

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE**

B712/02

**GATEWAY SCIENCE
SCIENCE B**

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

FRIDAY 10 JUNE 2016: Morning

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

MODIFIED ENLARGED 24pt

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

OCR SUPPLIED MATERIALS:

**A copy of the Periodic Table
Loose Sheet Question 16**

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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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 4–5.

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.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

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

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 (a) Sperm whales were once hunted.

Hunting of sperm whales was made illegal to prevent the number falling to a critical level.

(i) Explain why it is important that the number of sperm whales does not fall to a critical level.

[1]

(ii) Describe TWO reasons why it is difficult to prevent whales being hunted.

1 _____

2 _____

[2]

(b) Some other species of whales are still being hunted as SUSTAINABLE RESOURCES.

Explain how whale populations can be sustained.

[2]

[TOTAL: 5]

2 Jack reads this information about relationships between organisms.

ORGANISMS INVOLVED	INFORMATION ABOUT THE RELATIONSHIP BETWEEN THE ORGANISMS
bees and flowers	Bees transfer pollen from one flower to another. Bees make less honey in years when there are fewer flowers.
acacia trees and ants	Ants feed on nectar from the trees. The ants kill trees next to the acacia tree they live on.
mistletoe plants and birch trees	The mistletoe plant gets nutrients from the tree. Trees with mistletoe growing on them are usually smaller than those with no mistletoe.

(a) Jack makes a statement about the relationships.

He says ‘All of the relationships describe examples of mutualism.’

Is Jack correct? _____

Explain your answer.

[2]

(b) Jack finds out about another type of mutualism.

Leguminous plants have root nodules with bacteria living inside the nodule.

Explain why this is an example of mutualism.

[2]

[TOTAL: 4]

- 3 (a) Limestone formed millions of years ago at the bottom of a shallow sea.**

Acid rain is now weathering the rock.

Explain how carbon became locked up in the limestone and how weathering contributes to global warming. [6]



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

(b) Acid rain is one type of air pollution.

Some organisms living on trees and rocks can be used to indicate the levels of air pollution.

These organisms are one of many different types of indicator species.

Write down the name of this type of indicator species that lives on trees and rocks.

_____ **[1]**

[TOTAL: 7]

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

They collect some of the animals.

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

BEETLE	COMMON NAME	BINOMIAL NAME
A	whirligig beetle	<i>Gyrinus natator</i>
B	hairy whirligig beetle	<i>Orectochilus villosus</i>
C	great diving beetle	<i>Dytiscus marginalis</i>
D	there is no common name for this beetle	<i>Dytiscus latissimus</i>

Ellie makes this statement about the beetles.

She says ‘Beetles A and B are more closely related than the other beetles because they are both called whirligig beetles.’

Is Ellie correct? _____

Explain your answer.

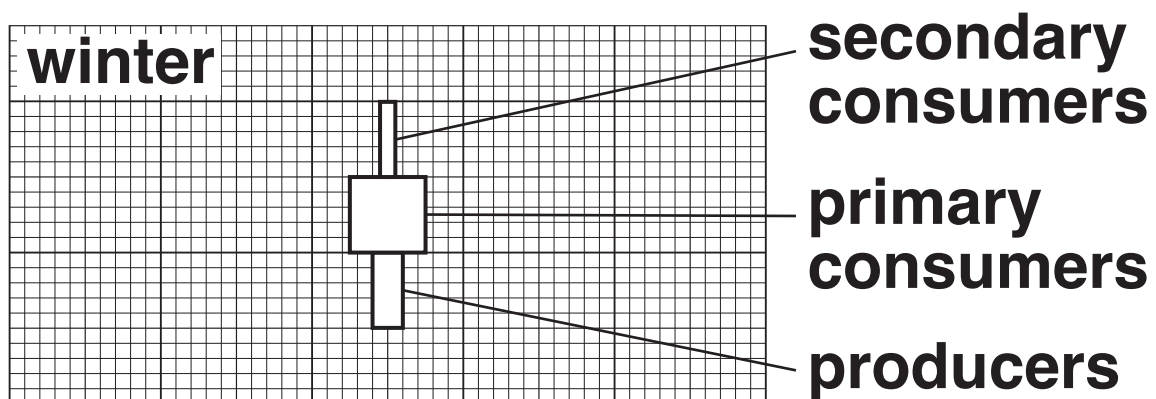
_____ **[1]**

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

Look at the table.

