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)

FRIDAY 12 JUNE 2009: 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 (CW/SW) OV90665 10370/1

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer ALL the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 Lynne is investigating some of the animals and plants in a wood.

(a) Lynne notices that small bushes grow in some of the spaces between the trees, but NOT under the trees.

Suggest why small bushes do NOT grow under the trees.

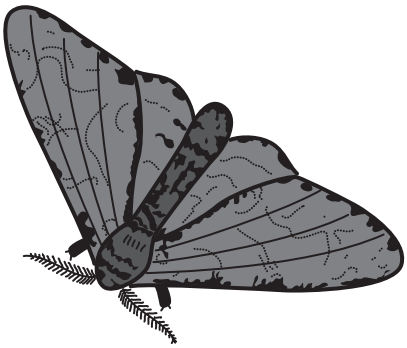
_____

_____ **[1]**

(b) Lynne is investigating peppered moths in the wood.

Some peppered moths are pale. Some are dark.

pale peppered moth



dark peppered moth

Lynne counts the number of both types of peppered moths on ten trees.

The table shows her results.

TREE NUMBER	NUMBER OF PALE PEPPERED MOTHS	NUMBER OF DARK PEPPERED MOTHS
1	1	0
2	0	1
3	1	0
4	3	0
5	0	1
6	1	0
7	0	0
8	0	0
9	2	0
10	0	0

(i) Lynne notices that there are more pale peppered moths than dark peppered moths.

She knows that there are 300 trees in the wood.

Lynne uses this information to estimate that there are 60 dark peppered moths in the whole wood.

Use the information given to estimate the number of pale peppered moths in the whole wood.

You are advised to show your working.

answer _____ [2]

(ii) Suggest ONE reason why there are more pale peppered moths than dark peppered moths in the wood.

_____

_____ [1]

(iii) The two types of peppered moths both belong to the same species.

How could Lynne show this?

_____

_____

_____ [2]

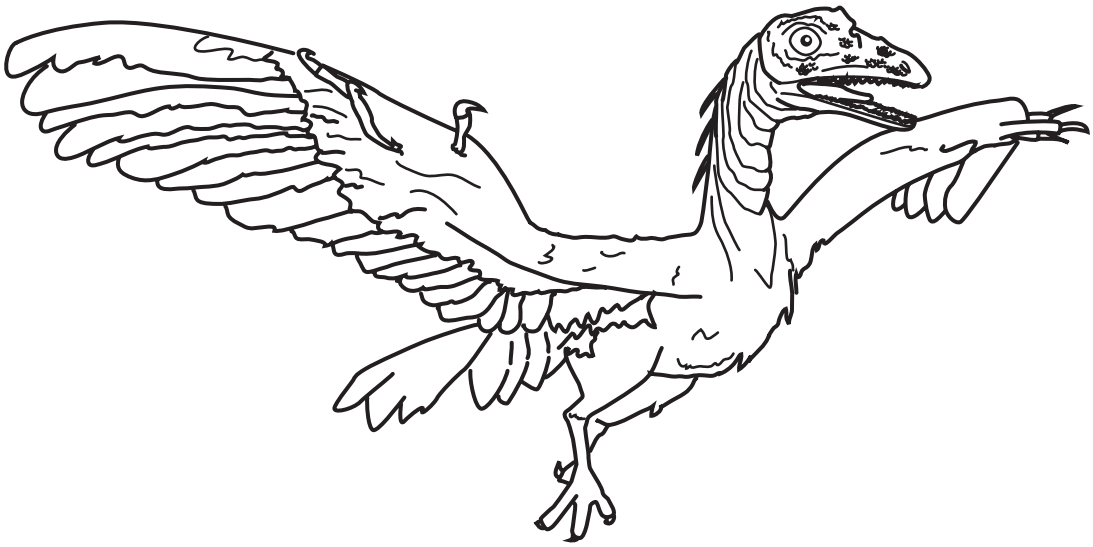
[Total: 6]

2 **Archaeopteryx is an animal that lived about 150 million years ago.**

Scientists think that it was descended from dinosaurs.

