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Friday 6 June 2014 – Afternoon

GCSE GATEWAY SCIENCE
SCIENCE B

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

12756205559

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

B712/01

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.

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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

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

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

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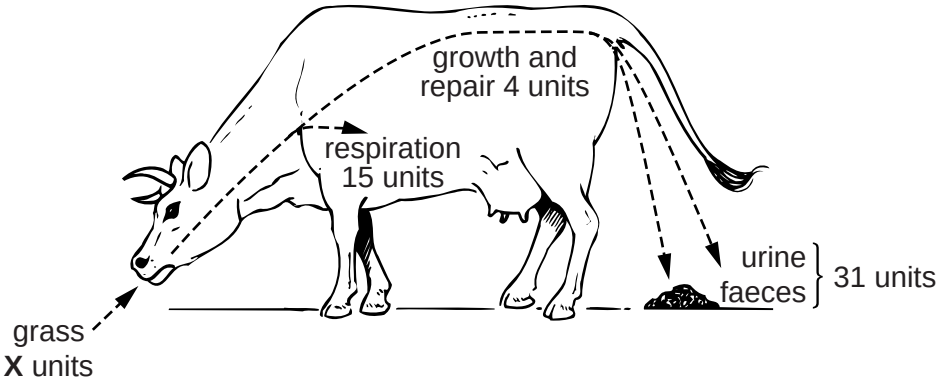
Answer **all** the questions.

SECTION A – Module B2

1 Cows eat grass. Look at the diagram.

It shows how a cow uses the energy it gets from the grass it eats.



(a) (i) **X** is the total units of energy in the grass that the cow eats.

Calculate the value of **X**.

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

(ii) Some humans eat cows.

What percentage of the energy in the grass could be passed on to humans?

Put a (ring) around the correct answer.

8% **30%** **38%** **50%** **[1]**

(b) Dung beetles feed on the faeces from cows.

Look at the picture of a dung beetle.

Dung beetles belong to a class of arthropods.

Use the picture to explain which class of arthropods dung beetles belong to.

.....

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

[Total: 4]

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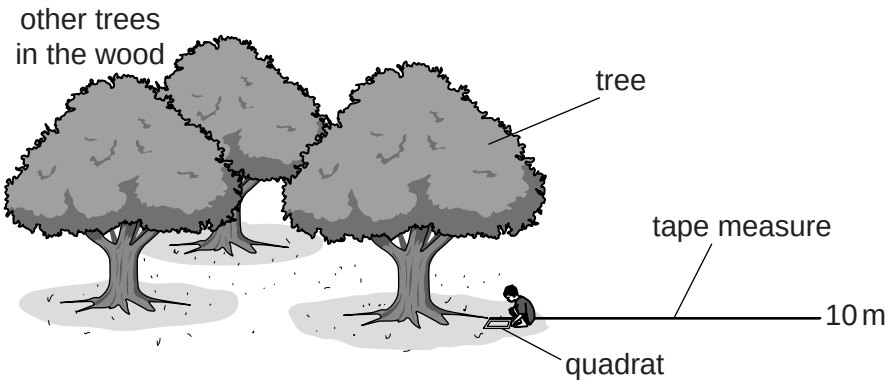
2 Jerry investigates plants growing near a tree on the edge of a wood.

He places a tape measure on the ground, marking a distance of 10 m from the tree.



Jerry uses a square frame called a quadrat.

He puts the quadrat next to the **start** of the tape measure under the tree.

He counts the number of different plant species he finds inside the quadrat.

Jerry then repeats this every metre until he reaches the end of the tape.

The table shows his results.

Distance from tree in m	Number of different plant species
0	0
1	1
2	1
3	2
4	2
5	3
6	4
7	5
8	5
9	5
10	5

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(a) Describe the patterns in Jerry's results.

.....

.....

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

(b) Jerry suggests there are no plants growing close to the tree because they would need to compete with the tree for resources.

Plants compete for minerals.

