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0653/21

May/June 2014

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **24** printed pages.

- 1 (a) Fig. 1.1 shows an experiment to compare how three metals react with dilute hydrochloric acid.

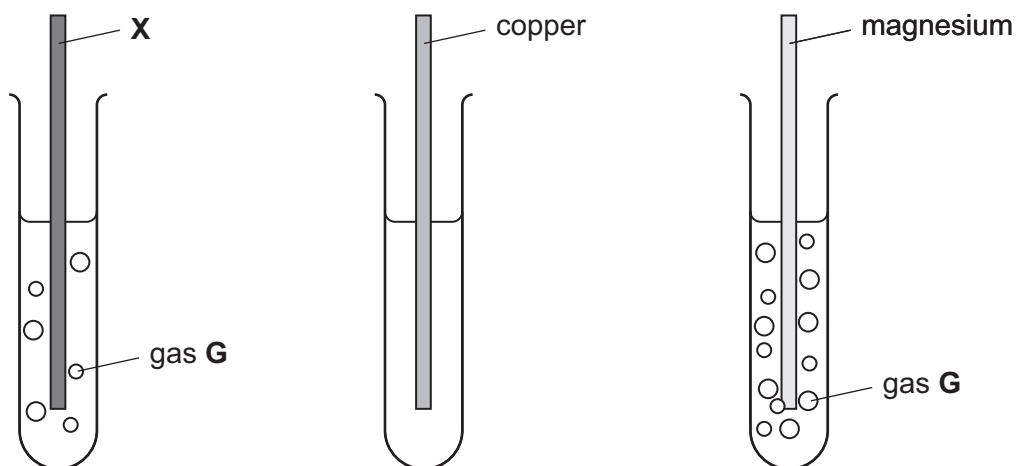


Fig. 1.1

In two of the test-tubes, bubbles of a gas **G** are produced. Gas **G** is an element.

- (i) State the name of gas **G**. [1]
- (ii) Describe a test for gas **G**.
 test
 result
 [2]
- (iii) List the four elements **X**, copper, magnesium and **G** in order of reactivity.
 most reactive

 least reactive [2]
- (iv) Suggest the identity of metal **X**. [1]

- (b) Fig. 1.2 shows how a teacher could use a Bunsen burner to heat a mixture of carbon and copper oxide until it starts to glow.

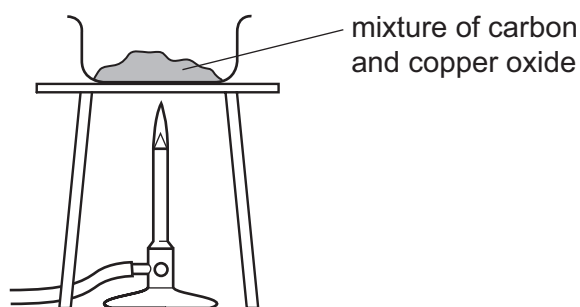


Fig. 1.2

The mixture glows even more brightly for some time after the burner is removed.

Carbon has reduced copper oxide to copper.

- (i) State what is meant by the term *reduced*.

..... [1]

- (ii) Name the other product that is formed in this reaction.

..... [1]

- (c) Lead can be produced from molten lead bromide using electrolysis, as shown in Fig. 1.3.

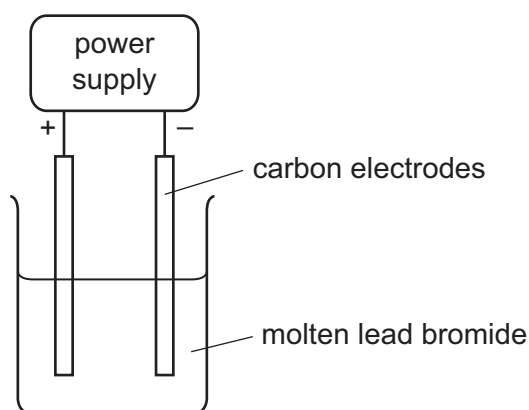


Fig. 1.3

- (i) Mark, with the letter **P** and a label line, the position on the diagram where lead first appears after the circuit is connected. [1]

- (ii) Name the other element that is formed during the electrolysis.

..... [1]

2 Fig. 2.1 shows a food web of the organisms in a woodland containing oak trees.

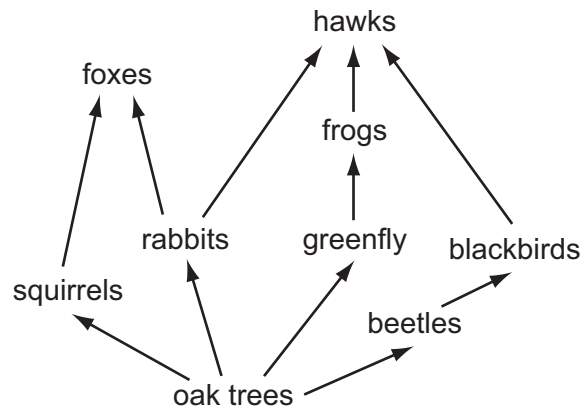


Fig. 2.1

(a) State the source of energy for this food web.

..... [1]

(b) From the food web, name

(i) **one** producer,

..... [1]

(ii) **one** herbivore.

..... [1]

(c) The food web is a network of interconnected food chains.

One food chain in Fig. 2.1 with three stages is shown.

oak tree → rabbit → hawk

Write down a food chain from Fig. 2.1 which has four stages.

[2]

(d) The oak trees are cut down.

Suggest **two** possible effects this could have on the organisms in the food web.

1

.....

2

..... [2]

(e) Describe how the concentration of carbon dioxide in the atmosphere may change as the result of the oak trees being cleared from the woodland.

Explain why this happens.

.....

.....

..... [2]

- 3 Fig. 3.1 shows a small torch (flashlight). The torch contains cells (batteries), a lamp and a switch.

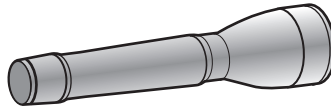


Fig. 3.1

- (a) Draw a circuit diagram for the torch using standard circuit symbols.

[2]

- (b) Fig. 3.2 shows a cell and lamp taken from the torch.



Fig. 3.2

- (i) State how many cells are needed to light up this lamp. Give a reason for your answer.

number of cells needed

reason

[1]

- (ii) State what is meant by the quantity 1.2 A on the lamp.

.....

..... [1]

(c) After a long time in use with the same cells, the torch lamp becomes less bright.

A student says that this is because the cell is running out of energy.

Draw a circuit, including an ammeter and a voltmeter, that could be used to test this.

[2]

- 4 (a) Petroleum (crude oil) is a fossil fuel consisting of a mixture of different hydrocarbons.

Fig. 4.1 shows the industrial apparatus used to separate useful products from petroleum.

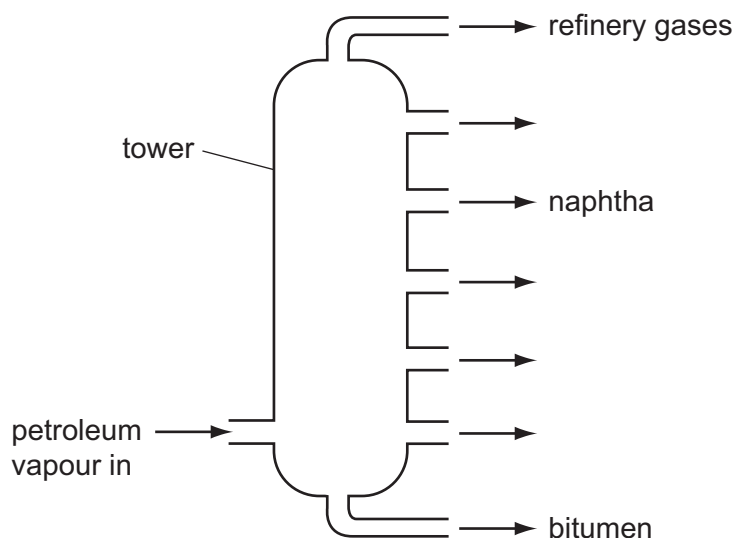


Fig. 4.1

Petroleum is vaporised and passed up a tower. Useful products from petroleum condense at different positions in the tower.

- (i) State the name of the process shown in Fig. 4.1.

..... [1]

- (ii) Different products from this process have different boiling point ranges.

State how the boiling point of a product affects the position in the tower where a product will condense.

.....
 [1]

- (iii) Three of the useful products obtained from petroleum are shown in Fig. 4.1.

State the name of **another** useful product that is separated from petroleum.

State **one** use of this product.

name of product

use

..... [2]

- (b) Table 4.1 contains some information about gases in the Earth's atmosphere.

Table 4.1

gases in the Earth's atmosphere	percentage
carbon dioxide	very small
nitrogen	
oxygen	
other gases	about 1%
water vapour	variable

Complete Table 4.1 to show the percentages of nitrogen and oxygen in the atmosphere. [2]

- (c) Natural gas is a fossil fuel consisting mostly of methane. It is used as a fuel to heat a greenhouse for growing vegetables.

- (i) Describe the changes to the atmosphere in a greenhouse that will occur.

.....

 [2]

- (ii) Burning methane is an exothermic chemical change.

State the meaning of

exothermic,

.....

chemical change.

.....

[2]

- 5 (a) A boy looks at himself in a mirror and waves his hand. Fig. 5.1 shows what he sees in the mirror.

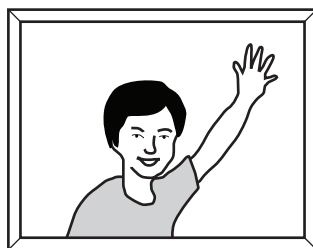


Fig. 5.1

Which hand is he waving?

Explain your answer.

.....
 [1]

- (b) The boy uses headphones to listen to the radio.

- (i) State the useful energy transformation that occurs in his headphones.

from energy to energy [1]

- (ii) The radio emits sounds with frequencies between 100 Hz and 10 000 Hz.

Explain why the boy is able to hear all the sounds emitted through the headphones. The boy has normal hearing.

.....
 [1]

- (c) The boy swims in an outdoor swimming pool. He swims one length of the 25 metre long pool in 40 seconds.

- (i) Calculate his speed.

