OCR

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Friday 6 June 2014 – Afternoon

GCSE GATEWAY SCIENCE
SCIENCE B

B712/02 Science modules B2, C2, P2 (Higher 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

B712/02

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

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

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

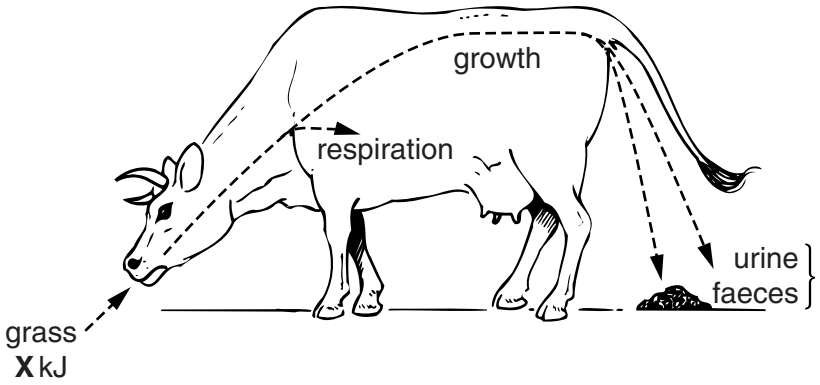
Answer **all** the questions.

SECTION A – Module 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) **X** is the total amount of energy in the grass that the cow eats.

The cow uses 150 kJ of energy for growth and has an efficiency of energy transfer of 4%.

Calculate the value of **X**.

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

(b) The energy in the faeces can be used by other organisms.

Describe how.

.....

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

[Total: 3]

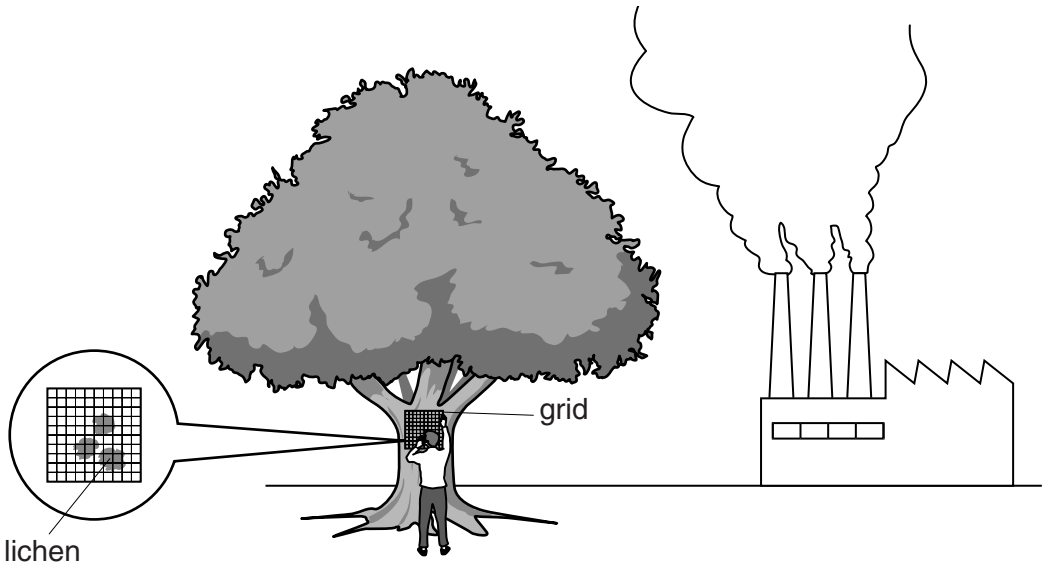
2 Jerry investigates lichen growing on trees.

He compares the amount of lichen on different trees growing near a factory.

The factory releases sulfur dioxide into the air.

He places a square grid on the **south** side of a tree trunk.

Jerry then records the percentage of the grid covered in lichen.



Jerry records the lichen growth on trees at different distances from the factory.

The table shows his results.

Distance from factory in m	Percentage cover of lichen
200	13
400	14
600	34
800	45
1000	51
1200	59
1400	60
1600	49
1800	63
2000	64

(a) Describe and explain the pattern in Jerry's results.

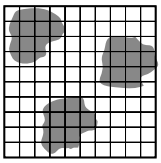
.....

.....

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

(b) Jerry takes another reading.

Look at his grid. It shows the amount of lichen cover on a tree.



