Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

B622/02

GATEWAY SCIENCE

SCIENCE B

Unit 2 Modules B2 C2 P2 (Higher Tier)

MONDAY 17 JANUARY 2011: Morning
DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (KN/KN) 11MEP01099 39947/2

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. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **A list of physics equations is printed on page three.**
- **The Periodic Table is printed on the back page.**
- **The total number of marks for this paper is 60.**

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

fuel energy input = waste energy output + electrical energy output

power = voltage × current

energy supplied = power × time

energy (kilowatt hours) = power (kW) × time (h)

wave speed = frequency × wavelength

Answer ALL the questions.

SECTION A – MODULE B2

1 (a) Plants and animals are different.

Look at the statements.

Which ONE is a correct statement about the difference between plants and animals?

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

Most animals are more compact than plants so they can move.	☐
Only animals carry out respiration.	☐
Parasites are only found in the plant kingdom.	☐
Plants are invertebrates and animals are vertebrates.	☐

[1]

(b) Plants make sugar by a process called photosynthesis.

(i) The sugar is called glucose.

Write down the chemical formula of glucose.

_____ [1]

(ii) The sugar is changed into starch.

Explain why.

_____ [1]

(c) A cactus is adapted to hot, dry conditions.

One adaptation is having long roots to reach water.

Describe ONE OTHER adaptation and the reason the cactus needs it.

adaptation _____

reason for adaptation _____ [1]

[Total: 4]

2 Read the report about ospreys.

OSPREY NEST PROTECTED

Ospreys have laid the first eggs of the season. The Royal Society for the Protection of Birds (RSPB) will protect the nest from illegal egg collectors.
Last year the ospreys raised two chicks. A spokesman from the RSPB said this would help to increase the small numbers of these special birds in Britain.

(a) Ospreys are birds. Scientists think birds evolved from reptiles.

(i) Look at the statements.

Which ONE is a correct statement about birds and reptiles?

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

Birds are vertebrates but reptiles are invertebrates.	☐
Birds have beaks but reptiles have teeth.	☐
Both birds and reptiles have gills.	☐
Both birds and reptiles are covered in dry scales.	☐

[1]

(ii) Scientists have used evidence from the fossil record to back up their ideas.

The fossil record is incomplete.

Write down ONE reason why it is incomplete.

_____ **[1]**

(b) When ospreys first returned to Scotland a conservation programme was set up to protect them.

People now travel to see the ospreys.

Suggest how the conservation programme may help people who live near the ospreys.

_____

_____ **[1]**

(c) There is a large lake near the ospreys' nest.

Some fishermen who use the lake do NOT want the ospreys to be protected.

Suggest why.

