OCR
Oxford Cambridge and RSA

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Monday 6 November 2017 – Afternoon

GCSE GATEWAY SCIENCE
SCIENCE B

B712/01 Science modules B2, C2, P2 (Foundation 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)

Duration: 1 hour 30 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **85**.
- This document consists of **28** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

$$\text{efficiency} = \frac{\text{useful energy output } (\times 100\%)}{\text{total energy input}}$$

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

$$s = \frac{(u + v)}{2} \times t$$

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

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

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

power = force × speed

$$KE = \frac{1}{2}mv^2$$

momentum = mass × velocity

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

GPE = mgh

$$mgh = \frac{1}{2}mv^2$$

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

Answer **all** the questions.

SECTION A – Module B2

1 Look at the picture of a plant growing in the desert.

(a) The plant is adapted to live in the desert.

Finish the sentences.

The plant has very long roots that grow deep underground.

This helps the plant compete for ..... and ..... . **[2]**

(b) The plant has developed long roots by a process called evolution by natural selection.

(i) What is **evolution** and how does it happen?

.....

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

(ii) Write down the name of the scientist who first suggested the theory of natural selection.

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

(c) Plants have an important role in the energy flow through a food web.

Describe this role.

.....

.....

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

2 Read the information about two different relationships.

relationship 1
ticks and cows

Ticks are arthropods.
They attach themselves to the skin of cows.
They then feed on the cows' blood.
Some ticks carry a disease called 'African tick-bite fever'.

relationship 2
oxpeckers and cows

Oxpeckers are birds that live in Africa.
They can be found sitting on the backs of cows.
The oxpeckers feed on ticks that they find on the cows' skin.

(a) Look at the picture of the tick in relationship 1.

Use the picture to explain which class of arthropods **ticks** belong to.

.....

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

(b) Write about the two different relationships, 1 and 2.

Include ideas about:

- the **type** of relationship in each case
- why they are classified as this type of relationship
- how the two relationships are similar and how they are different.

The quality of written communication will be assessed in your answer to this question.

