

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**GATEWAY SCIENCE**  
**SCIENCE B**

**B622/02**

Unit 2 Modules B2 C2 P2  
(Higher Tier)

**Friday 12 June 2009**  
**Morning**

**Duration: 1 hour**

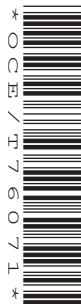
Candidates answer on the question paper  
A calculator may be used for this paper

**OCR Supplied Materials:**

- None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- 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 two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

## 2

**EQUATIONS**

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

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

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

$$\text{fuel energy input} = \text{waste energy output} + \text{electrical energy output}$$

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

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

$$\text{energy (kilowatt hours)} = \text{power (kW)} \times \text{time (h)}$$

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

3

Answer **all** the questions.**Section A – Module B2**

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



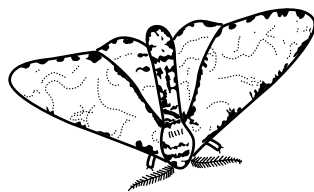
- (a) Lynne notices that small bushes grow in some of the spaces between the trees, but **not** under the trees.

Suggest why small bushes do **not** grow under the trees.

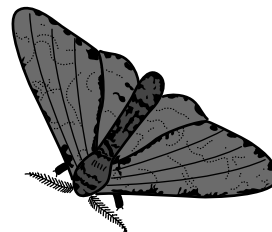
.....  
..... [1]

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

Some peppered moths are pale. Some are dark.



**pale peppered moth**



**dark peppered moth**

4

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]

5

- (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]

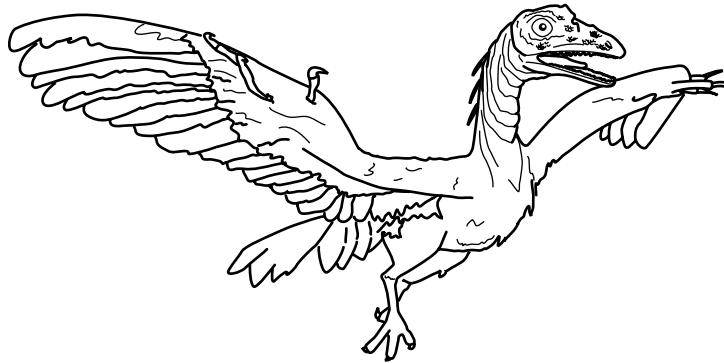
[Total: 6]

- 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]

7

(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.....

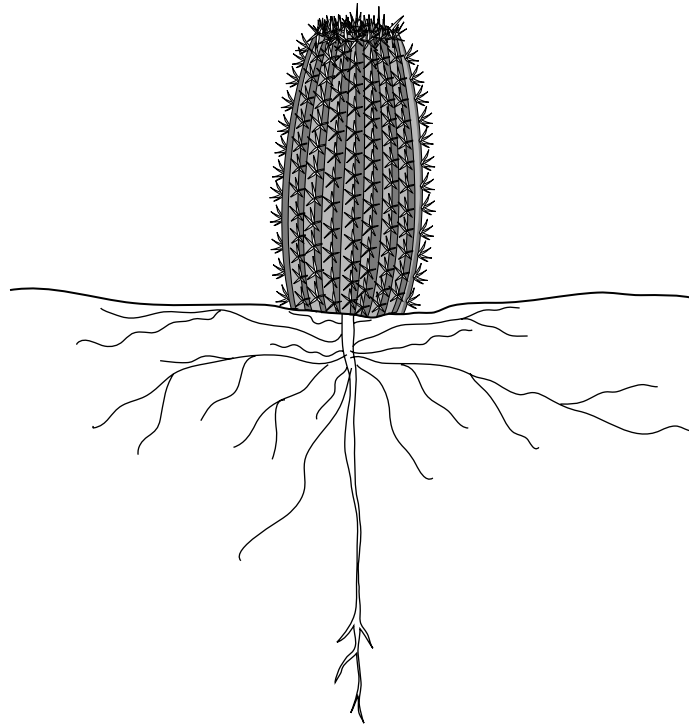
.....

3. Inheritance .....

..... [3]

[Total: 5]

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 **two other** adaptations that the cactus has to living in hot, dry desert conditions.

