

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE GATEWAY SCIENCE**

**B712/02**

**SCIENCE B**

**Science modules B2, C2, P2**  
**(Higher Tier)**

**FRIDAY 6 JUNE 2014: Afternoon**

**DURATION: 1 hour 30 minutes**  
**plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**  
**A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**Periodic Table**

**OTHER MATERIALS REQUIRED:**

**Pencil**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. 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).**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil (.**

**A list of equations can be found on pages 4 and 5.**

**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.**

**Any blank pages are indicated.**

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## **EQUATIONS**

$$\text{energy} = \text{mass} \times \frac{\text{specific heat}}{\text{capacity}} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

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

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

**force = mass × acceleration**

**weight = mass × gravitational field strength**

**work done = force × distance**

**power =  $\frac{\text{work done}}{\text{time}}$**

**power = force × speed**

**KE =  $\frac{1}{2}mv^2$**

**momentum = mass × velocity**

**force =  $\frac{\text{change in momentum}}{\text{time}}$**

**GPE = mgh**

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

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

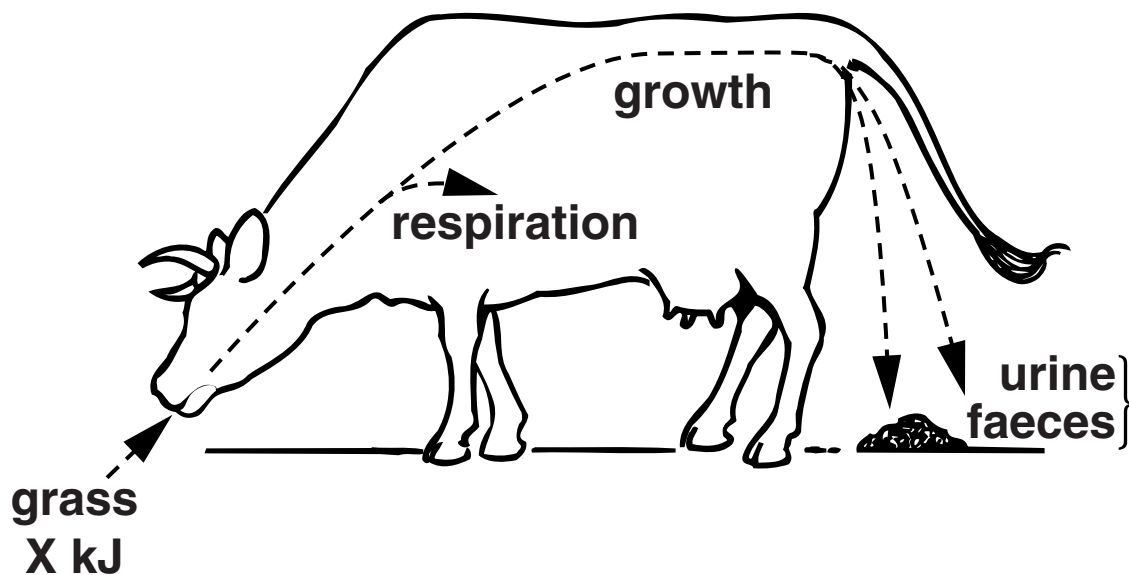
Answer ALL the questions.

## 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.**

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[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.**

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



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

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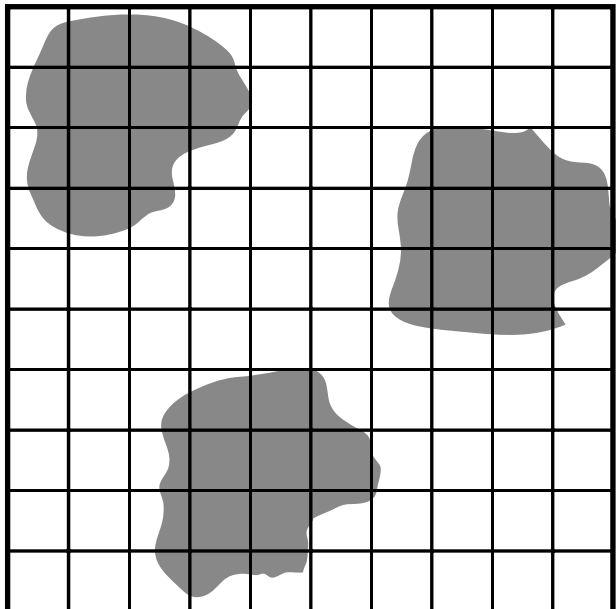
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[2]