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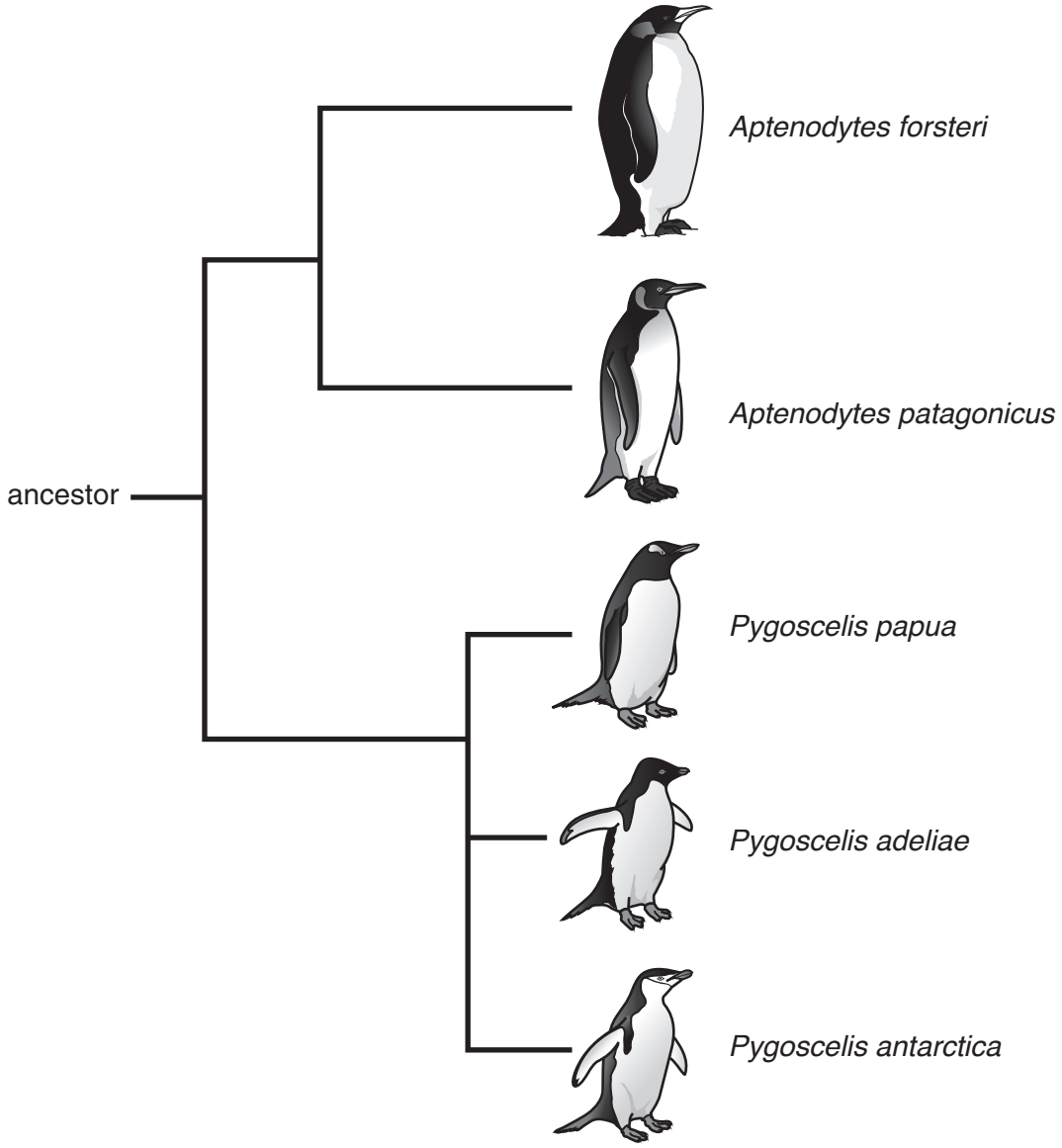
..... **[6]**

3 Look at the diagram. It shows part of the evolutionary tree for penguin species.



(a) Which penguin shares a **more recent** common ancestor with *Aptenodytes forsteri*?

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

(b) All five species of penguins live in or near oceans.

Put a tick (✓) in the correct box to explain why.

they all have small wings ☐

they all feed on fish ☐

they all lay eggs ☐

they are all birds ☐

[1]

(c) Penguins are kept in zoos for captive breeding programs.

Penguins born in zoos may then be released into the wild.

The released penguins may find it hard to survive in the wild.

Suggest reasons why captive breeding programs are still important.

.....

.....

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

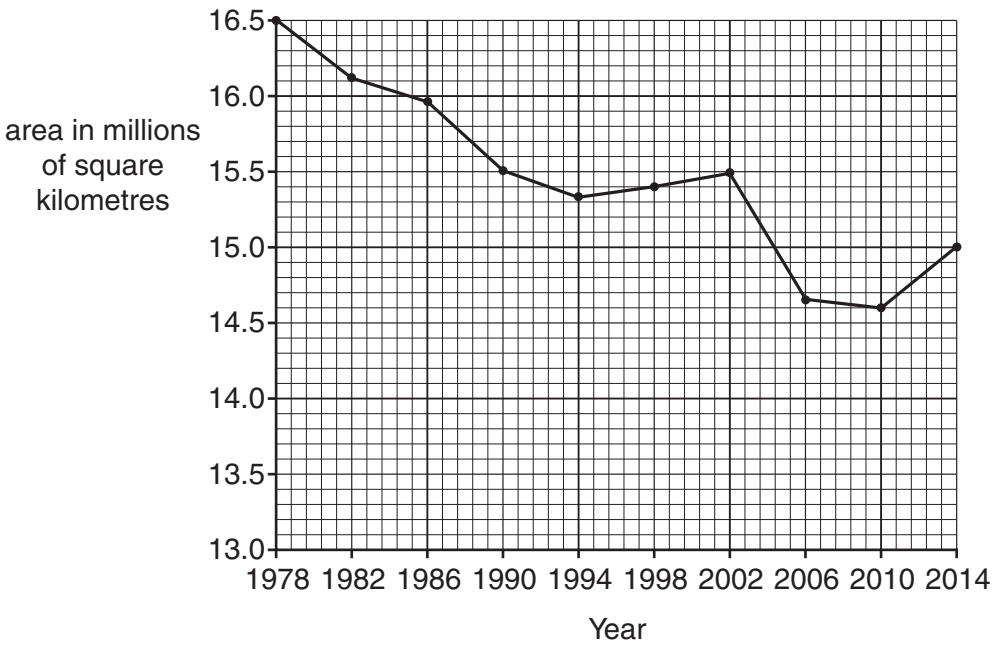
4 The Arctic is the northern-most part of the world. It is mainly ocean.