State the formula you use, show your working and state the units of your answer.

formula

working

speed = ... units [3]

- (ii) Fig. 5.2 shows two forces, the driving force and the frictional force, acting on the boy as he swims.



Fig. 5.2

The boy exerts a driving force of 100 N and swims at a constant speed.

Deduce the value of the frictional force and explain your reasoning.

The frictional force is N

because

..... [1]

Fig. 5.3 shows waves created by a wind blowing at constant speed across the water in the pool.

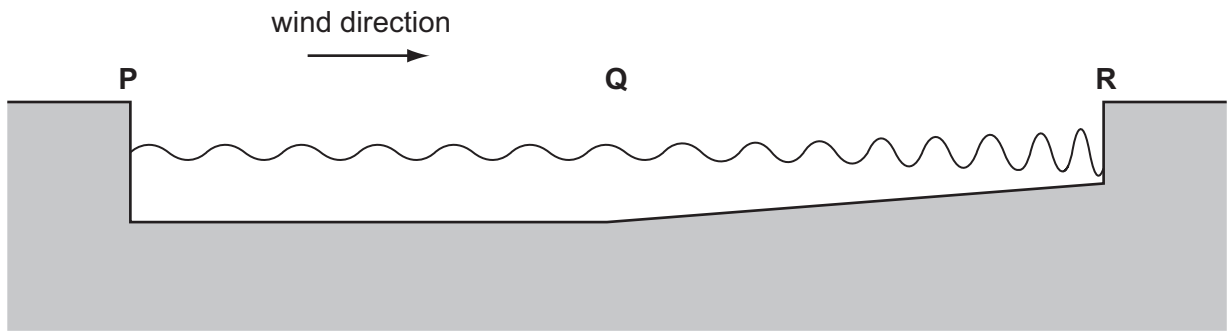


Fig. 5.3

- (iii) On Fig. 5.3, mark clearly and label **one** complete wavelength of the wave motion between **P** and **Q**. [1]
- (iv) As the water in the pool gets shallower between **Q** and **R**, the wavelength becomes shorter.

Use Fig. 5.3 to state **one** property of the wave motion that **increases** between **Q** and **R**.

..... [1]

- (d) The boy switches on a television set using a remote control.

Fig. 5.4 shows some of the parts of the electromagnetic spectrum.

In the correct blank box on Fig. 5.4, write the name of the part of the spectrum used by the remote control.

	X-rays		visible light		microwaves	
--	--------	--	---------------	--	------------	--

Fig. 5.4

[2]

Please turn over for Question 6.

6 Fig. 6.1 shows part of the human life cycle. The cells are not drawn to scale.

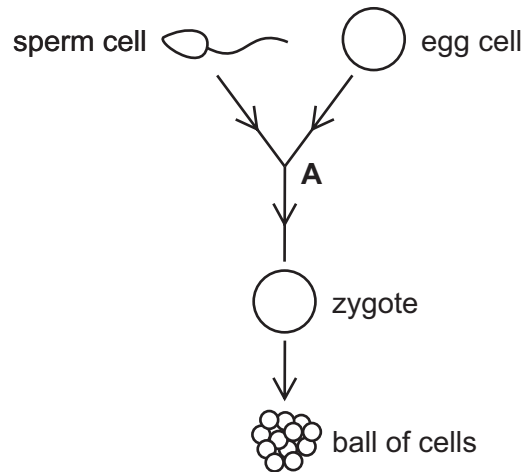


Fig. 6.1

(a) From Fig. 6.1

(i) name a diploid cell, ... [1]

(ii) State the term to describe what happens at **A**.

..... [1]

(b) Cell division of the zygote produces a ball of cells.

Describe in detail where in the female reproductive system this ball of cells is positioned for the next stage of development.

.....
 [2]

(c) Table 6.1 summarises some of the nutrients contained in 100g of milk.

Table 6.1

nutrient	mass in milk sample
protein	1.2 g
fat	3.8 g
carbohydrate	7.6 g
vitamin C	3.9 mg
calcium	33.0 mg

Name **one** vitamin, present in milk but not included in Table 6.1, which is essential for healthy growth of the baby and describe the function of this vitamin in the body.

vitamin

.....

function [2]

(d) Energy is released from milk by respiration.

1 g of fat releases 37 kJ of energy.

Use the information about milk in Table 6.1 to calculate how much energy can be released from the fat in the 100g sample of milk.

Show your working.

energy = ... kJ [2]

- 7 (a) Table 7.1 shows some of the properties of the halogens in Group VII of the Periodic Table.

Table 7.1

period	halogen	colour	physical state at room temperature
3	chlorine	pale yellow-green	gas
4	bromine	dark red-brown	liquid
5	iodine	blue-black	solid

Describe **one** trend in the physical properties of chlorine, bromine and iodine.

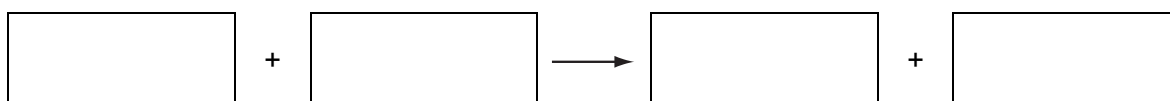
.....
 [1]

- (b) (i) A dilute solution of chlorine is added to a colourless solution of potassium bromide.

Describe what is seen.

..... [1]

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



[2]

- (c) Fig. 7.1 shows the arrangement of the outer electrons of the atoms in a chlorine molecule, Cl_2 .

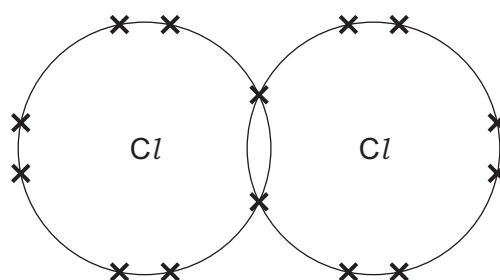


Fig. 7.1

State the name of this type of bonding. [1]

(d) Chlorine is used in the purification of the public water supply.

Explain why chlorine is added to water supplied to homes.

.....

.....

..... [2]

- 8 Fig. 8.1 shows a simple type of air conditioner called a 'swamp cooler' that is used in buildings in dry desert places.

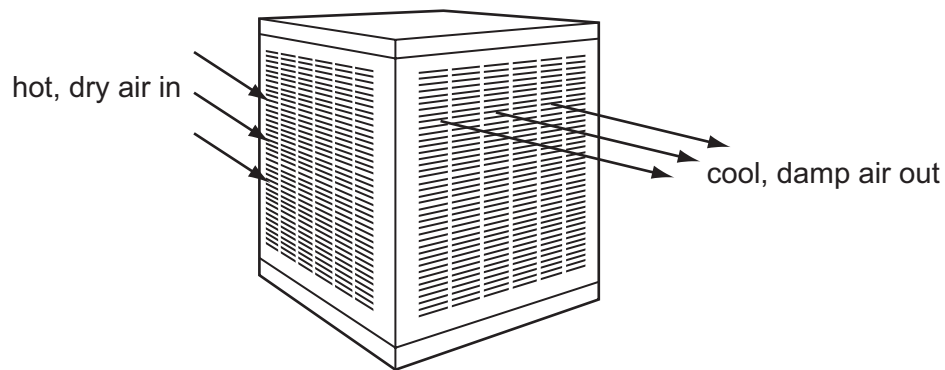


Fig. 8.1

Hot dry air is blown by a fan over the surface of water in a metal container. The hot dry air evaporates some of the water. The air coming out of the swamp cooler is cool and damp.

- (a) The boxes in Fig. 8.2 show different ways in which atoms and molecules may be arranged in different situations.

Three materials found in the swamp cooler are air, metal and water.

Draw lines from the materials in the left column to the correct arrangement of atoms or molecules for each material in the right column. One has been done for you.

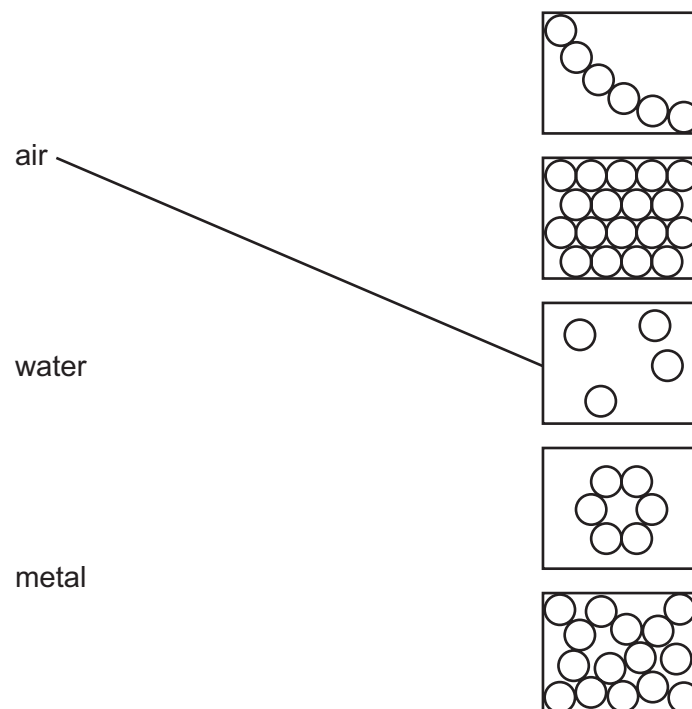


Fig. 8.2

[2]

- (b) (i) Explain, referring to molecules of water, why evaporation of water cools the remaining water.

.....

.....

..... [2]

- (ii) Describe how the water cools the hot air.

.....

..... [1]

- (c) In buildings in hot desert countries, where days are hot and nights can be very cold, windows with steel frames are often used.

Fig. 8.3 shows how a space is left between the steel frame and the mudbricks of the surrounding wall.