Write down **two other** resources plants compete for.

.....

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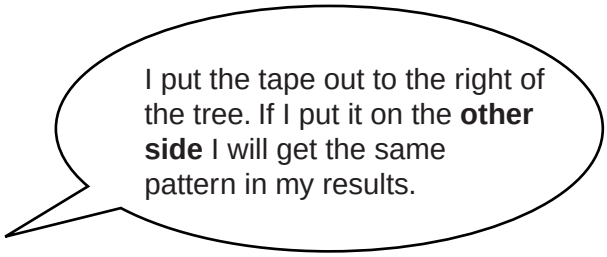
..... **[2]**

(c) Jerry makes this statement about his results.



Is Jerry's statement correct? .....

Explain your answer.

.....

.....

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

(d) In autumn the leaves from the tree fall to the ground.

Nitrogen compounds in these leaves can be used again by the tree for growth.

Explain how.

.....

.....

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

[Total: 8]

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3 Look at the picture of deer-like animals called caribou.

(a) Caribou have eyes on the side of their heads.

Explain how this helps them survive.

.....

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

(b) Caribou live in cold climates where there is a lot of snow.

Suggest and explain **one** way their bodies are adapted to reduce heat loss.

.....

.....

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

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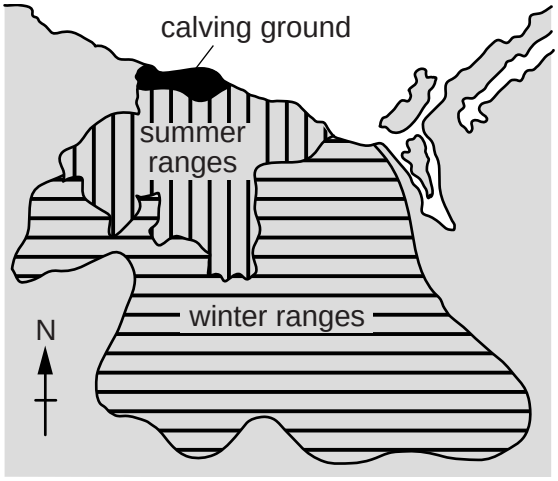
(c) Read the information about caribou.



Caribou live in large groups.

They live in Alaska and feed on lichen which grows on the ground.

Every year large groups of caribou walk thousands of miles following the same migration pattern.

They spend the spring in the north of Alaska. Here the caribou give birth to their calves. There is plenty of food and few predators.

During the summer they move south. They then spend the winter in areas where there is less snowfall.

Explain how caribou behaviour helps the species survive.

Include ideas about how their behaviour protects the whole species from predators and why they migrate.

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

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

[Total: 9]

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4 Look at the picture of the zebras.

There are many theories why zebras have stripes.

One theory is that the stripes stop flies sucking their blood.

