OCR
Oxford Cambridge and RSA

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Friday 10 June 2016 – Morning

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

3151369127

B712012

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

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

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

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Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

SECTION A – Module B2

1 Look at the picture of a sperm whale.

(a) Sperm whales are an endangered species.

The whales are endangered because they have been hunted.

Write down **two other** ways species can become endangered.

.....

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

(b) Some species of whales are still being hunted as **sustainable resources**.

Write down what is meant by sustainable resource.

.....

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

(c) People have differing views about hunting whales.

Some of these views are scientific and others are opinions.

Put a tick (✓) next to one statement that is an **opinion**.

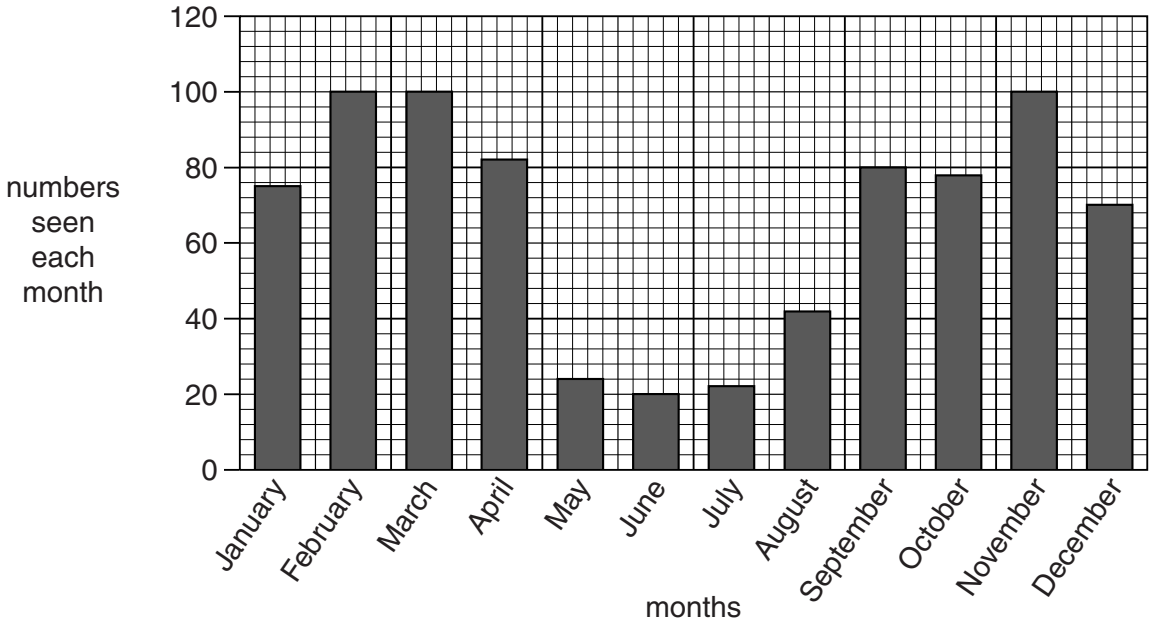
Hunting whales helps us to find out how they survive deep in the ocean.	☐
Hunting should be banned because it is cruel.	☐
Whale hunters can make money.	☐
Whale oil is used to make lipstick.	☐

[1]

(d) Whales and dolphins have become tourist attractions.

Tourists take boat trips to see whales and dolphins.

The graph shows the number of dolphins seen during one year by one boat.



The captain of the tourist boat made this statement to the tourists.

Explain why the graph only supports **part** of his statement.

