OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

B712/02

GATEWAY SCIENCE
SCIENCE B

Science modules B2, C2, P2
(Higher Tier)

FRIDAY 9 JUNE 2017: Morning
DURATION: 1 hour 30 minutes
plus your additional time allowance
MODIFIED ENLARGED

Candidate forename		Candidate surname	

Centre number				Candidate number				

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:

Loose sheet for Question 13
A copy of The Periodic Table

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

745852197 7

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.

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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

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

power = force × speed

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

momentum = mass × velocity

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

GPE = mgh

$$mgh = \frac{1}{2}mv^2$$
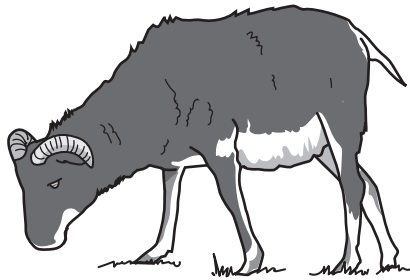
$$resistance = \frac{voltage}{current}$$

Answer ALL the questions.

SECTION A – Module B2

1 Look at the picture.
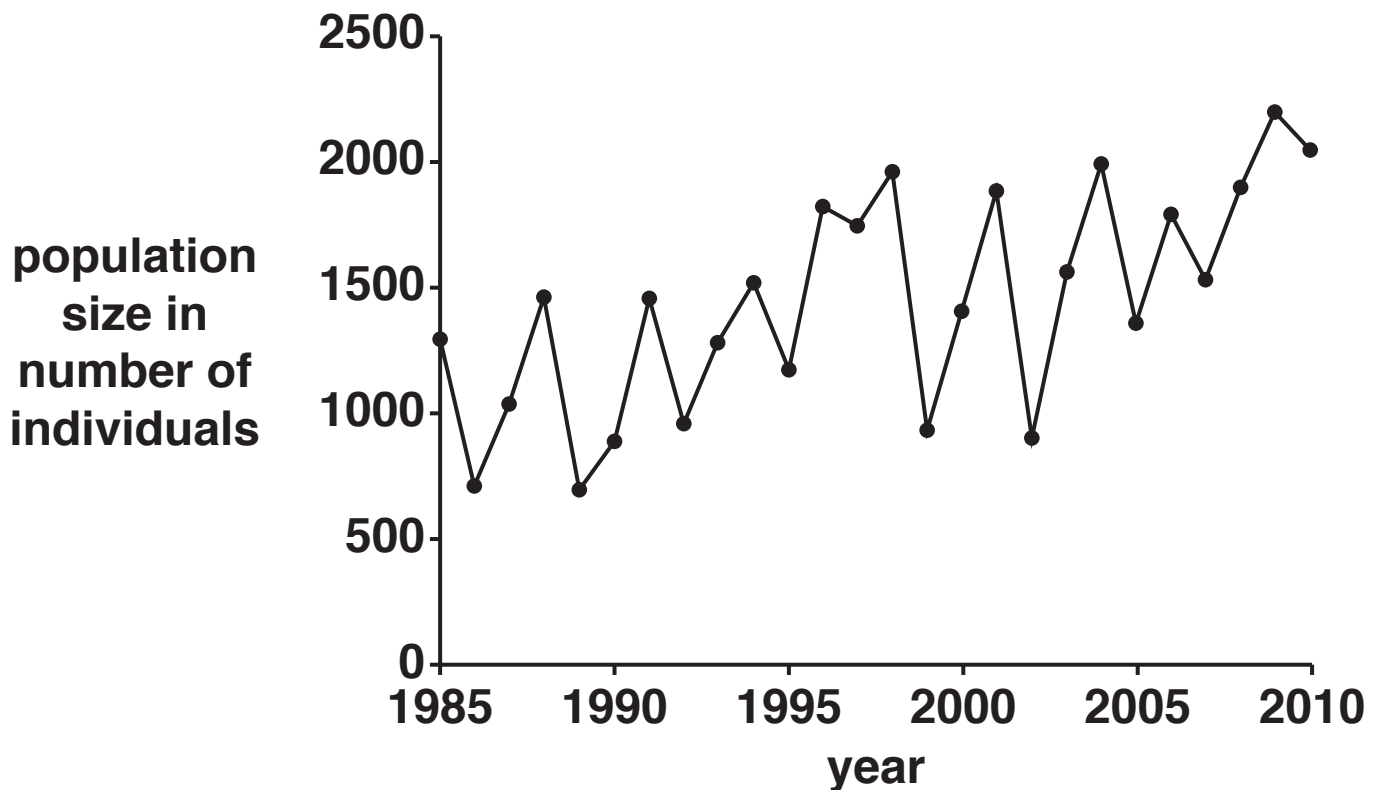
   It shows a Soay sheep.

   Soay sheep

   There is a population of Soay sheep living on the small Scottish island of St. Kilda.