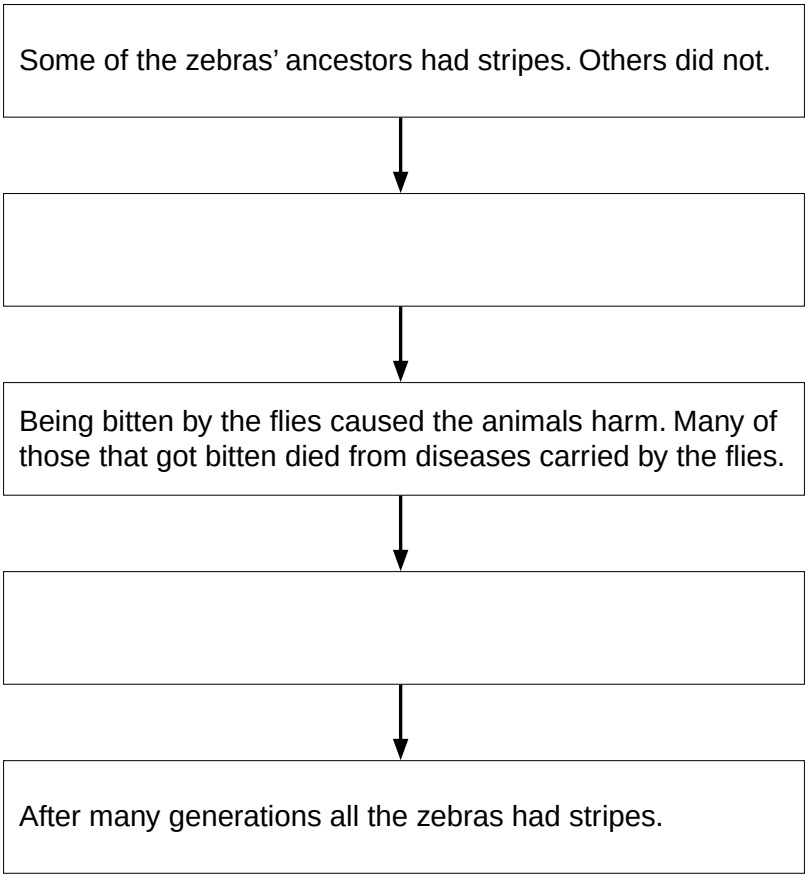
The stripes make the zebras less attractive to the flies.

(a) Darwin's theory of evolution explains how zebras evolved to have stripes.

Read the information in the flow chart.

There are two stages missing.

Finish the flow chart.



[2]

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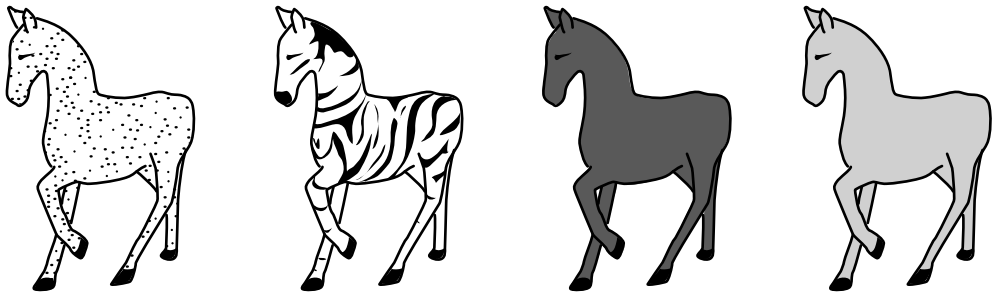
(b) A group of scientists investigated whether stripes were a defence against the flies.

They used four models of zebra each with different coat patterns.

All the models were covered in sticky glue.

The diagram shows the models.



The scientists observations supported the theory that stripes are a defence against flies.

(i) Suggest **one** observation the scientists could have made.

.....

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

(ii) Other people have different theories about the stripes.

What would allow this theory about flies to be accepted by more people?

Put a tick (✓) in the box next to the **best** answer.

Other scientists try the experiment with different coloured zebras. ☐

Other scientists repeat the experiment and they get similar results. ☐

Repeat the experiment with different sized zebras. ☐

Repeat the experiment in winter when there are fewer flies. ☐

[1]

[Total: 4]

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SECTION B – Module C2

5 This question is about metals and alloys.

Look at the word equation for the rusting of iron.

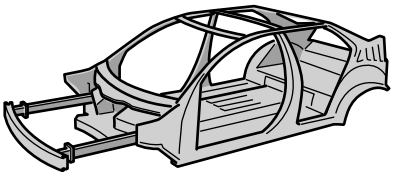
iron + oxygen + water $\longrightarrow$ hydrated iron(III) oxide

(a) Rusting is an example of **oxidation**.

Explain how you can tell this from the word equation.

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

(b) Iron and aluminium are used to make car bodies.



One **property** of both iron and aluminium is that they are strong.

Write about the **similarities** and **differences** between other properties of iron and aluminium.

.....

.....

.....

.....

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

(c) Alloys are mixtures that contain a metal.