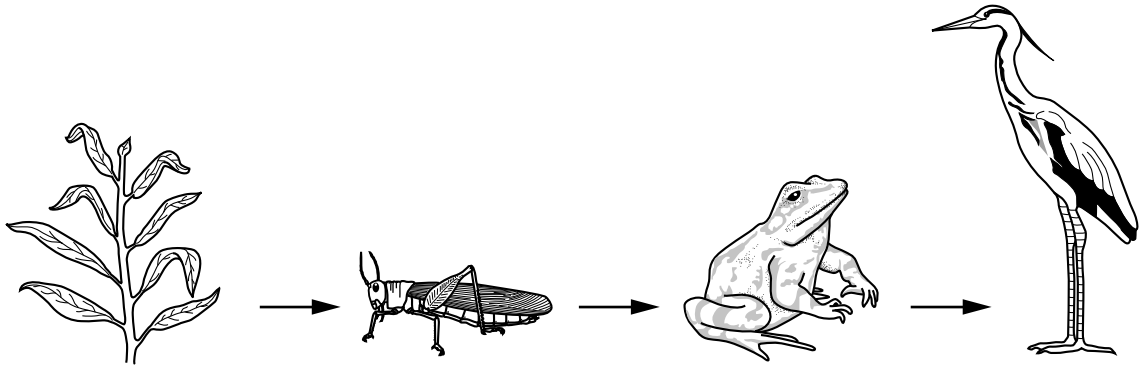
.....

.....

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

[Total: 6]

2 Look at the food chain.



(a) The food chain shows animals and plants living near a pond.

One year the number of herons increased.

The population of grasshoppers also increased.

The change in heron population caused the change in grasshopper population.

Explain how.

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

(b) The plants living near the pond need nitrogen to make protein.

Finish the sentences.

Choose words from the list.

carbon dioxide **colourless** **nitrates**

oxygen **reactive** **unreactive**

The air contains nitrogen gas.

Plants **cannot** use nitrogen directly from the air because it is ..... .

Plants take up nitrogen by using their roots to absorb ..... from the soil.

[2]

(c) When plants die, the elements in them are made available for other plants.

Describe how the elements are made available.

.....

.....

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

[Total: 6]

3 Landfill sites are used to dump household waste.

The picture shows a landfill site in an Arabian desert.

Eagles live in the same desert.
They fly over large areas of the desert looking for food.
Some eagles have started to spend a lot of time near landfill sites.

Explain why an increase in human population has resulted in more landfill sites being used.

Suggest how the eagles have **adapted** to benefit from landfill sites in the desert.

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

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

[Total: 6]

4 Matt and Ellie are investigating the animals living in a lake.

They collect some of the animals.

Look at the descriptions of some of the animals they collect.

Animal description	Arthropod class
has wings and six legs	insect
has two body sections and ten legs	.....
has eight legs and two body sections	.....

(a) Finish the table by writing in the correct scientific name of the arthropod class.

The first one has been done for you.

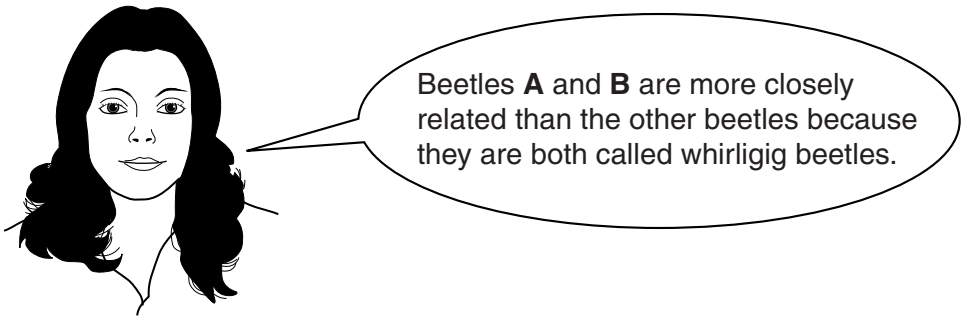
Choose from the list.

animal **arachnid** **crustacean** **myriapod** **protoctista** **[2]**

(b) Ellie identifies some of the beetles they collect and writes their names in a table.

Beetle	Common name	Binomial name
A	whirligig beetle	*Gyrinus natator*
B	hairy whirligig beetle	*Orectochilus villosus*
C	great diving beetle	*Dytiscus marginalis*
D	there is no common name for this beetle	*Dytiscus latissimus*

Ellie makes this statement about the beetles.



Is Ellie correct? .....

Explain your answer.

.....