Most of this ocean is frozen and is covered with ice in the winter.

Some of the Arctic ice melts each spring, but most of it stays solid.

Look at the graph.

It shows the area of the Arctic that is covered by ice during March from 1978 to 2014.



(a) (i) What was the area covered by ice in **1978**?

answer..... million square kilometres **[1]**

(ii) Calculate the difference between the area covered by ice in **1978** and **2014**.

answer..... million square kilometres **[1]**

(iii) Polar bears hunt by walking on ice to find food.

Sometimes they need to walk hundreds of kilometres.

Suggest ways the change calculated in part **(ii)** might affect polar bears.

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

(b) Polar bears could become **endangered**.

One way to stop polar bears becoming endangered could be to introduce a captive breeding program.

Write about **two other** ways the polar bears can be helped to stop them becoming endangered.

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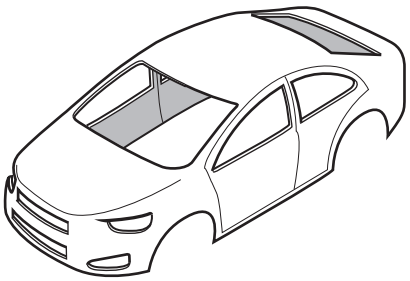
..... **[2]**

SECTION B – Module C2

5 Iron and aluminium can both be used to make car bodies.



Look at the statements about iron and aluminium.

(a) (i) Put ticks (✓) in the boxes next to the **three** correct statements.

Iron is more dense than aluminium.	☐
Both iron and aluminium are magnetic.	☐
Iron corrodes (rusts) very easily and aluminium does not.	☐
Iron is malleable but aluminium is brittle.	☐
Both iron and aluminium are good conductors of electricity.	☐

[2]

(ii) Both iron and aluminium can be recycled.

Write down **two advantages** of recycling iron and aluminium.

.....

.....

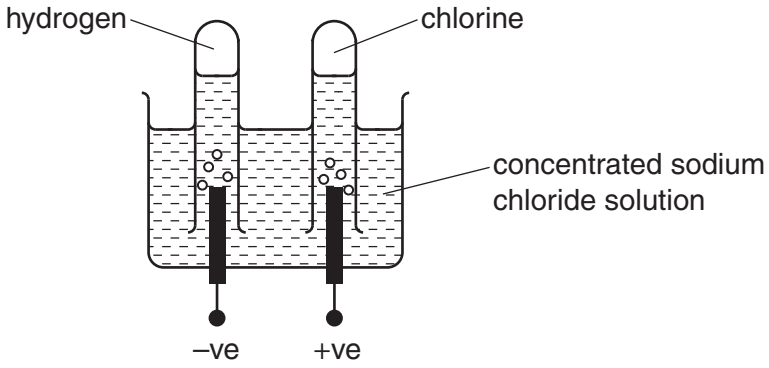
..... **[2]**

(b) Solder is an alloy of lead and tin.

Write down **one** use of solder.

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

6 Look at the diagram. It shows the electrolysis of sodium chloride (salt) solution.



(a) The electrolysis of sodium chloride is an important **industrial** process.