Draw a straight line from each **alloy** to its **use**.

alloy	**use**
amalgam	joining electrical wires
solder	making musical instruments
brass	fillings for teeth

[2]

[Total: 6]

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6 Chris is a gardener.

He uses different compounds in his garden.

Look at the table. It shows information about some of these compounds.

Compound	Formula	Solubility in water	Use
calcium hydroxide	$Ca(OH)_2$	slightly soluble	soil conditioner
glyphosate	$C_3H_8NO_5P$	highly soluble	weedkiller
ammonium phosphate	$(NH_4)_3PO_4$	highly soluble	fertiliser
sodium nitrate	$NaNO_3$	highly soluble	fertiliser

(a) How many different **elements** are in glyphosate?

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

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

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

(c) Which compound could Chris use to neutralise an acid soil?

Explain why.

.....

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

(d) Fertilisers contain elements that are **essential** for plant growth.

(i) Which compound does **not** contain any of these essential elements?

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

(ii) Chris thinks that ammonium phosphate is a better fertiliser than sodium nitrate.

Suggest why.

.....

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

[Total: 6]

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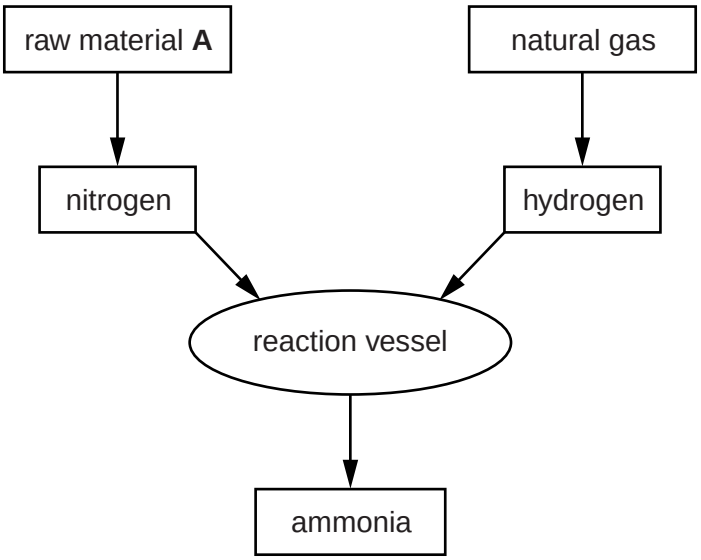
7 This question is about the Haber process for making ammonia.

Look at the flow chart.



(a) Write down the name of raw material **A**.

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

(b) In the reaction vessel, nitrogen, N_2, reacts with hydrogen, H_2, to make ammonia, NH_3.

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

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

(c) Ammonia is a useful chemical.

Write down **two** uses of ammonia.

.....

.....

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

[Total: 5]

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Question 8 begins on page 14

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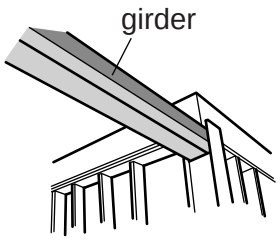
8 Look at the table. It shows the properties of some construction materials.

Material	Effect of water	Density in g / cm^3	Relative hardness (1=soft 10=very hard)	Relative strength (1=weak 500=very strong)	Cost per tonne in £
A	absorbs water	2.0	6	3	210
B	corrodes	7.7	6	400	440
C	no effect	2.9	7	23	2000
D	no effect	2.7	5	15	1500
E	corrodes very slowly	8.9	3	200	3800
F	absorbs water	0.9	0.8	1	1600

(a) Sam is building a house.



Sam needs to choose suitable materials to use for:

- a girder to support the roof
- a kitchen worktop.

Write about the properties of the materials needed for each of these jobs.

Which materials would you use and why?

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

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

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(b) Many of the materials needed to build houses come from ores.

Ores are dug out of the Earth's crust by quarrying.