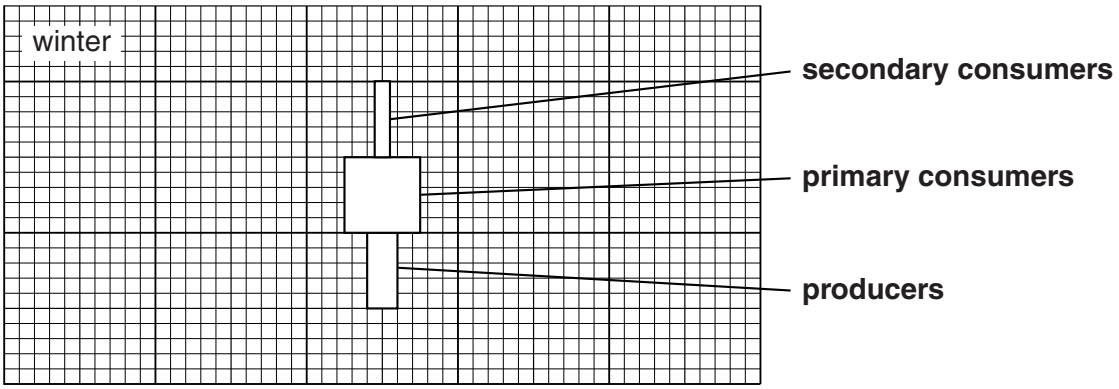
..... **[1]**

(c) Matt finds some information about the biomass values for the lake in winter and spring.

Look at the table.

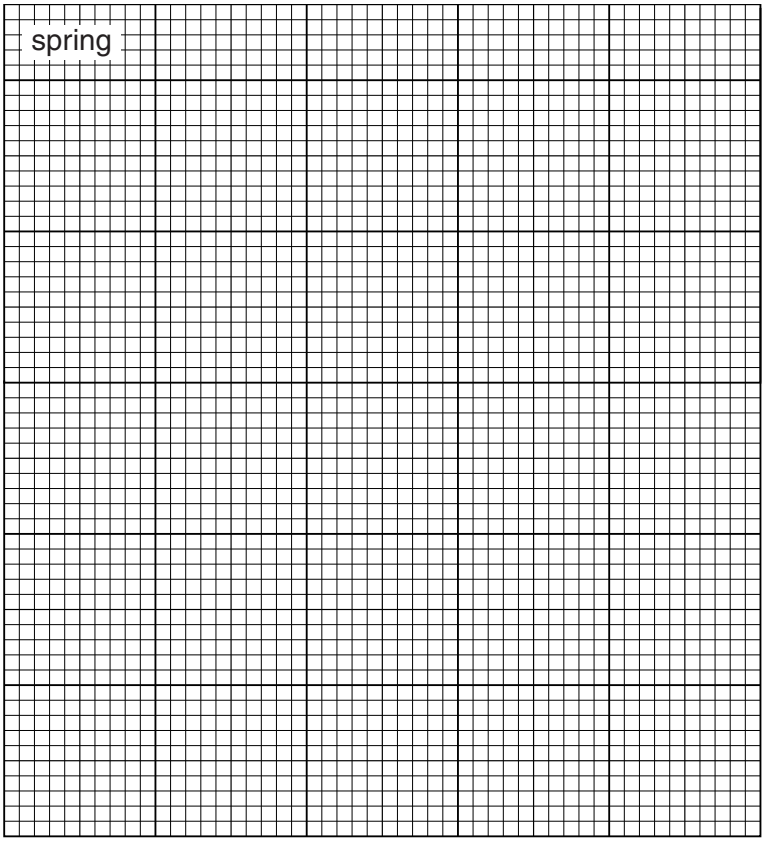
Trophic level	Biomass in mg dry mass per m^3	
	Winter	**Spring**
producers	4	100
primary consumers	10	12
secondary consumers	2	6

The diagram shows the pyramid of biomass for winter.



(i) Draw the pyramid of biomass for spring on the grid.

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



[2]

(ii) The pyramid of biomass for winter is a different shape to the spring pyramid of biomass.

Describe **one** way the winter pyramid is different in shape and suggest a reason for the difference.

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

[Total: 7]

SECTION B – Module C2

5 Potassium nitrate is used as a fertiliser.

Look at the formula of potassium nitrate.

$$KNO_3$$

(a) How many **different elements** are in potassium nitrate?

