OCR
Oxford Cambridge and RSA

F

Friday 17 June 2016 – Morning

GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B

B722/01 Additional Science modules B4, C4, P4 (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 bar codes.

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 **32** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

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 B4

1 Jenny grows strawberries in her garden.

(a) She gives the strawberry plants minerals to help them grow.

What is the name of the substance that she adds to the soil to give the plants extra minerals?

Put a (ring) around the correct answer in the list.

chlorophyll **fertiliser** **herbicide** **sugar**

[1]

(b) Her plants produce lots of strawberries.

She preserves the strawberries so that she can eat them months later.

Write down why she needs to preserve the strawberries if she wants to eat them months later.

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

(c) There are different methods she can use to preserve the strawberries.

Draw straight lines to join each **method** to **how it works**.

method	**how it works**
adding sugar	draws water out of microorganisms
canning	stops enzymes working in microorganisms
freezing	stops microorganisms getting to the strawberries

[2]

[Total: 4]

2 Read this article about ash trees.

> A fungus is killing ash trees.
>
> It is threatening much of Britain's native ash woodland.
>
> If it kills the trees, the fungus could also affect other organisms in this ecosystem.
>
> Many insect, bird and bat species, such as thorn moths, woodpeckers and horseshoe bats, rely on ash trees. They could all be in danger.
>
> The only organisms that might be helped are decomposers.

(a) (i) The death of the ash trees might affect insects, birds and bats.

Suggest **two** reasons why.

.....

.....

.....

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

(ii) The death of ash trees could help decomposers.

Explain how.

.....

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

(iii) Explain the difference between the terms **community** and **population**.

Use an example of each from the article to help explain the difference.

.....

.....

.....

.....

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

(iv) The native woodland is a natural ecosystem.

Write down **one other** natural ecosystem found in Britain.

Choose from the list.

farm **lake** **parkland** **plantation**

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

(b) The fungus causes a disease called die back.

The fungus blocks the xylem vessels leading to the leaves.

Explain why blocking the xylem vessels would kill the leaves.

.....

.....

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

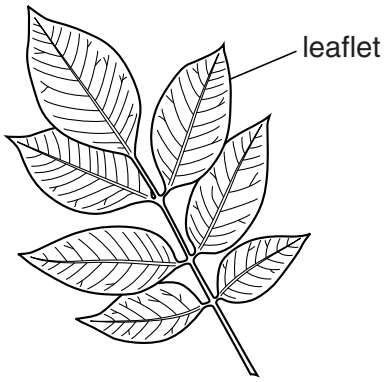
(c) Sachin has a tree in his garden.

He does not know what type of tree it is.

Sachin wants to know how likely it is to get the disease.

He takes a leaf from the tree and finds a key to identify the tree.

He also finds a table with some information.



Type of tree	How likely is it to get the disease?
spruce	impossible
pine	impossible
oak	impossible
American ash	possible
common ash	very likely

1 Are its leaves like needles? ..... yes go to 2

..... no go to 3

2 Are its needles single? ..... yes **spruce tree**

..... no **pine tree**

3 Are its leaves divided into smaller leaflets? ..... yes go to 4

..... no **oak tree**

4 Does it have **less** than eight leaflets? ..... yes **American ash**

..... no **common ash**

How likely is it for Sachin's tree to get the disease?

Use the key and the table to help you decide.

Explain your answer.

.....