Write about one **disadvantage** and one **advantage** of quarrying.

.....

.....

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

[Total: 8]

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SECTION C – Module P2

9 This question is about producing electricity.

(a) Complete the table by putting a tick (✓) in the correct box to show the type of electricity produced by each device.

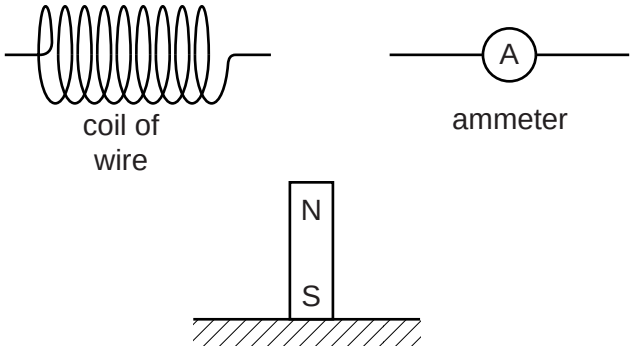
Device	Alternating current	Direct current
battery		
generator in power station		
photocell		

[2]

(b) Lisa investigates how to produce electricity in her science lesson.

Her teacher gives her a bar magnet, an ammeter and a coil of wire.

The magnet is fixed to a table.



magnet fixed to a table

Describe how she can use this equipment to produce an electric current.

You may use a labelled diagram to help your answer.

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

[Total: 4]

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10 This question is about the greenhouse effect.

(a) Methane is a **greenhouse gas**.

(i) Write down the name of one **other** greenhouse gas.

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

(ii) What is meant by a greenhouse gas?

.....

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

(b) Look at the information about a floodlight.

Voltage	230 V
Current	0.87 A
Time used in one year	2000 hours
Cost of electricity per kWh (unit)	£0.15

Calculate the power of the floodlight **in kW** and the cost of electricity used in one year.

.....

.....

Power ..... kW

.....

.....

.....

Cost of electricity used in one year: £ .....

[3]

[Total: 6]

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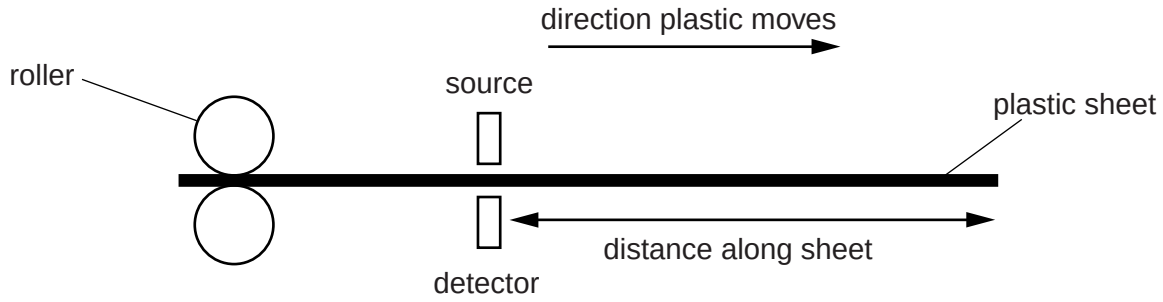
11 Mike manufactures plastic sheets.

He uses nuclear radiation to monitor the thickness of the sheet.

The plastic sheet moves between the radioactive source and the detector.

Look at the diagram.



He tries out three different types of radiation and collects some data.

Look at his results for a 100 cm length of the sheet.

distance along sheet in cm	0	10	20	30	40	50	60	70	80	90	100
count rate for alpha radiation	0	0	0	0	0	0	0	0	0	0	0
count rate for beta radiation	420	420	421	420	300	305	310	420	420	601	603
count rate for gamma radiation	975	974	976	975	975	976	974	975	975	976	974

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Mike decides to use a **beta** source to monitor the thickness of the plastic sheet.

Explain why beta radiation is the best choice and use the data to describe how the thickness of the plastic sheet changes between 0 cm and 100 cm.