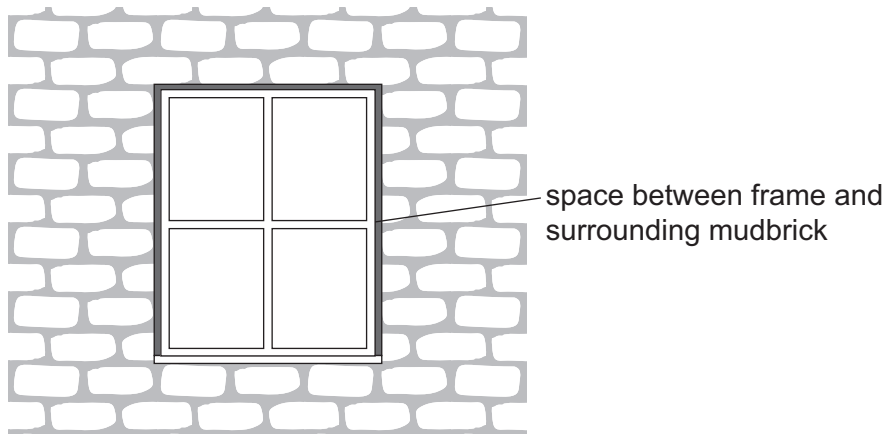


Fig. 8.3

Explain why it is necessary to leave this space between the window frame and the mudbricks.

.....

..... [1]

(d) A mudbrick is 30 cm long, 15 cm wide and 10 cm thick, and has a mass of 7 500 g.

(i) Calculate the volume of the mudbrick in cubic centimetres.

..... cm³ [1]

(ii) Calculate the density of the mudbrick in g/cm³.

State the formula that you use and show your working.

formula:

working

density = ... g/cm³ [2]

Please turn over for Question 9.

- 9 (a) Table 9.1 shows diagrams of two blood cells.

Complete Table 9.1 to show the names and functions of these cells.

[4]

Table 9.1

diagram	name of cell	function of cell
		
		

- (b) Fig. 9.1 is a flowchart to show the circulation of blood in the body.

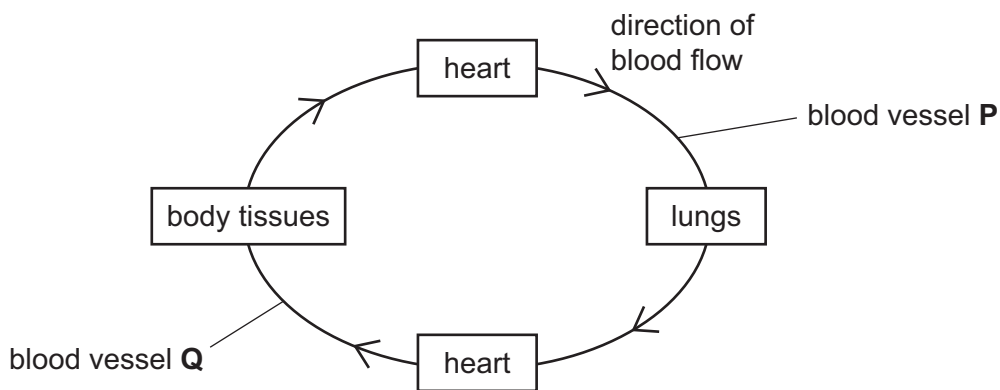


Fig. 9.1

Complete the paragraph using words or phrases from the list.

You may use each word or phrase once, more than once, or not at all.

aorta **body** **left** **lungs**
pulmonary artery **pulmonary vein** **right** **valves**

Blood leaves the ventricle of the heart to go through blood vessel **P**, which is the It then goes to the lungs. There are in the heart to make sure there is a one-way flow of blood.

[3]

- (c) The composition of blood changes as it flows through the tissues of the small intestine.

State

- (i) **one** substance that **leaves** the blood as it flows through the tissues of the small intestine,

..... [1]

- (ii) **two** substances that **enter** the blood as it flows through the tissues of the small intestine.

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

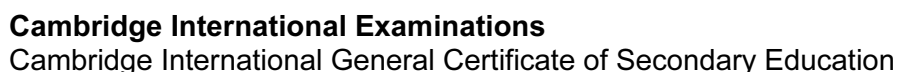
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The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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0653/22

May/June 2014

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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A copy of the Periodic Table is printed on page 28.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **26** printed pages and **2** blank pages.

- 1 (a) In many countries, vehicle speeds are measured by speed cameras to see if they are exceeding the speed limit. The camera takes two photographs of a vehicle after it passes the camera.

Fig. 1.1 shows a moving van about to pass a speed camera.

The van drives over lines painted on the road at 1 metre intervals.

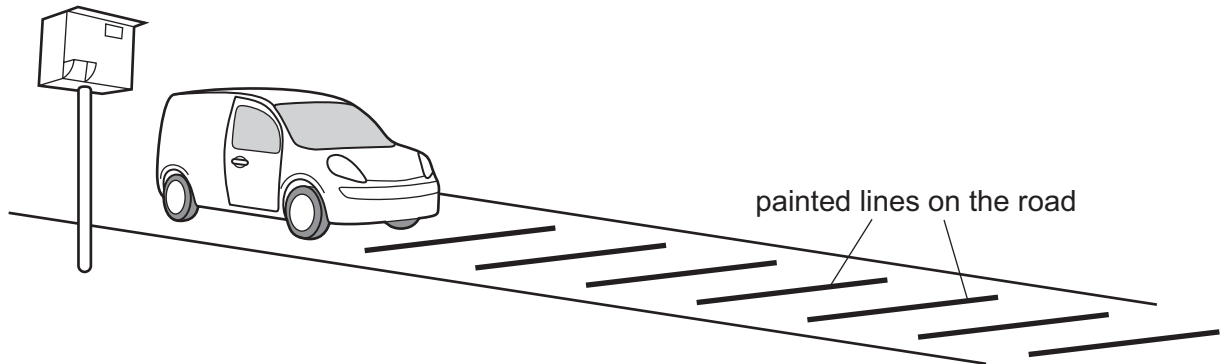


Fig. 1.1

Fig. 1.2 shows the position of the van as the camera takes the first photograph. Fig. 1.3 shows the position of the van 0.2 seconds later, as the camera takes the second photograph.

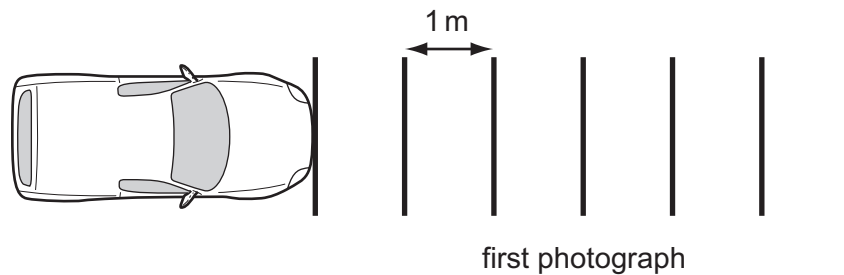


Fig. 1.2

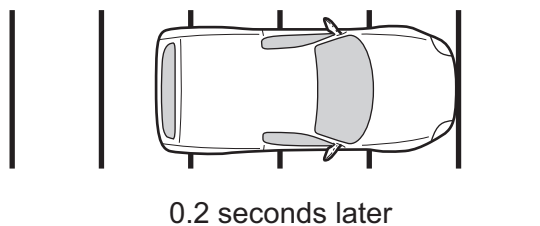


Fig. 1.3

- (i) State the distance travelled by the van between the first and second photograph.

..... m [1]

- (ii) Show, by calculation, that the speed of the van is 25 m/s.

State the formula that you use and show your working.

formula

working

[2]

- (iii) The speed limit on this road is 80 km/h.

Show, by calculation, that the van is breaking the speed limit when its speed is 25 m/s.

There are 3600 seconds in 1 hour.

Show your working.

the speed of the van = ... km/h [2]

- (b) The van enters a town where the speed limit is 50 km/h. The driver applies the brakes to slow down.
- (i) Complete Fig. 1.4 by drawing **two** arrows to show the forces acting to slow down the van. Label each arrow to show the name of the force acting.

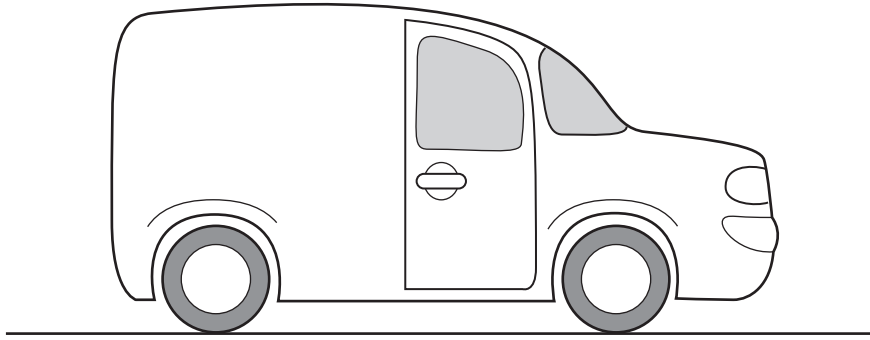


Fig. 1.4

[2]

- (ii) When the van slows down, it loses kinetic energy.

State what happens to most of the kinetic energy that is lost.

.....

..... [1]

Please turn over for Question 2.

- 2 Fig. 2.1 shows a water lily. The leaves of the water lily float on the surface of water.

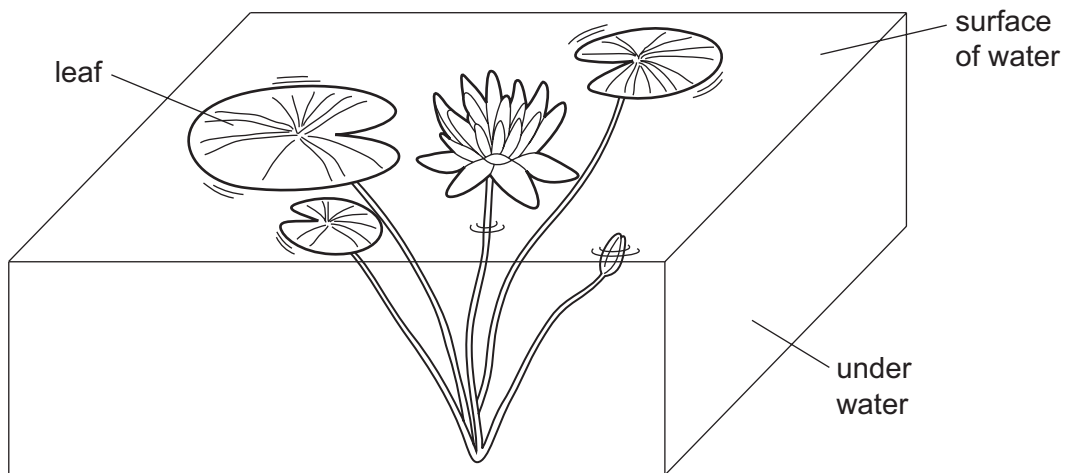


Fig. 2.1

The water lily produces carbohydrates by photosynthesis.