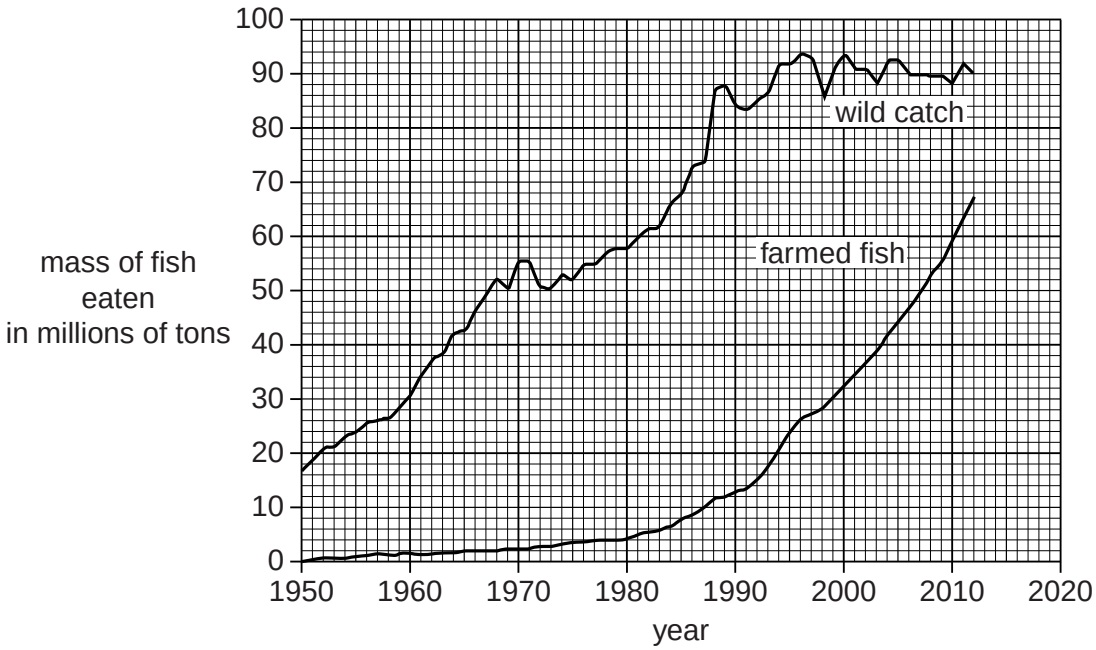
.....

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

[Total: 11]

3 The graph below shows the fish eaten from seas and rivers (wild catch) since 1950.

It also shows the fish eaten from fish farms (farmed fish).



(a) Describe any patterns shown by the graph.

.....

.....

.....

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

(b) Use the graph to predict the mass of farmed fish that will be eaten in 2015.

..... millions of tons **[1]**

(c) What type of farming method is fish farming?

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

hydroponics	☐
intensive	☐
native	☐
organic	☐

[1]

[Total: 4]

4 George and Eva are talking about the water in their fish pond.

George

It seems to go greener in the summer when there is more sunlight.
This must be because the oxygen level in the water changes.

Eva

I don't think that can be right.
I think the oxygen levels are changing because of the green colour.

They set up an experiment to test their ideas.

To do this, they use a black bottle and a clear bottle.

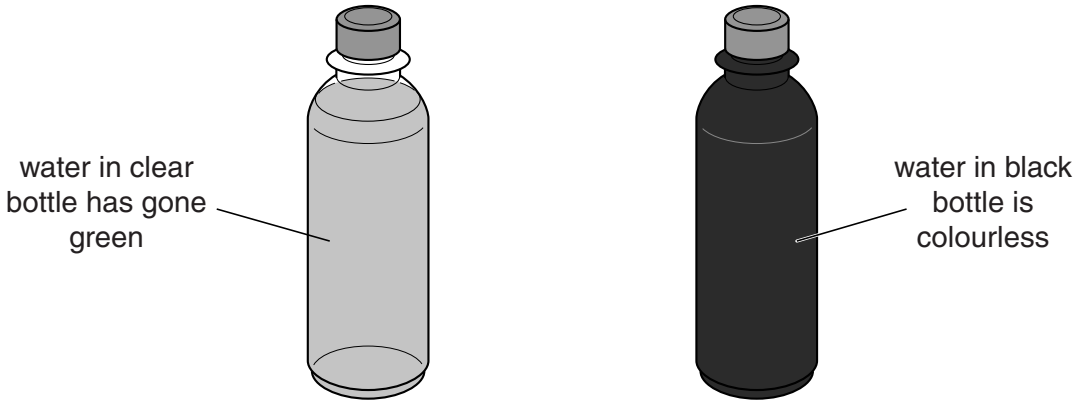
Into each bottle they put the same amount of pond water.