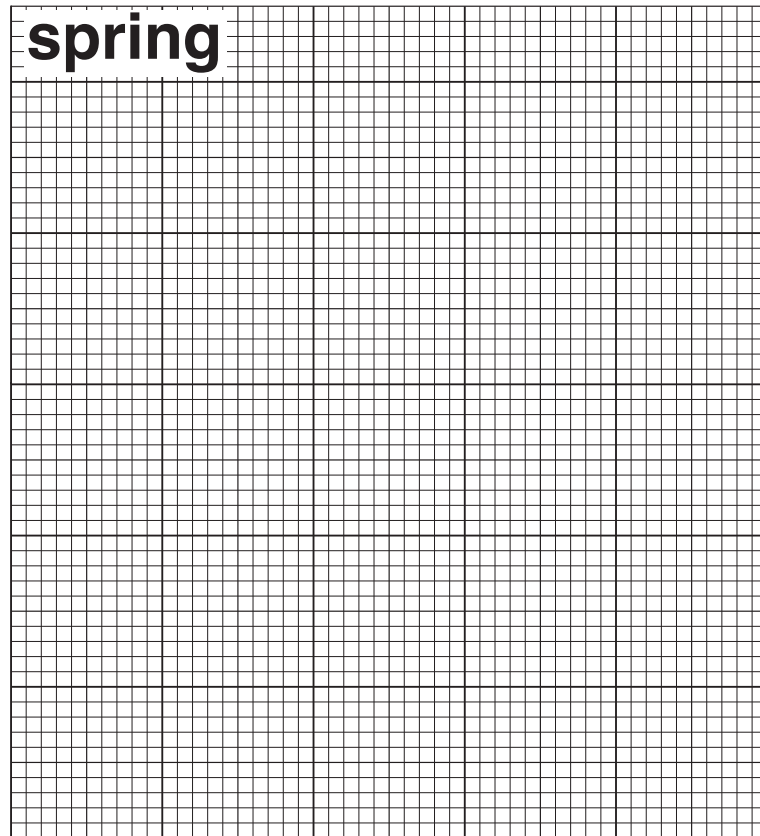
TROPIC LEVEL	BIOMASS IN mg DRY MASS PER m ³	
	Winter	Spring
producers	4	100
primary consumers	10	12
secondary consumers	2	6

The diagram below shows the pyramid of biomass for winter.



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

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.

[2]

[TOTAL: 5]

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5 Look at the pictures of different birds.



puffin



herring gull



penguin

(a) Classifying these birds as seabirds is an ARTIFICIAL classification.

Explain why.

[1]

(b) Puffins live in the Arctic.

Penguins live in the Antarctic.

Suggest reasons why puffins and penguins are both similar and different.

[3]

[TOTAL: 4]

SECTION B – Module C2

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



(a) 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 proposed by scientists like Wegener take some time to become widely accepted.

[2]

(b) The theory of plate tectonics can be used to explain SUBDUCTION.

What is subduction and how does it happen?

You may wish to draw a LABELLED diagram.

[3]

[TOTAL: 5]

- 7 Rachel is making some fertilisers by neutralising acids with alkalis.**

Complete the table.

NAME OF FERTILISER	NAME OF ALKALI USED	NAME OF ACID USED
ammonium phosphate	ammonia	phosphoric acid
potassium nitrate	potassium hydroxide	
	ammonia	sulfuric acid

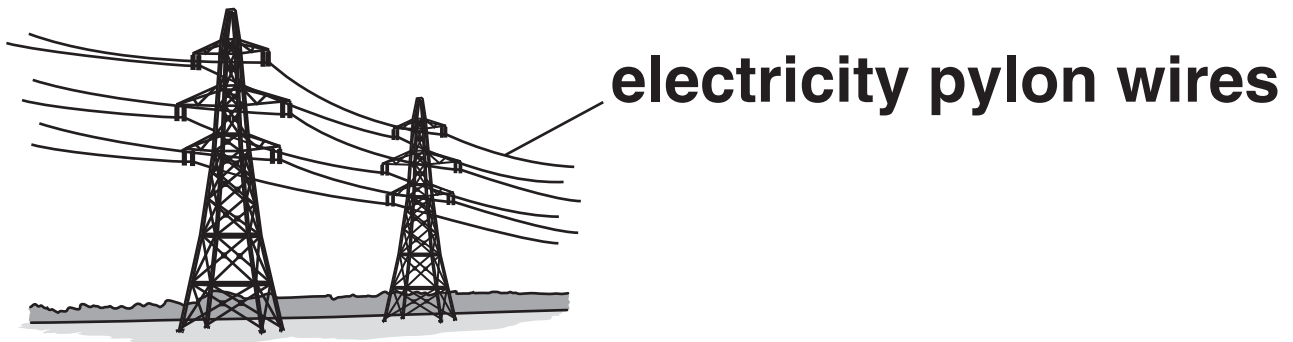
[2]