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

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

[Total: 6]

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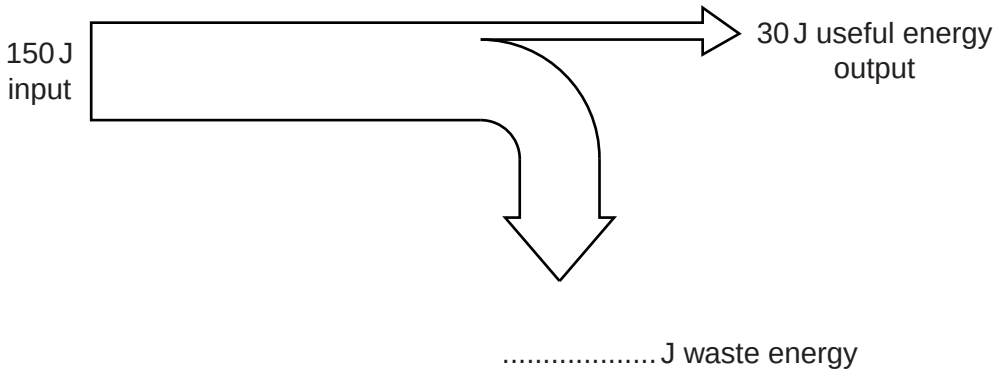
12 **(a)** A town council uses a solar panel to power a road sign.

In sunny weather the solar panel absorbs 150 J of light energy each second and produces 30 J of electrical energy.

Complete the Sankey diagram to show the energy wasted and calculate the efficiency of this way of producing electricity.



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.....

.....

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

(b) There are other ways that the Sun's energy can be harnessed.

Write down **two** other ways that the Sun's energy can be harnessed.

.....

.....

.....

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

[Total: 4]

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Question 13 begins on page 22

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13 **(a)** Several million years ago, a large object from space collided with the Earth.

A large crater was formed on the Earth's surface.

This collision caused climate change and some species became extinct.

What type of object collided with the Earth?

Choose from:

asteroid

black hole

comet

star

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

(b) Scientists think that the Moon was formed when an object collided with the Earth.

What type of object collided with the Earth to form our Moon?

Choose from:

asteroid

comet

galaxy

planet

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

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(c) Black holes do not give out light.

Explain why.

.....

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

(d) Look at the information about planets.

Planet	Distance from Sun in millions of km	Time to orbit Sun in days	Average surface temperature in °C
Earth	150	365	14
Mars	228	687	–63
Saturn	1430	10 760	–130
Neptune	4500	60 200	–200

Scientists wanting to explore Neptune will have to use unmanned spacecrafts.

Suggest reasons why.

.....

.....

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

[Total: 5]