- 1.....  
.....
- 2.....  
..... [2]

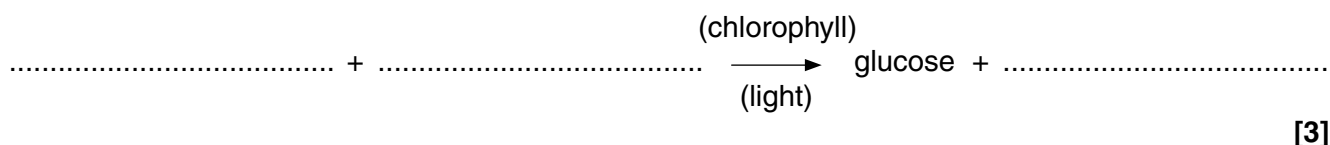


9

(b) The cactus is a plant.

It needs to photosynthesise.

Complete the word equation for photosynthesis.



[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]

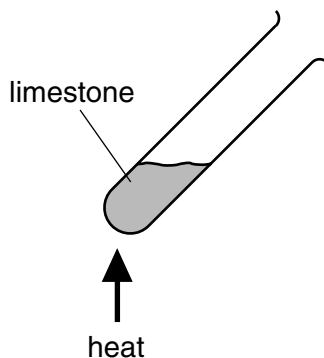
[Total: 3]

## Section B – Module C2

- 5 Pete and Sally investigate marble and limestone.

Limestone and marble both have the formula,  $\text{CaCO}_3$ .

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]

11

- (c) When calcium carbonate,  $\text{CaCO}_3$ , is heated it makes calcium oxide,  $\text{CaO}$ , 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]

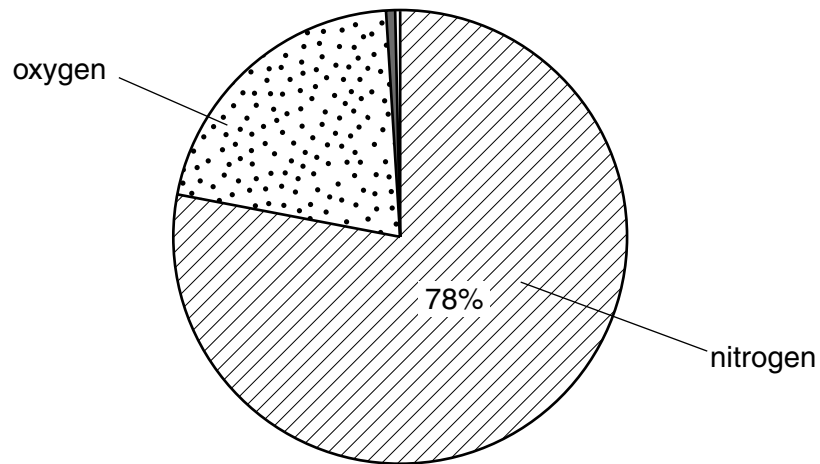
- (ii) What type of rock is limestone?

..... [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.

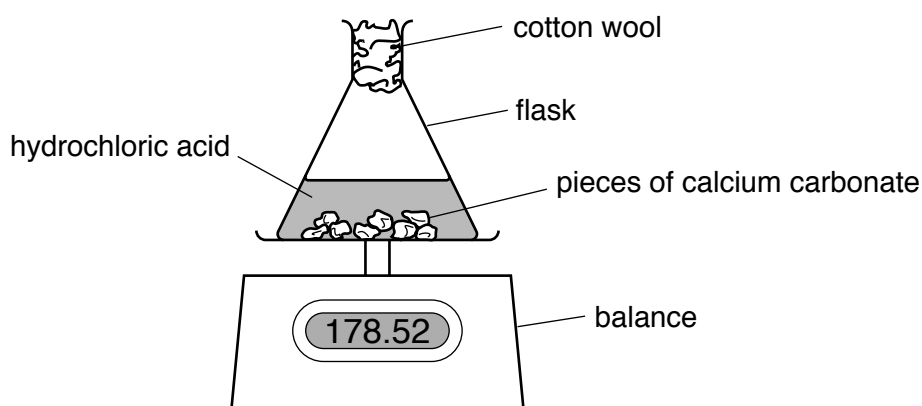
- (a) Write a **word** equation for this reaction.