Suggest how far this tree is from the factory. ..... m

Explain how you worked out your answer.

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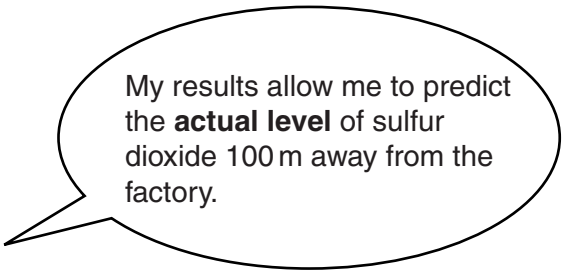
..... **[2]**

(c) Jerry makes this statement about his results.



Jerry's statement is **not** correct.

Suggest why.

.....

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

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

Explain how proteins in the leaves are changed into nitrates.

.....

.....

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

[Total: 7]

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

(a) 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]**

(b) Caribou feed on lichen that grow under the snow.

Lichen are small plant-like organisms.

They have biochemical adaptations that help them grow in very cold climates.

Write about these **biochemical adaptations** to very cold climates.

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.....

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

[Total: 5]

4 Look at the picture of a Bali Myna bird.

There are less than twenty Bali Myna birds left living in the wild.

They only exist in a **small** area of woodland on the island of Bali.

Local people have trapped them to sell for pets.

Each bird is worth more than a year's wages.

The local government has set up a conservation programme to save the Bali Myna birds.

They are paying local people to breed the birds.

The local people can then legally sell some of the birds.

They release the rest into the wild.

Explain reasons why the Bali Myna birds should be saved from extinction.

Apply your scientific knowledge to evaluate this conservation programme.

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

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

[Total: 6]

5 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.

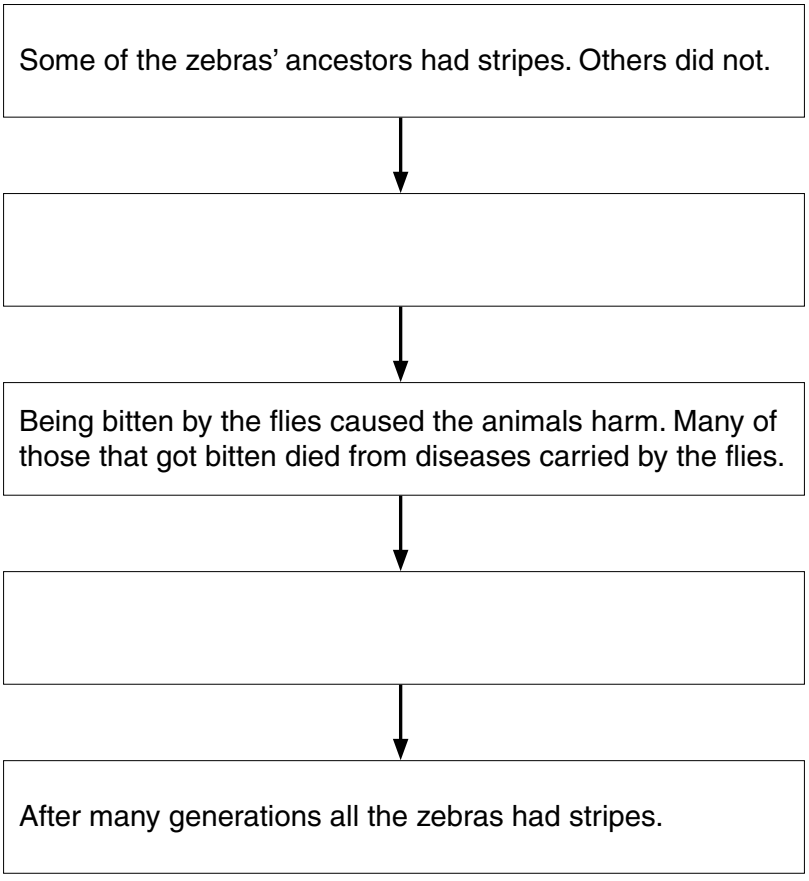
The stripes make the zebras less attractive to the flies.

(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.