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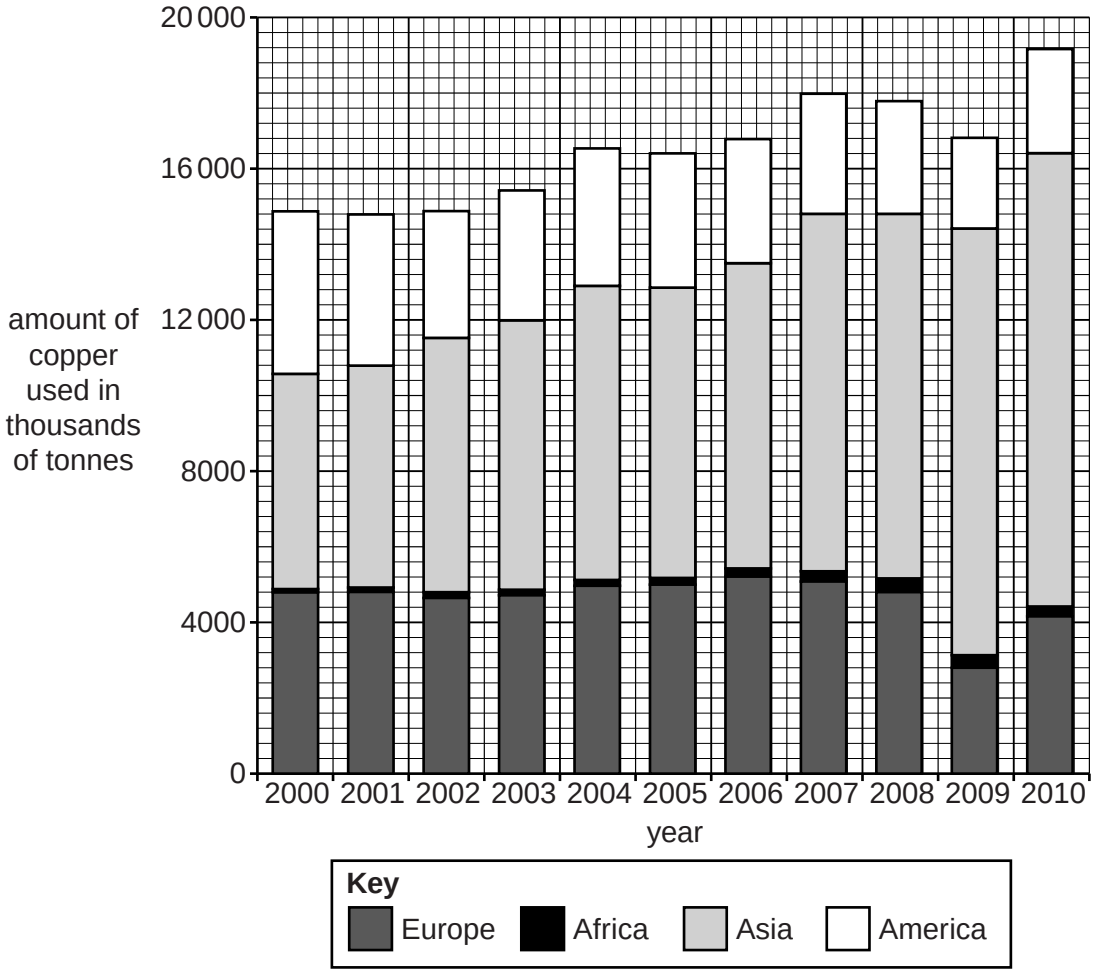
SECTION D

14 Copper is a very important metal.

Look at the bar chart.

It shows how much copper was used each year in different parts of the world.



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(a) (i) How much copper was used in Europe in 2004?

answer ..... thousand tonnes **[1]**

(ii) Describe the general trend in the **total** amount of copper used between 2000 and 2010.

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

(iii) How did the amount of copper used change in:

- Asia
- America

between 2000 and 2010?

.....

.....

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

Question 14(b) begins on page 26

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(b) Look at the table.

It shows the amount of copper produced between 2008 and 2012.

Amount of copper produced in thousands of tonnes					
Area of world	**2008**	**2009**	**2010**	**2011**	**2012**
China	3780	4250	4800	5120	5430
Europe	3710	3560	3610	3660	3760
Asia (not including China)	4340	4030	4100	4160	4210
North America	2210	2060	2080	2110	2140
Rest of World	4720	4820	5010	5200	5500
Total	18760	18720	19600	20250	21040

(i) Which area of the world has shown the **greatest increase** in the amount of copper produced between 2008 and 2012?

Explain your answer using the data in the table.

.....

.....

.....

Suggest why this increase has happened.

.....

.....

[3]

(ii) Look at the data for 2012.

How much copper was produced in China in 2012?

..... thousand tonnes

What percentage is this of the **total** amount of copper produced in the world in 2012?

answer ..... %

[2]

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(iii) The percentage of the world's copper **used** by China in 2012 was 34.5%.

Compare this value with your answer to part **(ii)**.

Write down one problem this causes for China.

.....

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

[Total: 10]

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.

PMT