Choose from

2 **3** **4** **5** **6**

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

(b) What is the total number of **atoms** in the formula for potassium nitrate?

Choose from

2 **3** **4** **5** **6**

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

(c) Potassium nitrate, KNO_3, is a **nitrogenous** fertiliser.

Write down the name of **another** nitrogenous fertiliser.

Choose from the list.

ammonium nitrate, NH_4NO_3

calcium hydroxide, $Ca(OH)_2$

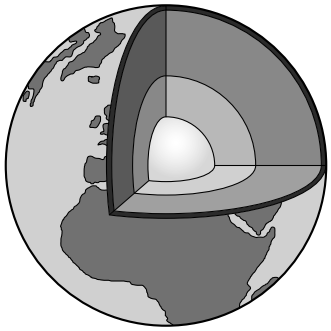
potassium sulfate, K_2SO_4

sodium phosphate, Na_3PO_4

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

[Total: 3]

6 Look at the diagram of the structure of the Earth.



(a) What are the three main parts of the structure of the Earth?

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.....

.....

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

(b) The surface of the Earth is made up of tectonic plates.

This was first suggested by a scientist called Wegener in 1914.

The theory of tectonic plates is now widely accepted.

Explain why theories that scientists like Wegener propose take some time to become widely accepted.

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

[Total: 5]

7 Look at the table. It shows some properties of different metals.

Metal	Density in g/cm^3	Relative electrical conductivity	Relative strength	Melting point in °C
A	8.9	64	13	1083
B	7.7	11	21	1510
C	2.7	40	15	660
D	11.4	5	2	328
E	19.4	20	41	3410

(a) (i) Which metal from the table can be used to make a container to hold a molten metal at 2000 °C?

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Explain your answer.

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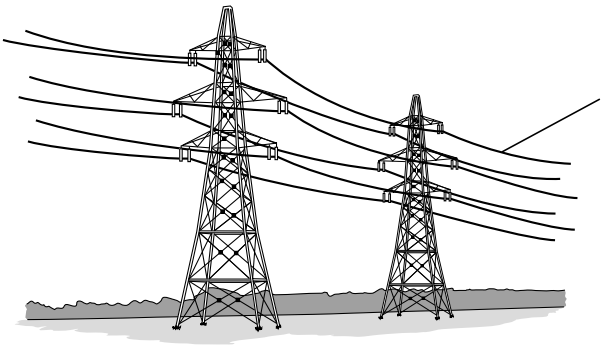
..... **[2]**

(ii) Which metal from the table is best to use to make electricity pylon wires?

Write down **two** reasons for your choice.



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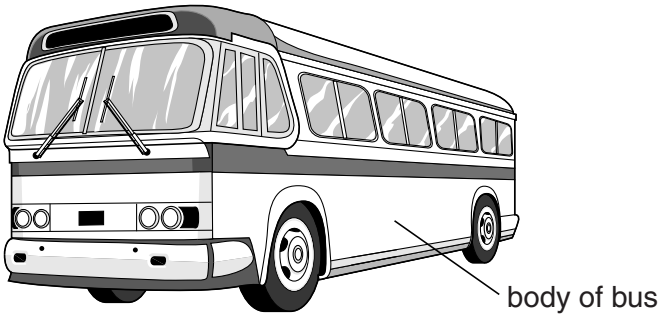
..... **[3]**

(b) The body of a bus is made from aluminium or steel.



What properties, apart from cost, are needed by the metal used to make the body of a bus?