They measure the oxygen content of the water.

They put both bottles next to a light.

After a week they measure the oxygen content of the water again in each bottle.

Here are their results.



		Clear bottle	Black bottle
Start	**Colour of water**	colourless	colourless
	Amount of oxygen in mg per litre	8	8
After one week	**Colour of water**	green	colourless
	Amount of oxygen in mg per litre	10	5

9

Explain the results of the experiment and explain why Eva is correct.

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

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

[Total: 6]

Question 5 begins on page 10

SECTION B – Module C4

5 Many scientists have been involved in the development of the Periodic Table and the structure of the atom.

(a) Draw a line from the **name** of the scientist to their **discovery or idea**.

name	discovery or idea
Bohr	Atoms were the smallest part of an element and could not be split
Dalton	The Periodic Table
J J Thomson	Electron orbits or shells
Mendeleev	The electron
Rutherford	Atoms had a nucleus surrounded by electrons

[3]

(b) The early theories of atomic structure were replaced by newer ideas.

Explain why.

.....

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

[Total: 4]

6 Calcium, Ca, reacts with oxygen, O_2, to make calcium oxide, CaO.

calcium + oxygen $\rightarrow$ calcium oxide

Use the formulas given to write the **balanced symbol** equation for the reaction between calcium and oxygen.

Explain why O_2 is a molecule and CaO is a compound.

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

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

[Total: 6]

7 Phil and Kate analyse a solution.

Look at Table 7.

It shows the tests they use and the results they get.

Test number	Test on solution	Results
1	appearance	colourless solution
2	flame test	lilac flame
3	adding sodium hydroxide solution	no precipitate
4	adding barium chloride solution	no precipitate
5	adding silver nitrate solution	pale yellow precipitate

Table 7

(a) Kate concludes that the solution is potassium iodide.

Do the results support her conclusion? .....

Explain your answer.

.....

.....

.....

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

(b) Describe how Kate and Phil do their flame test.

You may wish to draw a labelled diagram.

.....

.....

.....

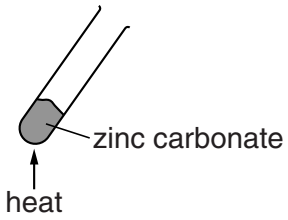
.....

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

[Total: 5]

8 Sam investigates what happens when she heats zinc carbonate.

Look at the apparatus she uses.



Sam measures the mass of zinc carbonate then heats it.

She measures the mass of solid left in the test tube after it has cooled down.

Look at her results.

Mass of zinc carbonate in g	2.50
Mass of solid in test tube after heating in g	1.62

Zinc carbonate decomposes when heated.

Look at the word equation for this decomposition.

zinc carbonate $\longrightarrow$ zinc oxide + carbon dioxide

(a) What is the name of the product that is a **solid**?

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

(b) The mass of the test tube and its contents **decreases** during the investigation.

Calculate the decrease in mass and explain why the mass decreases.

.....

.....

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

(c) Zinc carbonate has the formula $ZnCO_3$.

How many **different elements** are bonded together in zinc carbonate?

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

[Total: 4]

9 Group 1 elements are stored under oil.

(a) Explain why Group 1 elements are stored under oil.

.....

.....

.....

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

(b) Lithium, sodium and potassium are all Group 1 elements.

Write down the name of one **other** Group 1 element.

Use the Periodic Table on the back page to help you.

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

[Total: 3]

10 An atom has the electronic structure 2.8.8.2.

(a) How many electrons are there in this atom?

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

(b) How many occupied electron shells are there in this atom?

Explain your answer.

.....

.....

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

[Total: 3]

Question 11 begins on page 16

SECTION C – Module P4

11 This question is about electrostatics.

(a) Complete the following sentence.

Choose your answers from the list.

negative neutral north opposite positive south

The two types of electrostatic charge are

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

(b) Cala has two rubber balloons.

She rubs one balloon with a cloth.