Where does the sodium chloride (salt) needed for the process come from?

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

(b) The process involves the reaction of sodium chloride and water.

Sodium hydroxide, NaOH, chlorine, Cl_2, and hydrogen, H_2, are made.

Complete the **balanced symbol** equation for this reaction.

$$NaCl + H_2O \longrightarrow \text{.....}$$ **[2]**

(c) Write down **two** uses of chlorine.

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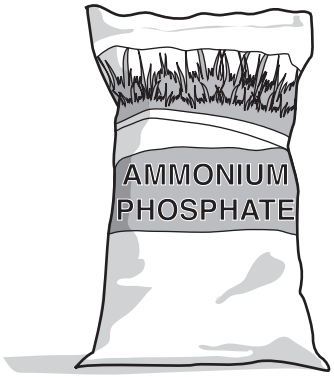
..... **[2]**

7 Ammonium phosphate is used as a fertiliser.



The formula for ammonium phosphate is

$$(NH_4)_3PO_4$$

(a) Which **two** essential elements for plant growth are present in ammonium phosphate?

..... and ..... **[2]**

(b) **(i)** Ammonium nitrate, NH_4NO_3, is another fertiliser.

Complete the table.

Type of atom	Number of atoms
nitrogen, N	.....
hydrogen, H	.....
oxygen, O	.....
total number of atoms	.....

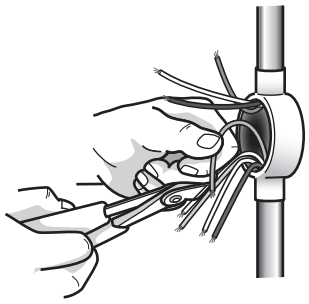
[2]

(ii) Nick wants to make ammonium nitrate by **neutralisation**.

Which acid and which alkali should he use?

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

8 John wants to replace the electrical wiring in his house.



Look at the table. It shows the properties of three metals **A**, **B** and **C**.

Metal	Density in g/cm^3	Relative flexibility (10 = high 1 = low)	Relative electrical conductivity (100 = high 10 = low)	Cost per tonne in £
A	8.9	10	64	3800
B	8.9	1	16	9120
C	2.7	8	40	1350

John needs to choose one of these metals to use as the metal in the electrical wiring for his house.

Write down the properties of the metal needed for the electrical wiring.

Which metal is the best choice and why?

The quality of written communication will be assessed in your answer to this question.

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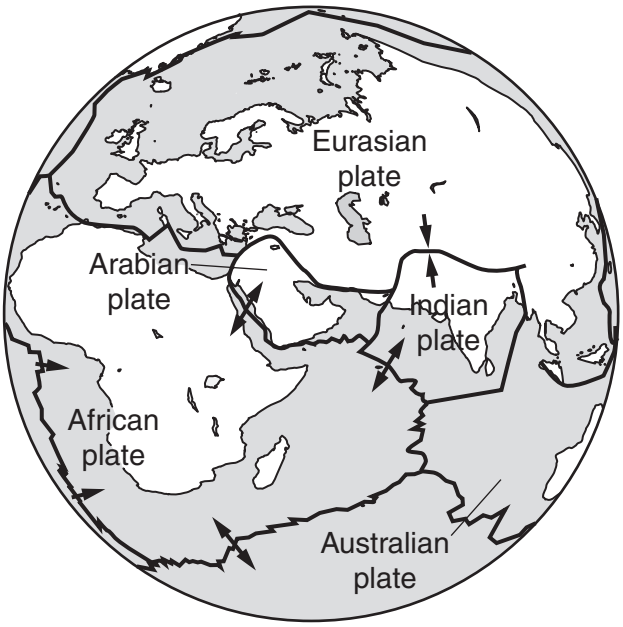
..... **[6]**

9 Scientists believe that the surface of the Earth is made up of plates.



They believe that the plates move very slowly.

(a) What is the name of this theory?

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

(b) The movement of the plates on the surface of the Earth can cause natural disasters.