- (a) Complete the following sentence.

In photosynthesis, plants use light energy to produce sugar and
from carbon dioxide and [2]

- (b) Fig. 2.2 shows a cross-section of a small part of a water lily leaf as seen under the light microscope.

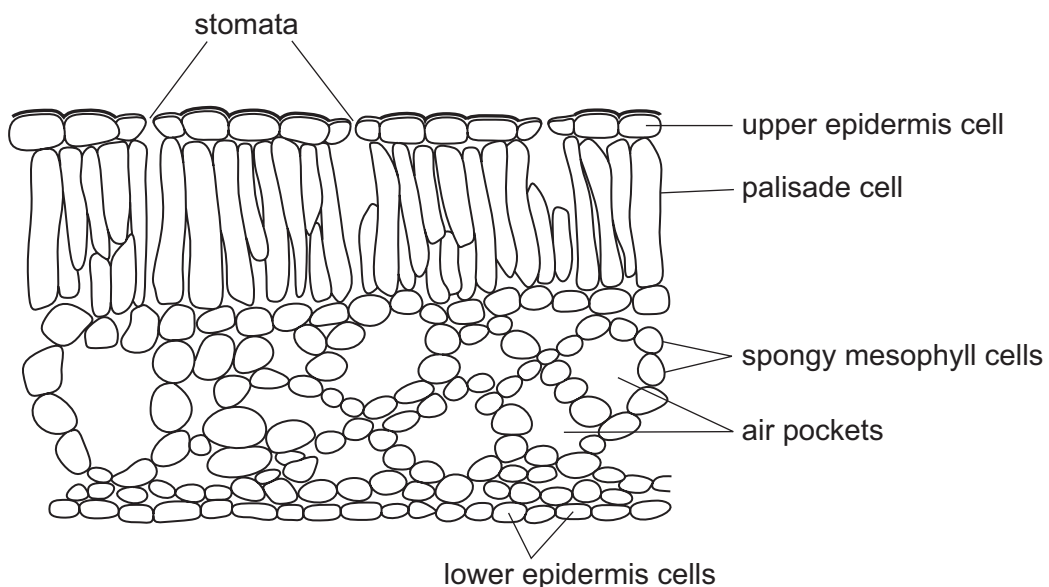


Fig. 2.2

Suggest how the large size of the air pockets in the leaf adapts the water lily to its habitat.

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

- (c) The stomata are found in the **upper** surface of the leaf of the water lily.

Suggest why this is an advantage to the plant.

.....

.....

..... [2]

- (d) The roots of most plants have root hair cells but water lily roots do not.

Suggest why the roots of water lily plants do **not** need root hair cells.

.....

.....

..... [2]

- (e) Some raw sewage is washed into the pond where the water lily is growing.

Explain why this causes the fish in the pond to die.

.....

.....

.....

..... [3]

- 3 (a) Copper slowly corrodes in air, forming a thin black coating of copper oxide. Copper oxide is an insoluble base which can be removed by reacting it with acid. The reaction forms a blue solution.

(i) State the type of compound formed when a base reacts with an acid.

..... [1]

(ii) Suggest an acid which could be used to produce copper chloride from copper oxide.

..... [1]

- (b) A different compound of copper and oxygen exists. It is coloured red and contains twice as many copper atoms as oxygen atoms.

Deduce the chemical formula of red copper oxide. [1]

- (c) The corrosion of iron is called *rusting*.

(i) State the **two** substances which must be present to cause the rusting of iron.

..... and [2]

(ii) Describe a method of rust prevention and explain how it works.

.....
.....
..... [2]

Please turn over for Question 4.

- 4 (a) When muscles contract they use energy released from respiration.

Complete the word equation for aerobic respiration.

glucose + oxygen $\longrightarrow$ + ... [1]

- (b) Oxygen is brought to the muscle cells by the red blood cells. Fig. 4.1 shows a cross-section diagram of a red blood cell.

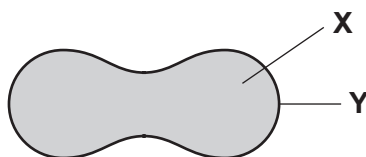


Fig. 4.1

Name the cell parts X and Y.

X

Y [2]

- (c) Starch is a good source of glucose for respiration. It must be digested by enzymes before it can be used.

Explain fully why starch must be digested.

.....

 [3]

- (d) A student does some exercise to find out if there is a relationship between type of exercise and pulse rate.

She measures and records her pulse rate when resting. She performs one type of exercise then immediately measures her pulse rate again. She repeats this procedure for two more types of exercise. Each exercise is performed for the same length of time.

She allows her pulse to return to the resting measurement between each exercise.

Her results are shown in Table 4.1.

Table 4.1

type of exercise	pulse rate / beats per minute
resting	74
walking slowly	87
walking quickly	116
running	163

State which exercise produced the greatest increase in pulse rate and calculate this increase.

type of exercise

increase in pulse rate = ... beats/minute [2]

- (e) Describe the trend shown by the results in Table 4.1.

.....

 [2]

- 5 (a) (i) State **one** difference between the **physical** properties of metals and of non-metals.

.....
 [1]

- (ii) Table 5.1 shows the elements of the third period of the Periodic Table.

Table 5.1

Group								
I	II		III	IV	V	VI	VII	0
Na	Mg		Al	Si	P	S	Cl	Ar

Describe how the metallic character of these elements changes across the period.

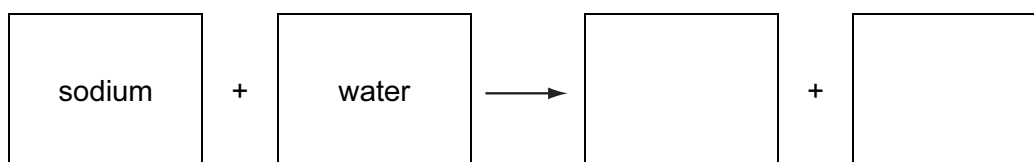
..... [1]

- (b) Table 5.2 shows the properties of some elements in Group I of the Periodic Table.

Table 5.2

name of element	melting point/°C	reaction with water
lithium	181	metal remains solid and a gas is given off
sodium	98	metal melts and a gas is given off quickly
potassium	64	metal melts and the gas given off catches fire

- (i) Complete the **word** equation for the reaction between sodium and water.



[2]

- (ii) Describe the trends in the properties of the Group 1 elements shown in Table 5.2.

.....

 [2]

- (c) When hot sodium is held in a gas jar of chlorine, it burns. Sodium chloride forms on the walls of the jar.

The apparatus used is shown in Fig. 5.1.

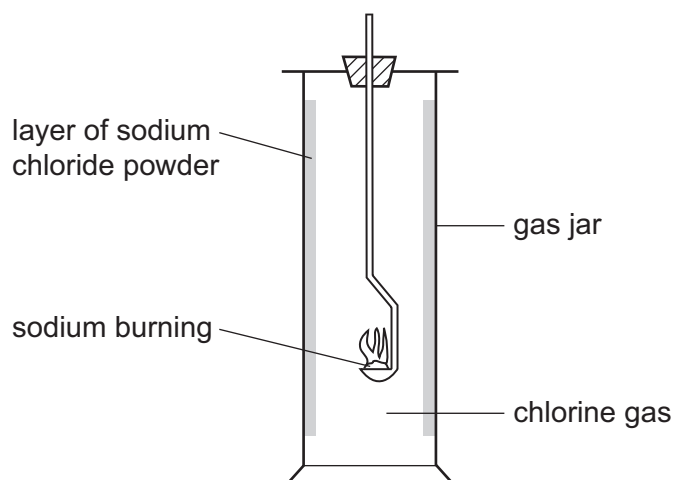


Fig. 5.1

Sodium chloride is an ionic compound made up of sodium ions, Na^+ , and chloride ions, Cl^- .

Describe how these ions are formed when sodium and chlorine atoms react.

.....

.....

..... [2]

- 6 Fig. 6.1 shows a flower that reproduces by insect pollination.

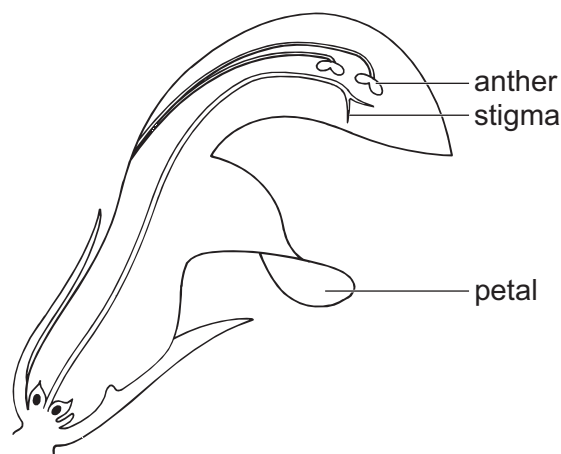


Fig. 6.1

- (a) Complete the paragraph using the words in the list. You may use the words once, more than once, or not at all.

anther colour noise platform
pollen sepal stigma

The of the flower attracts an insect which lands on the provided by the petal. The insect enters the flower to feed from the nectar and at the same time pollen from the sticks to its body. When the insect goes to another flower the is placed on the [5]

- (b) Fig. 6.2 shows a pollen grain from an insect-pollinated flower.

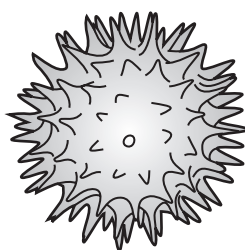


Fig. 6.2

Suggest how the structure of this pollen grain adapts it for insect pollination.

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

Please turn over for Question 7.

- 7 Fig. 7.1 shows a solar-powered lantern. It uses photovoltaic (solar) cells which charge a battery during the day.