The balloon becomes charged and sticks to the wall (see Fig. 11.1).

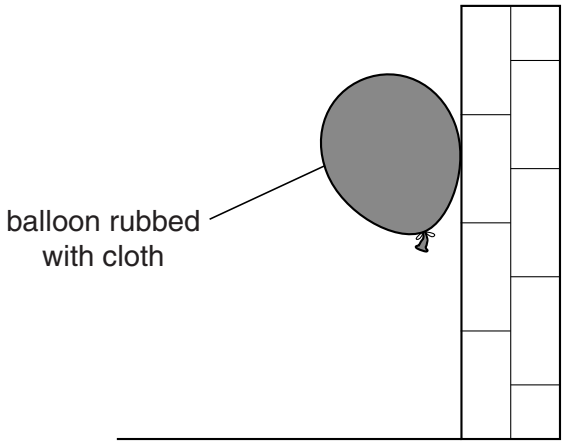


Fig. 11.1

When she rubs the other balloon with aluminium foil, the balloon does **not** stick to the wall (see Fig. 11.2).

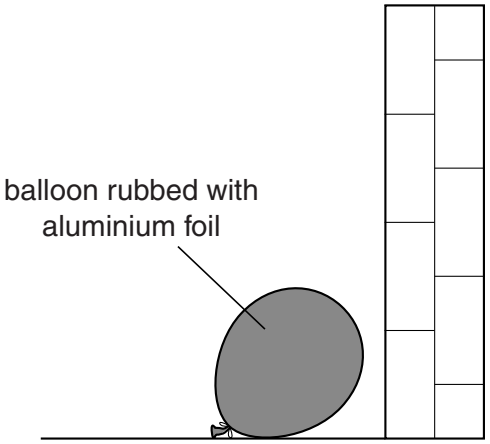


Fig. 11.2

Explain why the balloon rubbed with foil does not stick to the wall.

.....

.....

.....

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

(c) Electrostatics can be useful.

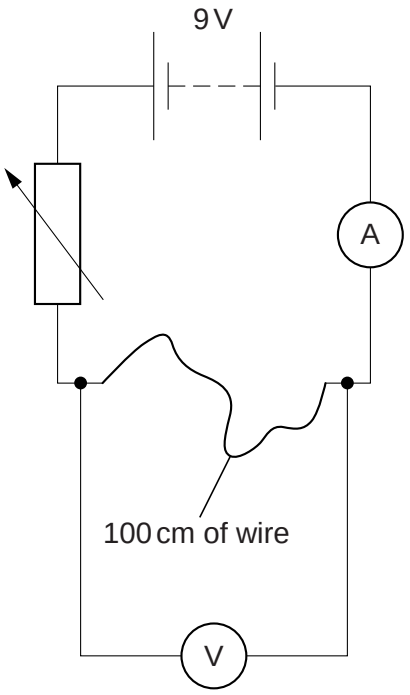
Write down **one** use of electrostatics.

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

[Total: 4]

12 Dave connects an electric circuit to find the resistance of 100 cm of wire.

Look at the diagram below.



The battery voltage is 9 V.

The reading on the ammeter is 2 A.

The reading on the voltmeter is 5 V.

(a) Calculate the resistance of the 100 cm of wire.

.....

.....

.....

answer ..... ohms **[2]**

(b) Dave now uses some thinner wire.

A 100 cm length of this wire has a resistance of 5 ohms.

What length of this wire is needed to make a 2 ohm resistor?

.....

.....

.....

answer ..... cm **[2]**

[Total: 4]

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Question 13 begins on page 20

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13 Emma has a slinky spring.

She makes two different types of wave using the slinky.

Fig. 13.1 shows how she makes one type of wave.

