OCR
Oxford Cambridge and RSA

F

Friday 12 June 2015 – Afternoon

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

B722 01

5070127377

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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 **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

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

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

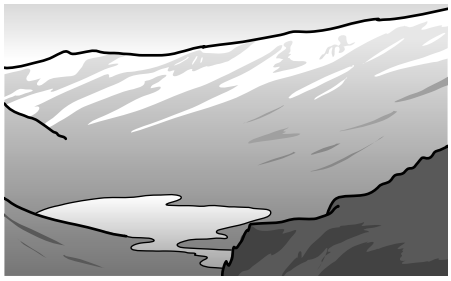
Answer **all** the questions.

SECTION A – Module B4

1 Read the article.

The most salty lake in the world

Scientists have found a small lake in Antarctica.



Don Juan pond is the most salty lake in the world.

Temperatures in the lake are as low as –40 °C.

However it does not freeze up.

This is because it is twelve times **more** salty than normal sea water.

Some scientists claim they have found bacteria living in the water.

Other scientists say that this is not possible.

(a) The bacteria in the lake may be able to use photosynthesis to make glucose.

They may use the same reaction as green plants.

Finish this word equation for photosynthesis.

carbon dioxide + ... → glucose + ...

[2]

(b) Some scientists think that it is not possible for bacteria to live in the lake.

Put ticks (✓) next to the **two** correct reasons that would support their view.

Temperatures would be too low for photosynthesis.	☐
It is never light in the Antarctic.	☐
Water would leave the bacteria by osmosis.	☐
There is no carbon dioxide in the Antarctic.	☐
The salt would enter the bacteria by osmosis.	☐

[2]

2 Harold is doing an experiment to investigate the loss of water from a plant.

(a) Which word describes the loss of water from the leaves of a plant?

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

photosynthesis **respiration** **transpiration** **translocation**

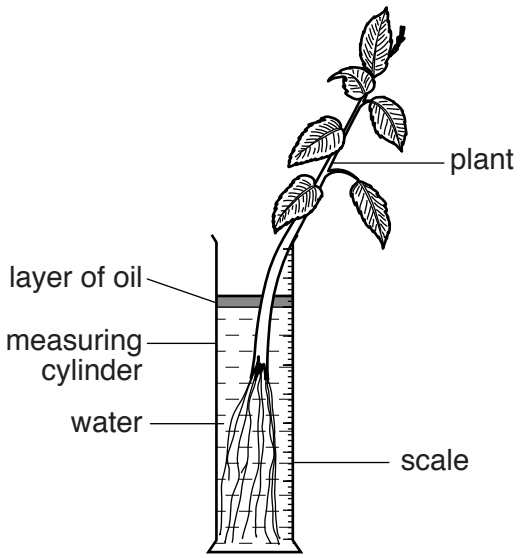
[1]

(b) Harold digs up a plant and puts it into a measuring cylinder with water.

He puts a small amount of oil on the surface of the water.

The oil stops the water evaporating from the measuring cylinder.

Harold measures the level of water in the measuring cylinder.



Harold leaves the plant in the measuring cylinder for six hours.

He then measures the level of water on the measuring cylinder.

His results are shown in the table.

Time	Reading on measuring cylinder in cm^3
Start	80
After 6 hours	74

(i) Describe how water from the measuring cylinder enters the plant and reaches the leaves.

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

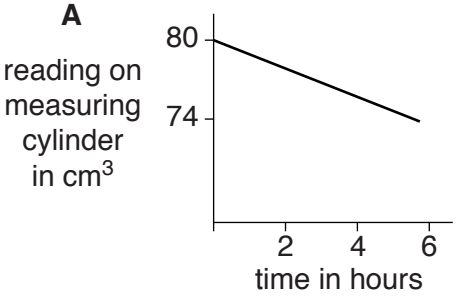
(ii) Harold repeats his experiment but **turns off the lights** in the room.

He takes measurements on the measuring cylinder every two hours.