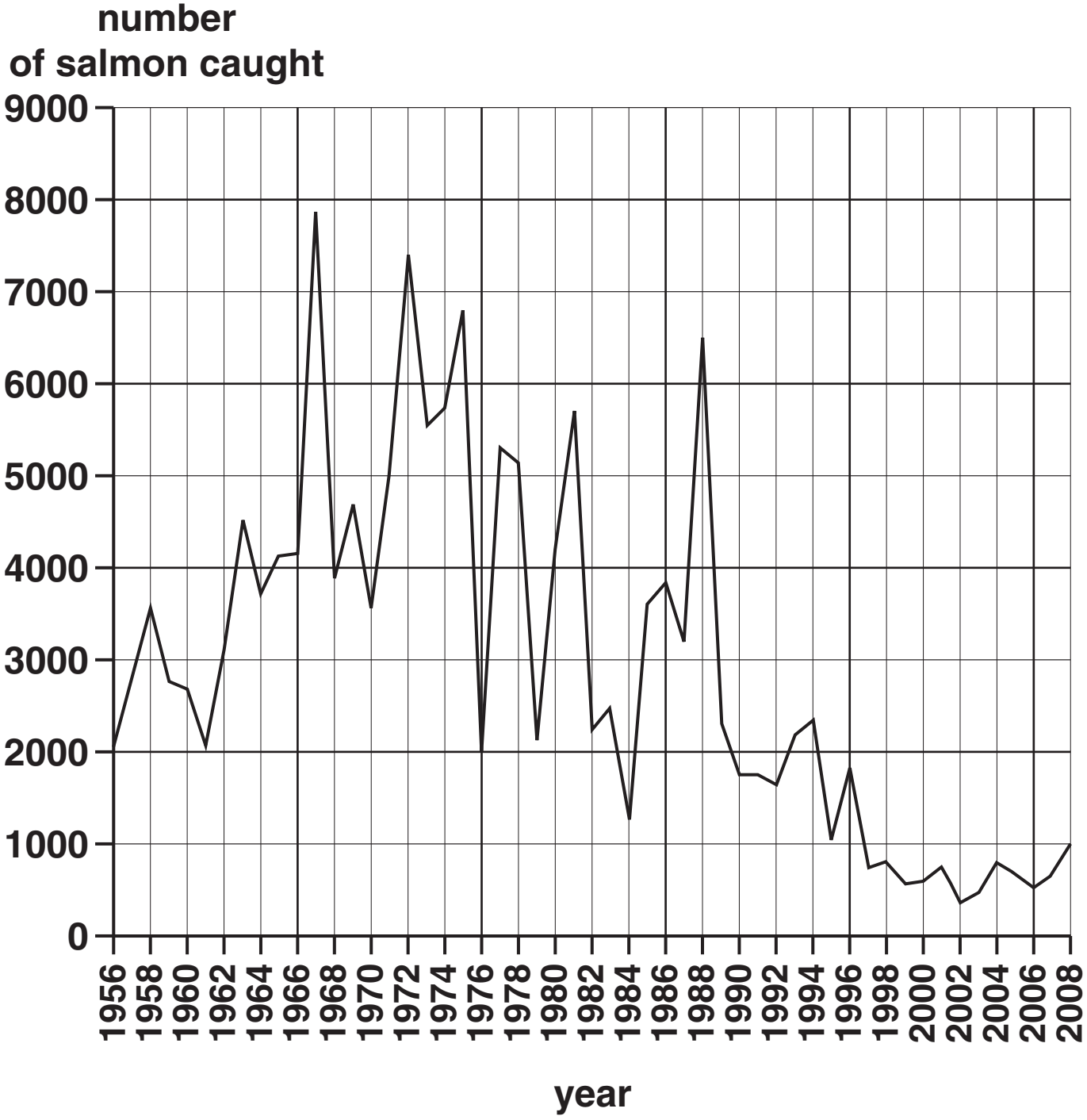
_____

_____ **[1]**

[Total: 4]

3 Look at the graph.

It shows the number of salmon caught in the river Wye between 1956 and 2008.



(a) In 1988 there were 6500 salmon caught in the river Wye.

In 2009 the catch was only 20% of that caught in 1988.

Calculate the number of fish caught in 2009.

_____

_____

answer _____ [2]

(b) The change in numbers is thought to be due to an increase of sulfur dioxide in the air.

(i) Increased amounts of sulfur dioxide cause one type of pollution.

Write down the name of this pollution.

_____ **[1]**

(ii) Since 2002, lime has been added to the river to reduce the effect of sulfur dioxide pollution.

Is there enough evidence on the graph to show that adding lime has been successful?

Give a reason for your answer.

answer _____

reason _____

_____ **[1]**

(c) In 2002, scientists monitored the amount of pollution in a river.

They used stonefly larvae as an indicator species.

Stonefly larvae are very active and use gills to take in oxygen.

Scientists counted the number of stonefly larvae in water samples taken from different places along the river.

The table shows the results.

place along the river	number of stonefly larvae in each 3 litre sample
A	4
B	5
C	4
D	2
E	0

Each sample of water had a volume of three litres.

The scientists suggested the average population of stonefly larvae in the river was 1 per litre.

Suggest ONE reason why they might be wrong.

_____

_____ **[1]**

[Total: 5]

4 Read the information about rats.

Two species of rat living in Britain are the brown rat (*Rattus norvegicus*) and the black rat (*Rattus rattus*).

Fleas living on black rats caused the plague of 1665.

There were no brown rats in Britain until the 1720s.

Black rats are now one of the rarest mammals in Britain.

Brown rats have increased in number to around 80 million.

In the past, warfarin was used successfully to reduce the rat population.

Now warfarin is no longer as effective so other methods of control are used.

(a) *Rattus rattus* is the scientific name for the black rat.

How do scientists describe this way of using two words to name a species?

_____ **[1]**

(b) Natural selection has led to a change in the way we control the rat population.

(i) Explain

- **why warfarin was used to control the rat population in the past**
- **why warfarin is no longer effective**
- **how Darwin would explain the change in effectiveness of warfarin.**

_____

_____

_____

_____

_____

_____ **[4]**

(ii) Lamarck would have given a different explanation to Darwin.

Write down ONE way in which Lamarck's explanation would be different.