..... [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.

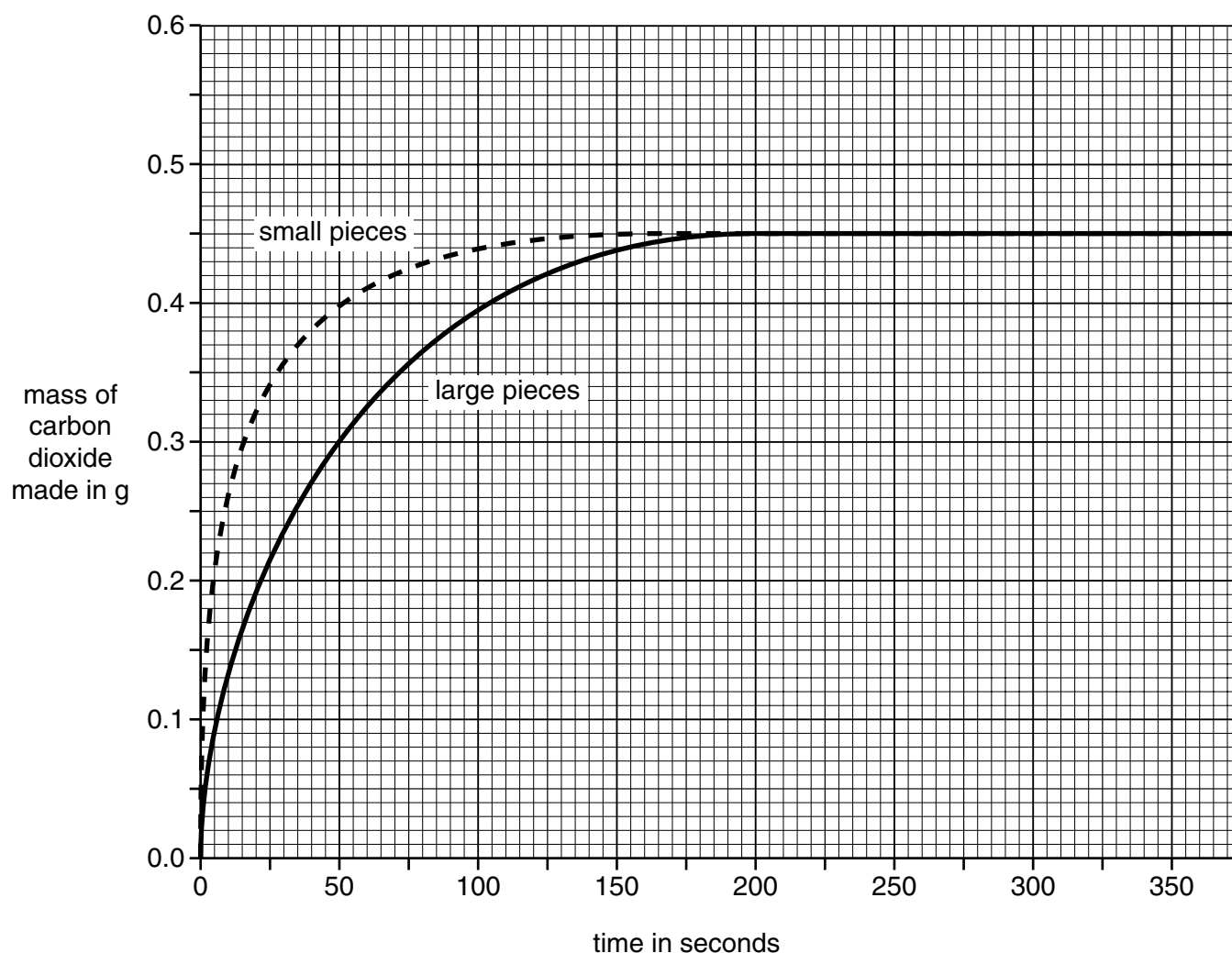
They do the experiment again.

They use the same amounts of acid and calcium carbonate.