**(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.**

**He says, ‘My results allow me to predict the  
ACTUAL LEVEL of sulfur dioxide 100m away from  
the factory.’**

**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]**

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**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.**

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[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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[3]

**[TOTAL: 5]**

**4 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]

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**5 Zebras are mammals, like horses, with striped bodies.**

**There are many theories why zebras have stripes.**

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

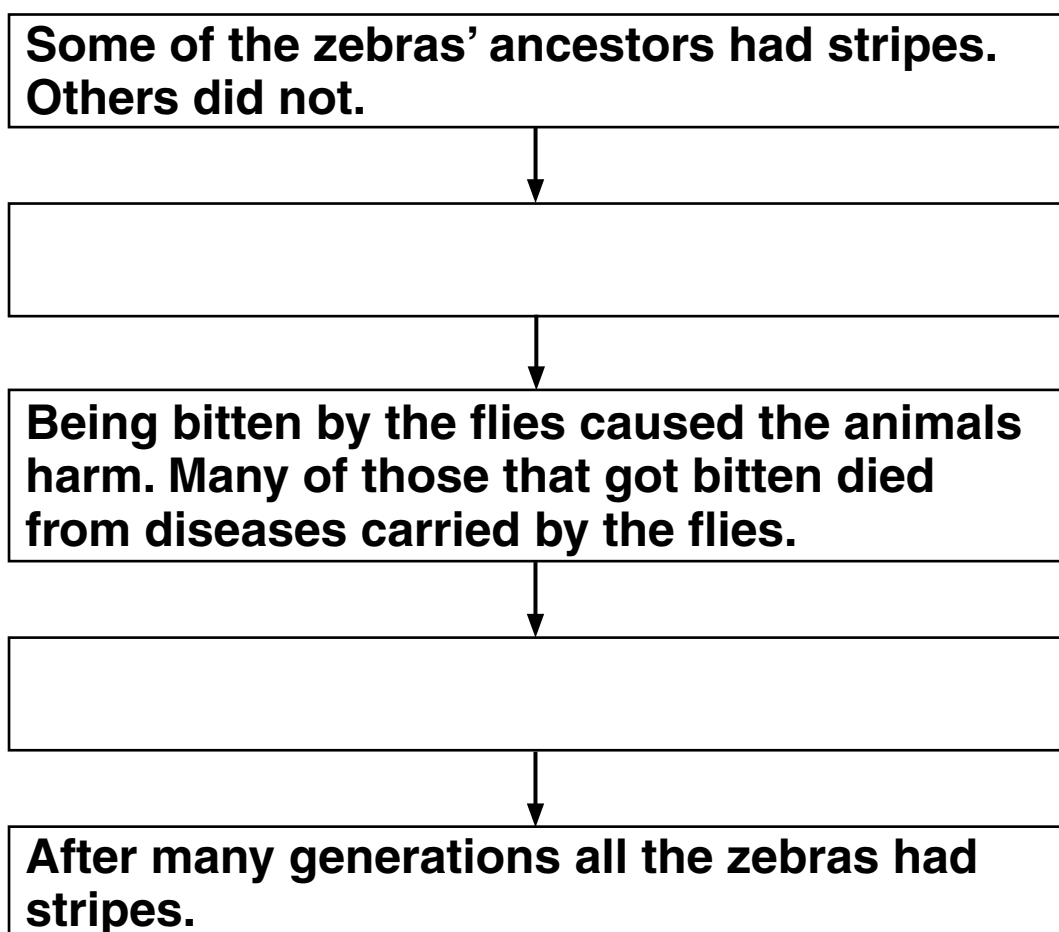
**The stripes make the zebras less attractive to the flies.**

**(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 opposite 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]**