_____

_____ **[1]**

(c) When Darwin first suggested his theory of natural selection many people objected to it because of their religious beliefs.

Write down ONE other reason why people objected.

_____

_____ **[1]**

[Total: 7]

SECTION B – MODULE C2

5 This question is about building materials.

(a) Cement is made using limestone.

The chemical name for limestone is calcium carbonate.

When calcium carbonate is heated, carbon dioxide and calcium oxide are made.

(i) Write down the WORD equation for this reaction.

_____ **[1]**

(ii) This reaction is an example of THERMAL DECOMPOSITION.

What is meant by thermal decomposition?

_____

_____ **[1]**

(b) Concrete is a building material made from cement.

Reinforced concrete has a solid steel support inside the concrete.

Reinforced concrete is a BETTER construction material than non-reinforced concrete.

Explain why. Use ideas about the properties of steel and concrete.

_____

_____

_____ **[2]**

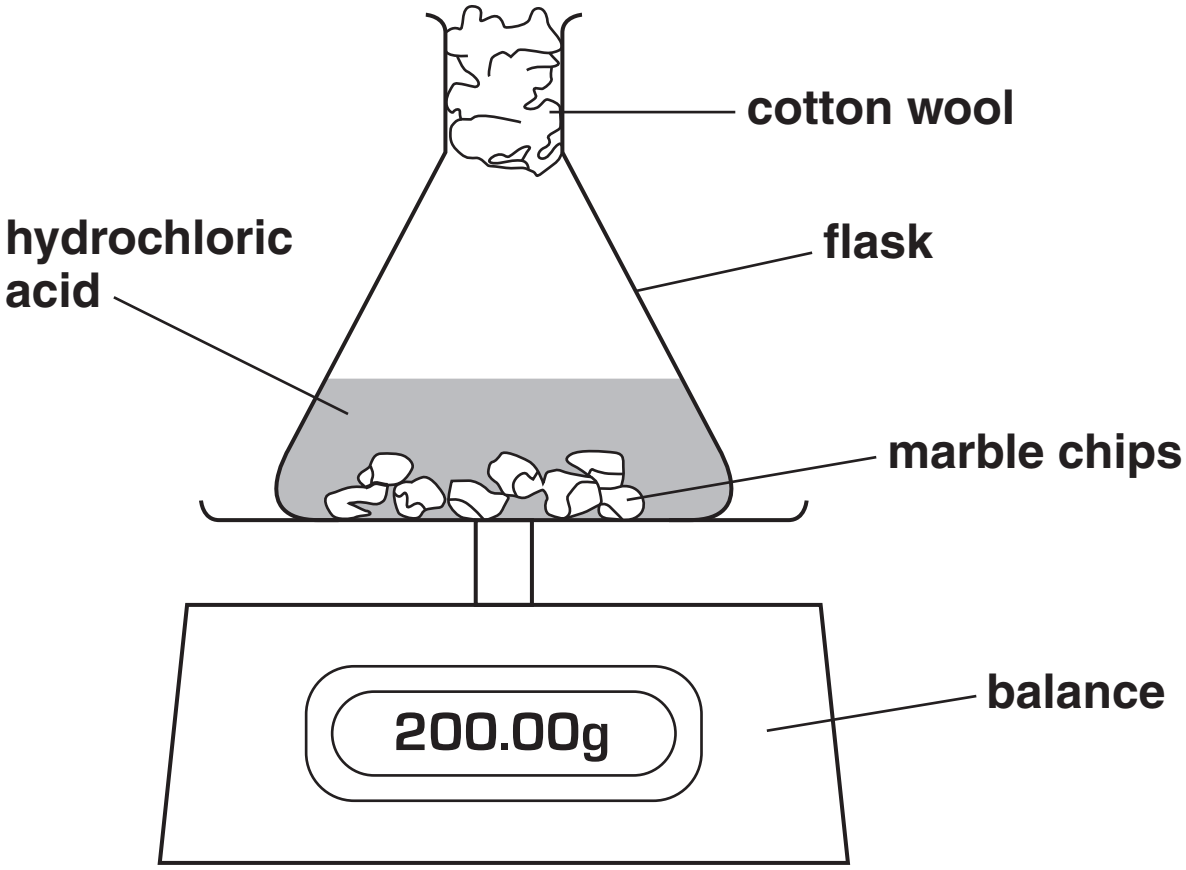
[Total: 4]

BLANK PAGE

6 Hilary and Jeff investigate the reaction between marble chips and hydrochloric acid.

Carbon dioxide is given off during the reaction.