Write about **two** of these natural disasters.

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.....

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

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SECTION C – Module P2

10 John investigates the energy used each day for four appliances in his home.

He records information for the four appliances.

Look at the table.

Appliance	Power in kilowatts	Time used each day in hours	Energy used each day in kilowatt hours
cooker	3.0	2.5	.....
heater	3.0	2.0	6.0
washing machine	2.0	1.0	.....
TV	0.5	1.0	.....
total			**16.0**

(a) (i) Calculate the **energy used** column in the table. One has been done for you. **[2]**

(ii) Explain which of the four appliances will have the **lowest** cost each day.

.....

.....

.....

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

(iii) Electricity costs 15 pence per kilowatt hour.

Calculate the **total** cost in pence of using the four appliances each day.

answer ..... pence **[1]**

(b) The electricity is generated in a power station.

The input energy for the power station is 5.0 MJ.

The useful energy output for the power station is 1.5 MJ.

Calculate the percentage efficiency of this power station.

efficiency .....% **[2]**

11 **(a)** A company is planning to launch a manned space mission to Mars in 2026.

An unmanned mission will go to Mars a few years earlier.

Describe two differences in the resources needed for a **manned** mission compared to an **unmanned** mission.

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.....

.....

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

(b) There are eight planets in our Solar System.

In order from the Sun they are:

Mercury

.....

Earth

Mars

.....

Saturn

Uranus

Neptune

Write the names of the two missing planets in the list. **[1]**

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PLEASE DO NOT WRITE ON THIS PAGE

12 (a) Global warming is caused by the greenhouse effect.

Greenhouse gases prevent heat from the Earth radiating into space.

Write down the names of three greenhouse gases.

Describe how they are released into the atmosphere.

The quality of written communication will be assessed in your answer to this question.

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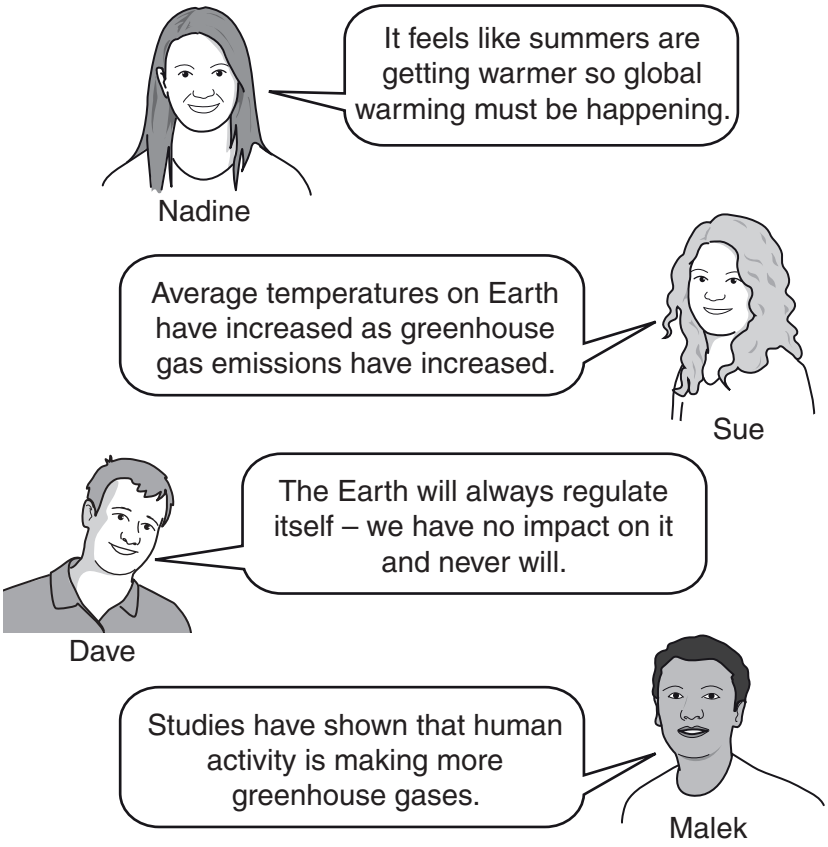
..... **[6]**

(b) Not everyone agrees that human activity is causing global warming.