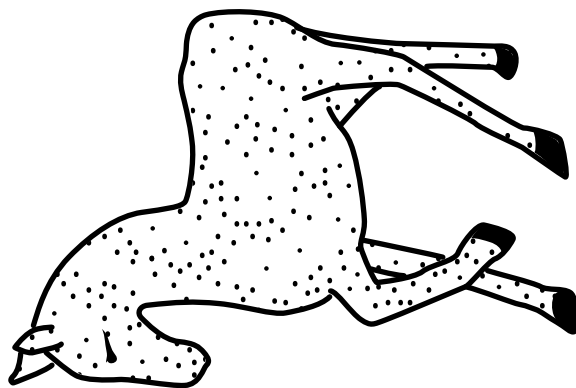
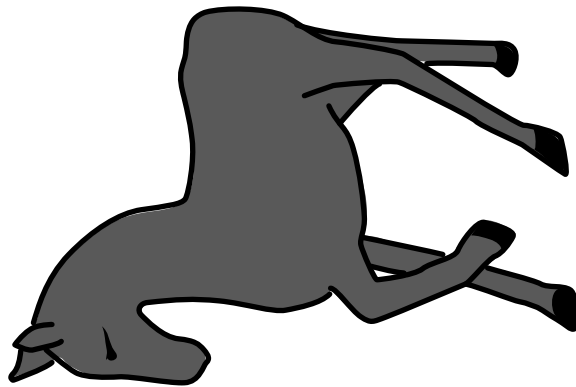
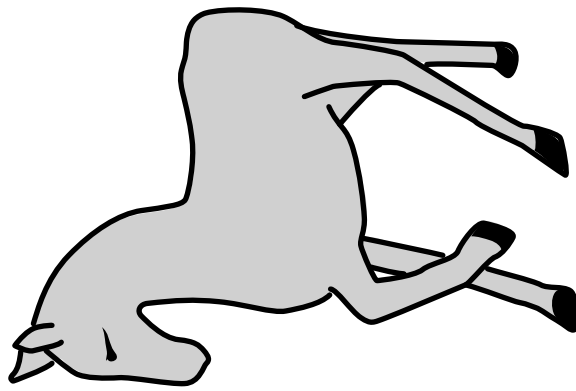
- (ii) The scientists published their results.**

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

**Write down ONE OTHER reason why scientists publish results.**

\_\_\_\_\_ **[1]**

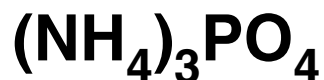
**[TOTAL: 4]**



## SECTION B – Module C2

6 Ammonium phosphate is used as a fertiliser.

The formula for ammonium phosphate is



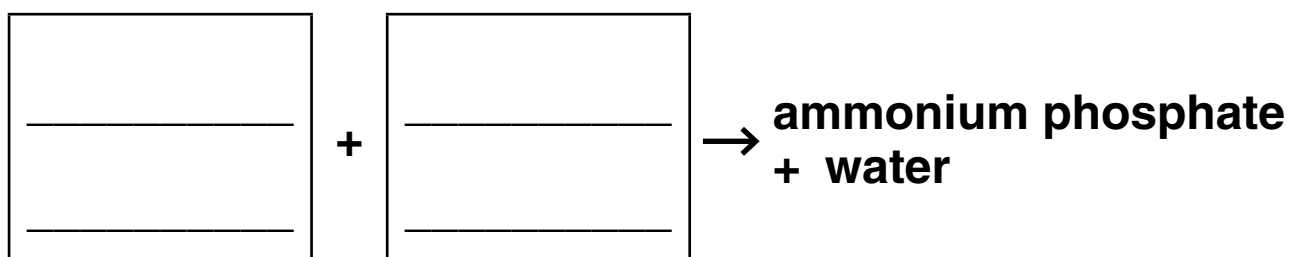
(a) Complete the table to show the number of atoms of each element in the formula for ammonium phosphate.

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.



[2]