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

[Total: 7]

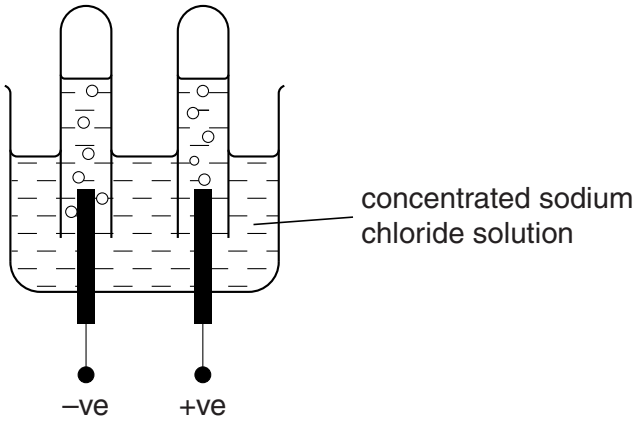
Question 8 begins on page 16

8 Sodium chloride (salt) is a very important chemical.

Sodium chloride can be extracted from salt deposits by solution mining.

Concentrated sodium chloride solution can be electrolysed to make useful products.

Look at the diagram. It shows how this can be done in the laboratory.



Write about how sodium chloride is extracted by **solution mining**.

What is made during the electrolysis of concentrated sodium chloride solution?

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

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

[Total: 6]

9 Sulfur trioxide, SO_3, is made in a chemical factory.

It is used to make sulfuric acid.

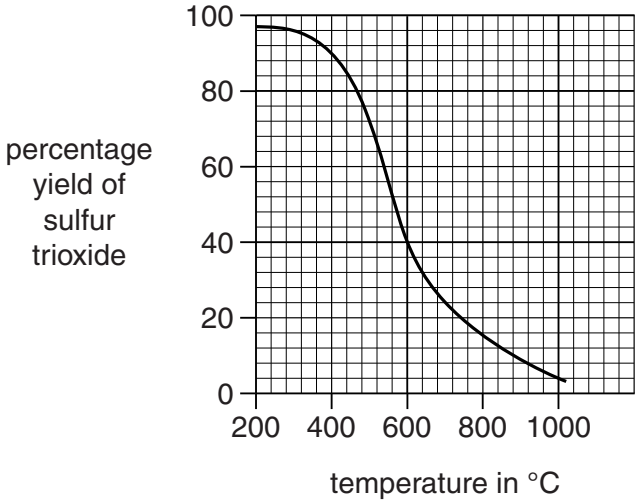
The equation shows how sulfur trioxide is made.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

sulfur dioxide + oxygen ⇌ sulfur trioxide

Look at the graph.

It shows how the percentage yield of sulfur trioxide changes as the temperature changes.



(a) What is the percentage yield of sulfur trioxide at 600 °C?

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

(b) How does **increasing** the temperature affect the percentage yield?

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

(c) The conditions used in the reaction are

- 450 °C
- low pressure
- catalyst of vanadium(V) oxide.

Suggest why these conditions are chosen.

.....

.....

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

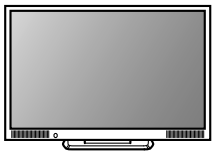
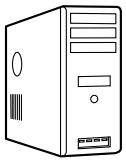
[Total: 4]

SECTION C – Module P2

10 This question is about electrical appliances and their running costs.

(a) Sally uses several electrical appliances.

Look at the information about each appliance.

	Appliance	Current in amps	Voltage in volts
A	 lamp	5	12
B	 television	1.5	230
C	 electric fire	6	230
D	 computer	4.5	20

(i) Which appliance has the highest power rating?

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

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

(ii) Sally uses each appliance for 1 hour.

Which appliance costs the **least** to run?

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

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

(b) Sally also uses an electric heater to produce her hot water.

The heater is rated at 3 kW.

It is switched on for 7 hours each day.

Electricity costs 15 pence per unit.

Calculate the cost to heat the water each day.

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.....

answer ..... pence **[2]**

[Total: 4]

Question 11 begins on page 20

11 (a) Most of our electrical energy is produced in large power stations.

A large power station produces up to 2000 MW of power.

Some of our electrical energy is now produced by wind farms.

A wind farm is made up of several wind turbines.

Each turbine produces up to 2 MW of power.

Suggest one reason why some people are **for** more wind farms and one reason why others are **against**.

reason for .....

.....

reason against .....

.....

[2]

(b) Tom uses solar panels to charge batteries.

He has four identical solar panels.

Tom puts each panel in a different place.

He connects a battery to each panel.

Look at his results.