[TOTAL: 2]

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

Metal	Density in g/cm³	Relative electrical conductivity	Relative strength	Melting point in °C	Cost per tonne in £
A	8.9	64	13	1083	3800
B	7.7	11	21	1510	440
C	2.7	40	15	660	1350

(a) Look at the diagram. It shows electricity pylon wires.



Jo says that metal A is the best for making electricity pylon wires.

Dave says that metal C is the best.

Evaluate metals A and C for making electricity pylon wires. [3]

(b) Metals A, B and C can be used to make the body of a bus.



body of bus

Describe the advantages and disadvantages of metals A, B and C for making the body of a bus.

[3]

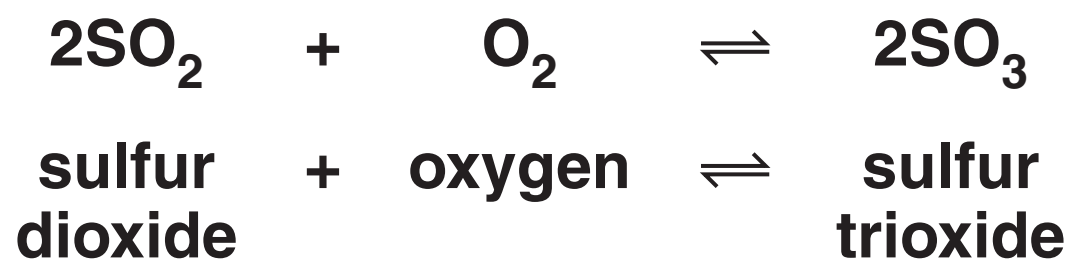
[TOTAL: 6]

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

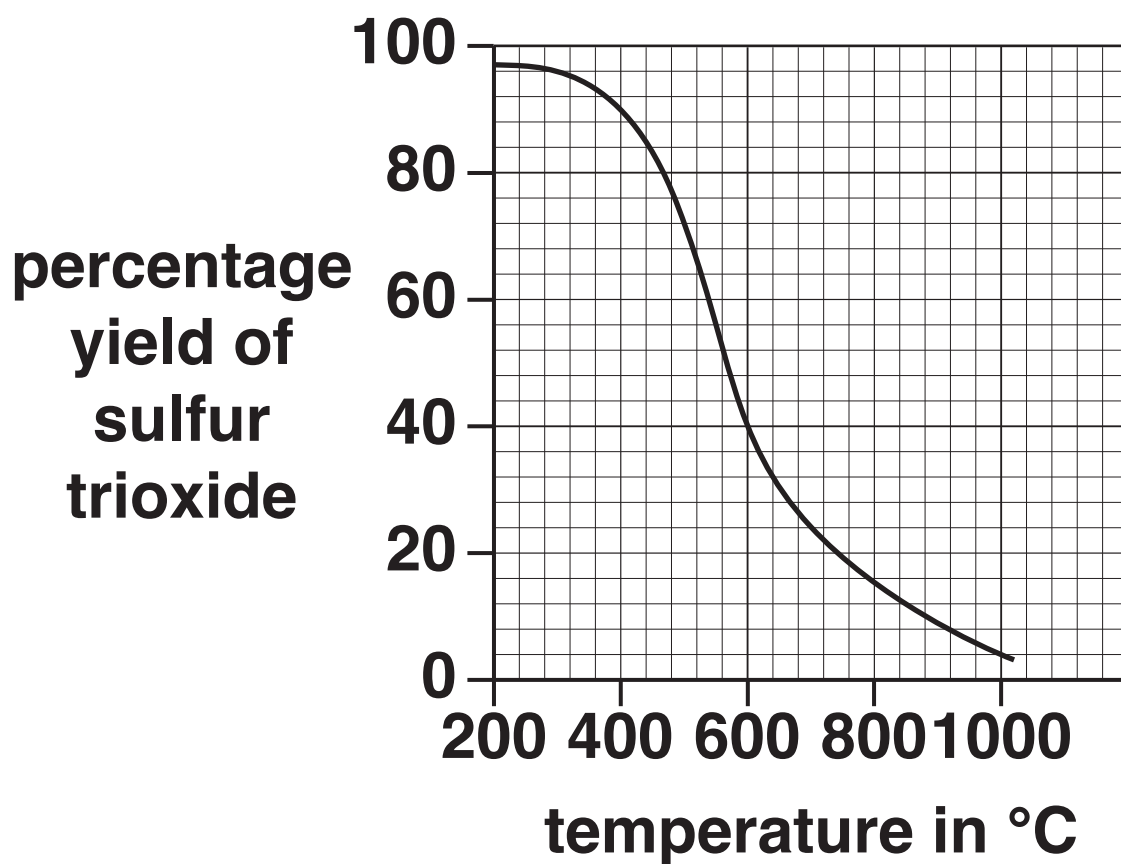
It is used to make sulfuric acid.