**(c) Fertilisers are used to increase crop yield.**

**Explain how plants use fertiliser to increase crop yield.**

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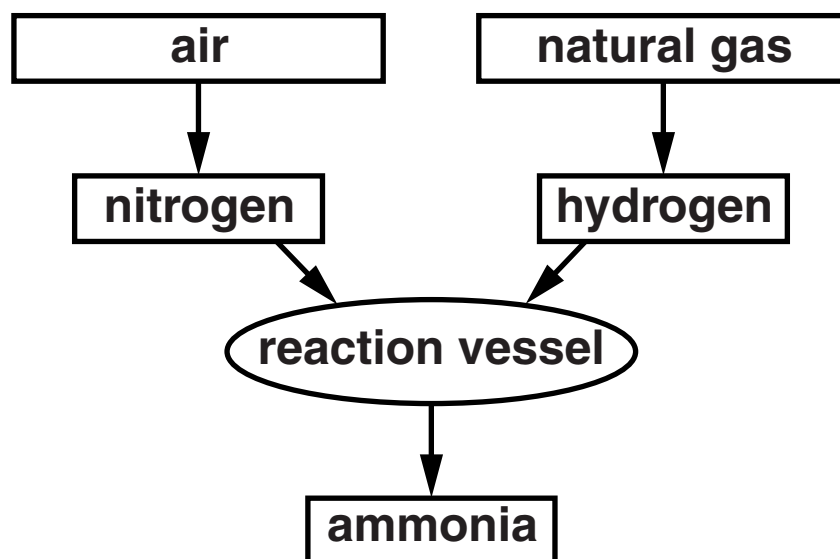
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**[2]**

**[TOTAL: 6]**

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

Look at the flow chart.



- (a) In the reaction vessel, nitrogen,  $\text{N}_2$ , reacts with hydrogen,  $\text{H}_2$ , to make ammonia,  $\text{NH}_3$ .

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** \_\_\_\_\_  
\_\_\_\_\_

**[4]**

**[TOTAL: 6]**

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

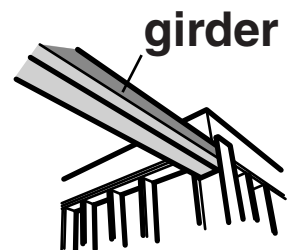
<b>Material</b>	<b>Effect of water</b>	<b>Density in g/cm<sup>3</sup></b>	<b>Relative hardness (1=soft 10=very hard)</b>	<b>Relative strength (1=weak 500=very strong)</b>	<b>Cost per tonne in £</b>
<b>A</b>	<b>absorbs water</b>	<b>2.0</b>	<b>6</b>	<b>3</b>	<b>210</b>
<b>B</b>	<b>corrodes</b>	<b>7.7</b>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

**(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?**





**[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]**

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**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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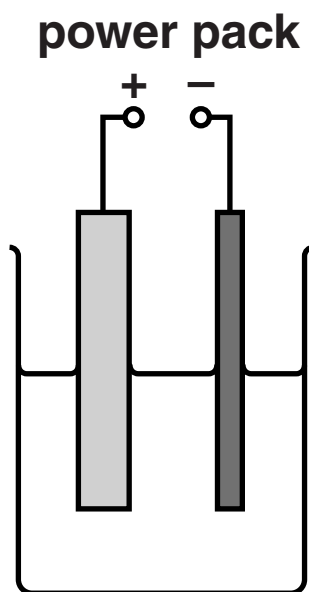
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**[2]**

(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]

## 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.**

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

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

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**[3]**

**[TOTAL: 5]**

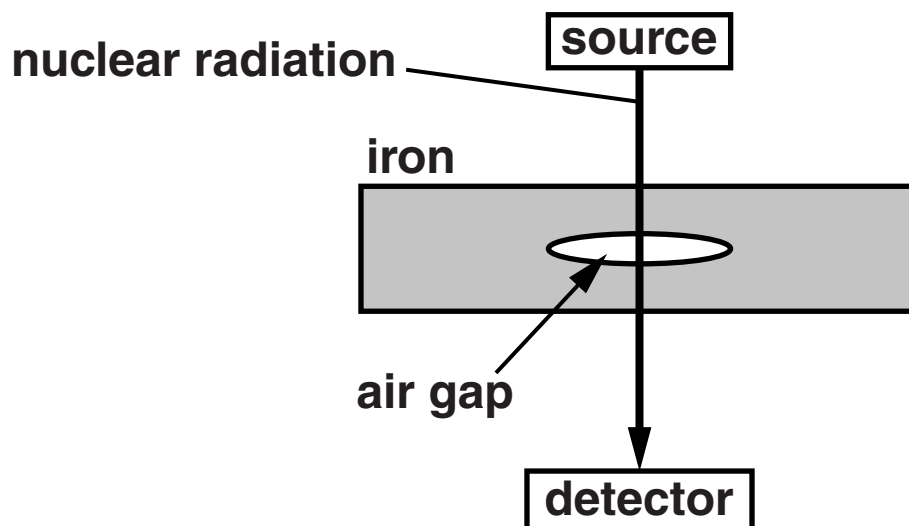
**11 A factory is making iron parts for a machine.**