Place of solar panel	Current produced at different times of day in amps			
	midnight	6am	12 noon	6pm
A	0.0	0.3	0.5	0.2
B	0.0	1.0	0.8	0.3
C	0.0	0.5	1.1	0.5
D	0.0	0.5	1.3	1.2

Which place, **A**, **B**, **C** or **D** is best for charging a battery?

Explain your answer.

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.....

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

(c) Tom wants to recharge one of the batteries in a shorter time.

He needs a new solar panel that produces a larger electric current.

Suggest how this new solar panel will be different.

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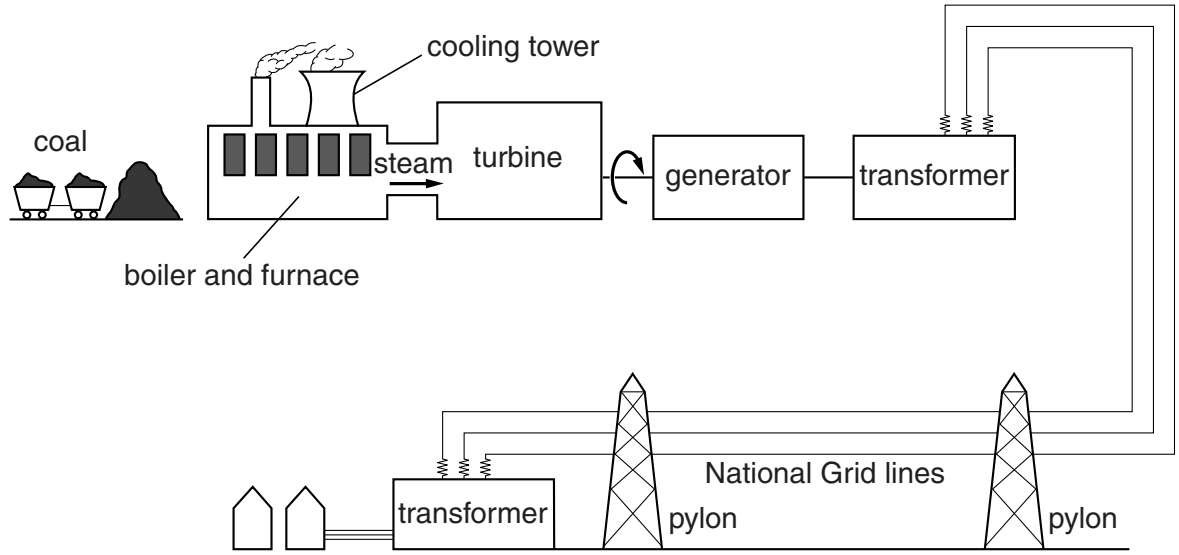
..... **[1]**

[Total: 5]

12 Power stations generate electricity.



Look at the data for a coal-fired power station.

useful electrical energy produced per second	1110 kJ
total energy input from coal per second	3700 kJ

Describe the different stages in the **production** and **distribution** of electricity from this power station and use the information to calculate its efficiency.

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

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

[Total: 6]

13 **(a)** Nuclear radiation can be useful and it can be harmful.

(i) Nuclear radiation can be used in hospitals.

Write down **one industrial** use of nuclear radiation.

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

(ii) Write down **one** harmful effect of nuclear radiation.

.....

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

(iii) People need to take precautions when handling radioactive materials.

Describe some of these precautions.

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

(b) Polly and Oliver were talking about the factory that is near their home.

Polly said that the factory produces dangerous radioactive waste.

Oliver said that if the waste was put into thick aluminium cans it could be stored safely.

Is Oliver correct? .....

Explain your answer.

.....

.....

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

[Total: 6]

14 (a) Scientists have observed a new solar system similar to ours.

It is four light years away from Earth.

The system contains a star and planets.

Write about the other **objects** that scientists may expect to find in this new solar system.

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.....

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

(b) This new solar system is four light years away from Earth.

This means it takes four years for the light from the new solar system to reach Earth.

Should manned or unmanned spacecraft be used to travel to this new solar system?

Explain your answer.

