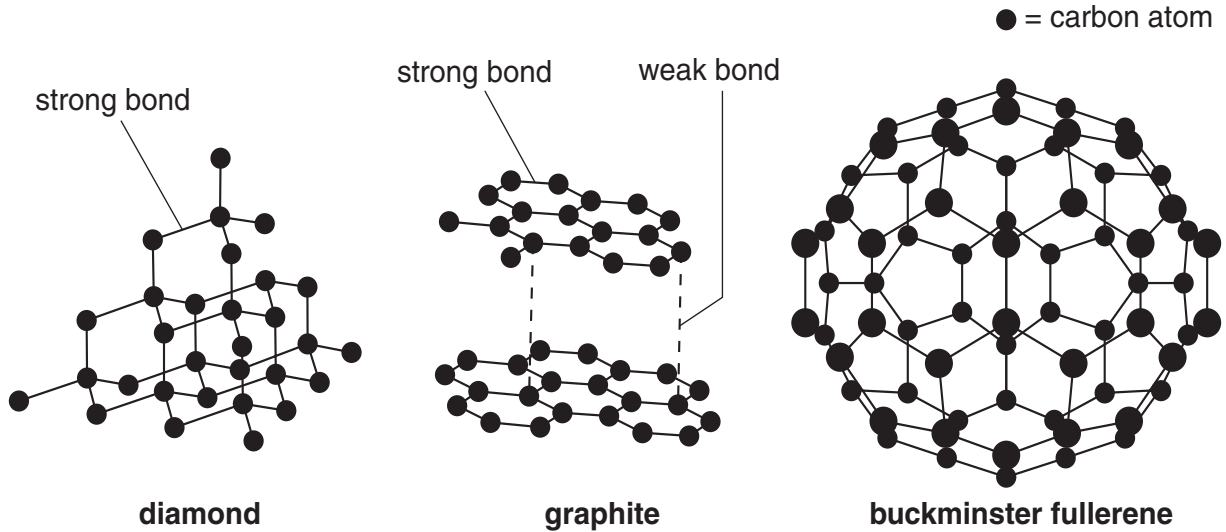
Explain how lead compounds get into water supplies.

.....

.....[1]

[Total: 3]

7 Carbon can exist in different solid forms.



(a) Give the name for 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 diamond is used to make cutting tools.

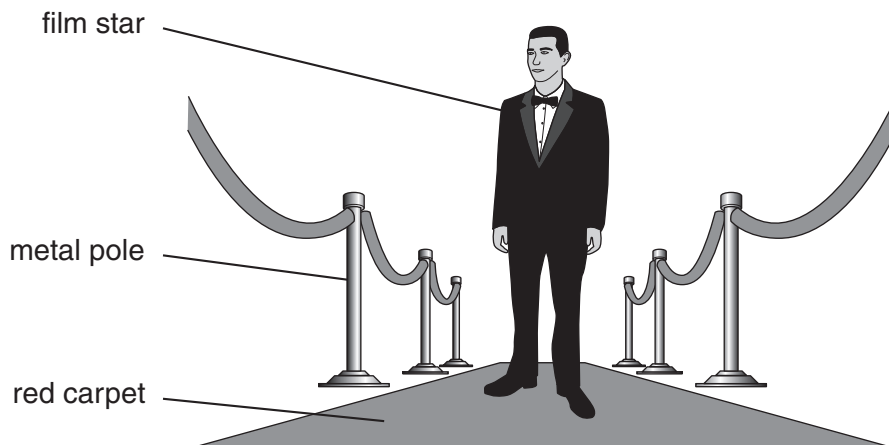
1

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. He gets an electrostatic shock.

(a) Give the name of these charged particles.

Choose from:

- alpha beta electrons neutrons protons

..... [1]

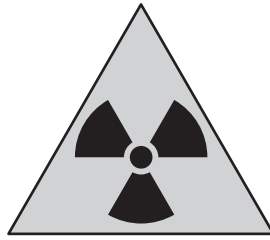
(b) Static electricity can cause shocks.

