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0653/31

October/November 2017

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

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

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

This document consists of **21** printed pages and **3** blank pages.

- 1 (a) Use the following words or phrases to complete the flow chart about the transport of oxygen to the tissues of the body.

Each word or phrase may be used once, more than once, or not at all.

aorta

capillaries

muscles

plasma

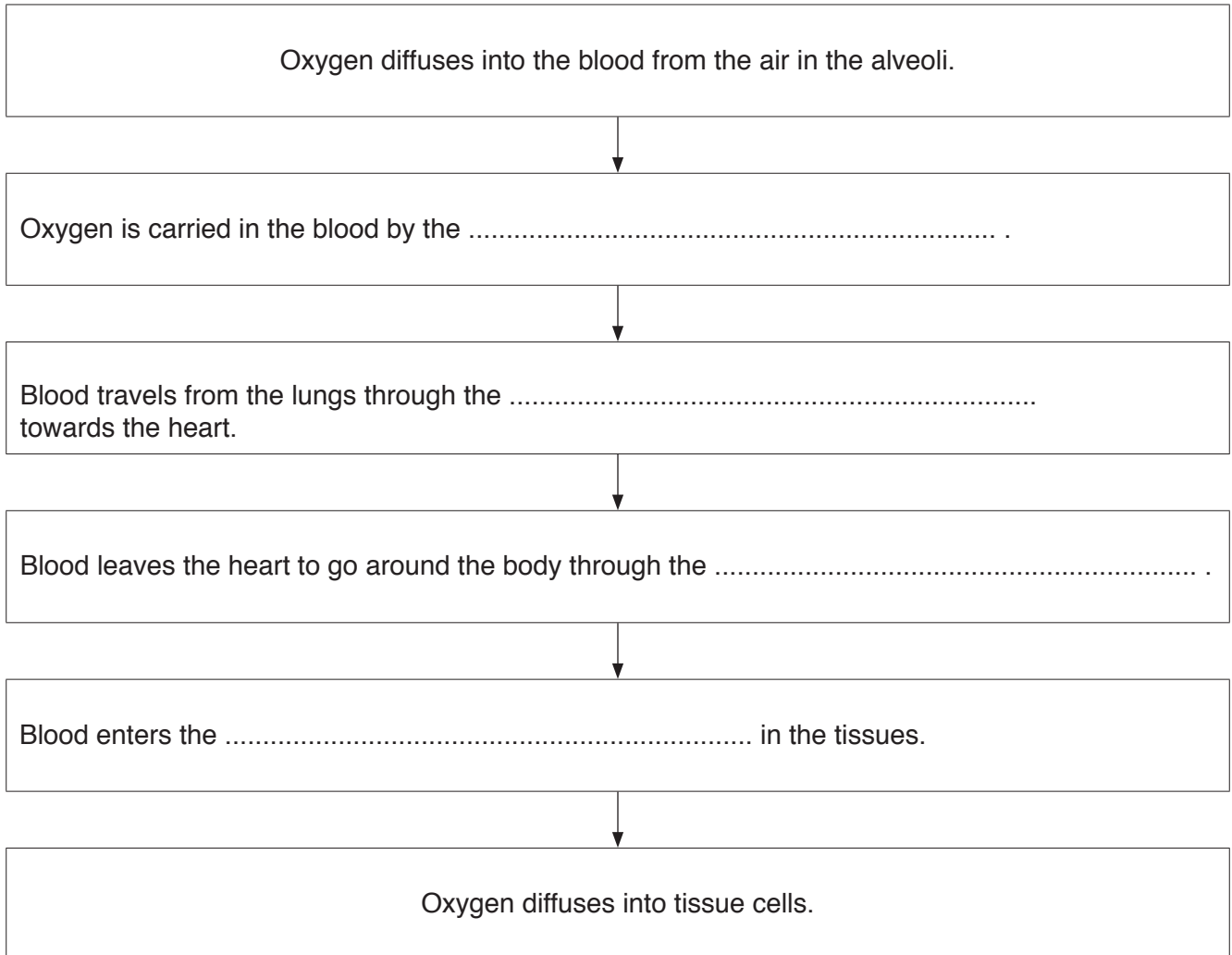
platelets

pulmonary artery

pulmonary vein

red blood cells

white blood cells



[4]

- (b) A person is going to run a race. Her heart starts to beat faster as she is waiting to start. This is due to the hormone adrenaline being released into her bloodstream.

- (i) Explain why the heart is described as a *target organ*.

.....
 [1]

- (ii) Describe how the adrenaline is removed from the bloodstream after the race.

.....
 [1]

(c) Fig. 1.1 shows the human gas exchange system.