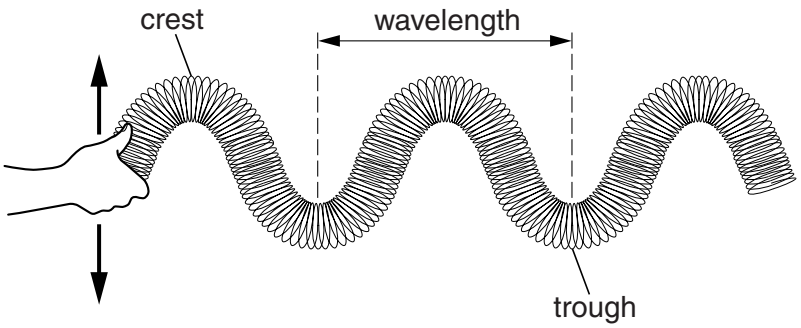

Fig. 13.1

Fig. 13.2 shows the other type of wave she makes.

This is a **longitudinal** wave.

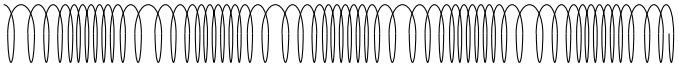

Fig. 13.2

On Fig. 13.2, label a **wavelength**, a **compression**, a **rarefaction** and show how the wave is made.

21

Use the information on these two diagrams to describe similarities and differences between these two waves.

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

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

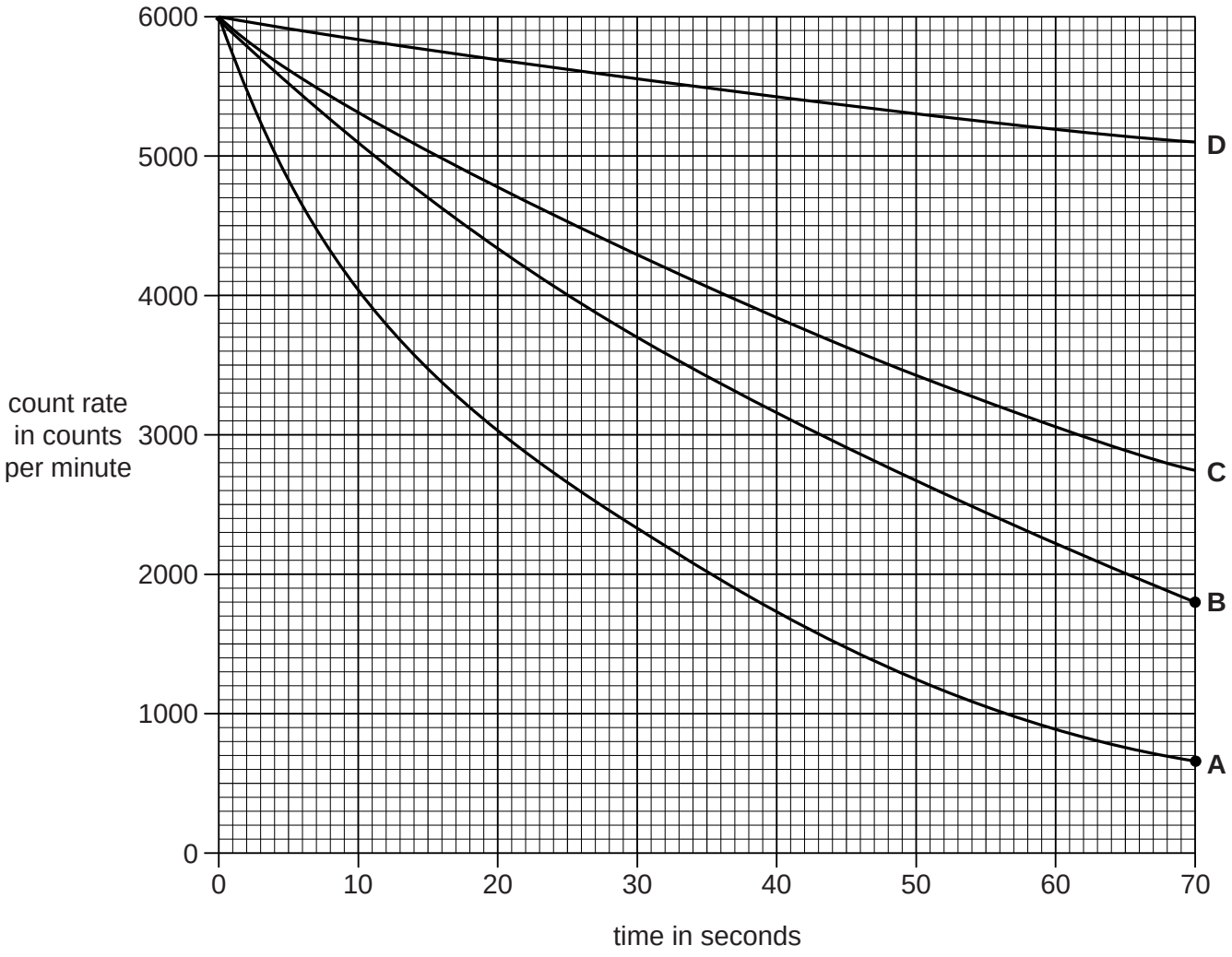
[Total: 6]