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) Give the name of the particles that are absorbed by the atoms.

..... [1]

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

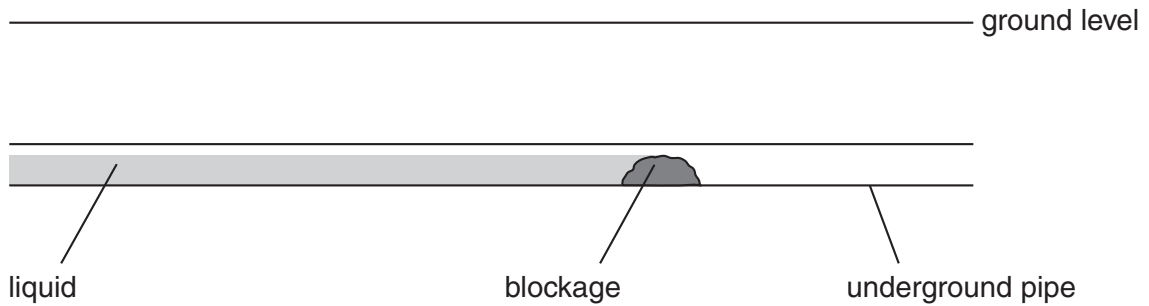
Describe what is special about the nucleus of a **radioactive** atom.

.....
 [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.

.....

.....

.....

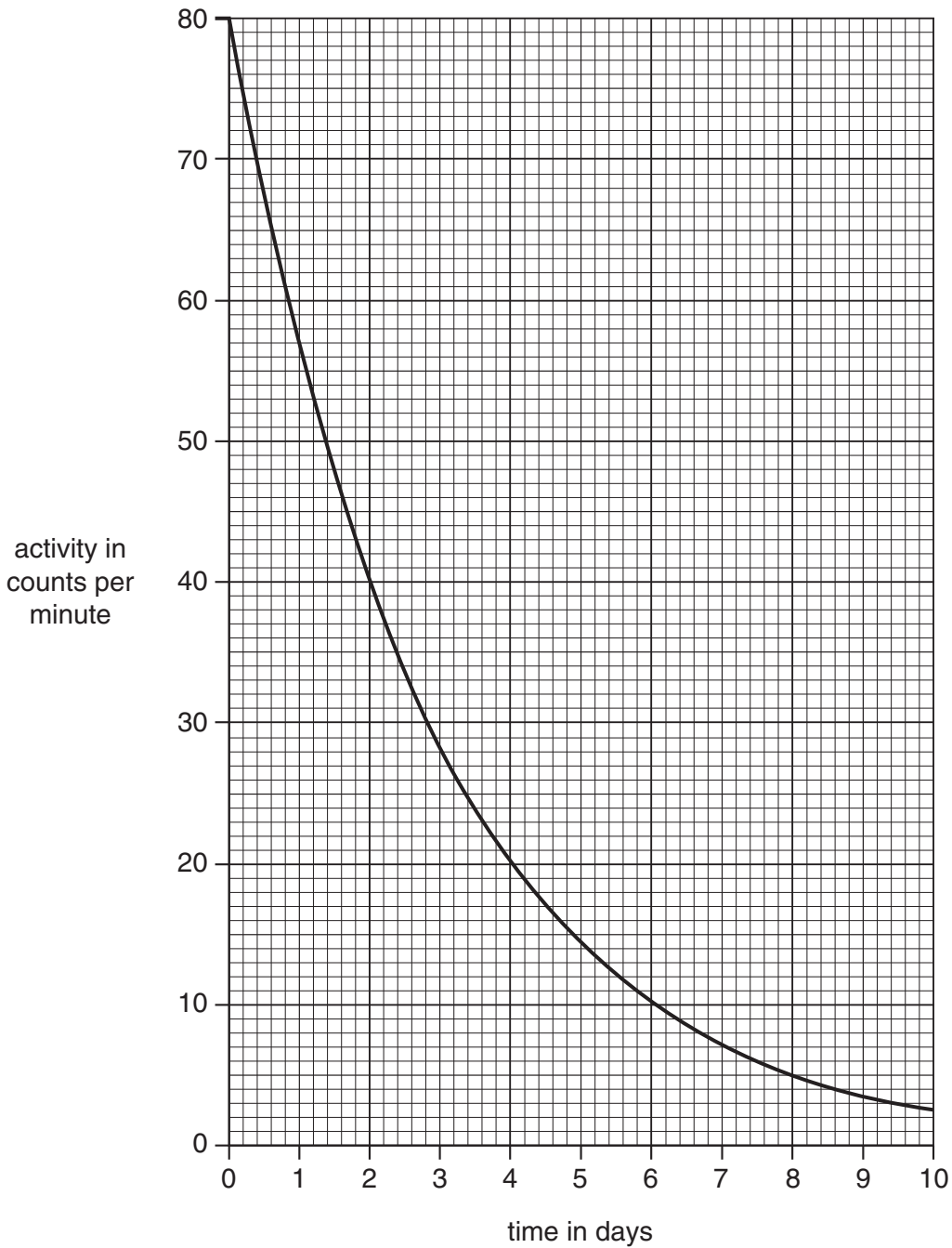
.....