It had feathers. It did not have a beak.

Scientists think it had scales.



RECONSTRUCTION OF WHAT ARCHAEOPTERYX MAY HAVE LOOKED LIKE

(a) (i) Most scientists classify Archaeopteryx as a bird.

Explain why.

_____ **[1]**

(ii) Some scientists classify Archaeopteryx as a reptile.

Explain why.

_____ **[1]**

(b) Scientists think that feathers evolved from scales.

Having feathers could have allowed animals like Archaeopteryx to fly or glide.

This could have helped them to escape from predators.

Explain how animals with scales could have evolved feathers.

Use ideas from the theory of natural selection to help you answer.

1. Variation _____

_____

2. Survival of the fittest_____

_____

3. Inheritance _____

_____ [3]

[Total: 5]

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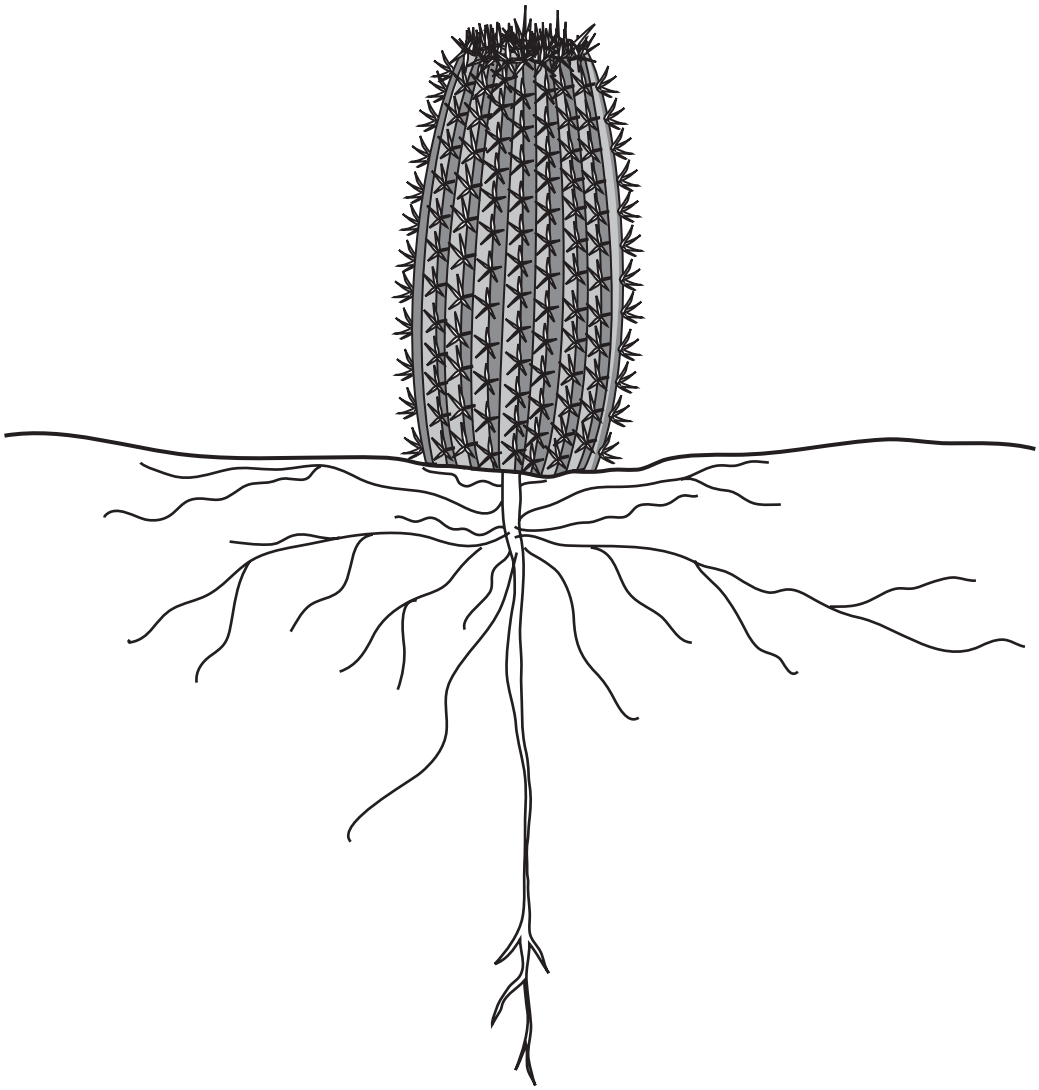
3 The diagram shows a cactus.