14 This question is about nuclear radiation.

Radioactive materials decay naturally.

The half-life is a measure of how quickly the radioactive materials decay.

(a) Look at the data below about the activity of some radioactive isotopes.



Which isotope has the shortest half-life?

Choose from **A** **B** **C** **D**

answer .....

Explain your answer.

.....

.....

.....

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

(b) Some radioactive atoms emit beta particles.

Which **part** of the atom gives out beta particles?

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

(c) Fred reads about proposals to build a nuclear power station near his house.

He writes down different statements about radioactivity.

Some of his statements are opinions and others are facts.

Look at the list of statements.

Put a tick (✓) in the correct box to show if each statement is an **opinion** or a **fact based on scientific evidence**.

Statement	Opinion	Fact based on scientific evidence
Nuclear waste becomes less radioactive over a long time.		
Nuclear radiation ionises materials.		
Nuclear power stations are better than wind farms.		
Nuclear power stations are an eyesore.		
Uranium nuclei split in a fission reaction.		

[2]

[Total: 6]

15 Greg is in hospital for some medical tests using a radioactive tracer.

He tells his friends about his tests.

(a) Here are three things he says.

Statement 1 "They gave me a radioactive drink which was giving out gamma radiation."

Statement 2 "Then a radiographer used a detector to measure the radiation on the outside of my body."

Statement 3 "Now that I have taken some radioactive drink I will always be highly radioactive."

Which of his statements could be correct and which must be incorrect?

Explain why.

.....

.....

.....

.....

.....

.....

.....

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

(b) X-rays and gamma radiation are both used in hospitals.

Write down **two** similarities between x-rays and gamma rays.

.....

.....

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

[Total: 5]

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Question 16 begins on page 26.

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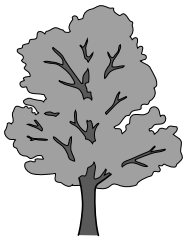
SECTION D