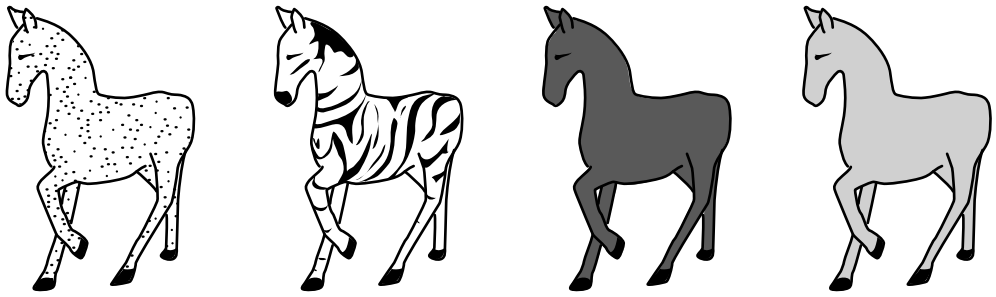
[2]

(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) The scientists published their results.

One reason for publishing results is so that other scientists can see them.

Write down **one other** reason why scientists publish results.

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

[Total: 4]

SECTION B – Module C2

6 Ammonium phosphate is used as a fertiliser.

The formula for ammonium phosphate is

$$(NH_4)_3PO_4$$

(a) Complete the table to show the number of atoms of each element in the formula for ammonium phosphate.

Element	Number of atoms
nitrogen	.....
hydrogen	.....
phosphorus	.....
oxygen	.....

[2]

(b) Ammonium phosphate is made by **neutralisation**.

Complete the **word** equation with the chemicals needed to make ammonium phosphate.

..... + ... → ammonium phosphate + water

....

[2]

(c) Fertilisers are used to increase crop yield.

Explain how plants use fertiliser to increase crop yield.

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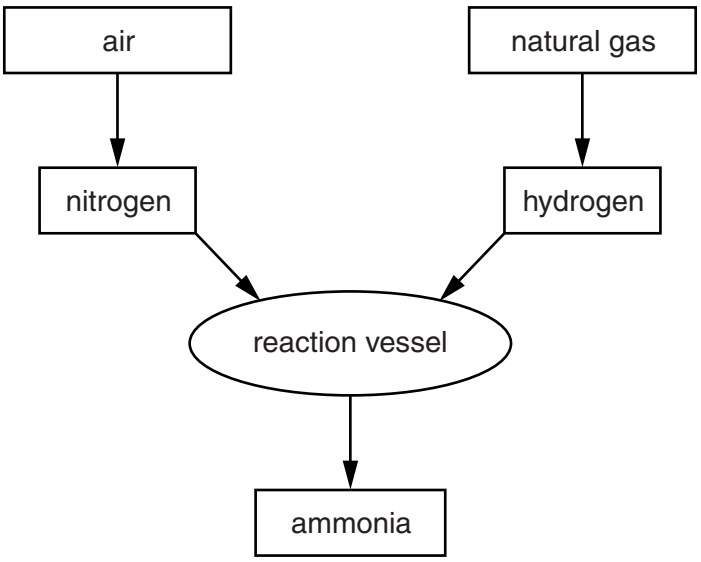
..... **[2]**

[Total: 6]

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

Look at the flow chart.



(a) 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]**

(b) A factory makes ammonia using the Haber process.

The factory owner has to consider:
- the percentage yield of ammonia
- the rate of reaction.

The conditions used in the Haber process are:
- iron catalyst
- high pressure
- 450 °C.

Explain why the factory owner chooses each of these conditions.

iron catalyst .....

.....

high pressure .....

.....

450 °C .....

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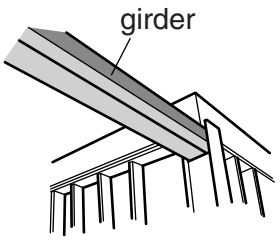
[4]

[Total: 6]

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.

Evaluate how good each material would be for the two 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]**

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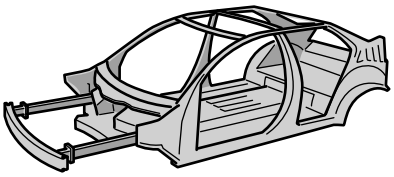
..... **[2]**

[Total: 8]

9 This question is about the metals used in cars.

(a) Aluminium and steel are used to make car bodies.



Write about the **advantages** of using aluminium rather than steel to make car bodies.

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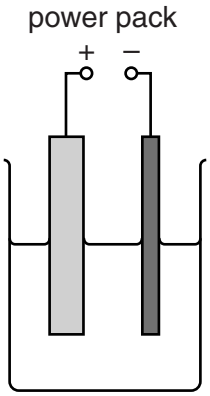
..... **[2]**

(b) Look at the diagram. It shows how impure copper is purified.