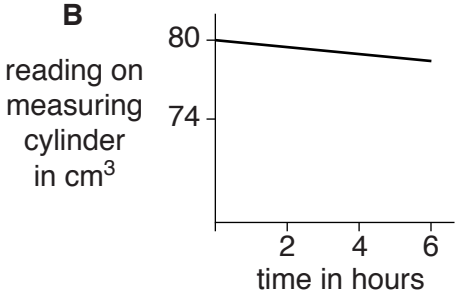
He is going to plot a graph of his results.

Look at the graphs.

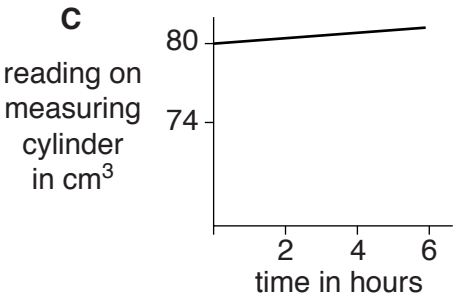
A



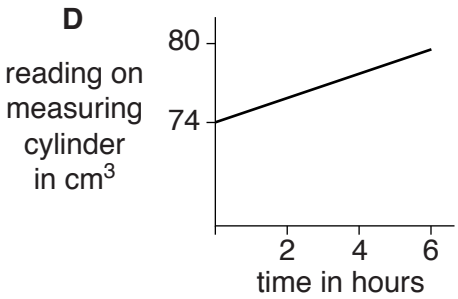
B



C



D



What will Harold's graph look like?

Choose from **A**, **B**, **C** or **D**.

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

(iii) Explain your answer to part **(ii)**.

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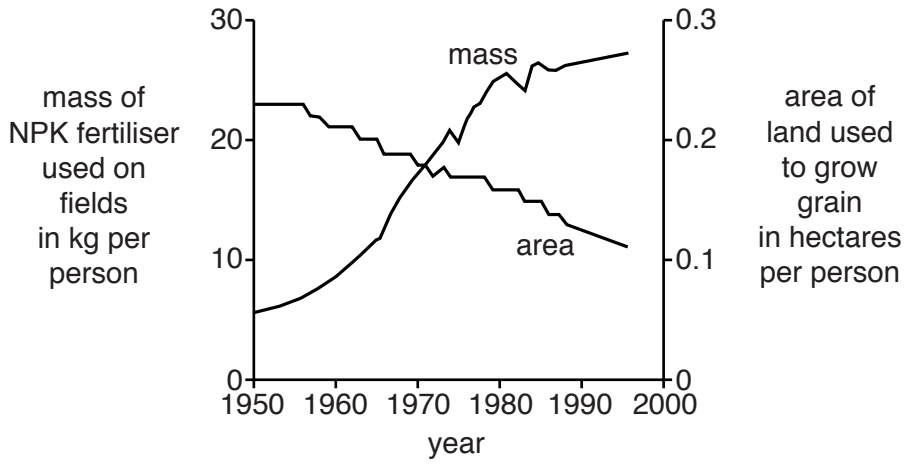
..... **[2]**

3 The graph shows the mass of NPK fertiliser used on land per person in the world.

It also shows the area of land used to grow grain crops per person in the world.



Heather is talking about the graph.

> I know that the same amount of grain was grown per person in 1995 as in 1950.
> So why has the area of land used to grow this grain changed?

Explain the effect of NPK fertiliser on crops.

Use the information in the graph to suggest an answer to Heather's question.

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

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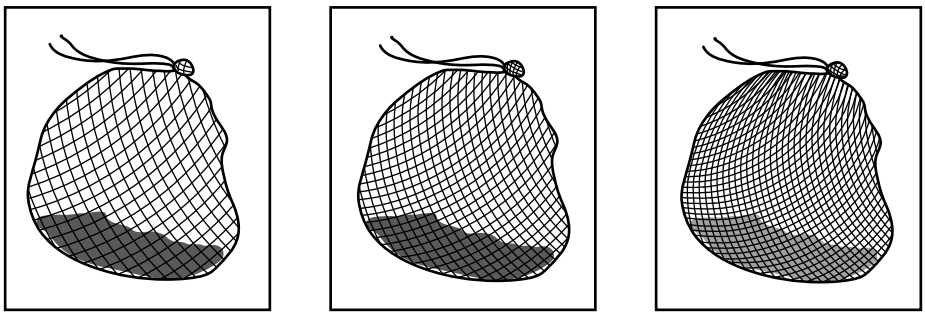
..... **[6]**

4 Some students did an experiment to see how quickly leaves decay.

They put some leaves into three different bags, **A**, **B** and **C**.