(a) The cactus is adapted to living in hot, dry desert conditions.

One adaptation is a thick waxy cuticle to help reduce water loss.

Look at the diagram.

Explain <u>TWO OTHER</u> adaptations that the cactus has to living in hot, dry desert conditions.

1 _____

_____

2 _____

_____ [2]

(b) The cactus is a plant.

It needs to photosynthesise.

Complete the word equation for photosynthesis.

$$\text{\_\_\_\_\_} + \text{\_\_\_\_\_} \xrightarrow[\text{(light)}]{\text{(chlorophyll)}} \text{glucose} + \text{\_\_\_\_\_}$$

[3]

(c) Suggest what substance the cactus uses to make wax for the cuticle.

_____ [1]

[Total: 6]

4 The human population is increasing exponentially.

(a) What does EXPONENTIAL GROWTH mean?

_____

_____ [1]

(b) As the human population increases, sustainable development becomes more important.

Describe how an increasing energy demand can be met in a SUSTAINABLE way.

_____

_____

_____ [2]

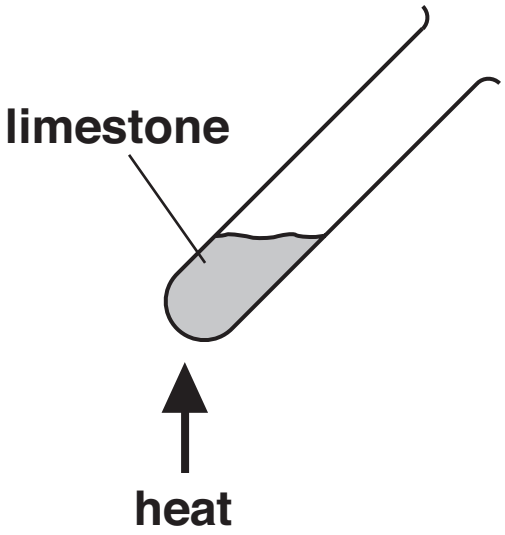
[Total: 3]

SECTION B – MODULE C2

5 Pete and Sally investigate marble and limestone.

Limestone and marble both have the formula, $CaCO_3$.

Sally heats some limestone.



(a) When limestone is heated, THERMAL DECOMPOSITION happens.

What is thermal decomposition?

_____ [1]

(b) Limestone is used to make cement.

Limestone is mixed with another substance.

Write down the name of this substance.

Choose from the list.

CLAY

GLASS

GRANITE

IRON ORE

answer _____ [1]

(c) When calcium carbonate, $CaCO_3$, is heated it makes calcium oxide, CaO, and carbon dioxide.

Write a balanced SYMBOL equation for this reaction.

_____ [1]

(d) Marble is a harder rock than limestone.

(i) What type of rock is marble?