Look at the apparatus they use.



Hilary and Jeff measure the total mass of the reaction mixture every minute.

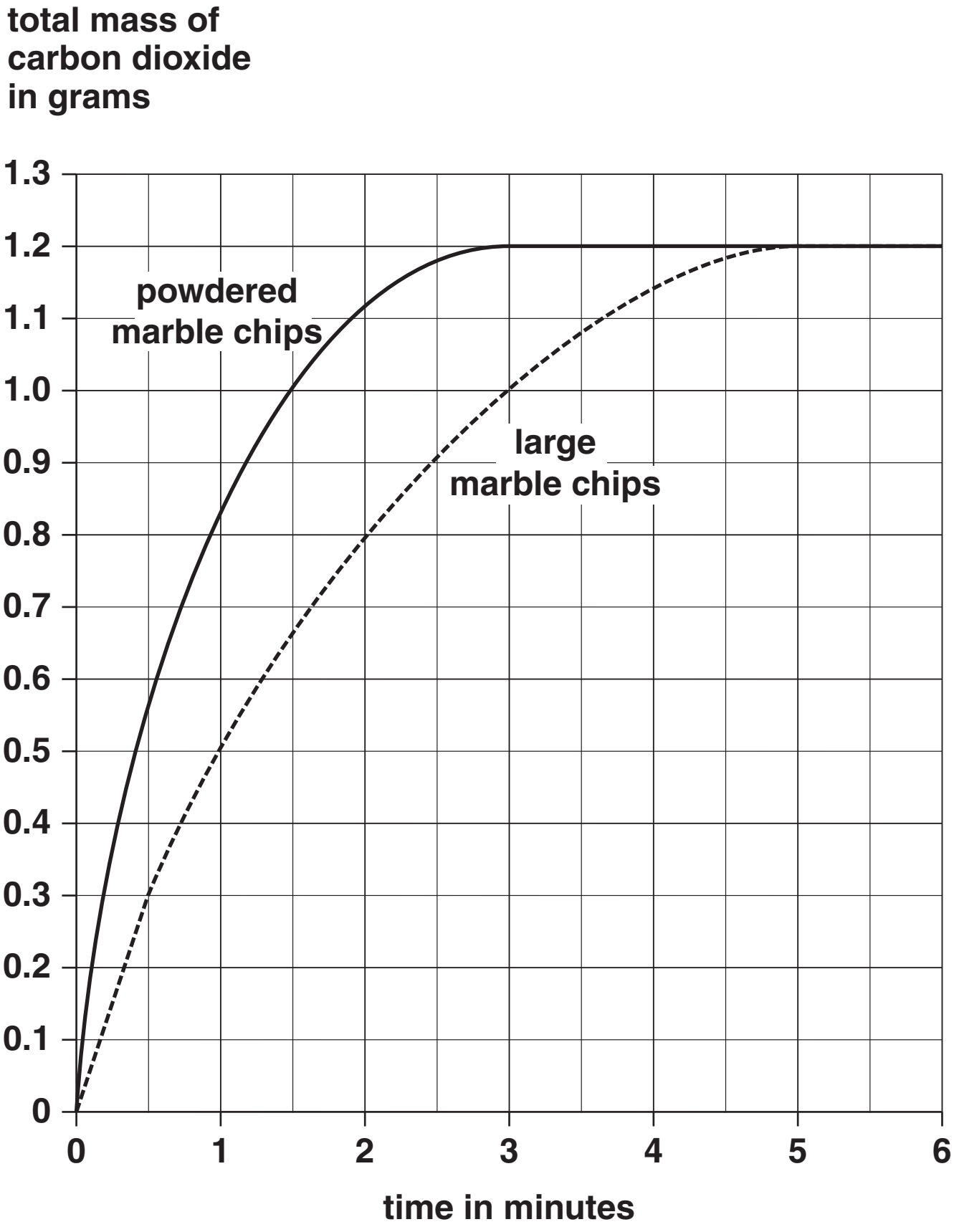
Hilary and Jeff do the experiment again.

They use the same volume of acid and the same amount of marble chips.

This time they use POWDERED marble chips.

After each measurement they work out the total mass of carbon dioxide given off.

Look at the graph. It shows their results from both experiments.



(a) Look at the line for LARGE marble chips.

Calculate the total mass of carbon dioxide given off between 1 minute and 2 minutes.

_____

answer _____ g [1]

(b) Look at the line for the POWDERED marble chips.