**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.**

\_\_\_\_\_  
\_\_\_\_\_ [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?**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(ii) Nuclear radiation can damage human cells.**

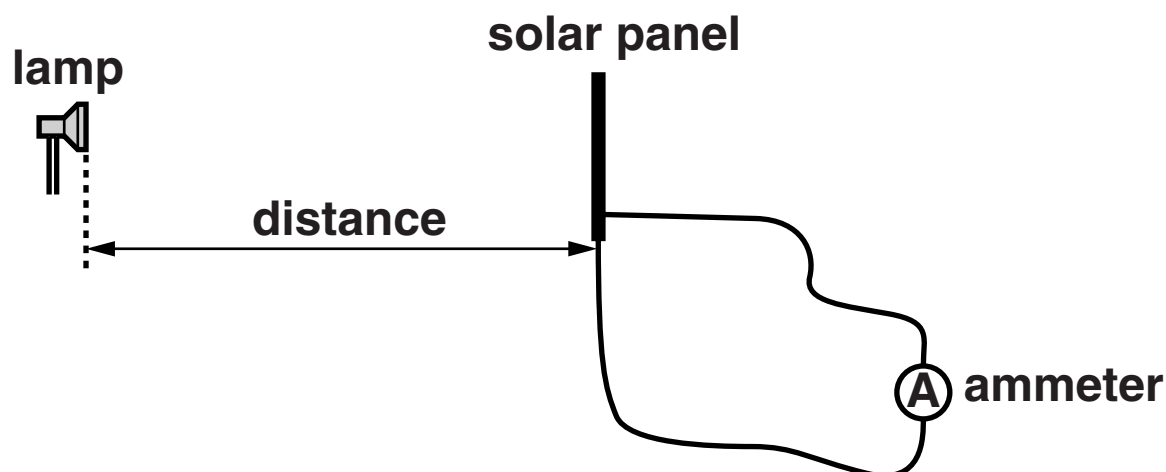
**Explain how.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**[TOTAL: 6]**