_____ [1]

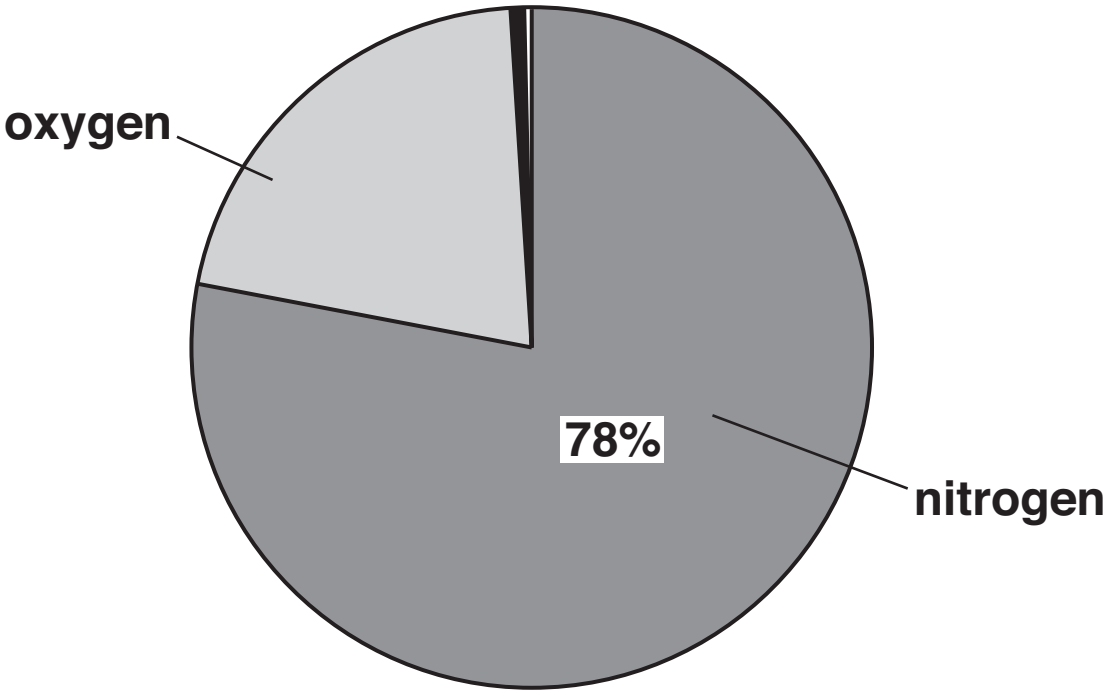
(ii) What type of rock is limestone?

_____ [1]

[Total: 5]

6 This question is about gases in the air.

Look at the pie chart. It shows the composition of the air.



(a) What percentage of the air is oxygen?

_____ [1]

(b) Sulfur dioxide is a pollutant in the air.

Explain how sulfur dioxide gets into the air.

_____

_____ [1]

(c) Carbon monoxide is also a pollutant in the air.

Most carbon monoxide is made when petrol burns in car engines.

It can be removed from the exhaust gases using a catalytic converter.

What gas is carbon monoxide changed into in a catalytic converter?

_____ [1]

[Total: 3]

7 This question is about paints.

(a) Emulsion paints are water based.

Emulsion paints are applied as a thin surface coating which dries quickly.

Explain how emulsion paints dry.

_____ [1]

(b) Some pigments used in paint change colour when they are heated.

They are called THERMOCHROMIC PIGMENTS.

Write down ONE use of thermochromic pigments.

_____ [1]

(c) Paints are COLLOIDS.

Look at the sentences about colloids.

Put a tick (✓) in the boxes next to the TWO sentences which are correct.

Solid particles are mixed with particles of a liquid but not dissolved.	☐
Colloids are two liquids mixed together.	☐
The solid particles will not separate out because they are very small and do not sink to the bottom.	☐
The solid particles will not separate out because they are held together by an emulsifier.	☐

[2]

[Total: 4]

8 Fred and Sue investigate the reaction of pieces of calcium carbonate and hydrochloric acid.

Carbon dioxide is given off during the reaction.

Calcium chloride and water are also made.