Each bag was made of material that had different size holes.

The bags are going to be buried in the soil.



bag **A** holes 8 mm wide	bag **B** holes 5 mm wide	bag **C** holes 1 mm wide

(a) Different organisms have different roles in breaking down the leaves.

- Bacteria and fungi which are less than 0.005 mm wide.
- Woodlice which are about 4 mm wide.
- Earthworms which are about 7 mm wide.

Complete this table.

Organism	**Role in breaking down the leaves**	**Can the organism get into bag A?**	**Can the organism get into bag B?**	**Can the organism get into bag C?**
bacteria	.....	yes	yes	.....
fungi	decomposers	yes	yes	yes
earthworms	detritivores	yes	.....	no
woodlice	.....	yes	.....	no

[3]

(b) The students put 100 g of leaves in each bag.

They buried the bags in the soil.

After two months they dug up the bags and reweighed the leaves.

Their results are shown in the table.

	Bag A	**Bag B**	**Bag C**
Mass at the start in grams	100	100	100
Mass after two months in grams	75	85	95

(i) In which bag did the leaves decay fastest?

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

(ii) Explain why decay was fastest in this bag.

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

(iii) The students repeated this experiment in the winter.

They found that the leaves in all the bags decayed less than in the first experiment.

Suggest why.

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

SECTION B – Module C4

5 Word equations are used to describe reactions.

Look at these word equations.

reaction **A** **copper carbonate → copper oxide + carbon dioxide**

reaction **B** **potassium + chlorine → potassium chloride**

reaction **C** **potassium chloride + silver nitrate → silver chloride + potassium nitrate**

reaction **D** **sodium hydroxide + copper sulfate → copper hydroxide + sodium sulfate**

reaction **E** **sodium + water → sodium hydroxide + hydrogen**

(a) One reaction is thermal decomposition.

Which one?

Choose from **A**, **B**, **C**, **D** or **E**.

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

(b) One reaction makes a colourless gas and an alkaline solution.

Which one?

Choose from **A**, **B**, **C**, **D** or **E**.

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

(c) One reaction makes a **white** precipitate.

Which one?

Choose from **A**, **B**, **C**, **D** or **E**.

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

(d) One reaction makes a **blue** precipitate.

Which one?

Choose from **A**, **B**, **C**, **D** or **E**.

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

6 A factory makes potassium sulfate, K_2SO_4.

(a) How many different elements are in the formula K_2SO_4?

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

(b) The factory produces a lot of waste water.

The waste water is pumped into a local river.

Sarah thinks the water is getting polluted with small amounts of potassium sulfate.

She tests samples of the river water.

Her results are shown in the table.

Test	Result
flame test	yellow flame
barium chloride solution	white precipitate

Describe how Sarah does the flame test.

Explain whether her results support the idea that the river water is polluted with potassium sulfate.

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

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

7 The United Kingdom uses many water resources such as seawater and water from lakes.

(a) Write down the name of one **other** water resource.

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

(b) Look at the table. It shows some information about water resources.

Region	Volume of water available each day in m^3	Volume of water needed each day in m^3	Difference between water available and water needed in m^3
A	1000	600	400
B	2500	2500	.....
C	3000	1500	.....
D	4000	2000	2000
E	500	400	.....

(i) Complete the table by calculating the last column for the three remaining regions. **[1]**

(ii) It is important that people living in region **B** conserve water.

Suggest why. Use information from the table.

.....

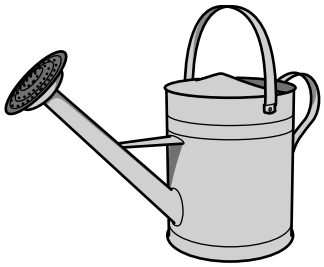
..... **[1]**

8 The properties of four metals are shown in the table.

Look at the table.