The equations show how sulfur trioxide is made.



Look at the graph opposite.

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



(a) How does **INCREASING** the temperature affect the percentage yield?

[1]

(b) The conditions used in the reaction are

450 °C

low pressure

catalyst of vanadium(V) oxide.

(i) Suggest why a catalyst is used.

_____ **[1]**

(ii) Suggest why a temperature of 450 °C rather than 200 °C is used.

Use ideas about rate of reaction and percentage yield.

_____ **[2]**

- (c) In another industrial process, nitrogen, N_2 , reacts with hydrogen, H_2 , to make ammonia, NH_3 .

Write a **BALANCED SYMBOL** equation for this reaction.

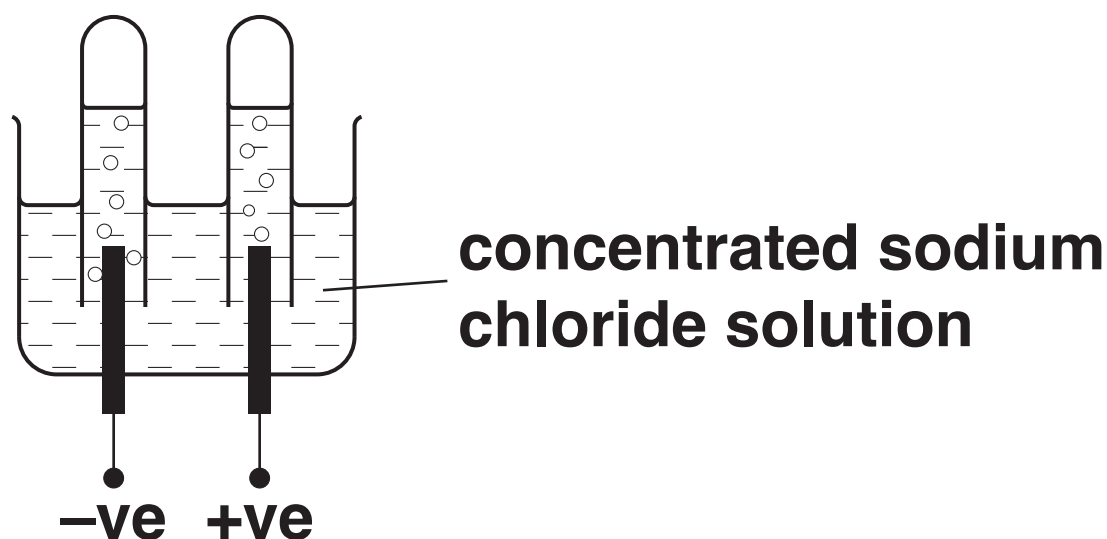
_____ [2]

[TOTAL: 6]

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

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

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



Sodium chloride solution contains the ions Na^+ , Cl^- , H^+ and OH^- .

What happens during the electrolysis of concentrated sodium chloride solution?

Your answer should include equations for the reactions at each electrode.

Use e^- to represent an electron. [6]



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

[TOTAL: 6]

SECTION C – Module P2

11 Nuclear radiation can be alpha, beta or gamma radiation.

(a) Draw one line from each RADIATION on the left to its correct USE on the right.

RADIATION

alpha

beta

gamma

USE

**paper thickness
gauge**

**non-destructive
testing**

smoke detector

[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.