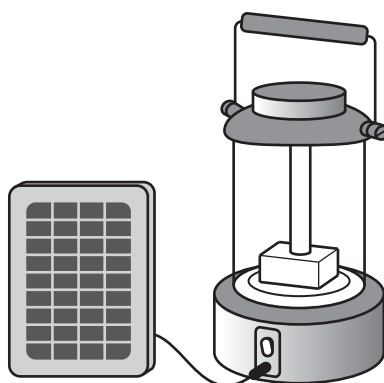


Fig. 7.1

- (a) When the lantern is switched on, the battery supplies a current to the lamp which emits light.

Complete the circuit diagram for the circuit within the lantern that connects the battery to the switch and lamp.



[1]

- (b) A larger model of the solar lantern has two lamps. A special switch enables the lamps to be connected to the battery either in series or in parallel.

- (i) The two lamps each have a resistance of 6 ohms when lit.

State the combined resistance of the two lamps when connected in series.

..... ohms [1]

- (ii) The lamps are now connected in parallel instead of in series.

Describe the effect on the current taken from the battery.

..... [1]

- (iii) State **one** advantage of using the lantern with the lamps connected in parallel.

.....
 [1]

- (c) A man keeps a solar lantern ready in case his mains electricity supply fails.

One night all the lights go out in his house, and he uses the lantern to investigate what has gone wrong. Fig. 7.2 shows what he finds:

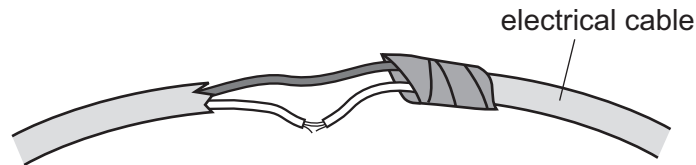


Fig. 7.2

State the hazard you can see in this picture and explain why using this cable could be dangerous.

hazard

explanation

..... [2]

- (d) Fig. 7.3 shows a different electrical hazard.

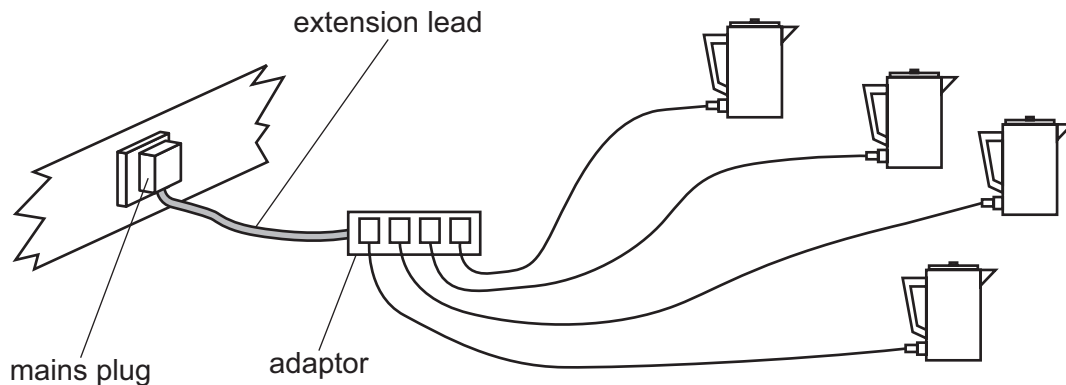


Fig. 7.3

Describe how a fuse in the mains plug can provide protection from the hazard shown.

.....

 [2]

- 8 Excess hydrochloric acid in the stomach can cause discomfort. Medicine containing magnesium carbonate can be used to ease this discomfort.

(a) (i) Describe and explain the effect that magnesium carbonate has on the pH of the contents of the stomach.

.....
.....
..... [2]

(ii) Magnesium carbonate produces a gas when it reacts with hydrochloric acid.

State the name of the gas and describe a test for it in the laboratory.

name

test

..... [3]

- (b) Fig. 8.1 shows that medicine containing magnesium carbonate can be supplied as a tablet in different sizes.



Fig. 8.1

Two students investigate the effect of tablet size on the rate of the chemical reaction between magnesium carbonate and dilute hydrochloric acid.

The total volume of gas produced is measured at one minute intervals from the start of the reaction. Readings are taken for a total of 10 minutes.

One student uses one 1 g tablet. The other student uses two 0.5 g tablets.

Fig. 8.2 shows some of the apparatus used.

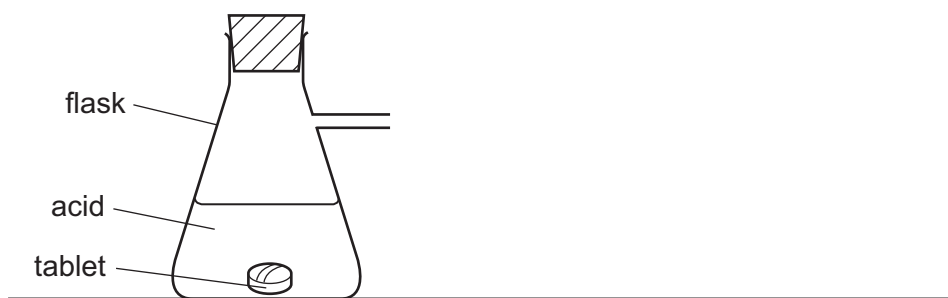


Fig. 8.2

Fig. 8.3 shows **some** of the other apparatus that is available.



Fig. 8.3

Complete the diagram of the apparatus in Fig. 8.2 to suggest how the volume of gas produced is measured. You may wish to include some of the apparatus in Fig. 8.3.

[2]

- (c) The graph in Fig. 8.4 shows the results obtained by the student who uses one 1 g tablet of magnesium carbonate.

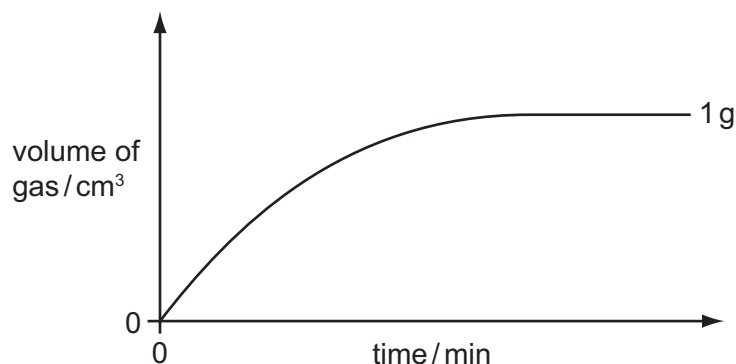


Fig. 8.4

- (i) Using the axes in Fig. 8.4, sketch a graph to predict the results obtained by the student who uses two 0.5 g tablets. [1]

Fig. 8.5 shows the label on the bottle of the medicine containing magnesium carbonate.

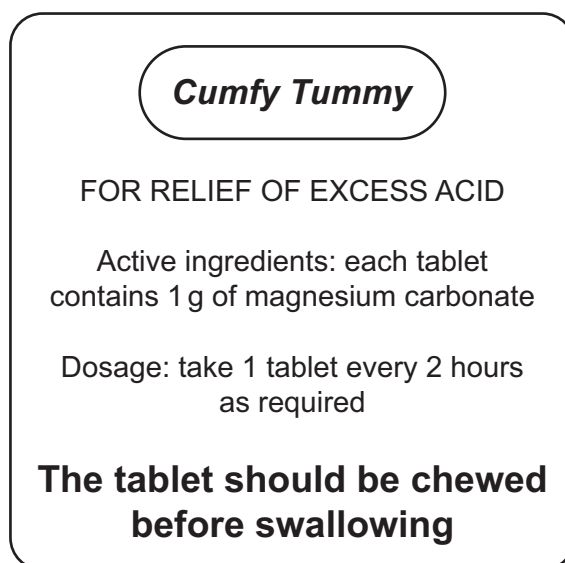


Fig. 8.5

- (ii) Explain why the tablet should be chewed before swallowing.

.....

.....

..... [2]

- (iii) Each student uses the same mass of medicine containing magnesium carbonate and the same volume of hydrochloric acid solution for his or her experiment.

The acid used in both experiments is at the same temperature before the reactants are mixed.

State what else must be kept the same in both experiments to ensure that this investigation is a fair test. Give a reason for your answer.

.....

.....

..... [2]

- 9 Many modern houses in colder countries are designed to conserve energy.



- (a) Heat is lost from a house in many ways, through walls, doors, windows, roof and floor.

- (i) State the main way by which heat is lost through solid walls.

..... [1]

- (ii) Fig. 9.1 shows how the outside walls of the house are constructed. The 5 cm air gap between bricks and concrete building blocks has been filled with sheets of expanded polystyrene.

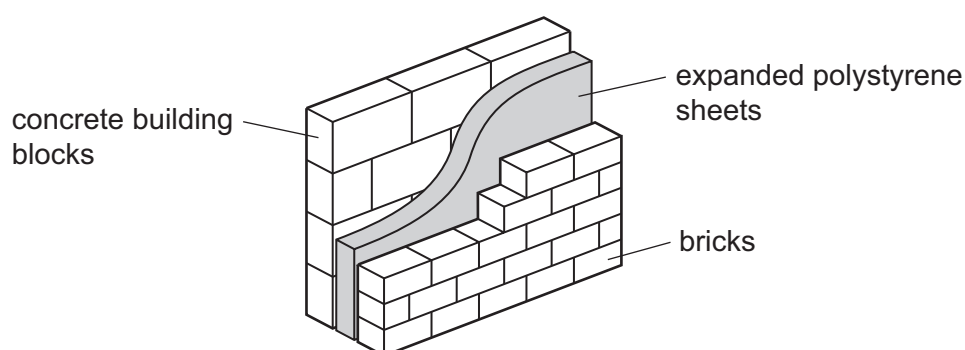


Fig. 9.1

Suggest why expanded polystyrene sheets are placed between bricks and concrete building blocks.

.....

 [2]

- (b) Fig. 9.2 shows graphs of the temperatures inside and outside the house over a 24 hour period.