Look at the graph.

It shows the population size of Soay sheep on St. Kilda between 1985 and 2010.

(a) Does the population of Soay sheep on St. Kilda show EXPONENTIAL growth between 1985 and 2010?

Explain your answer.

_____

_____ **[1]**

(b) Exponential growth in populations can have some consequences.

Write down TWO possible consequences of exponential growth.

_____

_____

_____ **[2]**

(c) Sheep can mate with goats.

The fertilised egg formed when a sheep and a goat mate normally dies early in development.

Hybrids are rarely born.

The sheep and goat remain two separate species because their populations are isolated in this way.

Write down the name of this type of isolation and explain why it maintains two separate species.

_____

_____

_____

_____

_____ **[2]**

2 This question is about protecting the environment.

(a) Ben and Hollie want a new fire for their living room.

They have different ideas on which fire is better for the environment.

Hollie says 'I think that burning coal on a fire is better as you are NOT destroying trees.'

Ben says 'I think that burning logs on a fire is better as more trees can be planted.'

Who has the best idea on which type of fire is better for the environment?

Explain your answer.

_____

_____

_____

_____ **[2]**

(b) Scientists are developing microbes that can remove sulfur dioxide from industrial waste.

Some people think using microbes to remove sulfur dioxide from industrial waste will help the environment.

Others think that it could possibly harm the environment.

Suggest one reason for both sides of the argument.

help _____

_____

harm _____

_____ **[2]**

(c) Bluefin tuna are fish that are caught for food.

Fishermen are told how much bluefin tuna they can catch in one year.

This is called the QUOTA.

Look at the table.
It shows the quota for bluefin tuna and the estimated total amount of bluefin tuna ACTUALLY caught between 2005 and 2009.

Year	Quota of bluefin tuna in tonnes	Estimated total amount of bluefin tuna actually caught in tonnes
2005	32 000	48 000
2006	30 000	60 000
2007	28 000	60 000
2008	20 000	52 000
2009	12 900	46 000

(i) In 2006, the estimated total amount of bluefin tuna actually caught was 30 000 tonnes more than the quota.

This is a 100% increase on the quota.

Calculate the percentage increase on the quota for estimated catches in 2005.

answer _____ % [1]

(ii) The quota is designed to prevent overfishing of bluefin tuna.

Discuss reasons why the quota may or may not be preventing overfishing of bluefin tuna.

Use the information in the table and your answer to part (c)(i) in your answer.

_____

_____

_____

_____ **[2]**

3 **(a)** Animals and plants are classified using the binomial system.

One species of gum tree has the binomial name *Eucalyptus marginata.*

(i) The binomial name is made up of two parts, *marginata* is the species.

What is *Eucalyptus?*

Choose from.

class   family   genus   order   phylum

answer _____ **[1]**

(ii) Explain why the use of binomial names is important.

_____

_____ **[1]**

(b) Bushfires are fires that go out of control and can damage large areas of wild land.

Bushfires are very common in hot climates.

Eucalyptus marginata can survive bushfires by producing lots of buds just beneath the soil.

The ability to produce these buds is an adaptation.

(i) What controls adaptations in plants and animals?

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

competition ☐

genes ☐

habitats ☐

populations ☐

[1]

(ii) *Eucalyptus marginata* has a similar ECOLOGICAL NICHE to other species of gum trees.

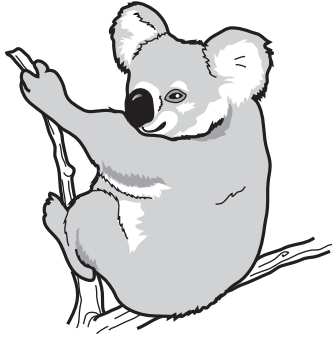Explain what is meant by ecological niche and why similar species occupy similar niches.

_____

_____

_____

_____ [2]

(c) Look at the picture of a koala.

Koalas are mammals native to Australia.

They are NOT found anywhere else in the wild.

Koalas were hunted and killed for the fur trade until 1927.

This hunting nearly caused the extinction of koalas.