[2]

[TOTAL: 4]

12 (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]

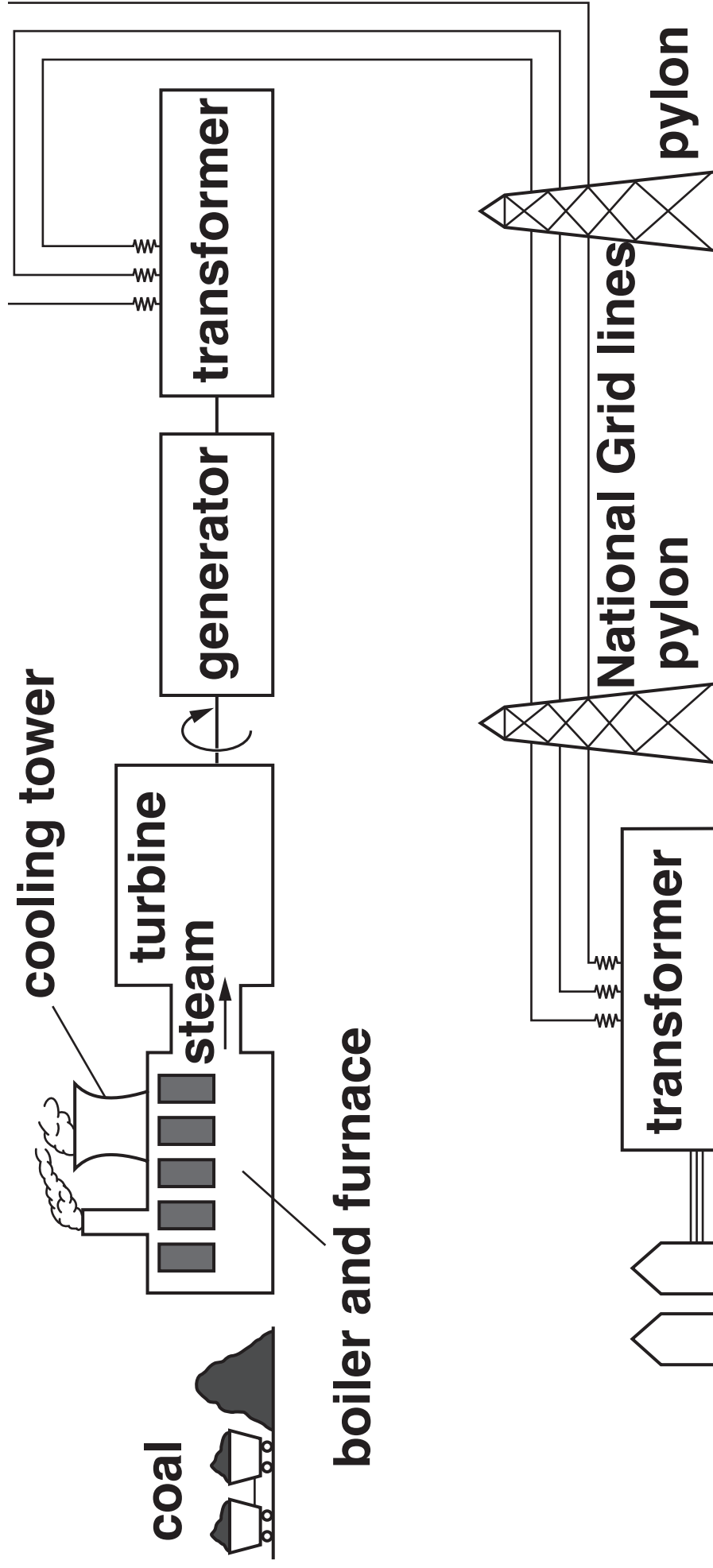
(b) Some companies are now designing and heating their offices using passive solar heating.

Explain how passive solar heating works and suggest why the position of the windows is important.

[3]

[TOTAL: 5]

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13 Power stations generate electricity.

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

efficiency of power station	30%
average electrical energy generated each second	$1.5 \times 10^6 \text{ J}$
heat energy produced by 1 kg of coal	$2 \times 10^4 \text{ J}$

- (a) Describe in detail the different stages in the production of electricity from this power station and use the information to calculate the mass of coal (in kg) burnt each second. [6]**



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

(b) Ruth investigates the output of a model a.c. generator.

Look at the graph opposite showing the voltage output of the generator.