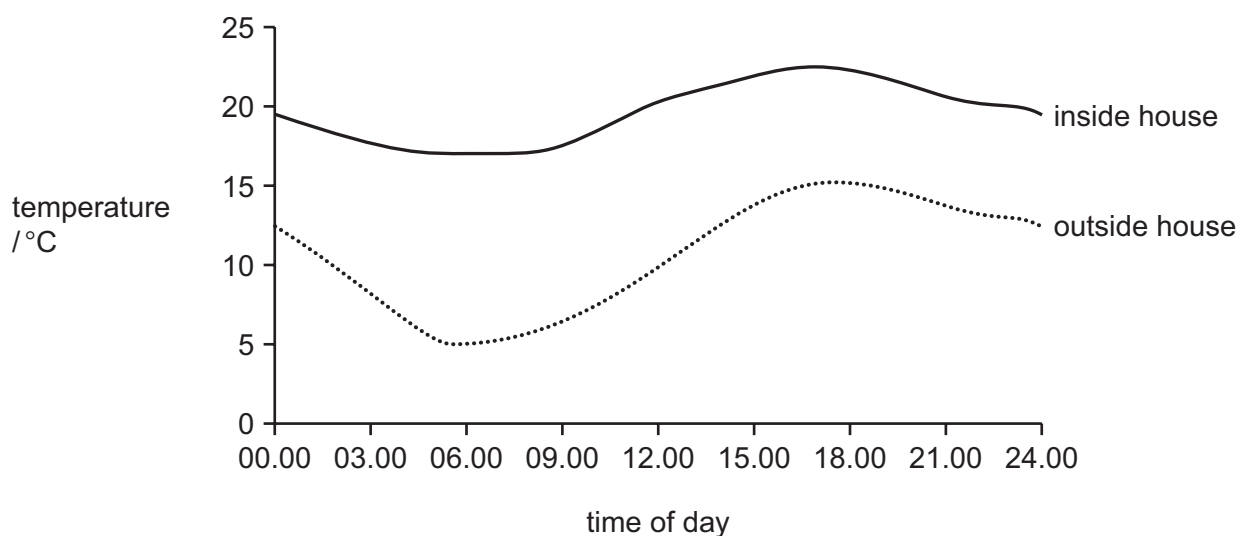


Fig. 9.2

More heat is lost when the difference in temperature between inside and outside the house is greater.

State the time of day at which heat loss from the house is greatest.

..... [1]

- (c) On a hot summer day, the Sun warms the house and the temperature inside the house reaches 30°C.

- (i) The people inside the house open the windows to cool the house.

State the main process by which heat is now lost from the house.

..... [1]

- (ii) The Sun heats the house by electromagnetic radiation.

Fig. 9.3 shows the electromagnetic spectrum.

In the correct blank box on Fig. 9.3, write a label to name the part of the spectrum that causes the Sun to heat the house.

	X-rays		visible light		microwaves	
--	--------	--	---------------	--	------------	--

Fig. 9.3

[2]

- (d) Electricity for the house is partly supplied by a row of solar panels.

Fig. 9.4 shows the solar panels facing the Sun. In front of the solar panels is a metal mirror.

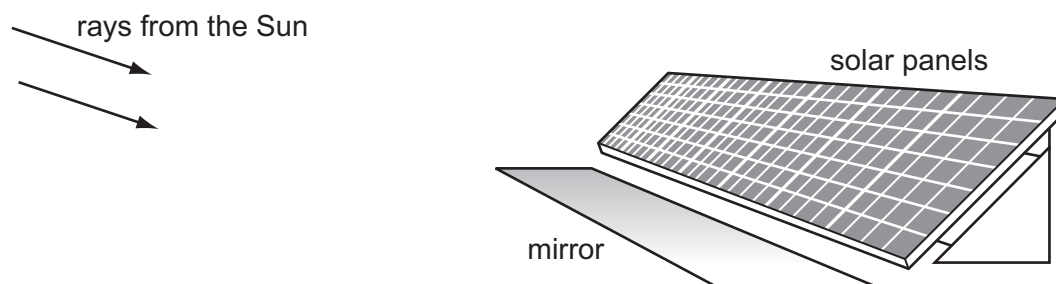


Fig. 9.4

Complete the diagram in Fig. 9.5 to show how the mirror increases the amount of the Sun's rays reaching the solar panels when the Sun is setting.

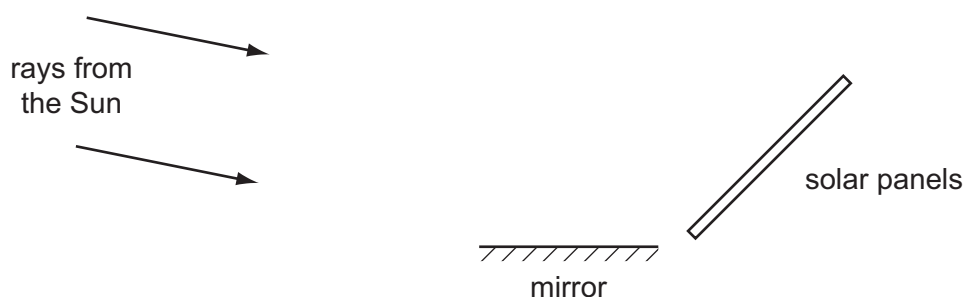


Fig. 9.5

[2]

- (e) The electrical output from the solar panels is called *direct current* and is similar to the current from a battery. For use in the house it has to be converted to a type of current called *alternating current*.

Fig. 9.6 is a graph of current against time for the alternating current supplied to the house. The graph shows a wave form.

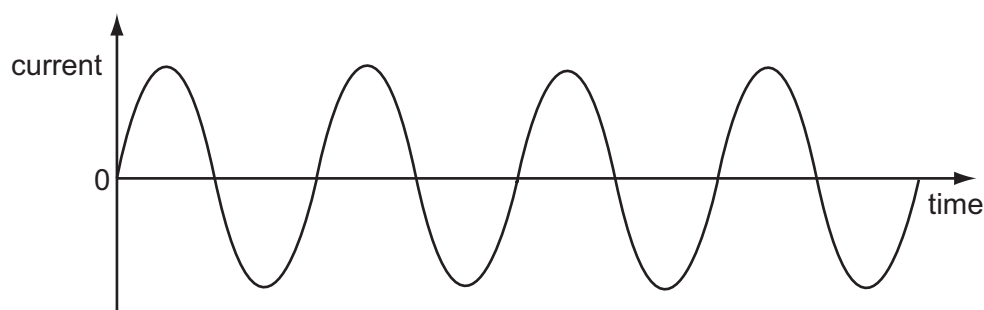


Fig. 9.6

- (i) On Fig. 9.6 mark and label one complete wave.

[1]

- (ii) The wave which represents alternating current has a frequency of 50 Hz.

Explain the meaning of the term *frequency of 50 Hz*.

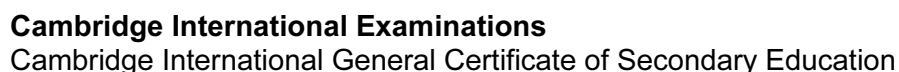
.....
..... [1]

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The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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0653/23

May/June 2014

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **24** printed pages.

- 1 (a) Fig. 1.1 shows an experiment to compare how three metals react with dilute hydrochloric acid.

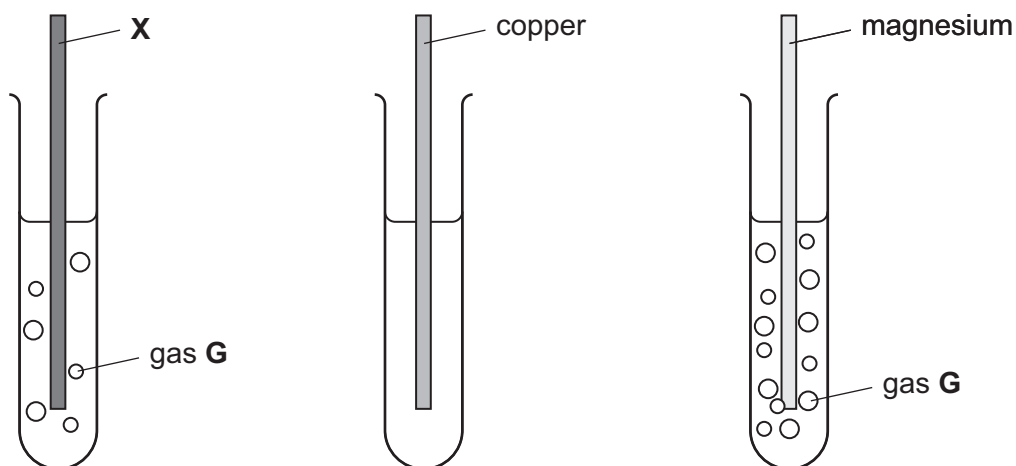


Fig. 1.1

In two of the test-tubes, bubbles of a gas **G** are produced. Gas **G** is an element.

- (i) State the name of gas **G**. [1]
- (ii) Describe a test for gas **G**.
 test
 result
 [2]
- (iii) List the four elements **X**, copper, magnesium and **G** in order of reactivity.
 most reactive

 least reactive [2]
- (iv) Suggest the identity of metal **X**. [1]

- (b) Fig. 1.2 shows how a teacher could use a Bunsen burner to heat a mixture of carbon and copper oxide until it starts to glow.

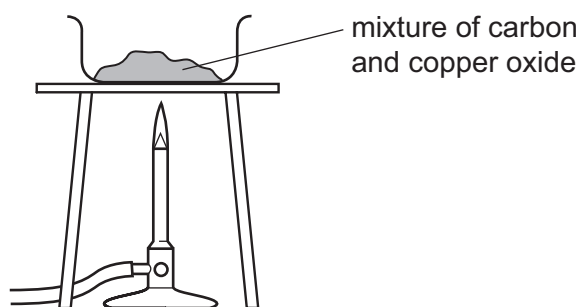


Fig. 1.2

The mixture glows even more brightly for some time after the burner is removed.

Carbon has reduced copper oxide to copper.

- (i) State what is meant by the term *reduced*.

.....
 [1]

- (ii) Name the other product that is formed in this reaction.

..... [1]

- (c) Lead can be produced from molten lead bromide using electrolysis, as shown in Fig. 1.3.