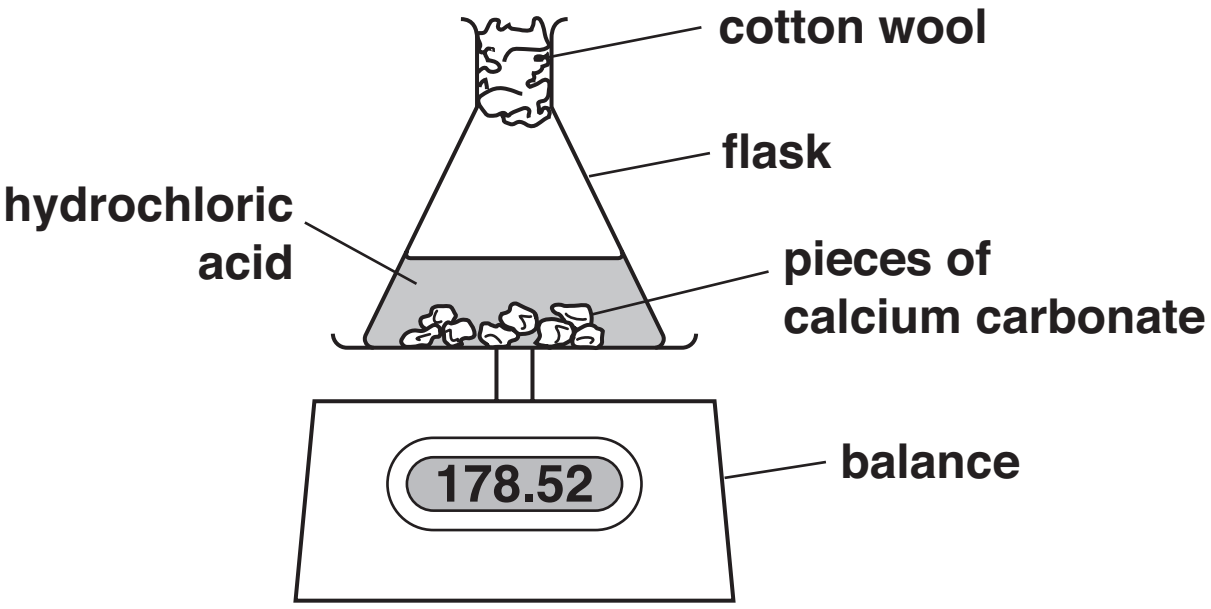
(a) Write a <u>WORD</u> equation for this reaction.

_____ [1]

(b) Fred and Sue measure the mass of the reaction mixture every 30 seconds during the experiment.

Look at the diagram.

It shows the apparatus they use.



After every measurement, Sue works out the total mass of carbon dioxide given off.

They do the experiment again.

They use the same amounts of acid and calcium carbonate.

This time they use <u>SMALLER</u> pieces of calcium carbonate.

Look at the graph opposite. It shows their results.

Look at the curve for the LARGE pieces.

How long does it take for this reaction to finish?

_____ seconds [1]

(c) The reaction using small pieces is faster than the reaction using large pieces.

Explain why. Use ideas about collisions between particles.

_____

_____

_____ [2]

(d) Increasing the concentration of the hydrochloric acid makes the reaction go faster.