(i) Koalas live in small, isolated populations.

Explain why this increases the risk of extinction.

_____

_____

_____

_____ **[2]**

(ii) **Koalas are SPECIALISTS.**
They are adapted to only eat the leaves of gum trees.

Very few other animals can eat gum tree leaves.

Other animals in the forest such as mice are GENERALISTS.
They eat various types of seeds, fruits, roots, small insects and worms.

Bushfires destroy most plant life above the ground, including gum trees.

Explain why koalas are better able to compete with the mice in a gum tree forest AND suggest reasons why koalas find it harder to compete with mice following bushfires. [6]

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

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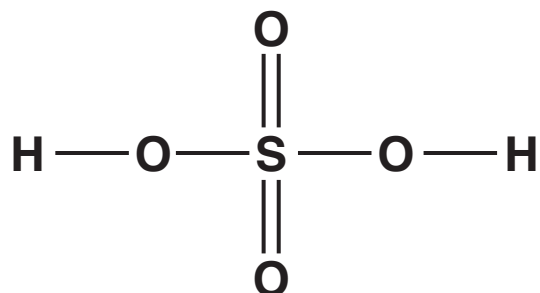
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SECTION B – Module C2

4 **Look at the displayed formula for sulfuric acid.**

(a) **What is the MOLECULAR FORMULA of sulfuric acid?**

_____ **[1]**

(b) **The atoms in a sulfuric acid molecule are held together by covalent bonds.**

Explain how a covalent bond is made.

_____

_____ **[1]**

(c) Sarah neutralises dilute sulfuric acid with a base.

She uses sodium hydroxide solution as the base.

(i) Write the names of the TWO compounds made when dilute sulfuric acid is neutralised by sodium hydroxide solution.

_____ and _____ [2]

(ii) Dilute hydrochloric acid contains hydrogen ions.

Sodium hydroxide solution contains hydroxide ions, OH^-.

Construct the IONIC equation to show the reaction of hydrogen ions with hydroxide ions.

_____ [2]

5 David investigates different fertilisers.

(a) He finds this information from the internet.

David concludes that fertiliser B is the best of the five fertilisers.

Does the information in the table support this conclusion?

Explain your answer using evidence from the table.

_____

_____

_____

_____

_____

_____ [2]

(b) The manufacture of ammonia is very important in food production.

Explain why.

_____

_____

_____

_____ [2]

Fertiliser	Percentage (%) by mass of element in fertiliser				Solubility in water
	Nitrogen	Oxygen	Phosphorus	Potassium	
A	34	45	0	0	very soluble
B	24	5	20	20	very soluble
C	10	40	5	0	soluble
D	0	24	15	10	soluble
E	32	10	20	25	insoluble

6 **Scientists study the structure of the Earth.**

Many scientists believe in the theory of PLATE TECTONICS.

Describe the theory of plate tectonics and explain why the theory is now widely accepted by scientists. [6]

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

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7   Julie investigates the corrosion of aluminium and iron in different conditions.

She puts an iron nail into each three stoppered test tubes.

She leaves the test tubes for 2 weeks.
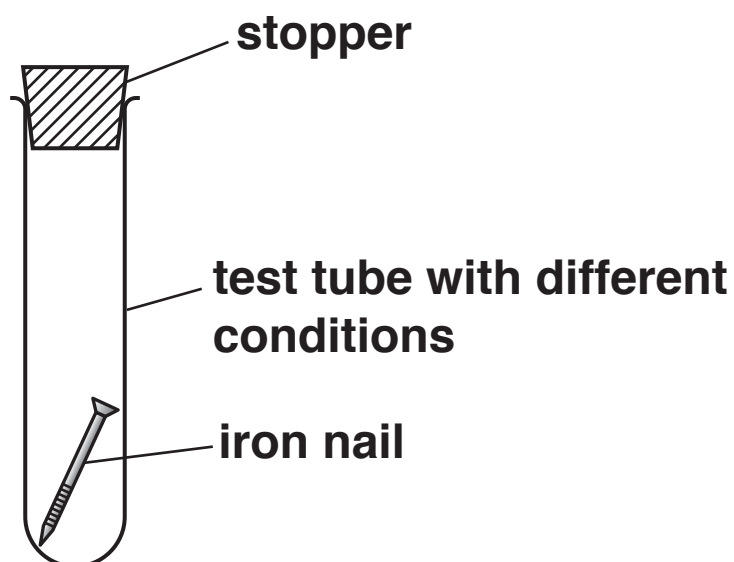
The condition inside each test tube is different.