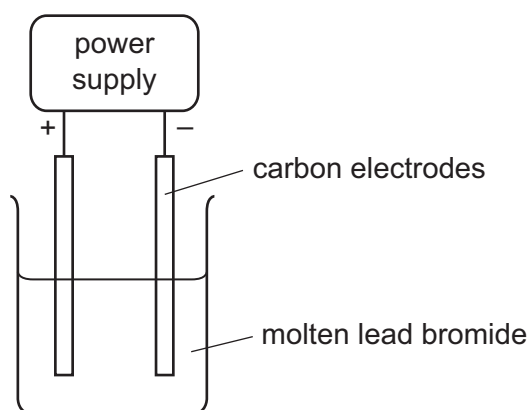


Fig. 1.3

- (i) Mark, with the letter **P** and a label line, the position on the diagram where lead first appears after the circuit is connected. [1]

- (ii) Name the other element that is formed during the electrolysis.

..... [1]

2 Fig. 2.1 shows a food web of the organisms in a woodland containing oak trees.

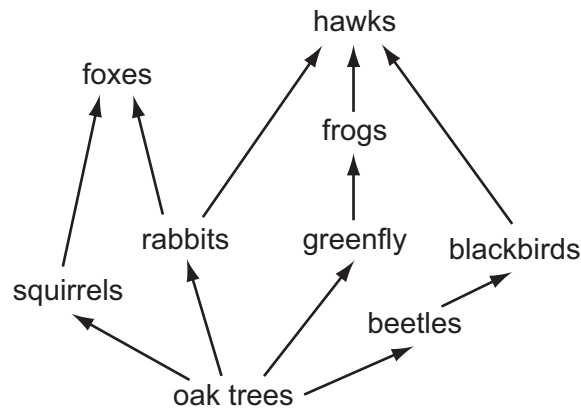


Fig. 2.1

(a) State the source of energy for this food web.

..... [1]

(b) From the food web, name

(i) **one** producer,

..... [1]

(ii) **one** herbivore.

..... [1]

(c) The food web is a network of interconnected food chains.

One food chain in Fig. 2.1 with three stages is shown.

oak tree → rabbit → hawk

Write down a food chain from Fig. 2.1 which has four stages.

[2]

(d) The oak trees are cut down.

Suggest **two** possible effects this could have on the organisms in the food web.

1

.....

2

..... [2]

(e) Describe how the concentration of carbon dioxide in the atmosphere may change as the result of the oak trees being cleared from the woodland.

Explain why this happens.

.....

.....

..... [2]

- 3 Fig. 3.1 shows a small torch (flashlight). The torch contains cells (batteries), a lamp and a switch.

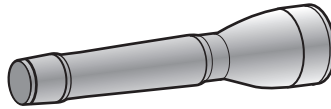


Fig. 3.1

- (a) Draw a circuit diagram for the torch using standard circuit symbols.

[2]

- (b) Fig. 3.2 shows a cell and lamp taken from the torch.



Fig. 3.2

- (i) State how many cells are needed to light up this lamp. Give a reason for your answer.

number of cells needed

reason

[1]

- (ii) State what is meant by the quantity 1.2 A on the lamp.

.....

..... [1]

(c) After a long time in use with the same cells, the torch lamp becomes less bright.

A student says that this is because the cell is running out of energy.

Draw a circuit, including an ammeter and a voltmeter, that could be used to test this.

[2]

- 4 (a) Petroleum (crude oil) is a fossil fuel consisting of a mixture of different hydrocarbons.

Fig. 4.1 shows the industrial apparatus used to separate useful products from petroleum.

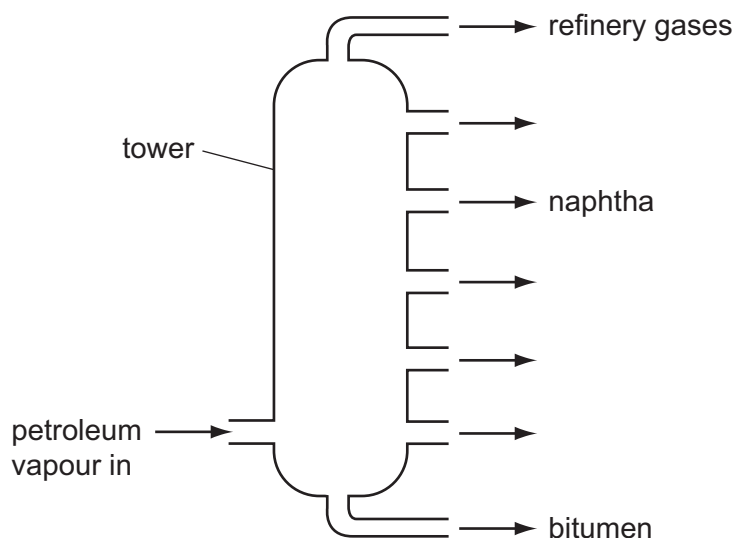


Fig. 4.1

Petroleum is vaporised and passed up a tower. Useful products from petroleum condense at different positions in the tower.

- (i) State the name of the process shown in Fig. 4.1.

..... [1]

- (ii) Different products from this process have different boiling point ranges.

State how the boiling point of a product affects the position in the tower where a product will condense.

.....
 [1]

- (iii) Three of the useful products obtained from petroleum are shown in Fig. 4.1.

State the name of **another** useful product that is separated from petroleum.

State **one** use of this product.

name of product

use

..... [2]

(b) Table 4.1 contains some information about gases in the Earth's atmosphere.

Table 4.1

gases in the Earth's atmosphere	percentage
carbon dioxide	very small
nitrogen	
oxygen	
other gases	about 1%
water vapour	variable

Complete Table 4.1 to show the percentages of nitrogen and oxygen in the atmosphere. [2]

(c) Natural gas is a fossil fuel consisting mostly of methane. It is used as a fuel to heat a greenhouse for growing vegetables.

(i) Describe the changes to the atmosphere in a greenhouse that will occur.

.....

.....

..... [2]

(ii) Burning methane is an exothermic chemical change.

State the meaning of

exothermic,

.....

.....

chemical change.

.....

.....

[2]

- 5 (a) A boy looks at himself in a mirror and waves his hand. Fig. 5.1 shows what he sees in the mirror.

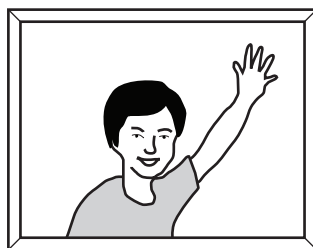


Fig. 5.1

Which hand is he waving?

Explain your answer.

.....
 [1]

- (b) The boy uses headphones to listen to the radio.

- (i) State the useful energy transformation that occurs in his headphones.

from energy to energy [1]

- (ii) The radio emits sounds with frequencies between 100 Hz and 10 000 Hz.

Explain why the boy is able to hear all the sounds emitted through the headphones. The boy has normal hearing.

.....
 [1]

- (c) The boy swims in an outdoor swimming pool. He swims one length of the 25 metre long pool in 40 seconds.

- (i) Calculate his speed.

State the formula you use, show your working and state the units of your answer.

formula

working

speed = ... units [3]

- (ii) Fig. 5.2 shows two forces, the driving force and the frictional force, acting on the boy as he swims.



Fig. 5.2

The boy exerts a driving force of 100 N and swims at a constant speed.

Deduce the value of the frictional force and explain your reasoning.

The frictional force is N

because

..... [1]

Fig. 5.3 shows waves created by a wind blowing at constant speed across the water in the pool.

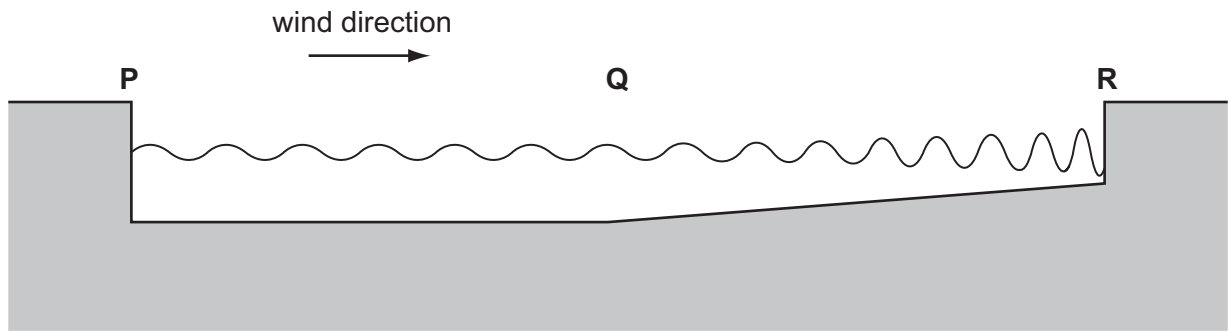


Fig. 5.3

- (iii) On Fig. 5.3, mark clearly and label **one** complete wavelength of the wave motion between **P** and **Q**. [1]
- (iv) As the water in the pool gets shallower between **Q** and **R**, the wavelength becomes shorter.

Use Fig. 5.3 to state **one** property of the wave motion that **increases** between **Q** and **R**.

..... [1]

- (d) The boy switches on a television set using a remote control.

Fig. 5.4 shows some of the parts of the electromagnetic spectrum.

In the correct blank box on Fig. 5.4, write the name of the part of the spectrum used by the remote control.

	X-rays		visible light		microwaves	
--	--------	--	---------------	--	------------	--

Fig. 5.4

[2]

Please turn over for Question 6.

6 Fig. 6.1 shows part of the human life cycle. The cells are not drawn to scale.

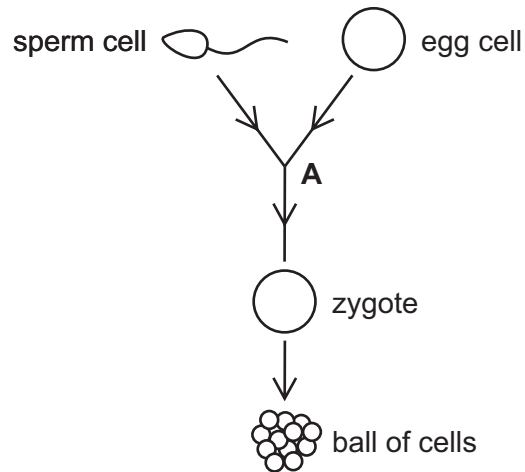


Fig. 6.1

(a) From Fig. 6.1

(i) name a diploid cell, ... [1]

(ii) State the term to describe what happens at **A**.

..... [1]

(b) Cell division of the zygote produces a ball of cells.