.....

..... [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.

Write down the **half life** of radioactive material X.

answer days

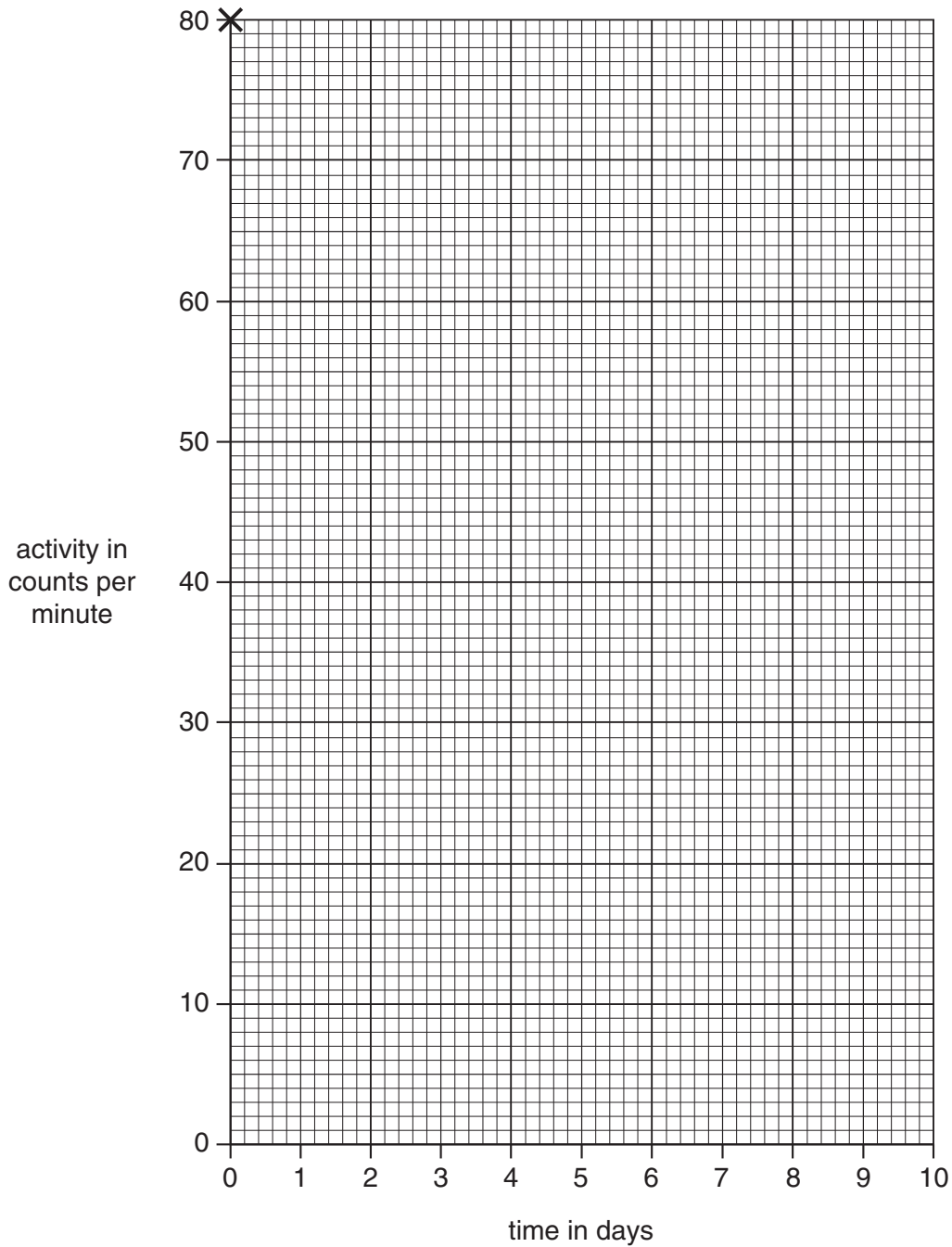
[1]