This time they use **smaller** pieces of calcium carbonate.

15

Look at the graph. 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]

16

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

Explain why. Use ideas about collisions between particles.

.....

.....

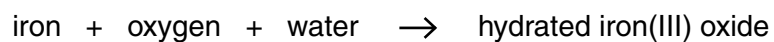
..... [2]

[Total: 6]



17

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



- (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]

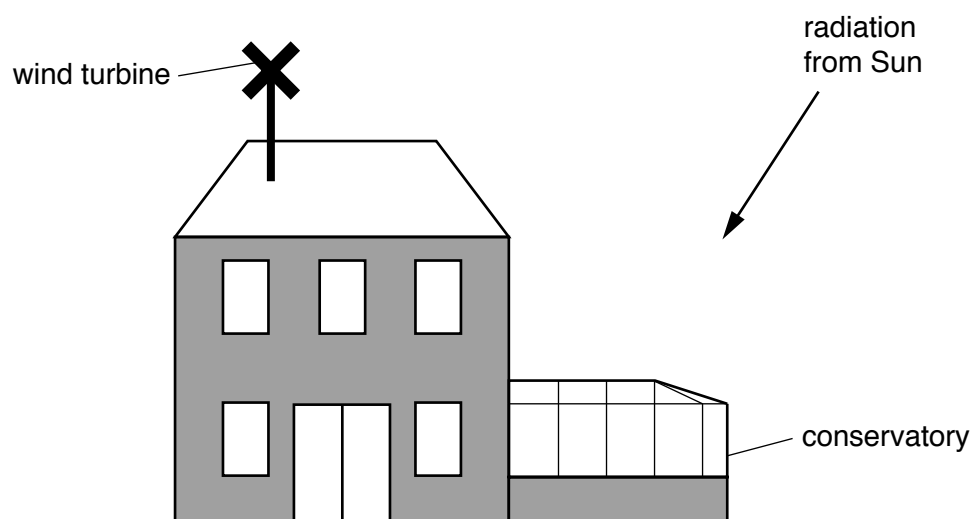
(ii) What is **plutonium** used for?

..... [1]

[Total: 6]

11 Look at the diagram of Paul's house.

It 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.

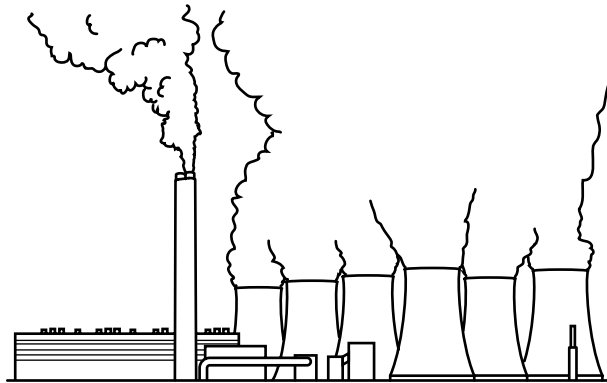
disadvantage 1 .....

disadvantage 2 .....

[2]

[Total: 4]