She increases the number of rotations of the coil each second.

How will this affect the output of this generator?

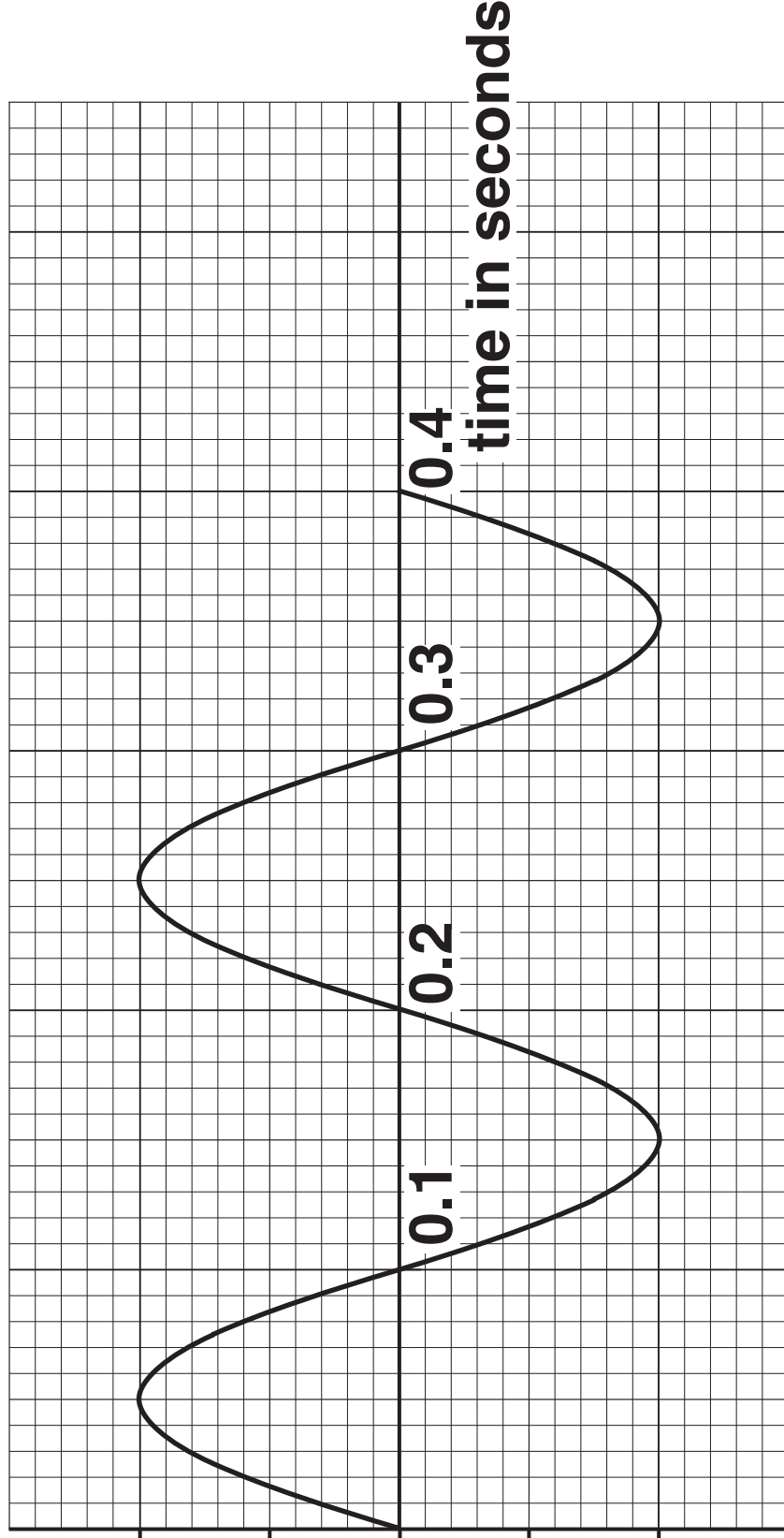
DRAW your answer on the graph. [2]

[TOTAL: 8]

49

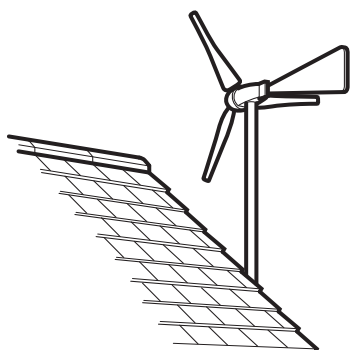
voltage
in
volts

2
1
0
-1
-2



14 Sam wants to reduce his energy costs.

He fits a wind generator to his house.