Look at these quotes.



Write down and explain which two quotes are based on **opinions**.

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

13 Eric completes his homework on radioactivity.

Radioactivity Homework

Types of Radioactivity
Alpha, beta and gamma are three of the five types of radioactivity.

Only alpha and beta cause ionisation.

Keeping Safe
You must always wear protective clothing and use tongs to handle sources.

You must have a long exposure time and use shielding where possible.

There are three mistakes in Eric's homework.

(a) (i) Write down the three mistakes.

1 .....

2 .....

3 .....

[3]

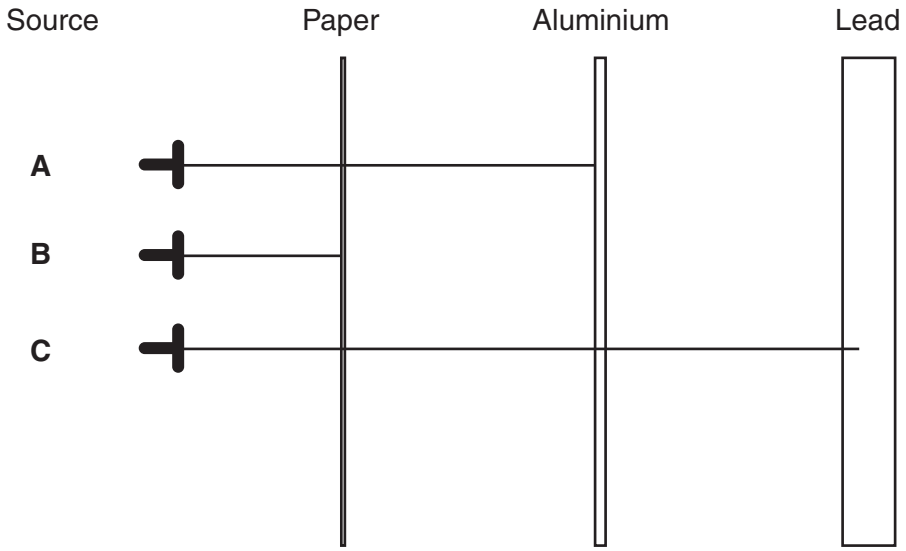
(ii) Choose **one** of the mistakes and write down the correct information.

.....

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

(b) Different types of radiation are stopped by different materials.

The diagram shows three radiation sources and the materials that stop the radiation they emit.



Each source emits one type of radiation.

Use the information in the diagram to draw a line between the **source** and the **type of radiation** it is emitting.

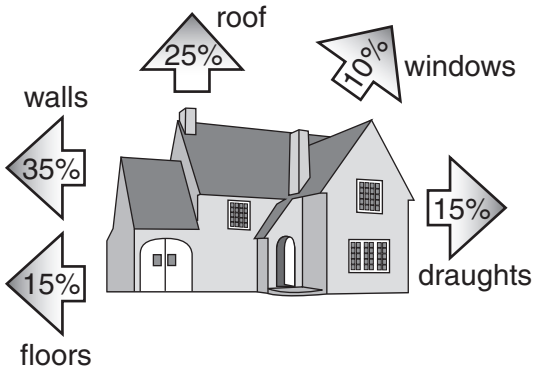
source	type of radiation
A	alpha
B	beta
C	gamma

[2]

SECTION D

14 This question is about saving money on household energy bills.

Look at the diagram. It shows information about energy losses from Bob's house.



Some energy saving methods are

- cavity wall insulation
- loft insulation in roof
- draught-proofing windows and doors
- double glazed windows.

(a) (i) Suggest which **two** methods are likely to reduce Bob's energy bills the most.

.....

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

(ii) The diagram shows Bob's house **loses** 35% of energy through the walls.

Bob considers fitting cavity wall insulation.