**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.**

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

**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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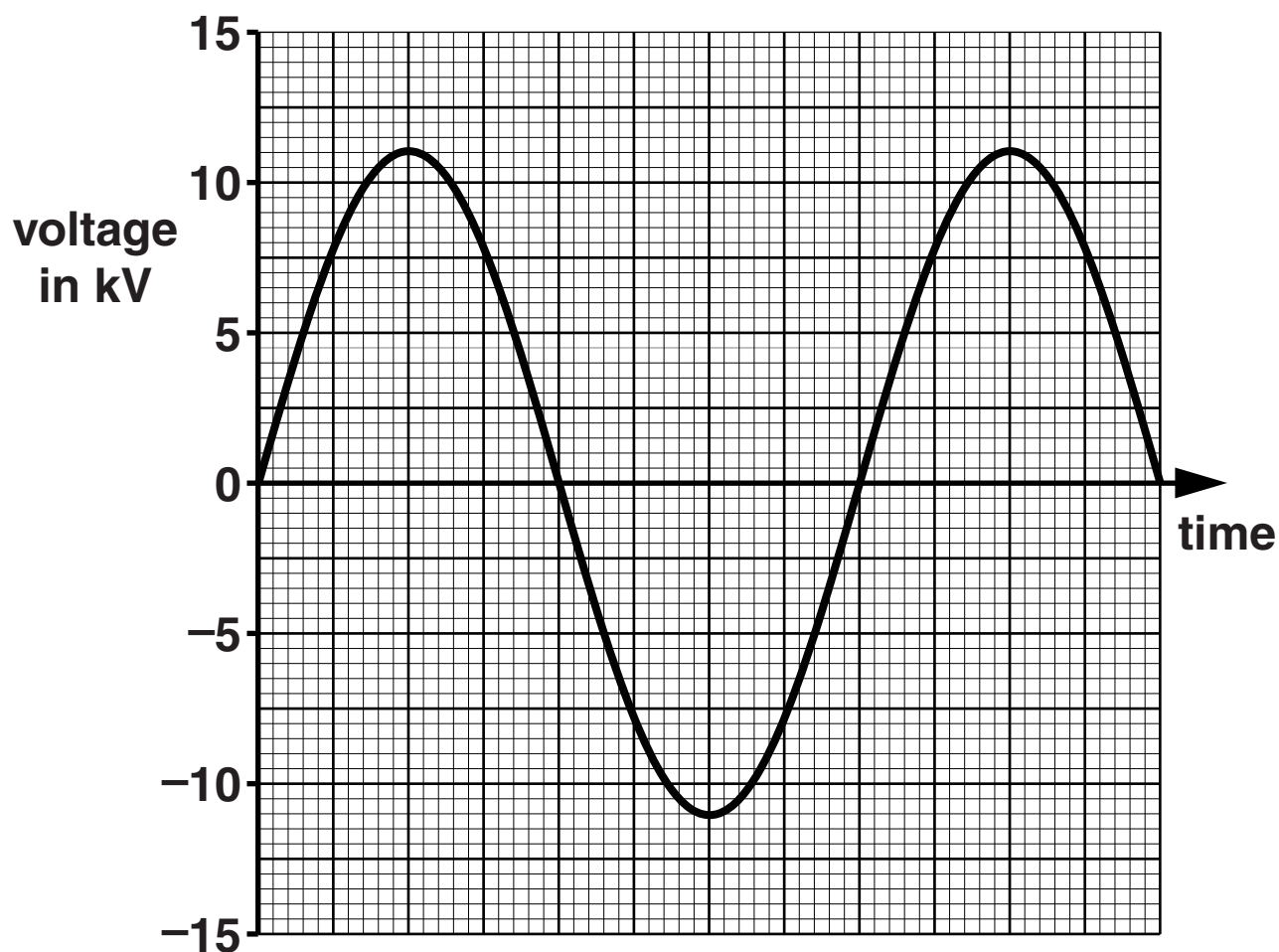
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[6]

[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  $9 \times 10^8 \text{ J}$ .**