Describe how **impure** copper can be purified by electrolysis.

You may wish to put some labels on the diagram to help your answer.

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

[Total: 5]

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Question 10 begins on page 16

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SECTION C – Module P2

10 Look at the statements about global warming.

Some of the statements are facts. Other statements are the opinions of scientists.

(a) Put a tick (✓) in the correct box next to each statement to show if it is a fact or an opinion.

Statement	Fact	Opinion
The amount of carbon dioxide in the atmosphere has increased over the past 100 years.		
The average temperature of the Earth has increased over the past 50 years.		
All the ice at the poles will melt.		
The increase in temperature of the Earth is caused by burning fossil fuels.		

[2]

(b) In 2011, 60W filament bulbs were banned from sale.

The government said using 10W low energy bulbs would:

- give out the same amount of light
- be better value
- reduce energy use.

Look at the information about the two types of bulb.

Type of bulb	Cost of bulb	Lifetime of bulb in hours	Usage in hours each year	Number of units used each year	Cost of electricity per unit in pence
60W filament 	£0.50	600	2000	120	15
10W low energy 	£5.00	10 000	2000	20	15

Use the data in the table to explain why the government came to their conclusion.

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

[Total: 5]

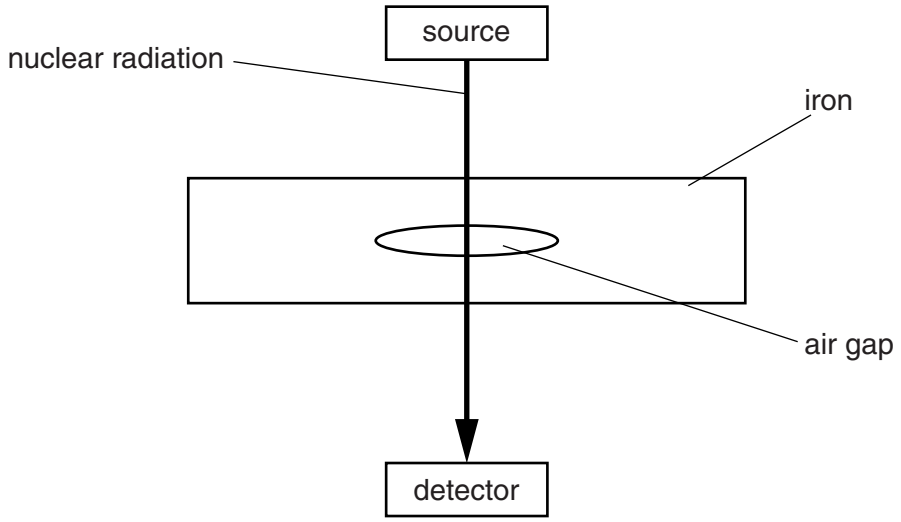
11 A factory is making iron parts for a machine.

It is very important that there are no air gaps in the iron.

The company uses non-destructive testing (NDT) to check for air gaps.

Nuclear radiation passes through the iron to check for air gaps.

Look at the diagram.



(a) (i) Which type of radiation is used for NDT?

Explain your answer.

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

(ii) Describe how NDT can be used to detect air gaps in iron.

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

(b) (i) When nuclear radiation passes through air, it ionises some of the gases in the air.

What happens to the air molecules to make them ions?

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

(ii) Nuclear radiation can damage human cells.

Explain how.

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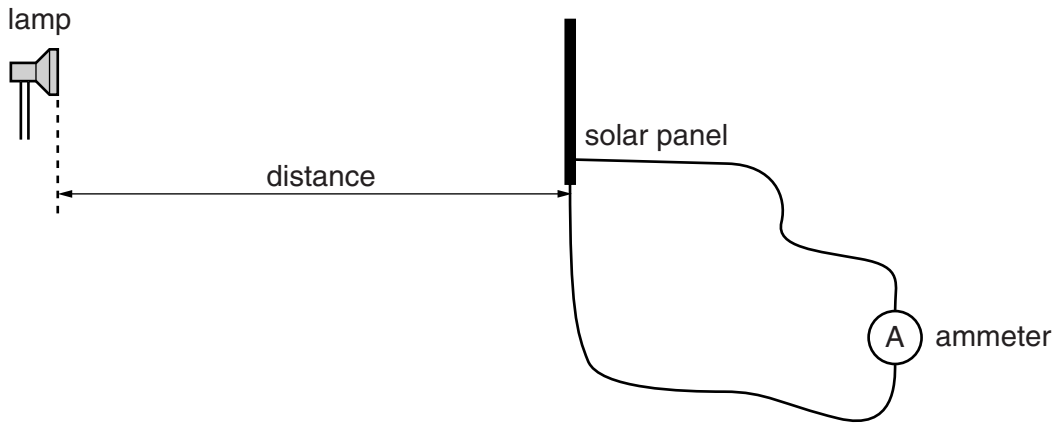
..... **[1]**