Metal	Melting point in °C	Density in g/cm^3	Reaction with water
W	1540	7.9	rusts rapidly
X	98	1.0	reacts violently
Y	660	2.7	no visible reaction
Z	840	1.6	slowly reacts

(a) Oskar's grandad wants to buy Oskar a new watering can.



Which metal, **W**, **X**, **Y** or **Z** would be best to use to make the watering can?

Write down **one** reason for your answer.

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

(b) The table shows some properties of metals.

Write down **three other** properties of metals.

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

9 Many scientists helped to develop the theory of atomic structure.

Dalton's theory stated that atoms could not be split.

Later, scientists such as Rutherford and Bohr developed theories that had particles smaller than an atom.

Now even more detailed theories of atomic structure are being developed.

(a) Explain why all theories of atomic structure are only provisional and keep changing.

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

(b) An atom has both an **atomic number** and a **mass number**.

What do these **two** terms mean?

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

(c) An element has the electronic structure of 2.8.6.

Identify the element.

Explain your answer.

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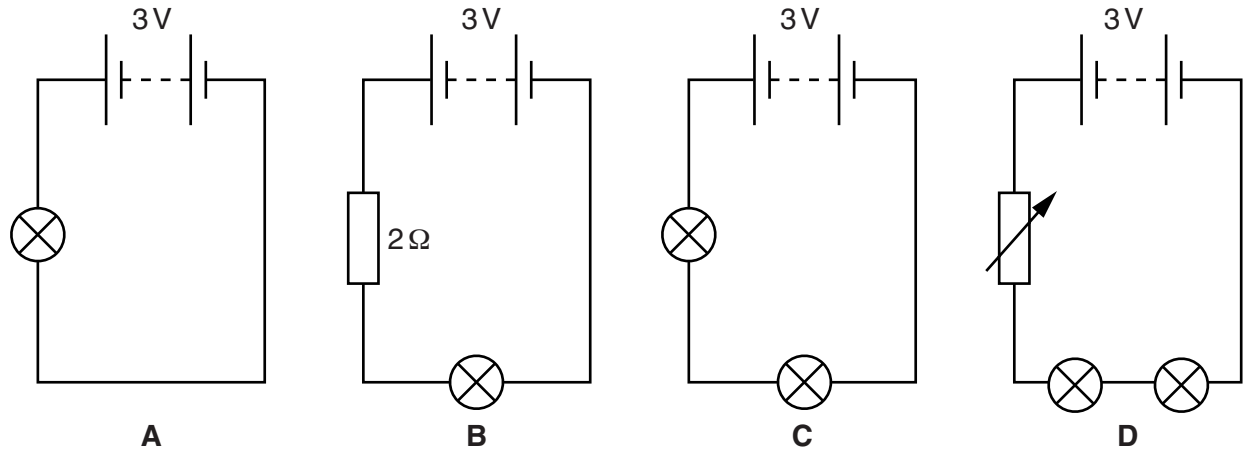
..... **[2]**

SECTION C – Module P4

10 Charles is investigating electrical circuits.

(a) Look at the four diagrams.



Electric charge flows round each circuit.

The lamps in each circuit are identical.

In which circuit is the flow of charge the **greatest**?

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

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

(b) Charles connects an ammeter into circuit **A**.

The reading on the ammeter is 0.5 amps.

Calculate the resistance of the lamp.

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

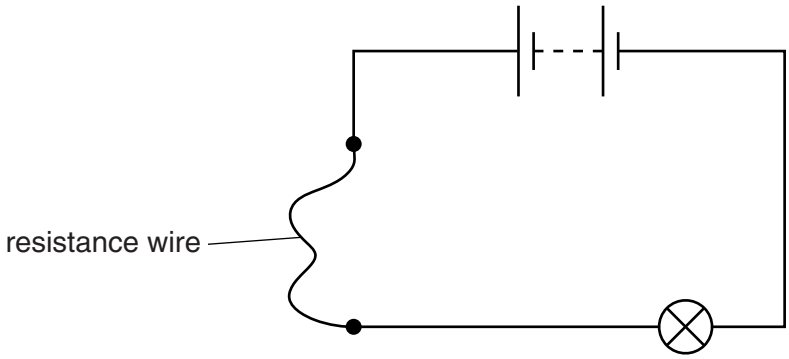
(c) What is the power of the lamp in circuit **A**?