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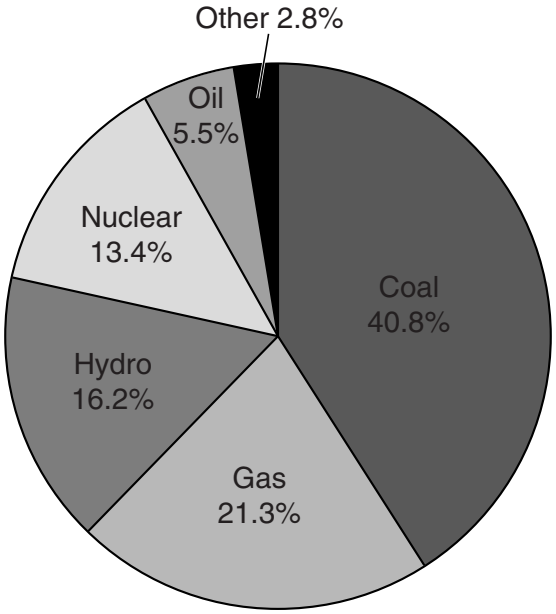
..... **[2]**

[Total: 4]

SECTION D

15 Look at the pie chart. It shows information about world electricity production in 2008.

Sources for world electricity production 2008



(a) (i) Coal, oil and gas are fossil fuels.

Fossil fuels are non-renewable.

What percentage of world electricity production in 2008 came from burning fossil fuels?

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

(ii) Suggest some problems this may create for world electricity production in the next 30 years.

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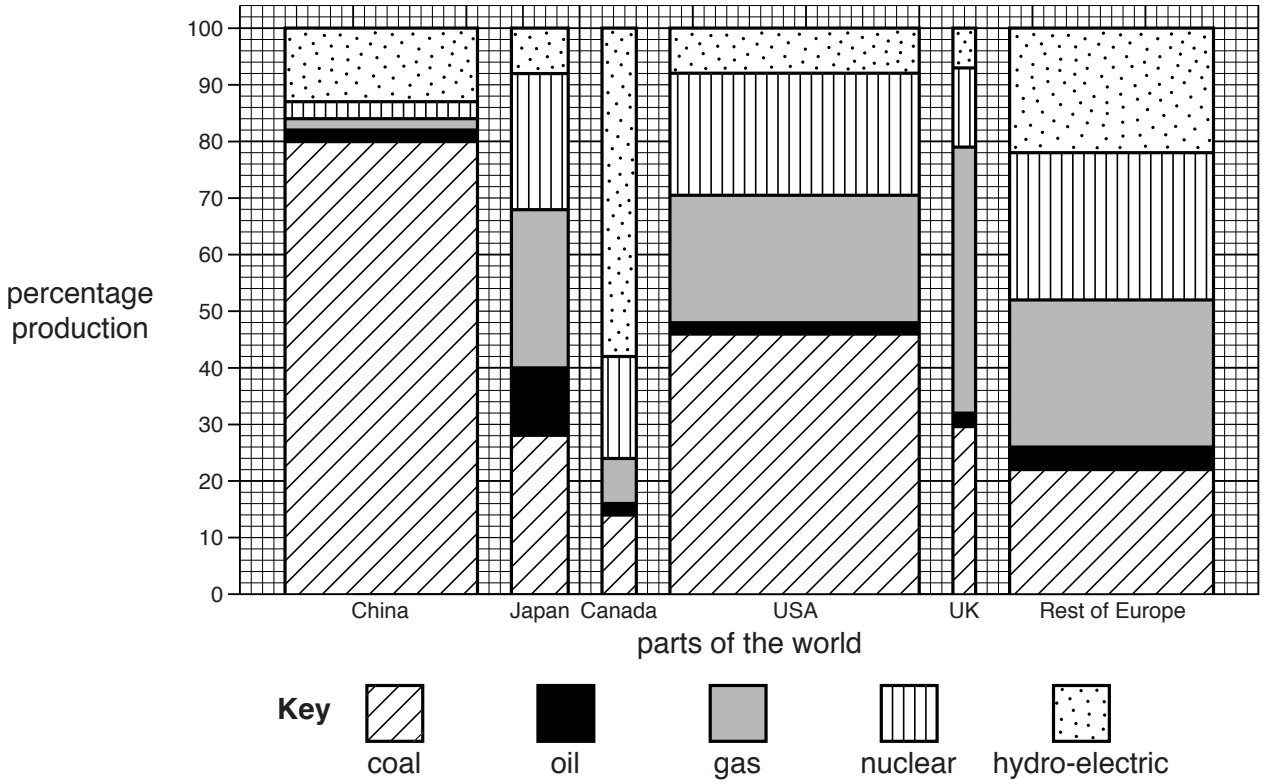
..... **[2]**