[Total: 6]

Question 12 begins on page 20

12 Sally knows that several factors affect the current output for a solar panel.

She investigates how the current output depends on the distance between the light source and the solar panel.



These are her results.

distance between lamp and solar panel in cm	20	30	40	60	80	120
current in milliamps	800	356	200	89	50	22

Describe and explain how the current from the solar panel depends on the distance between the light source and the solar panel.

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

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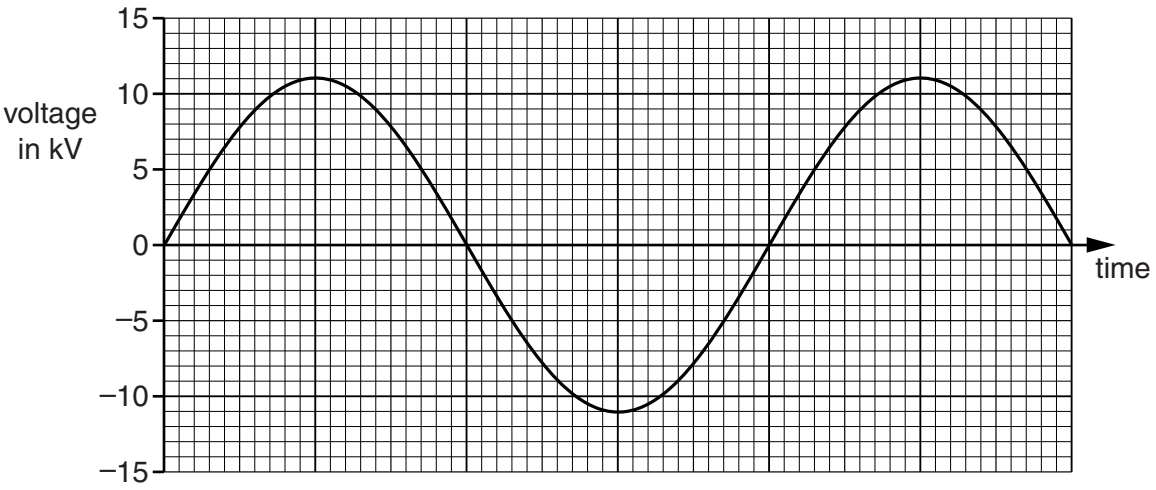
..... **[6]**

[Total: 6]

13 (a) Look at the graph.

It shows the output from a generator in a power station.



What is the peak voltage?

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

(b) The power station has an efficiency of 0.34 (34%).

The energy supplied to the power station each second is 9×10^8 J.

Calculate the **useful** energy produced each second.

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.....

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

[Total: 3]

14 **(a)** A small star like our Sun starts its life as an interstellar gas cloud and ends its life as a white dwarf.

Complete the flowchart to show the life history of a **small** star.

Choose from the list.

main sequence star

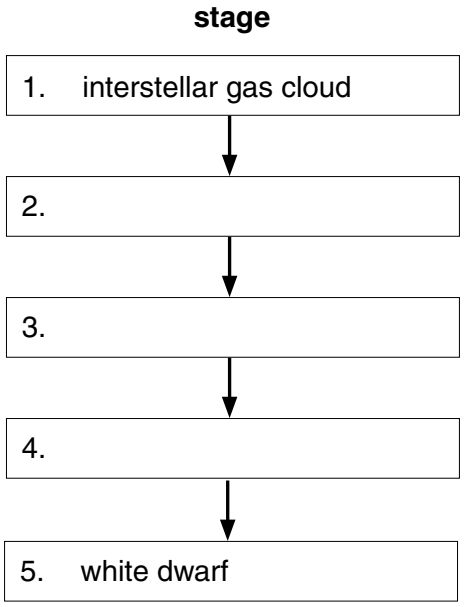
neutron star

red giant

proto star

black hole

supernova



[2]

(b) Describe and explain one property of a black hole.