Choose from: 0.5W 1.5W 3.0W 6.0W

answer = ... **[1]**

(d) Charles investigates how changes to a circuit affect the brightness of a lamp.

He builds this circuit and notes that the lamp has normal brightness.



He makes changes to the circuit.

Put one tick (✓) on each row to show whether the lamp is brighter, is less bright, or has normal brightness.

Change made	Lamp is brighter	Lamp is less bright	Lamp has normal brightness
Wire same length but thinner			
Wire made longer			
Lamp and wire change places			
Battery connected opposite way			

[2]

(e) Some electrical appliances can be double insulated.

Look at the diagram.

appliance		material for the case	double insulated
kettle		stainless steel	☐
food mixer		plastic	☐
hairdryer		plastic	☐
toaster		steel	☐
washing machine		steel	☐

Put a tick (✓) in the box next to the **two** appliances that are double insulated. **[2]**

11 (a) Daisy knows that some materials can become charged when rubbed with a nylon cloth.

She has five rods.

The rods are made from **glass** **plastic** **copper** **polythene** **steel**

She holds each rod in turn and rubs it with a nylon cloth.

How many of the rods can become charged?

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

(b) Daisy's car has seats covered in a synthetic material.

Daisy gets an electric shock when she gets out of her car on a dry summer day.

Explain why.

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

(c) Static electricity can be useful.

Put a (ring) around each of the two items in the list that use static electricity to make them work.

paint sprayers

electric motors

smoke detectors using alpha sources

defibrillators

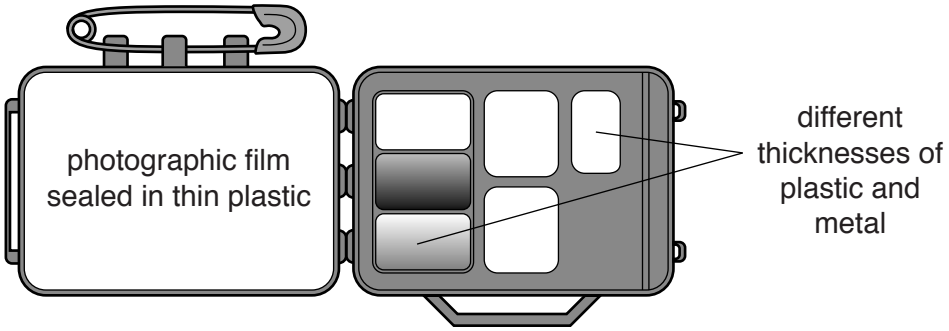
CD players **[1]**

12 Edward works as a radiographer in a hospital.

He has to wear a radiation film badge while he is working.

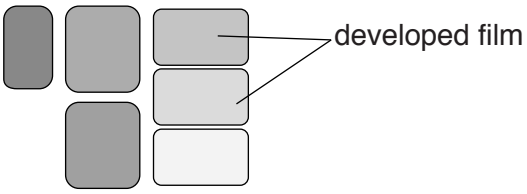
The badge has different thicknesses of plastic and metal covering a photographic film.

Look at the diagram of a film badge.



Radiation absorbed by the film causes the film to darken when developed.

Look at the diagram of the developed film from the badge.



Explain why Edward needs to wear a radiation film badge, and how the badge gives information about the radiation that Edward has been exposed to.

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

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

13 (a) Doctors use a radioactive tracer.

Fay drinks some radioactive liquid and the radiation is monitored on the outside of her body.

Look at the data for some radioactive isotopes.

Radioactive isotope	Radiation given out	Half-life
A	Gamma	3 years
B	Beta	6 weeks
C	Alpha	2 days
D	Gamma	1 day
E	Gamma	2 weeks

Which radioactive isotope should the doctor choose?