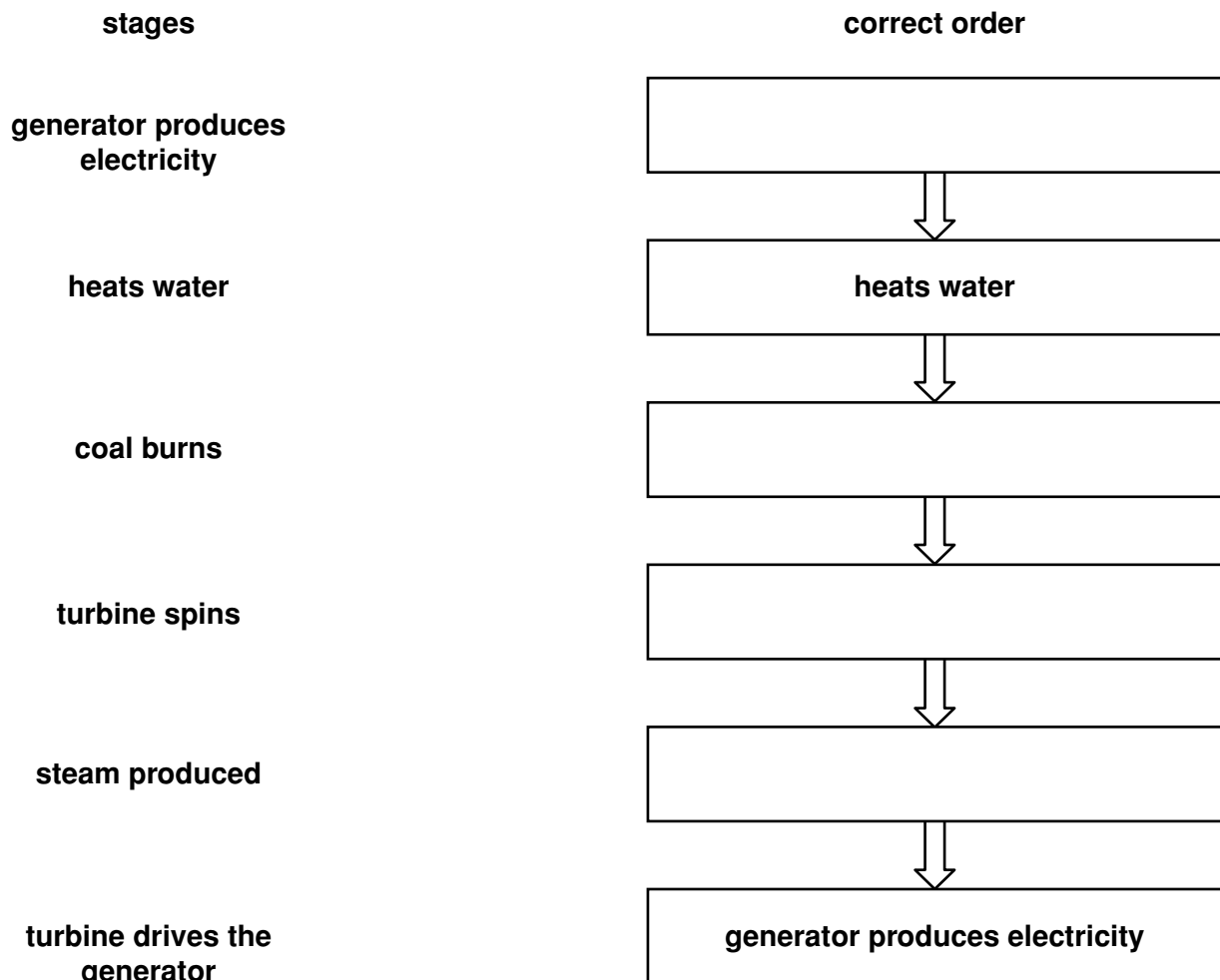
12 Electricity is generated in power stations.



(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.



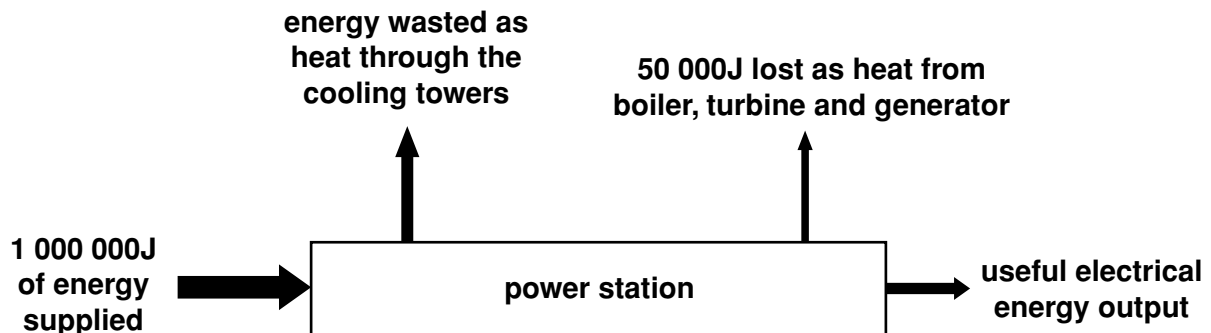
[2]

21

(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 2 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 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.