The generator produces 1.8 kWh (kilowatt hour) of energy each day (24 hours).

(a) Calculate the average power output of the generator in kW.

answer _____ kW [2]

(b) Electricity costs 16p per kWh.

How much money will Sam save on his electricity bills each day?

answer _____ pence [1]

(c) A factory needs 100 kW of electrical power to operate its machinery.

Energy is wasted in transmitting the electricity from the power station to the factory.

Look at the data showing the effect of using different transmission voltages for the power cables to the factory.

Transmission voltage in volts	1000	2000	5000	10 000
Energy wasted per second for each km of cable in W/km	8000	2000	320	80

10 000 volts is the most efficient voltage for the transmission of 100 kW of electricity.

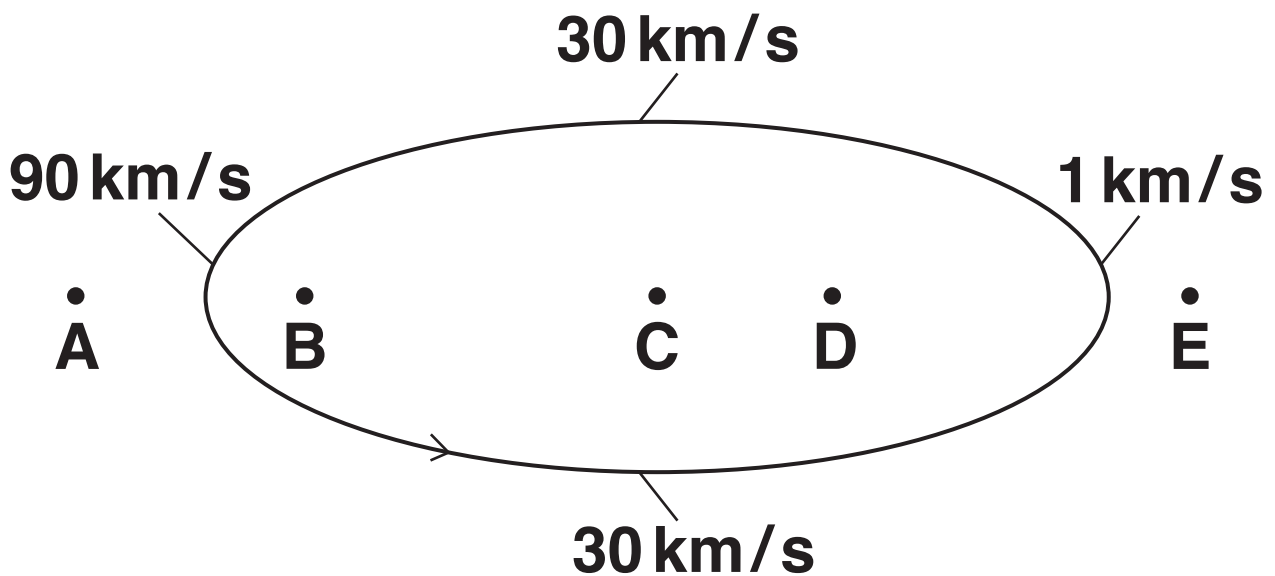
Explain why.

[2]

[TOTAL: 5]

15 Comets are objects in our solar system that orbit the Sun with highly elliptical orbits.

Look at the diagram below showing the path of a comet and its speed at different points on the path.



(a) Where is the Sun on the diagram?

Choose from:

A B C D E

answer _____

**Use information from the diagram
and ideas about forces to explain
your answer.**

[2]

(b) There is an asteroid belt between Mars and Jupiter.

Some people think that some asteroids in this belt could join together to form a new planet.

There is no sign of this happening.

Explain why.

[1]

[TOTAL: 3]

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SECTION D

- 16 (a) Look at GRAPH 1 on the loose sheet. This bar chart shows how electricity was produced in different parts of the world.**

The WIDTH of each bar is a measure of the total amount of electricity produced 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) China, USA and the rest of Europe generated the largest amounts of electricity in 2008.**

Suggest why they need to produce the largest amounts of electricity.

[1]

- (iii) What OTHER conclusions can you make from this bar chart about electricity production in different parts of the world?**

[3]

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

Look at GRAPH 2 opposite.