Explain your answer.

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

(b) There are two ways of obtaining energy from nuclear reactions.

These can be explained by the fission model and the fusion model.

Describe these two models.

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

(c) There is radiation all around us.

This is called background radiation.

Write down **one** of the main sources of background radiation and explain why this radiation varies from place to place.

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

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Section D starts on the next page

SECTION D

14 This question is about different materials.

(a) Table 1 shows the strength of several materials.

It also shows the density of each material (the mass of 1 cm^3).

Table 1

Material	Impact strength in MPa	Density in grams per cm^3
steel	500	7.8
nylon	75	1.1
spider silk	1000	1.3

(i) Special jackets are worn by soldiers.

They are designed to have enough impact strength to stop bullets but they also have to be comfortable.

Spider silk would be a good material to use to make these jackets.

Use information in Table 1 to explain why.

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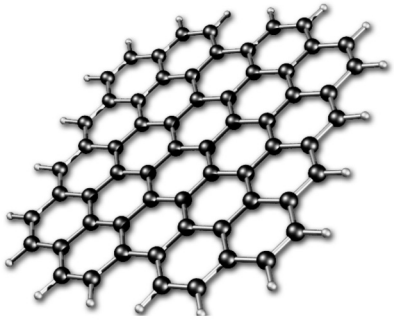
..... **[2]**

(ii) In 2004 a new material called graphene was made.

It is made from graphite.



Graphene is a single sheet of carbon atoms that is one atom thick.

Although it is very thin, it has an impact strength of **5000 MPa**.

Use a calculation to compare the impact strength of graphene with steel.

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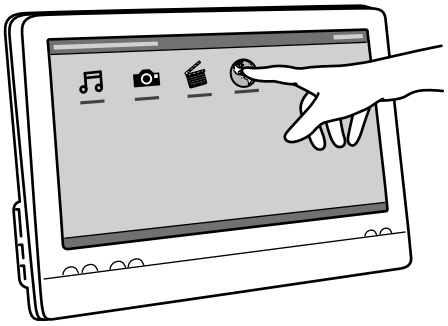
..... **[2]**

(b) Computer touch screens are usually made from a metal called indium.

Scientists think that graphene made from graphite could be used instead.



(i) Table 2 contains some information about indium and graphite.

Table 2

	World reserves in tonnes	**World use in tonnes per year**
indium	5 760	640
graphite	71 000 000	1 100 000

If **indium** is used at the present rate it will run out.

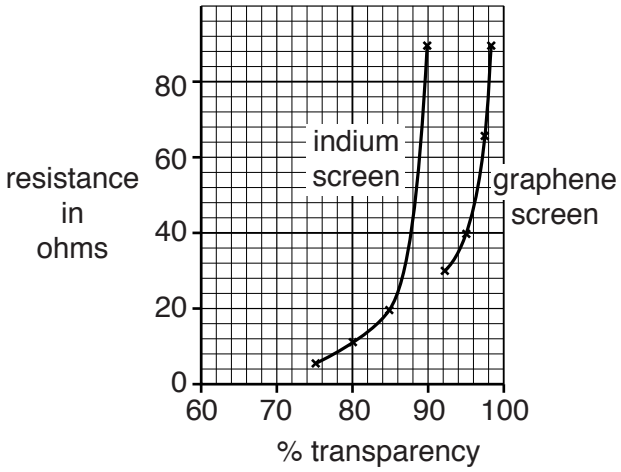
Use the data to work out how long it will last before it runs out.

answer ..... years **[1]**

(ii) Computer touch screens need to be transparent and have a low electrical resistance.

Look at the graph.

It shows the range of transparency and resistance for screens made using graphene and screens made using indium.



A screen has a resistance of 40 ohms.

If it was made with indium it would be 88% transparent.

How transparent would it be if it was made with graphene?

answer = ... % **[1]**

(iii) Scientists think the discovery of graphene is important.

Suggest reasons why this is.

Use information from Question 14 in your answer.

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..... **[4]**

END OF QUESTION PAPER

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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.