How long does it take for the reaction to finish?

_____ **minutes [1]**

(c) (i) The reaction using powdered marble chips is faster than the reaction using large chips.

How can you tell from the TWO LINES?

_____

_____ **[1]**

(ii) Explain why the reaction is faster using POWDERED marble chips.

Use ideas about particles.

_____

_____

_____ **[2]**

(d) Look at the line for the LARGE marble chips.

The rate of reaction during the first half minute can be calculated using the equation

$$\text{rate} = \frac{\text{total mass of carbon dioxide produced}}{\text{time in minutes}}$$

Calculate the rate of reaction during the first half minute for the LARGE chips.

_____

rate = _____ g/minute [1]

[Total: 6]

BLANK PAGE

7 This question is about tectonic plates.

(a) In 1906 there was a major earthquake in San Francisco.

The earthquake was caused by the movement of tectonic plates.

(i) There are two types of tectonic plates.

Write down the names of the two TYPES of plates.

1 _____

2 _____ **[1]**

(ii) Use a fully labelled diagram to explain how tectonic plates move.

_____

_____ **[2]**

(b) Volcanoes occur at plate boundaries.

When a volcano erupts, molten rock comes out and solidifies as igneous rock.

Some igneous rocks contain large crystals and others contain small crystals.

Explain why.

_____

_____ **[1]**

[Total: 4]

8 This question is about the composition of the air.

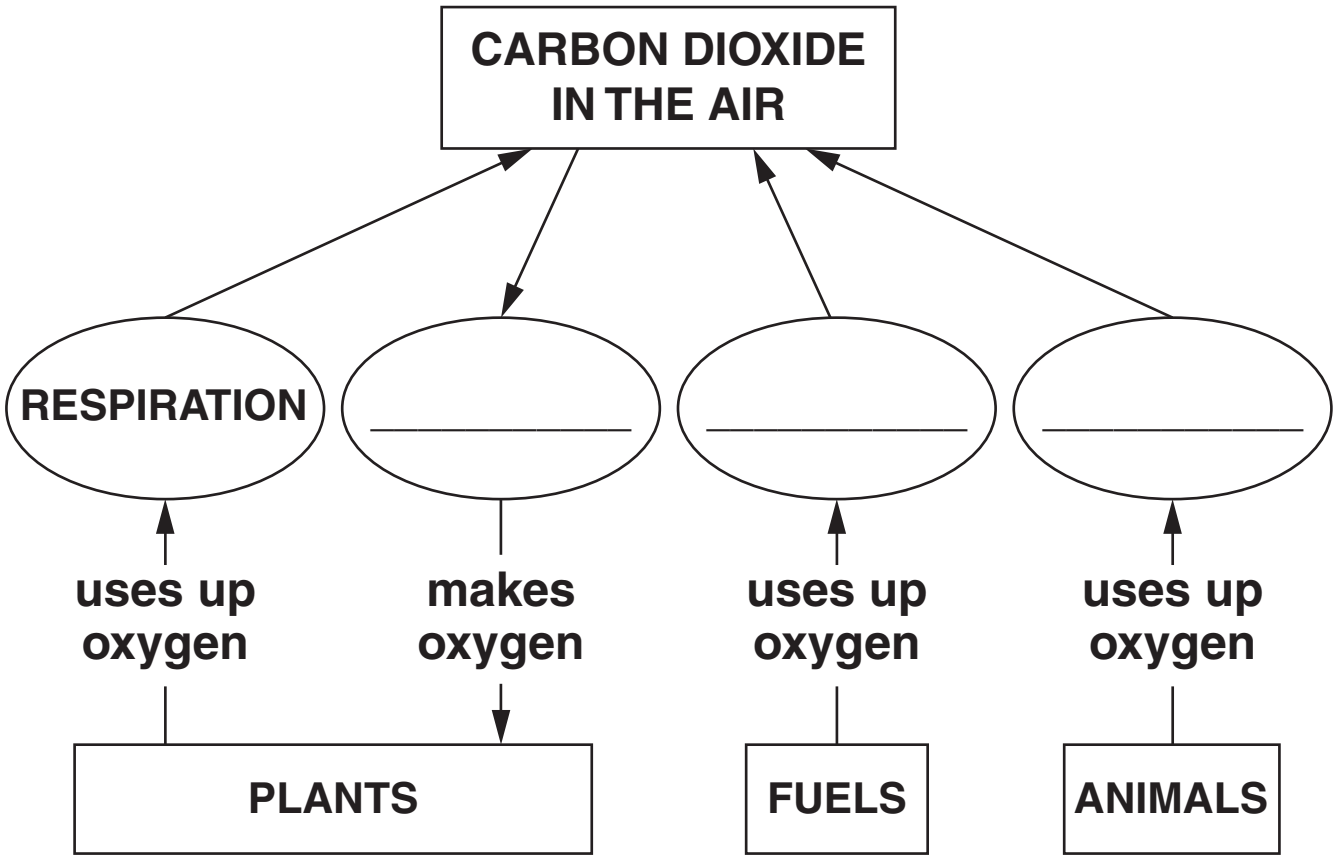
Look at the table.