She repeats each experiment with strips of aluminium instead of iron nails.

Look at Julie's results.

Conditions inside test tube	Result with iron	Result with aluminium
acidic moist air	nail is covered with lots of rust	very little corrosion
moist air	nail is covered with rust	no corrosion
dry nitrogen	no rust	no corrosion

(a) The results do NOT show that water is needed for rusting.

Describe an EXTRA set of conditions that would need to be done to show that water is needed for rusting.

_____

_____ [1]

(b) Look at the word equation for rusting.

iron + oxygen + water → hydrated iron(III) oxide

Rusting of iron is an example of OXIDATION.

How can you tell from the word equation?

_____

_____ [1]

(c) Aluminium does not corrode in moist air.

This is because aluminium, Al, reacts with oxygen, O_2, to form a protective layer.

This layer is aluminium oxide, Al_2O_3.

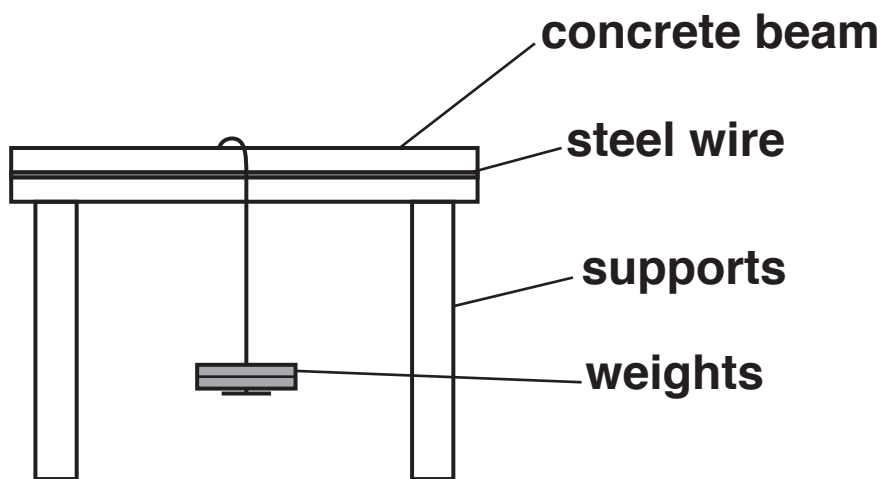Write the BALANCED SYMBOL equation for this reaction.

_____ [2]

8 Ali investigates the strength of concrete beams.

He makes some beams using a cement, sand and water mixture.

Ali reinforces the beams with steel wire.

Each beam he uses has a different mass of steel wire.

Ali measures the maximum weight the beam will support before it breaks.

concrete beam

steel wire

supports

weights

Ali repeats all the experiments so he can get a mean (average) result.

Look at Ali's results.

Mass of steel wire in g	Maximum weight supported by the beam in N	
	test 1	test 2
0.0	80	85
1.0	90	95
2.0	85	105
3.0	120	120
4.0	150	115
5.0	150	150

(a) Ali wants to identify any trends in the data.

Suggest how he should PROCESS and PRESENT the data in order to easily identify any trend.

Explain your answer.