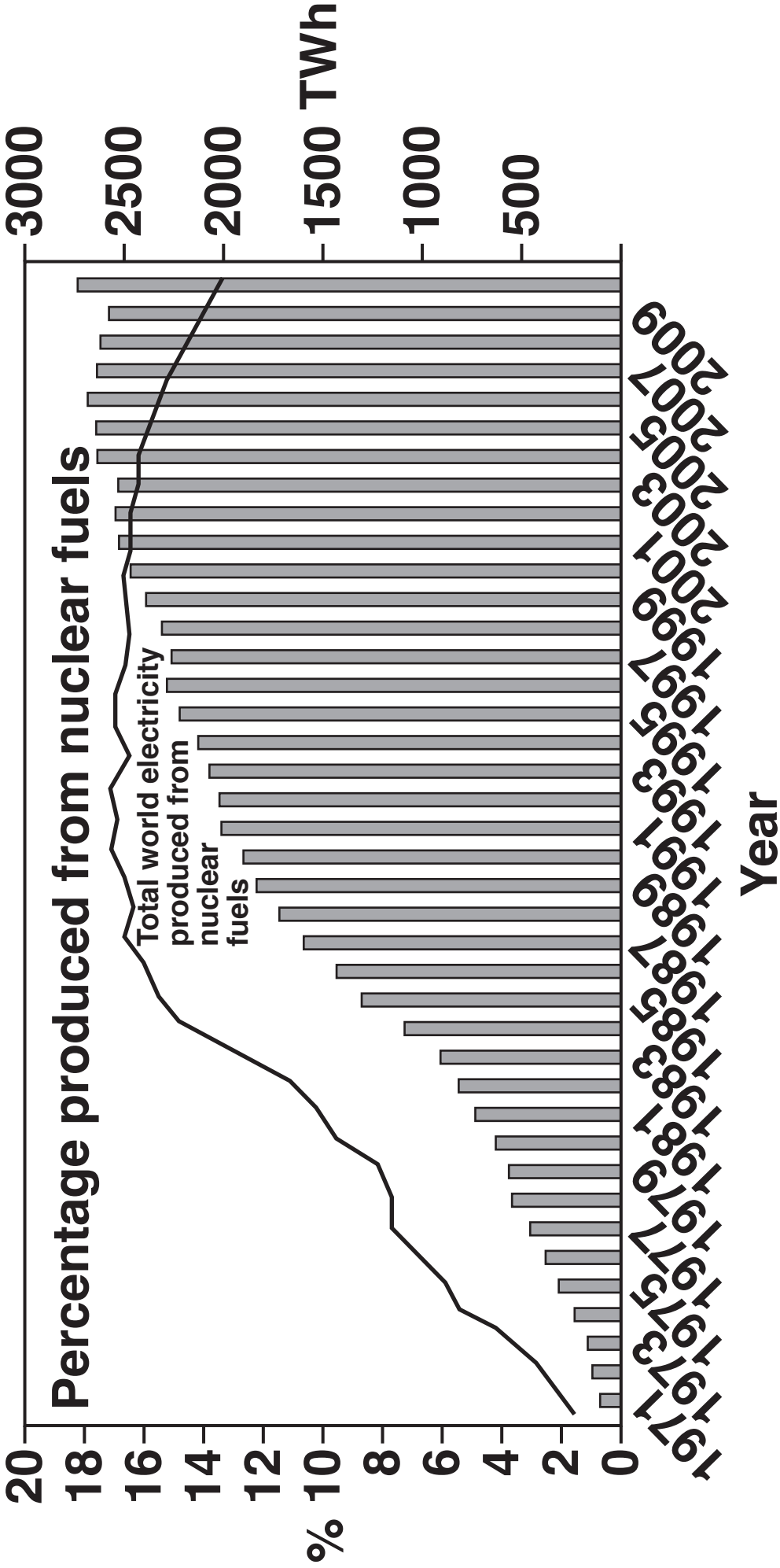
The bars show the TOTAL world electricity produced from nuclear fuels (in TWh).

The line shows the PERCENTAGE of world electricity produced from nuclear fuels.

What conclusions can you make from GRAPH 2?

[2]

GRAPH 2



(c) Using GRAPHS 1 and 2, suggest what problems may arise for electricity production during the next 30 years.

[2]

[TOTAL: 10]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

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