It lists the percentages of three gases in clean air.

gas	percentage %
nitrogen	78
oxygen	21
carbon dioxide	0.035

These percentages do not change very much. This is mainly due to the carbon cycle.

(a) Look at the diagram, it shows part of a simple carbon cycle.



Respiration by plants uses up oxygen and makes carbon dioxide.

Complete each box by writing in the name of the correct process.

Choose from the following words.

COMBUSTION

PHOTOSYNTHESIS

RESPIRATION

[2]

(b) Exhaust gases from a car contain carbon monoxide and oxides of nitrogen.

Cars are fitted with a catalytic converter.

The catalytic converter changes carbon monoxide, CO, and nitrogen monoxide, NO, into nitrogen, N_2, and carbon dioxide.

Write down the BALANCED SYMBOL equation for this reaction.

_____ **[2]**

[Total: 4]

9 This question is about paints.

Louise paints the wooden window frames in her house.

She uses oil based paint.

Oil based paints contain a pigment mixed in the oil and a solvent that dissolves the oil.

How does the oil paint DRY?

Describe what happens to the solvent and the oil.

solvent _____

_____

oil _____

_____ **[2]**

[Total: 2]

10 This question is about ways of producing electricity.

(a) Carlos has solar powered lamps in his garden.

Energy from the Sun is absorbed by photocells and stored in a battery.

The battery then supplies the solar lamps with energy when it is dark.

Write down two ADVANTAGES of using photocells.

1 _____

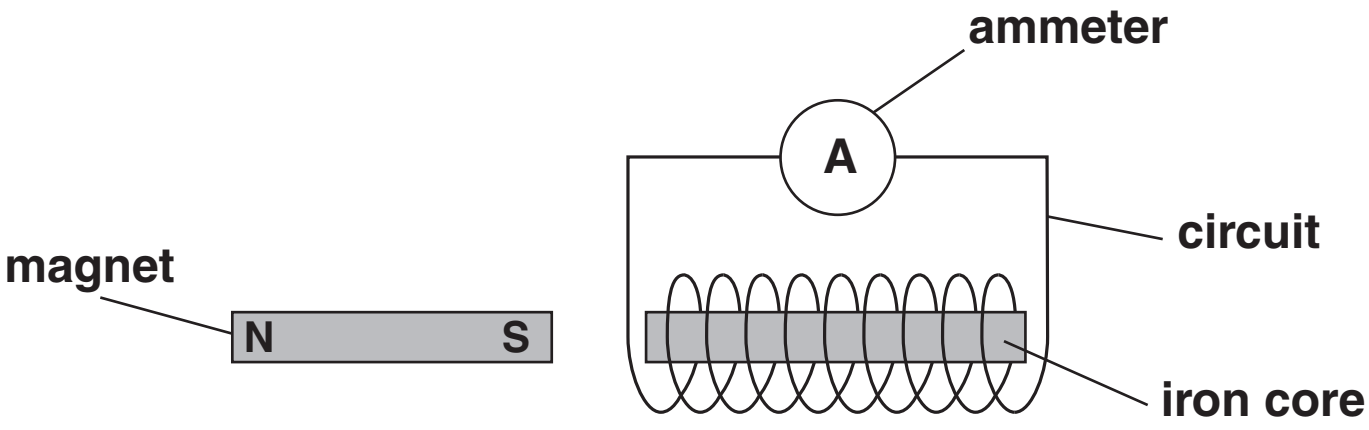
_____

2 _____

_____ **[2]**

(b) Carlos sets up this circuit. It is a type of GENERATOR.

It is a different way of producing electricity.



When Carlos moves

- **the magnet towards the coil**

or

- **the coil towards the magnet**

a current is produced in the circuit.

The iron core increases the current in the circuit.

Write down one OTHER thing that Carlos could do to INCREASE the current in the circuit.