(b) Look at the bar chart. It shows how electricity was produced in different parts of the world in 2008.

The **width** of each bar is a measure of the total amount of electricity produced in 2008.

Electricity production in 2008



(i) Look at the percentage of electricity produced from **coal** in each part of the world.

Put these parts of the world in the correct order. Put the highest first.

highest percentage from coal .....

.....

.....

.....

.....

lowest percentage from coal ..... **[2]**

(ii) Which part of the world produced the **lowest** percentage of their electricity from **fossil fuels**?

Suggest why.

.....

.....

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

(iii) The **width** of each bar is a measure of the total amount of electricity produced.

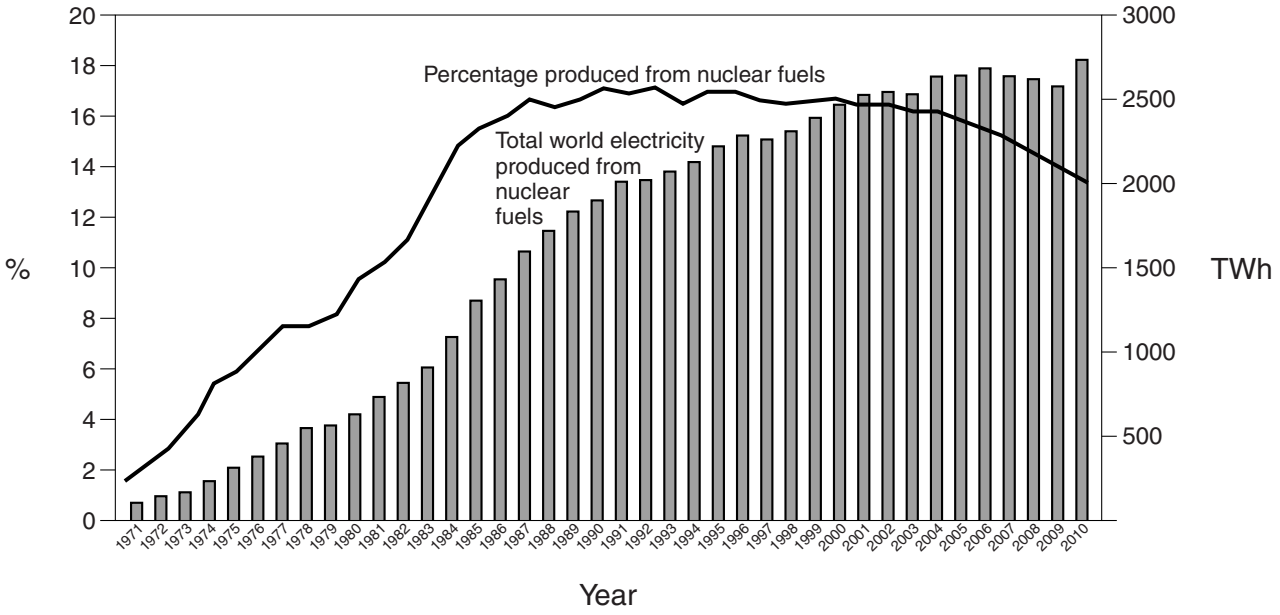
Which part of the world produced most electricity?

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

(c) The production of electricity from nuclear fuels changed between 1971 and 2010.

Look at the graph.

- The bars show the **total** world electricity produced from nuclear fuels (in TWh).
- The line shows the **percentage** of world electricity produced from nuclear fuels.



What conclusions can you make from this graph?

.....

.....

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

[Total: 10]

END OF QUESTION PAPER

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.