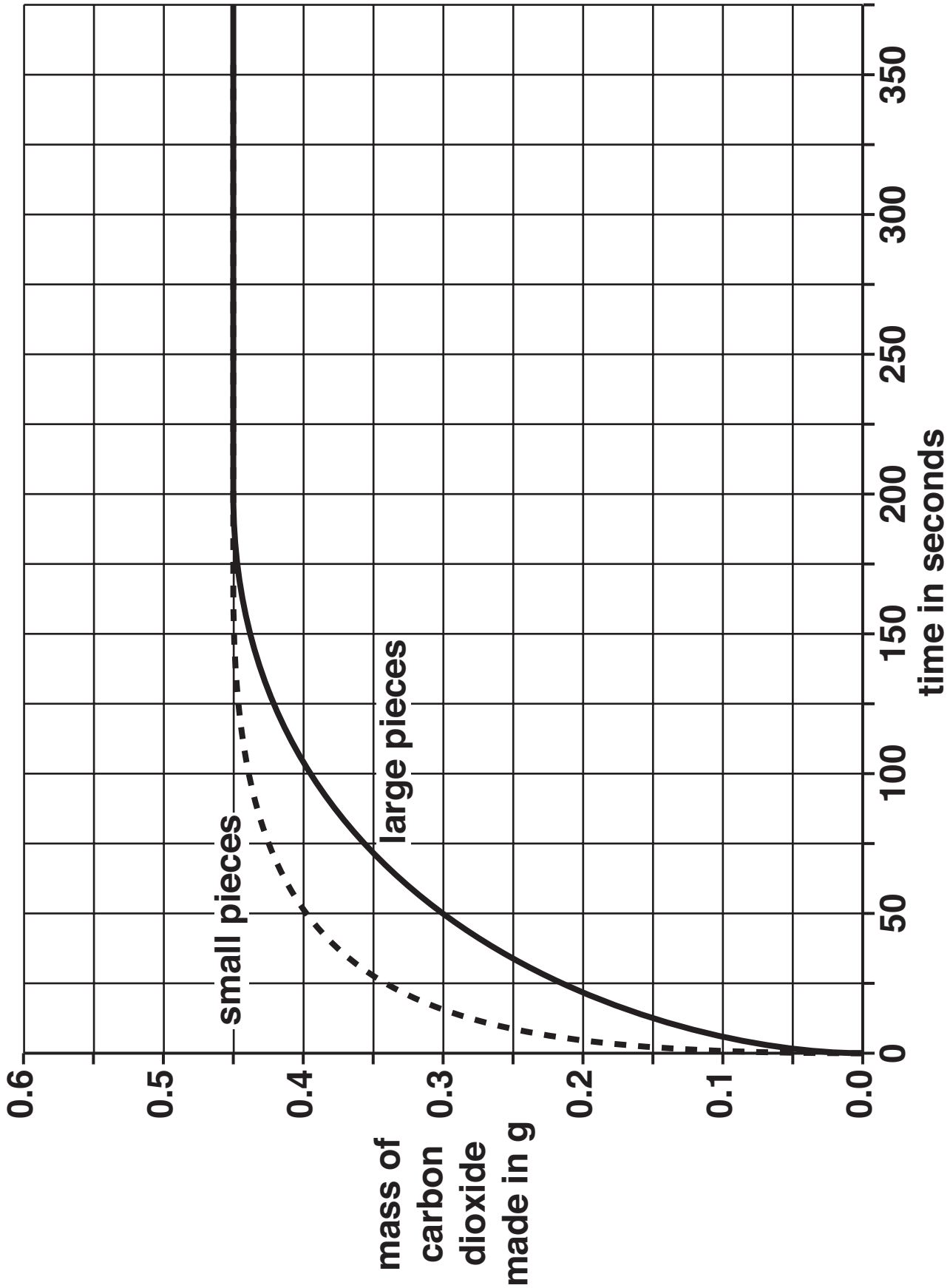
Explain why. Use ideas about collisions between particles.

_____

_____

_____ [2]

[Total: 6]



9 Look at the word equation for the corrosion (rusting) of iron.

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

(a) What type of reaction is rusting?

Choose from

COMBUSTION

DECOMPOSITION

ELECTROLYSIS

OXIDATION

answer _____ [1]

(b) Aluminium does not corrode in moist conditions.

Explain why.

_____

_____ [1]

[Total: 2]

SECTION C – MODULE P2

10 This question is about nuclear radiation.

(a) The three types of nuclear radiation are alpha, beta and gamma.

They can all be used in cancer treatment.

(i) Write down one other use of ALPHA radiation.

_____ **[1]**

(ii) Write down one other use of BETA radiation.

_____ **[1]**

(iii) Write down one other use of GAMMA radiation.

_____ **[1]**

(b) Background radiation is around us all the time.

Write down one source of this background radiation.

_____ **[1]**

(c) A nuclear power station uses uranium as a fuel.

(i) Why do we get PLUTONIUM in this nuclear power station?

_____ [1]

(ii) What is PLUTONIUM used for?

_____ [1]

[Total: 6]

11 Paul's house has a conservatory and a wind turbine.

(a) The conservatory faces the Sun during the day.

The radiation from the Sun warms the conservatory.

This is called PASSIVE solar heating.

Explain how passive solar heating works.

_____

_____

_____ **[2]**

(b) The wind turbine collects energy from the wind.