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

(c) Light from distant galaxies shows a greater red shift than light from closer galaxies.

Explain why.

.....

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

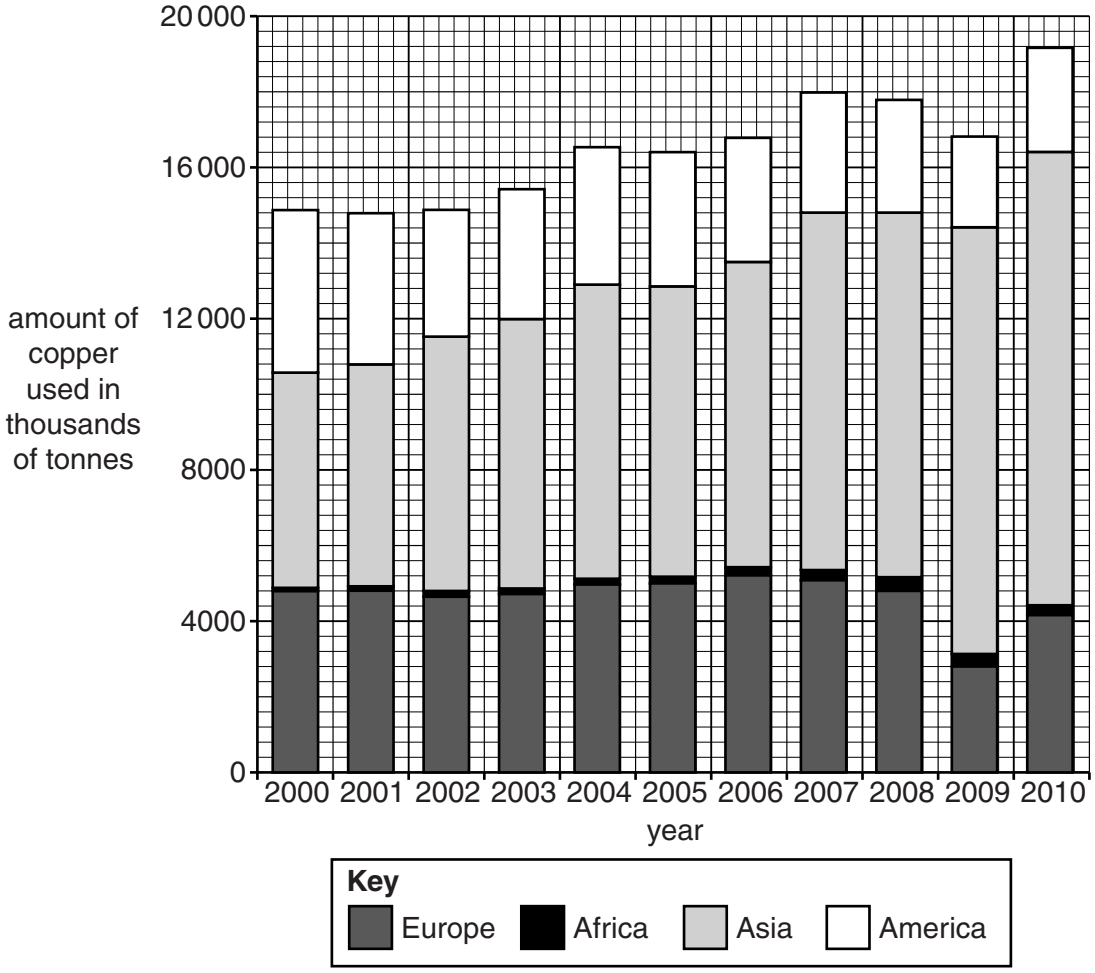
[Total: 5]

SECTION D

15 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.



(a) What does the bar chart tell you about:

- the **total** amount of copper used
- the amounts of copper used in different parts of the world

between 2000 and 2010?

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

(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.

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Suggest why this increase has happened.

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[3]

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

The percentage of the world's copper **produced** by China is 25.8%.

What problem does this cause for China?

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

(iii) Look at the table below.

It shows the total amounts of copper **produced** and copper **used** in the world in 2008 and 2012.

Complete the table using information from the table in part **(b)**.

Amount of copper in thousands of tonnes	**2008**	**2012**
total amount of copper **produced** in the world	.....	.....
total amount of copper **used** in the world	18490	21600

What issues does this raise?

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

[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.