(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.

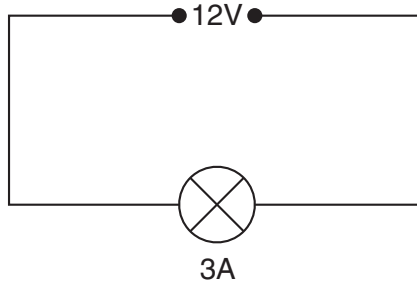


[1]

[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.

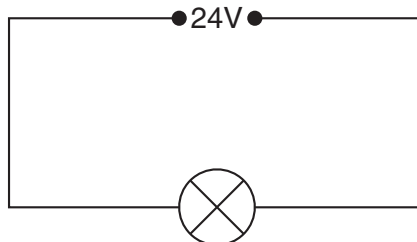
Calculate the **resistance** of the lamp.

The equations on page 2 may help you.

.....
.....

answer..... Ω [2]

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



Describe 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]

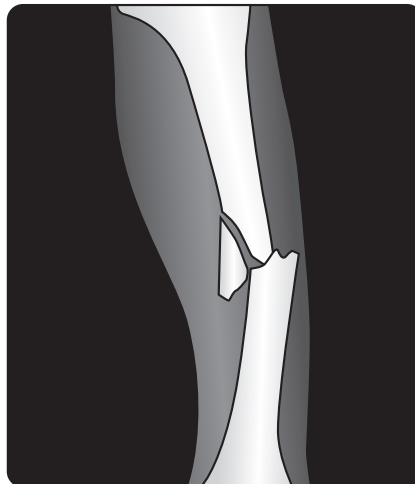
(b) Ultrasound is used in hospitals for scanning.

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 to scan unborn babies instead of 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
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	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
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
[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	
			65 Zn zinc 30	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	
			70 Ga gallium 31	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	
			73 Ge germanium 32	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	
			75 As arsenic 33	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	
			79 Se selenium 34	201 Hg mercury 80	204 TI thallium 81	207 Pb lead 82	
			122 Sb antimony 51	209 Bi bismuth 83	209 Bi bismuth 83	209 Bi bismuth 83	
			127 I iodine 53	[210] At astatine 85	[209] Po polonium 84	[222] Rn radon 86	
Elements with atomic numbers 112-116 have been reported but not fully authenticated							

1
H
hydrogen
1

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.