**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

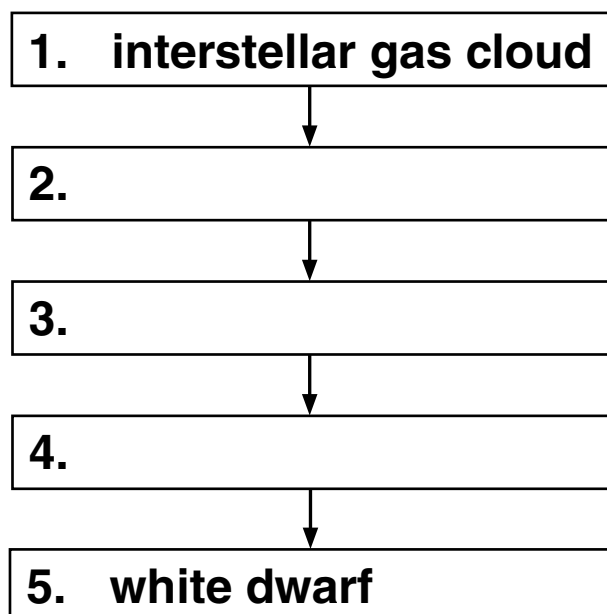
red giant

proto star

black hole

supernova

stage



[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.**

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**[1]**

**[TOTAL: 5]**

## SECTION D

**15 Copper is a very important metal.**

**Look at the bar chart opposite.**

**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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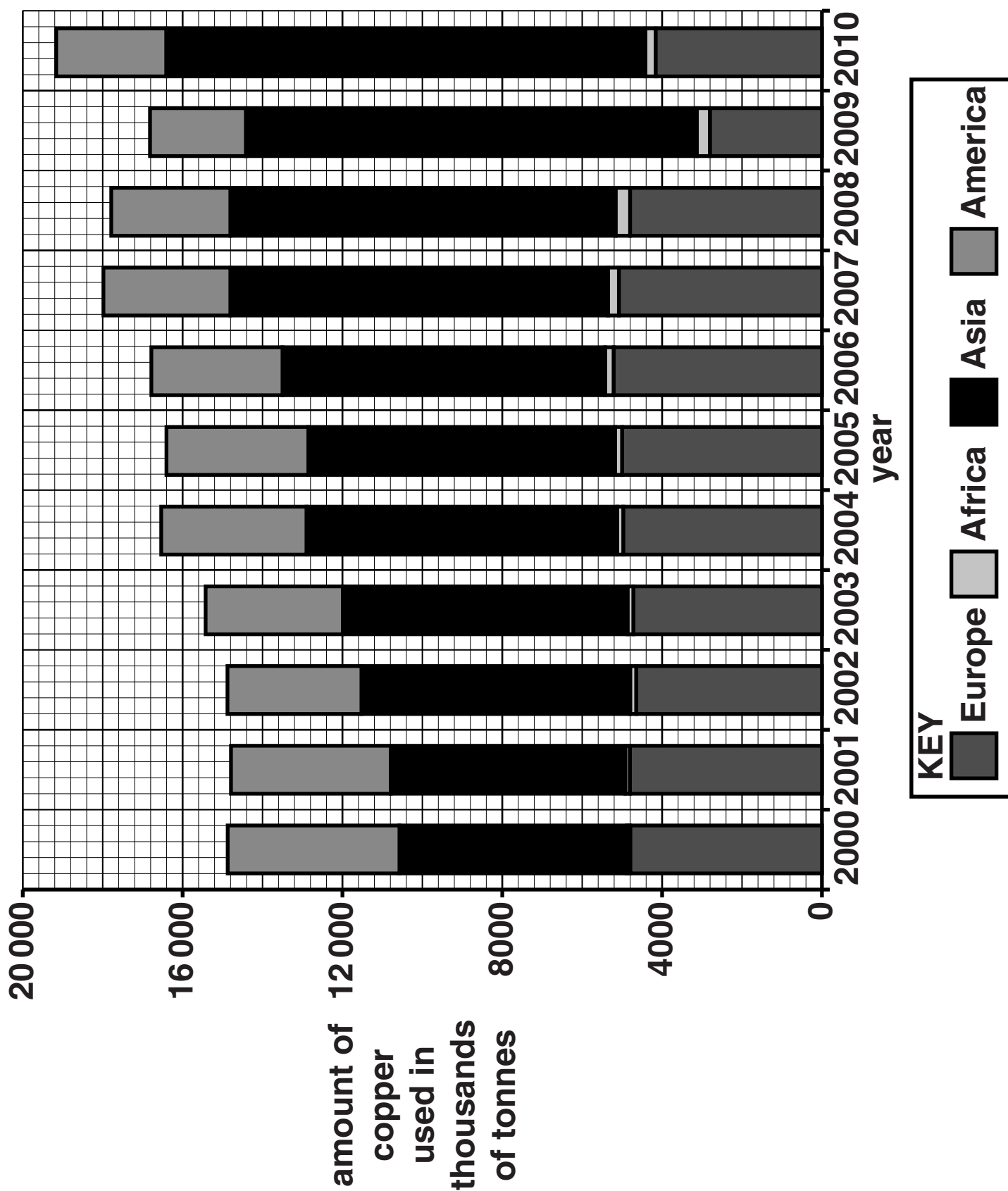
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[4]





**(b) Look at the table.**

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

<b>Amount of copper produced in thousands of tonnes</b>					
<b>Area of world</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>China</b>	<b>3780</b>	<b>4250</b>	<b>4800</b>	<b>5120</b>	<b>5430</b>
<b>Europe</b>	<b>3710</b>	<b>3560</b>	<b>3610</b>	<b>3660</b>	<b>3760</b>
<b>Asia (not including China)</b>	<b>4340</b>	<b>4030</b>	<b>4100</b>	<b>4160</b>	<b>4210</b>
<b>North America</b>	<b>2210</b>	<b>2060</b>	<b>2080</b>	<b>2110</b>	<b>2140</b>
<b>Rest of World</b>	<b>4720</b>	<b>4820</b>	<b>5010</b>	<b>5200</b>	<b>5500</b>
<b>Total</b>	<b>18 760</b>	<b>18 720</b>	<b>19 600</b>	<b>20 250</b>	<b>21 040</b>

- (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	18 490	21 600

What issues does this raise?

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[2]

[TOTAL: 10]

END OF QUESTION PAPER

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