_____

_____ **[2]**

(b) **REINFORCED concrete beams are better construction materials than NON-REINFORCED beams.**
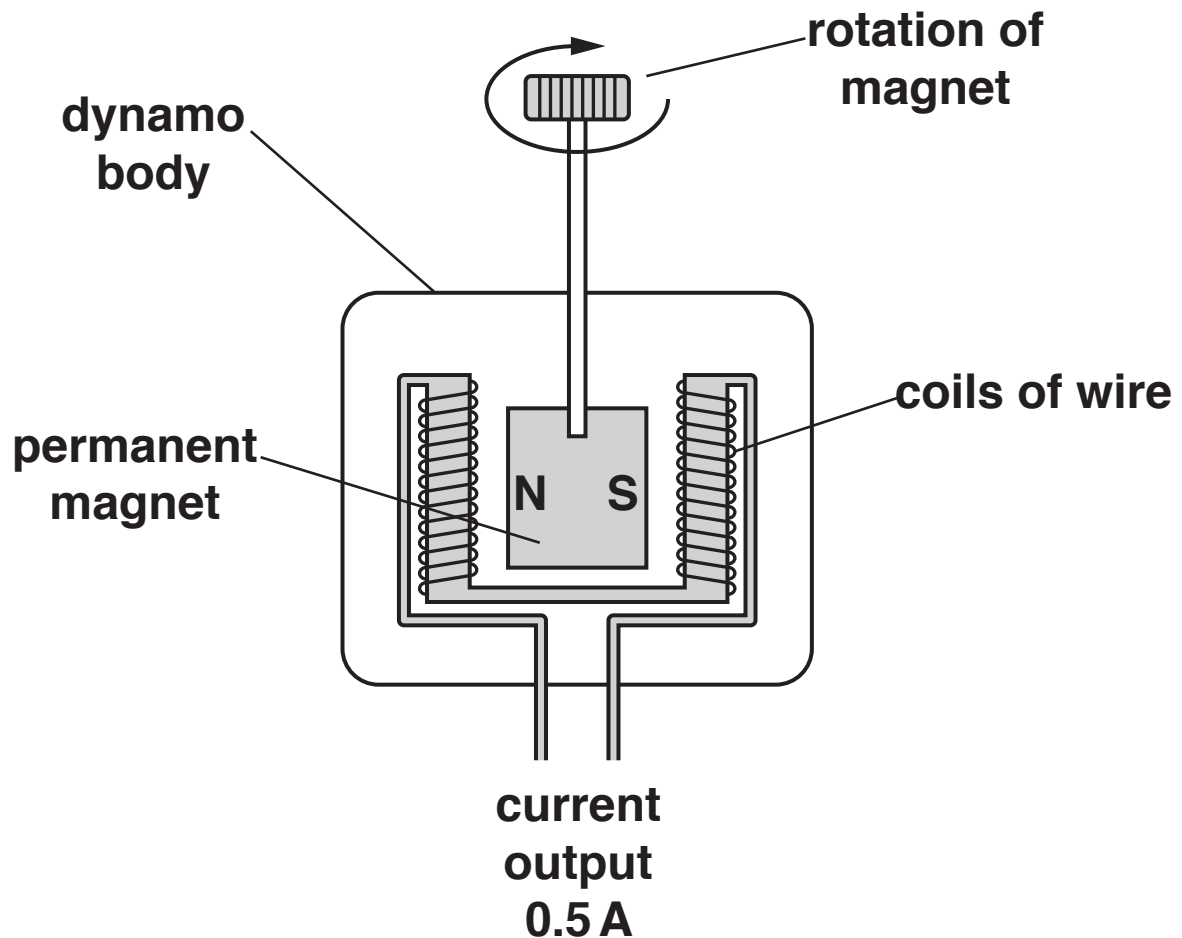
Explain why.

_____

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_____ **[3]**

9   (a) Bill uses a dynamo to generate electricity.

He spins the magnet at a steady speed.
The current output is 0.5 A.

Look at the diagram.

Bill wants to double the output current to 1.0 A so he changes two things at once.

he doubles the speed of rotation

he halves the strength of the magnet.

The output current does NOT double.

Explain why and suggest the size of the output current.

_____

_____

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_____ **[3]**

(b) **Power stations produce energy but they waste energy too.**

The efficiency target for a fossil fuel power station is 40%.

7 MJ of energy is wasted when the energy input to the power station is 12 MJ.

(i) **Does this power station meet the 40% efficiency target?**

Explain your answer using a calculation.

_____

_____

_____

_____ **[2]**

(ii) Fuel is burned in power stations to produce energy.

How is this energy used to produce electricity?

_____

_____

_____

_____ **[2]**

(iii) Transformers are used in power stations to pass electricity onto the National Grid.

Explain why.

_____

_____

_____

_____ **[3]**

10 Nuclear scientists do lots of research into nuclear power.

These teams of scientists have investigated:

accidents in nuclear power stations

the nuclear industry in other countries

the management and disposal of nuclear waste.

(a) Why is it better to use TEAMS of scientists from different countries to do these investigations?

_____

_____

_____

_____ [2]

(b) Nuclear power stations have to manage two types of waste.

LOW LEVEL nuclear waste

HIGH LEVEL nuclear waste.

Explain some of the problems when dealing with nuclear waste and describe how the two different types of waste can be disposed of.

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

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_____ **[6]**

11 Halley's Comet orbits the Sun in 76 years.

It was seen from Earth for a short period in 1986 when it was near the Sun.

The speed of Halley's Comet varies from 70 km/s to 0.89 km/s.

Look at the diagram of the path of the comet. It is not to scale.