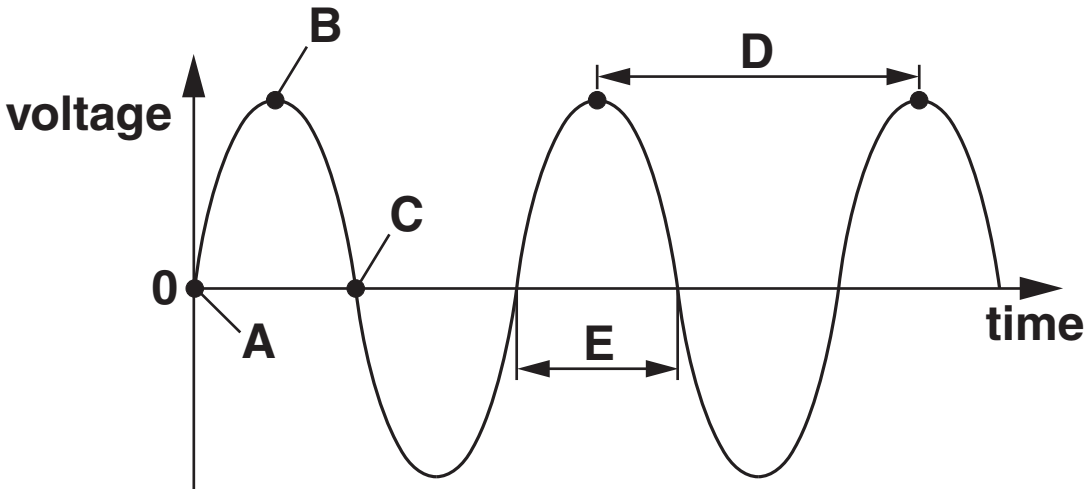
_____ **[1]**

(c) Carlos removes the ammeter. It is replaced with a cathode ray oscilloscope (CRO).

The magnet is moved steadily towards and away from the coil.

Alternating current (AC) is produced.

The pattern on the screen of the CRO looks like this.



(i) Where does the current START to move in the opposite direction?

Choose from A B C D E

answer _____ [1]

(ii) Which letter represents ONE COMPLETE CYCLE of AC?

Choose from A B C D E

answer _____ [1]

[Total: 5]

11 Jake investigates the POWER of a light bulb.

He measures the current and voltage for a light bulb.

Look at his results.

current = 1.5 amps (A)

voltage = 12 volts (V)

Calculate the power of the light bulb.

The equations on page 3 may help you.

_____

_____

_____

answer _____ watts (W) [2]

[Total: 2]

12 The Moon is close to our planet, the Earth.

Together they are called the Earth-Moon system.

There are many theories about how the Earth-Moon system was made.

Some scientists think that the Earth-Moon system was made when another planet came towards the 'old' planet Earth.

(a) Describe how the Earth-Moon system could have been made in this way.

_____

_____

_____ **[2]**

(b) What evidence suggests that the Earth-Moon system was made in this way?

_____

_____

_____

_____ **[2]**

[Total: 4]

13 This question is about nuclear power and nuclear radiation.

Two scientists are talking.

Sharon:
"You have to be very careful when handling radioactive materials."

Gary:
"Radioactive waste is dangerous. It can only be disposed of in certain ways."

Both scientists are correct.

(a) Gary disposes of radioactive waste safely.

Write down TWO ways in which he can do this.

1 _____

_____

2 _____

_____ **[2]**

(b) One problem in dealing with radioactive waste is the level of radioactivity given off by the waste now and in the future.

Explain why this is a problem.

_____

_____ **[1]**

[Total: 3]

14 This question is about the Universe.

(a) Complete the sentences about our Solar System and beyond.

The Earth is one of the _____ in the Solar System.

The Sun is at the centre of our Solar System.

The Solar System is just a tiny part of the Milky Way.

The Milky Way is an example of a

_____ .

There may be an object near the centre of the Milky Way from which light cannot escape.

If not even light can escape from an object it is

called a _____ .

[2]

(b) A star like our Sun takes millions of years to form.

The birth of a star can be described using the statements below.

They are NOT in the correct order.

GRAVITY MAKES DUST PARTICLES SPIRAL TOGETHER

THERMONUCLEAR FUSION TAKES PLACE

MAIN SEQUENCE STAR FORMS

PROTOSTAR FORMS

TEMPERATURE BECOMES VERY HIGH

DUST AND GAS CLOUDS FORM

Put the statements in the correct order.