It changes this energy into electricity.

(i) Write down two ADVANTAGES of using wind turbines.

advantage 1 _____

advantage 2 _____

(ii) Write down two DISADVANTAGES of using wind turbines.

disadvantage 1 _____

disadvantage 2 _____

[2]

[Total: 4]

12 Electricity is generated in power stations.

(a) Coal is the fuel in the power station.

Put the stages in the correct order to show how the power station works.

Complete the boxes. Two have been done for you.

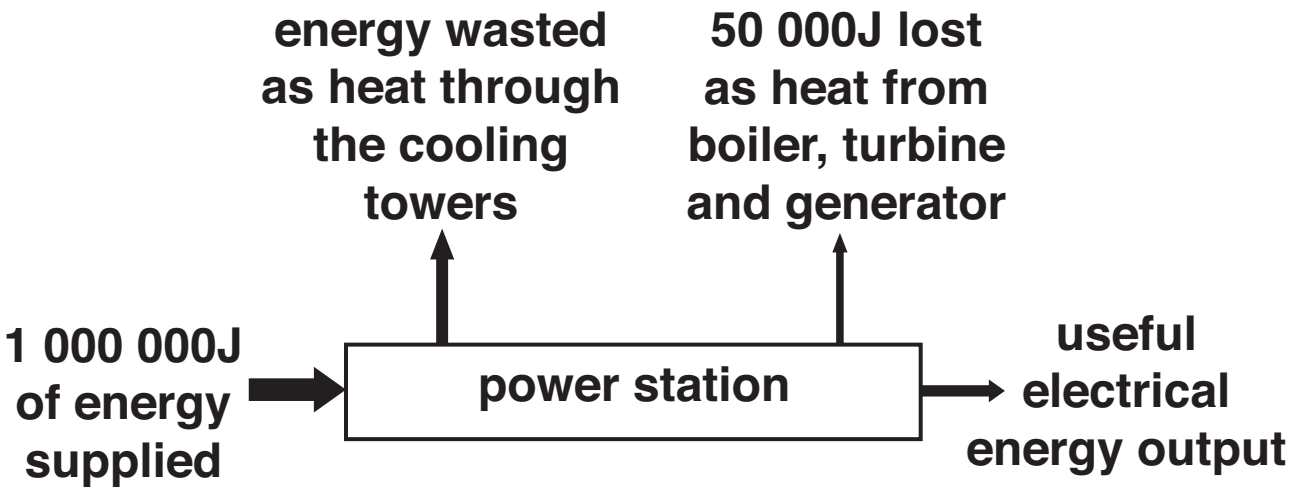
stages	correct order
generator produces electricity	
heats water	heats water
coal burns	
turbine spins	
steam produced	
turbine drives the generator	generator produces electricity

[2]

(b) The power station makes useful electrical energy.

It also wastes energy as heat escapes.

Look at the diagram.



The power station has an electrical efficiency of 0.35 (35%).

Calculate the energy wasted as heat through the cooling towers.

The equations on page 3 may help you.

_____

_____

_____

_____

_____

answer_____ joules [2]

(c) The electricity leaves the power station.

The voltage is increased before it joins the National grid.

This reduces energy waste and costs.

Explain how increasing the voltage reduces energy waste.

_____

_____

_____

_____ [2]

[Total: 6]

13 Asteroids and comets orbit in the Solar System.

(a) Asteroids are large rocks.

(i) Asteroids orbit between two planets.

Where are these asteroids found?

Choose from

BETWEEN MERCURY AND VENUS

BETWEEN VENUS AND EARTH

BETWEEN EARTH AND MARS

BETWEEN MARS AND JUPITER

_____ [1]

(ii) Asteroids have hit the Earth in the past.

What evidence is there to support this?

_____

_____ [1]

(b) Comets orbit the Sun. They have a very elliptical orbit.

(i) What are comets made of?

_____ [1]

(ii) The speed of a comet increases as it gets nearer to the Sun.

Explain why.

_____

_____ [1]

[Total: 4]

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.