(Not drawn to scale)
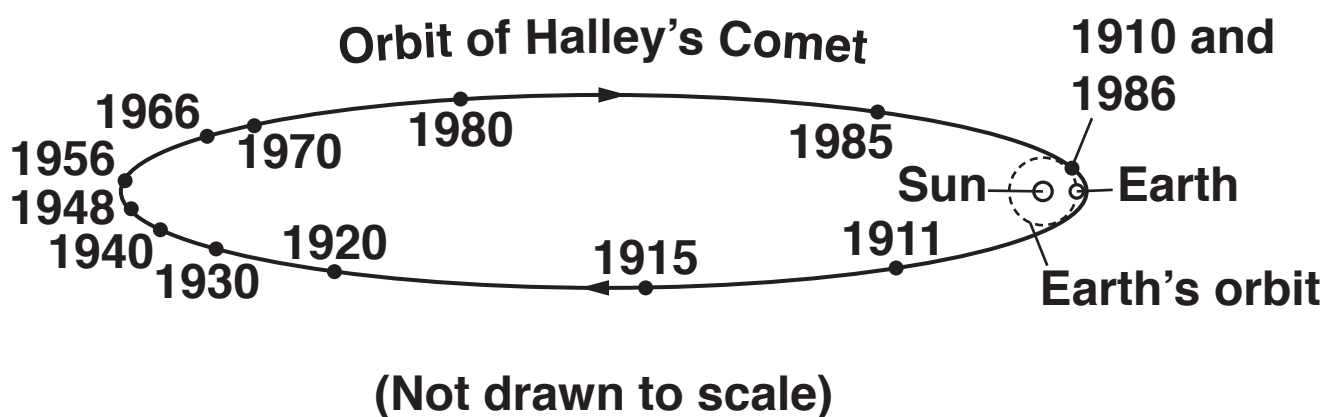
(a) Use the diagram to estimate when the comet reached its highest and lowest speeds.

date of HIGHEST speed _____

date of LOWEST speed _____ [1]

(b) Explain how and why the speed of the comet changes during its orbit.

_____

_____

_____

_____

_____ **[3]**

12 Jo researches electrical safety information for household appliances.

Look at the table of her findings.

Range of current	Recommended fuse	Recommended cable
0 to 2.9 A	3 A plug fuse	5 A
3 to 4.9 A	5 A plug fuse	7 A
5 to 9.9 A	13 A plug fuse	13 A
10 to 12.9 A	13 A plug fuse	15 A
13 to 19.9 A	20 A circuit fuse	30 A static cable
20 to 49.9 A	50 A circuit fuse	60 A static cable

Jo has an electric kettle that uses 276 kJ in 2 minutes when connected to 230 V mains supply.

Calculate the current in the kettle and use the data in the table to decide which fuse and cable Jo should use for the kettle.

current = _____ A

recommended fuse _____

recommended cable _____ [3]

SECTION D

13 This question is about the atmospheric pollutants:

sulfur dioxide, SO_2

oxides of nitrogen, NO_x

(a) Look at bar chart 1 on the Loose Sheet.

It shows the mass of SULFUR DIOXIDE pollution made in France in different ways between 1990 and 2010.

(i) What is the difference between the masses of sulfur dioxide pollution made by generating electricity between 1990 and 2010?

answer _____ thousand tonnes

[1]

(ii) The total mass of sulfur dioxide made between 1990 and 2010 has fallen.

Suggest possible reasons why.

_____

_____

_____

_____ [2]

(b) Look at bar chart 2 on the Loose Sheet.

It shows the mass of OXIDES OF NITROGEN pollution made in France in different ways between 1990 and 2010.

(i) Identify THREE trends about the mass of oxides of nitrogen pollution made from 1990 to 2010.

_____

_____

_____

_____

_____ **[3]**

(ii) The percentage of oxides of nitrogen pollution made by road transport in 2010 is 58.2%.

The percentage of oxides of nitrogen pollution made by household heating is 9.1%

Calculate the percentages made by manufacturing industry and by generating electricity in 2010.

manufacturing industry _____ %

generating electricity _____ % [2]

(c) Look at the table.

It shows the percentages of oxides of nitrogen pollution made in different ways IN THE UK in 2010.

Way oxides of Nitrogen Pollution were made	Percentages of oxides of Nitrogen Pollution
road transport	40%
generating electricity	20%
manufacturing industry	22%
household heating	16%
other	2%

Use bar chart 2, your answers to part (b)(ii) and the table to compare the production of oxides of nitrogen pollution in France and in the UK in 2010.

_____

_____

_____

_____

_____ [2]

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 margin(s).