Write each statement in the correct box below.

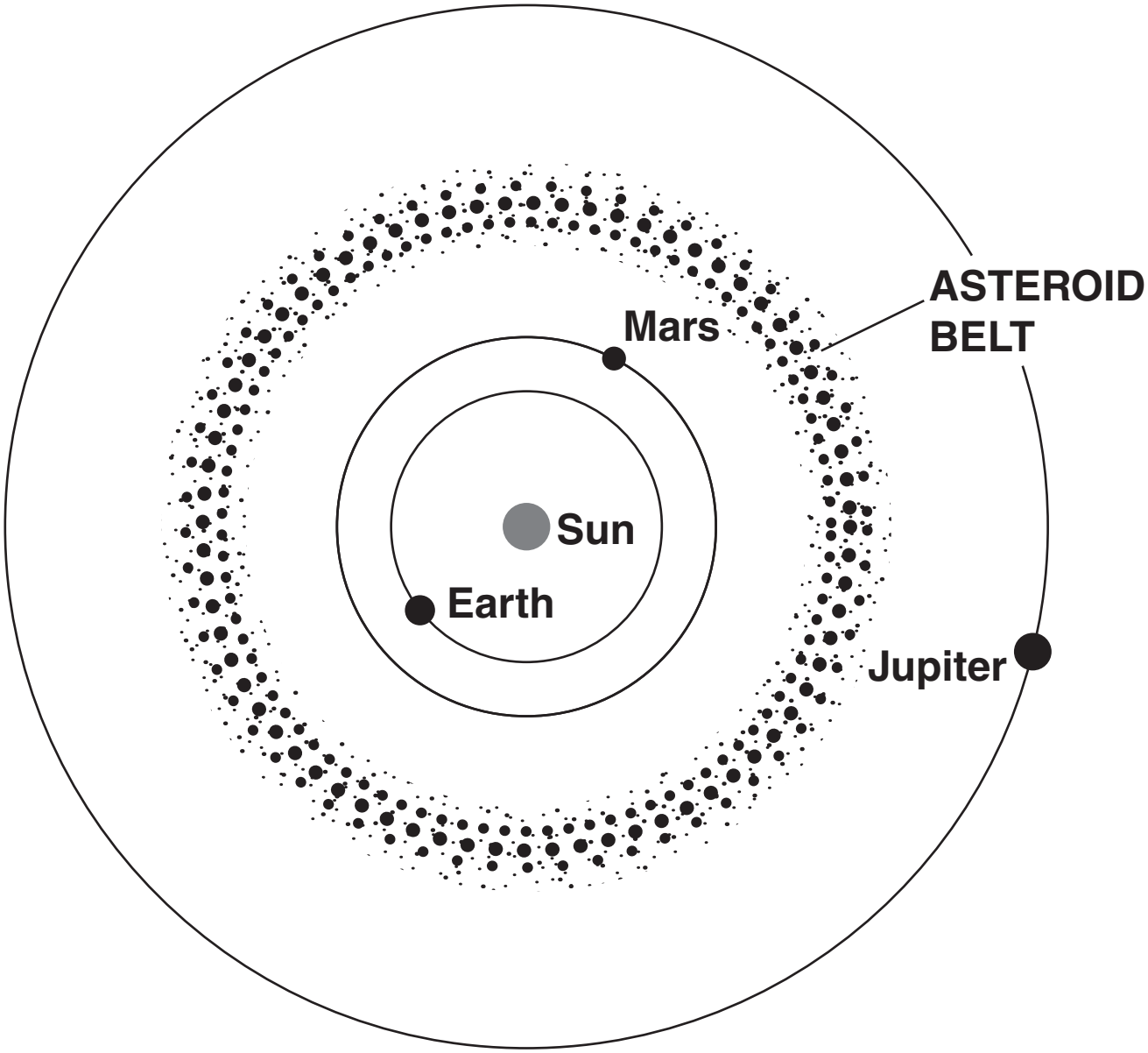
Two have been done for you.

ORDER

1	
2	
3	protostar formed
4	temperature becomes very high
5	
6	

[2]

(c) The asteroid belt is between the planets Jupiter and Mars.



(Orbits drawn approximately to scale)

Use the diagram to help you complete the following sentences about the asteroids.

Some of the asteroids in the asteroid belt clump together.

The huge _____ force from

_____ pulls them apart.

This stops the formation of another

_____ between Mars and

_____ .

[2]

[Total: 6]

END OF QUESTION PAPER

BLANK PAGE

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.