16 This question is about two types of tree.



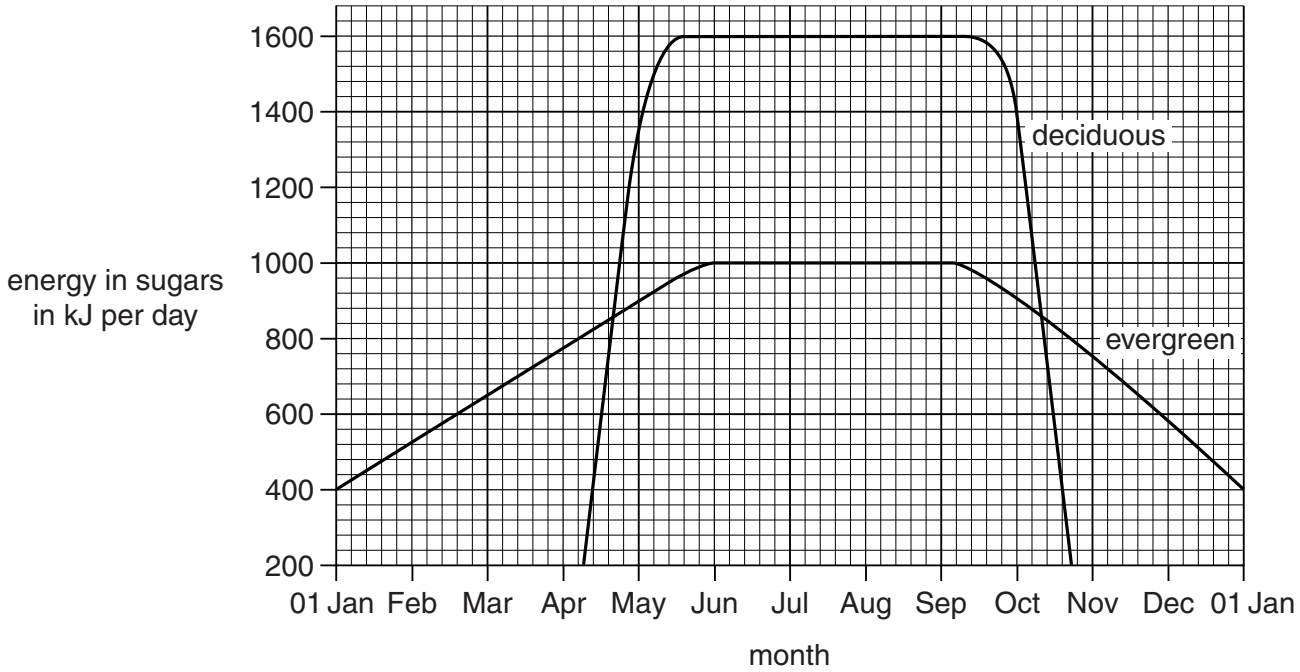
Some trees lose their leaves every year and grow new ones.
They are called **deciduous**.

Other trees keep their leaves throughout the year.
They are called **evergreen**.

(a) Look at the graph below.

It shows the energy in sugars made by photosynthesis in

- a deciduous tree
- an evergreen tree.



Trees use leaves to make sugar by photosynthesis.

(i) In which month does the deciduous tree lose most of its leaves?

month .....

How can you tell this from the graph?

.....

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

(ii) The highest amount of energy in sugars made per day by the deciduous tree is 1600 kJ.

What is the **highest** amount made per day by the **evergreen** tree?

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

(b) Scientists want to find out the total amount of light energy trapped by the leaves on a deciduous tree and an evergreen tree.

They measure the amount of light trapped by different parts of the trees.

They do this in July for trees growing in the same area.

The results are shown in the table below.

	Deciduous tree	**Evergreen tree**
energy trapped by top part of the tree in kJ per day	13 000	23 500
energy trapped by middle part of the tree in kJ per day	11 000	7 000
energy trapped by bottom part of the tree in kJ per day	8 000	1 500
total energy trapped by the tree in kJ per day	32 000	

(i) The scientists assume that the amount of light **hitting** each 1 m^2 of each tree was the same.

Why is it reasonable to assume this?

Explain your answer.

.....

.....

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

Turn over for the remainder of question 16

(ii) The graph in part **(a)** on page 26 shows that in July, the deciduous tree makes more sugar than the evergreen tree.

Is this because it traps more light?

Use the table on page 27 to help you answer.

.....

.....

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

(c) The scientists work out how efficiently the trees make use of the trapped light.

They do this using the formula:

$$\text{efficiency} = \frac{\text{energy in sugars made per day}}{\text{total energy trapped by the tree per day}} \times 100$$

The efficiency for the evergreen tree is **3.1%**.

Use the information from the **graph** and the **table** to calculate the efficiency for the deciduous tree.

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

(d) What can the scientists conclude from this experiment?

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

The evergreen tree has more efficient photosynthesis because it traps more light.	☐
The evergreen tree has more efficient photosynthesis because it uses more of the trapped light.	☐
The deciduous tree has more efficient photosynthesis because it traps more light.	☐
The deciduous tree has more efficient photosynthesis because it uses more of the trapped light.	☐

[1]

[Total: 10]

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 margins.

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.