His energy bills would be reduced.

Suggest reasons why his energy bills would **not** be reduced by 35%.

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

(b) Look at the table. It shows

- the cost to install each energy saving method
- the saving made each year
- the payback time – how long before the savings cover the cost of installation
- the saving on carbon dioxide emissions each year.

Energy saving method	Cost to install in £	Saving per year in £	Payback time in years	Carbon dioxide saving per year in kg
internal wall insulation	5500	460	11.9	1800
external wall insulation	6250	490	12.7	1900
energy efficient boiler	3100	310	10.0	1200
loft insulation in roof	350	180	1.9	730
cavity wall insulation	350	140	2.5	560
energy saving light bulbs	600	35	17.1	110
draught-proofing windows and doors	200	30	6.7	120

(i) Bob considers fitting external wall insulation and an energy efficient boiler.

How much carbon dioxide saving would he make in one year?

answer ..... kg **[1]**

(ii) Bob decides to spend up to £1000 on energy saving methods.

He plans to live in his house for 10 years.

Suggest the energy saving methods he should choose.

Explain your answer.

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

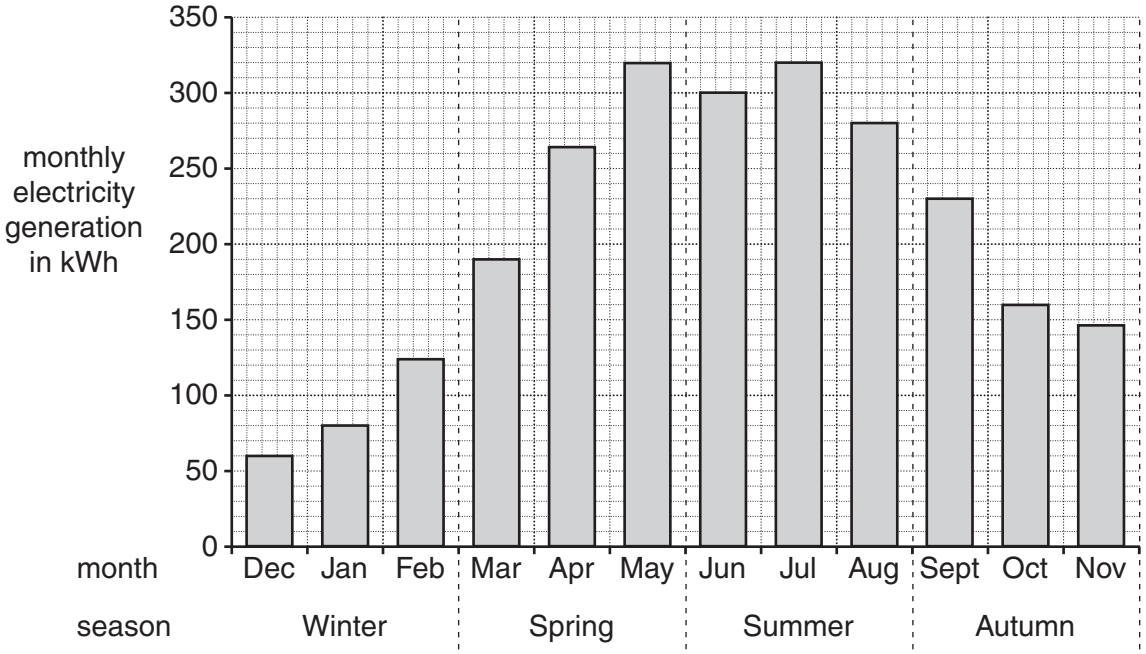
(c) Bob is considering fitting solar panels to his roof to reduce his electricity bills.

Solar panels generate electricity.

He looks at some data for a typical house.

Look at the bar chart.

It shows the monthly electricity generation for each month of the year.



(i) During which **season** will Bob save most energy on his electricity bills?

Explain your answer.

.....

.....

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

(ii) Less electricity is generated in June than in May or July.

Suggest a reason why.

.....

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

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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.