Describe in detail where in the female reproductive system this ball of cells is positioned for the next stage of development.

.....
 [2]

(c) Table 6.1 summarises some of the nutrients contained in 100g of milk.

Table 6.1

nutrient	mass in milk sample
protein	1.2 g
fat	3.8 g
carbohydrate	7.6 g
vitamin C	3.9 mg
calcium	33.0 mg

Name **one** vitamin, present in milk but not included in Table 6.1, which is essential for healthy growth of the baby and describe the function of this vitamin in the body.

vitamin

.....

function [2]

(d) Energy is released from milk by respiration.

1 g of fat releases 37 kJ of energy.

Use the information about milk in Table 6.1 to calculate how much energy can be released from the fat in the 100g sample of milk.

Show your working.

energy = ... kJ [2]

- 7 (a) Table 7.1 shows some of the properties of the halogens in Group VII of the Periodic Table.

Table 7.1

period	halogen	colour	physical state at room temperature
3	chlorine	pale yellow-green	gas
4	bromine	dark red-brown	liquid
5	iodine	blue-black	solid

Describe **one** trend in the physical properties of chlorine, bromine and iodine.

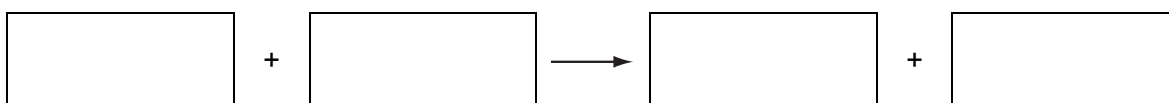
.....
 [1]

- (b) (i) A dilute solution of chlorine is added to a colourless solution of potassium bromide.

Describe what is seen.

..... [1]

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



[2]

- (c) Fig. 7.1 shows the arrangement of the outer electrons of the atoms in a chlorine molecule, Cl_2 .

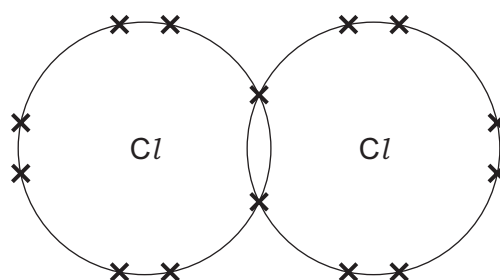


Fig. 7.1

State the name of this type of bonding. [1]

(d) Chlorine is used in the purification of the public water supply.

Explain why chlorine is added to water supplied to homes.

.....

.....

..... [2]

- 8 Fig. 8.1 shows a simple type of air conditioner called a 'swamp cooler' that is used in buildings in dry desert places.

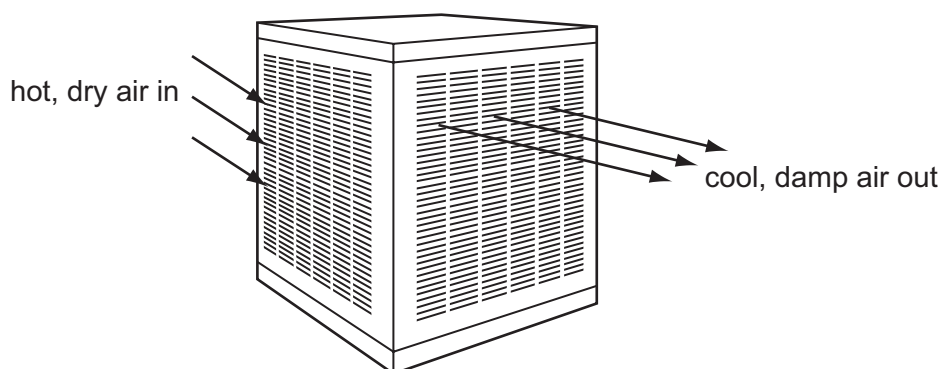


Fig. 8.1

Hot dry air is blown by a fan over the surface of water in a metal container. The hot dry air evaporates some of the water. The air coming out of the swamp cooler is cool and damp.

- (a) The boxes in Fig. 8.2 show different ways in which atoms and molecules may be arranged in different situations.

Three materials found in the swamp cooler are air, metal and water.

Draw lines from the materials in the left column to the correct arrangement of atoms or molecules for each material in the right column. One has been done for you.

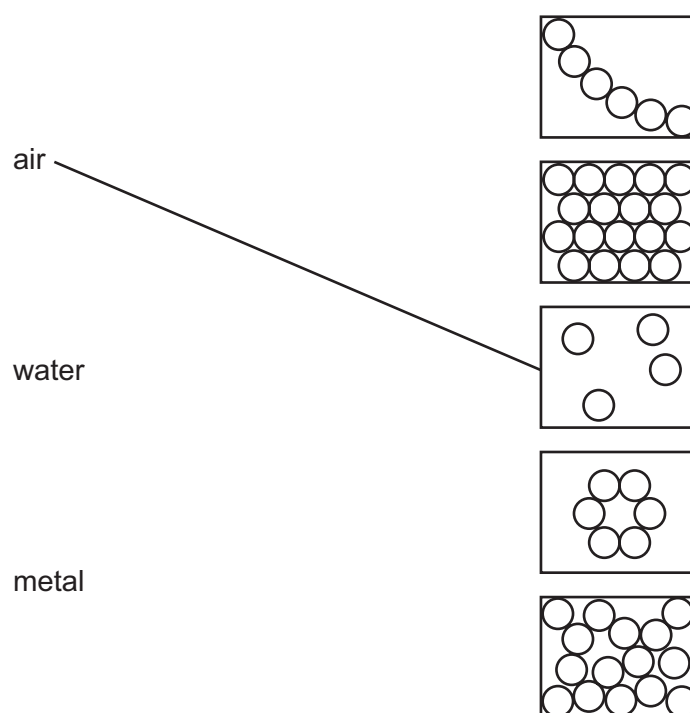


Fig. 8.2

[2]

- (b) (i) Explain, referring to molecules of water, why evaporation of water cools the remaining water.

.....

.....

..... [2]

- (ii) Describe how the water cools the hot air.

.....

..... [1]

- (c) In buildings in hot desert countries, where days are hot and nights can be very cold, windows with steel frames are often used.

Fig. 8.3 shows how a space is left between the steel frame and the mudbricks of the surrounding wall.

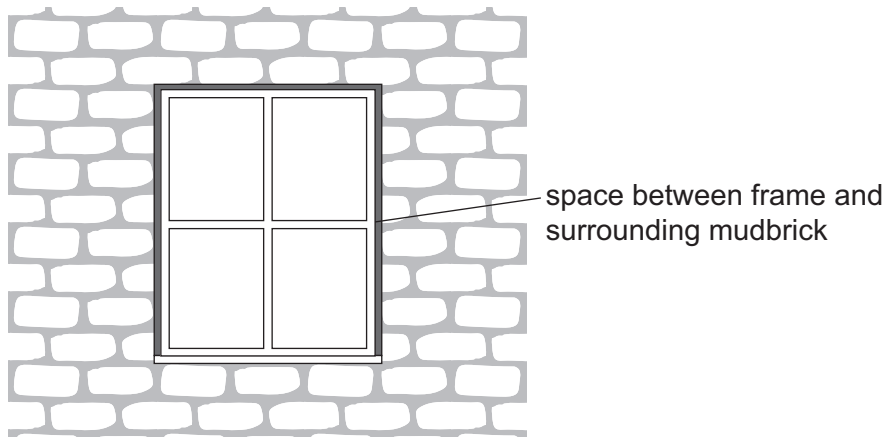


Fig. 8.3

Explain why it is necessary to leave this space between the window frame and the mudbricks.

.....

..... [1]

(d) A mudbrick is 30 cm long, 15 cm wide and 10 cm thick, and has a mass of 7 500 g.

(i) Calculate the volume of the mudbrick in cubic centimetres.

..... cm³ [1]

(ii) Calculate the density of the mudbrick in g/cm³.

State the formula that you use and show your working.

formula:

working

density = ... g/cm³ [2]

Please turn over for Question 9.

- 9 (a) Table 9.1 shows diagrams of two blood cells.

Complete Table 9.1 to show the names and functions of these cells.

[4]

Table 9.1

diagram	name of cell	function of cell
		
		

- (b) Fig. 9.1 is a flowchart to show the circulation of blood in the body.

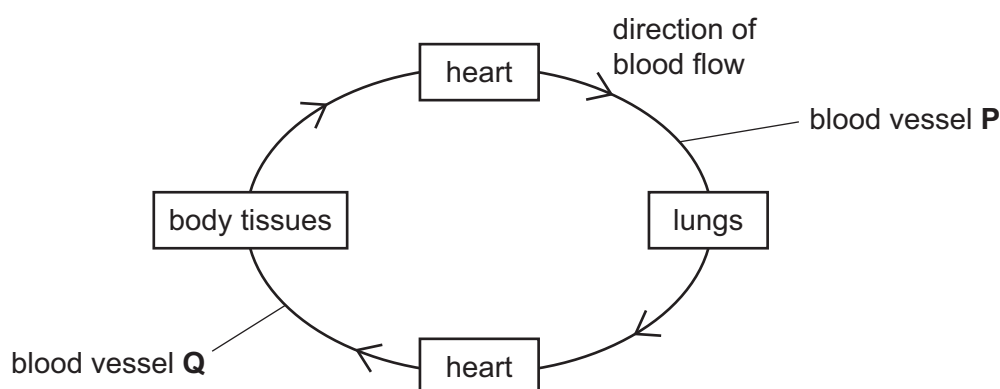


Fig. 9.1

Complete the paragraph using words or phrases from the list.

You may use each word or phrase once, more than once, or not at all.

aorta **body** **left** **lungs**
pulmonary artery **pulmonary vein** **right** **valves**

Blood leaves the ventricle of the heart to go through blood vessel **P**, which is the It then goes to the lungs. There are in the heart to make sure there is a one-way flow of blood.

[3]

- (c) The composition of blood changes as it flows through the tissues of the small intestine.

State

- (i) **one** substance that **leaves** the blood as it flows through the tissues of the small intestine,

..... [1]

- (ii) **two** substances that **enter** the blood as it flows through the tissues of the small intestine.

.....

..... [2]

DATA SHEET

The Periodic Table of the Elements

[illegible]

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).