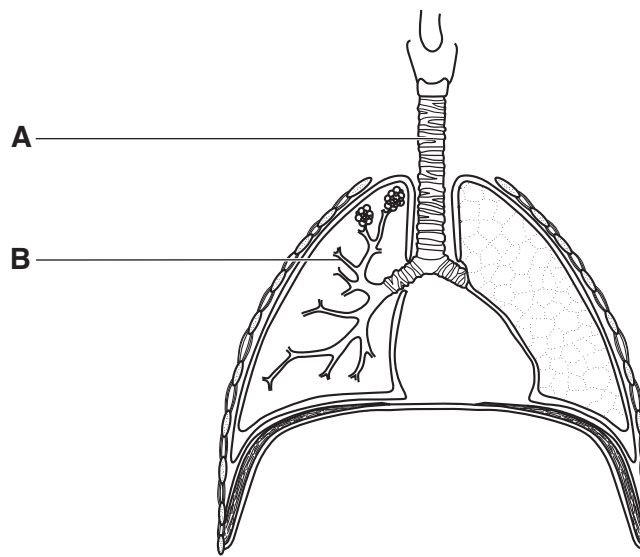


Fig. 1.1

Name the structures **A** and **B** shown in Fig. 1.1.

A

B [2]

(d) Describe **two** ways in which a person's pattern of breathing changes during a race.

1.

2. [2]

- 2 (a) Electrolysis is used to break up some compounds into simpler substances.

Fig. 2.1 shows the electrolysis of molten lead(II) bromide using inert electrodes.

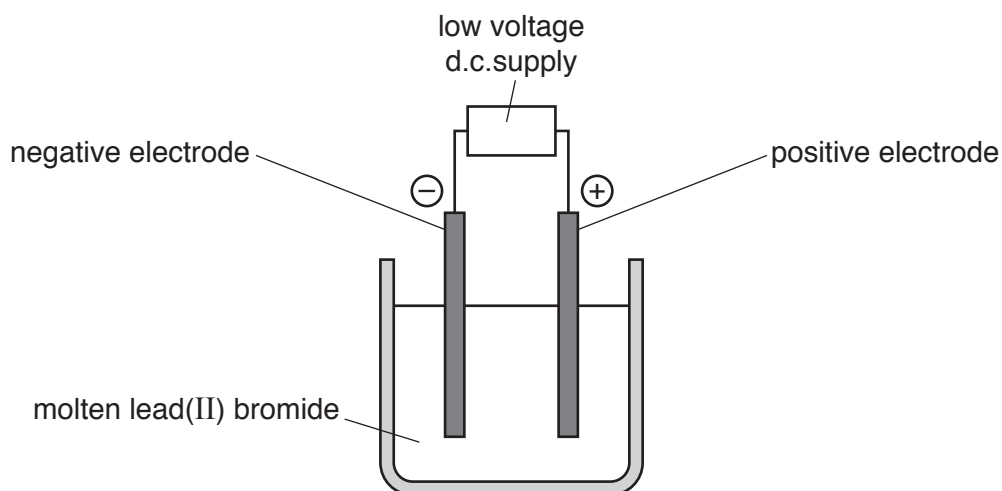


Fig. 2.1

- (i) State the names of the negative electrode and of the positive electrode.

negative electrode

positive electrode [1]

- (ii) Identify the substances formed at the negative electrode and at the positive electrode.

at negative electrode

at positive electrode [2]

- (iii) State the type of chemical bonding in compounds that are broken up by electrolysis.

..... [1]

- (iv) Electrolysis results in a *chemical change*.

Explain what is meant by the term *chemical change*.

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

- (b) Potassium chloride is made when solid potassium carbonate reacts with an acid.

A gas is made during this reaction.

- (i) Name the acid that reacts with potassium carbonate to form potassium chloride.

.....[1]

- (ii) Describe the change of the pH of the solution during the reaction.

.....[1]

- (iii) Describe a test to show that the colourless solution formed by this reaction contains chloride ions.

test

observation

[2]

3 Fig. 3.1 shows a guitar.

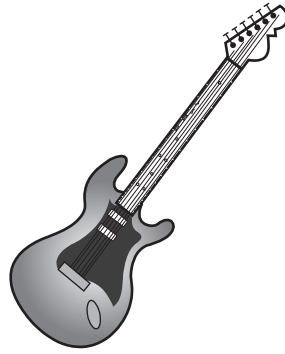


Fig. 3.1

(a) The guitar produces sounds with frequencies between 80 Hz and 5000 Hz.

(i) State what is meant by a frequency of 80 Hz.

.....[1]

(ii) A guitarist plays a note of frequency 250 Hz twice on his guitar.

The first time he plays the note with a large amplitude.

The second time he plays the note with a small amplitude.

Describe the difference the listener will hear between these two notes.

.....
[1]

(iii) State whether a person with normal hearing can hear all the frequencies produced by this guitar. Give a reason for your answer.

.....
[1]

(b) At a concert the sound of the guitar is broadcast on a radio programme using radio waves.

Name the type of wave to which radio waves belong.

.....[1]

- (c) Fig. 3.2 shows a girl using a periscope to see the guitarist over the heads of people in front of her.

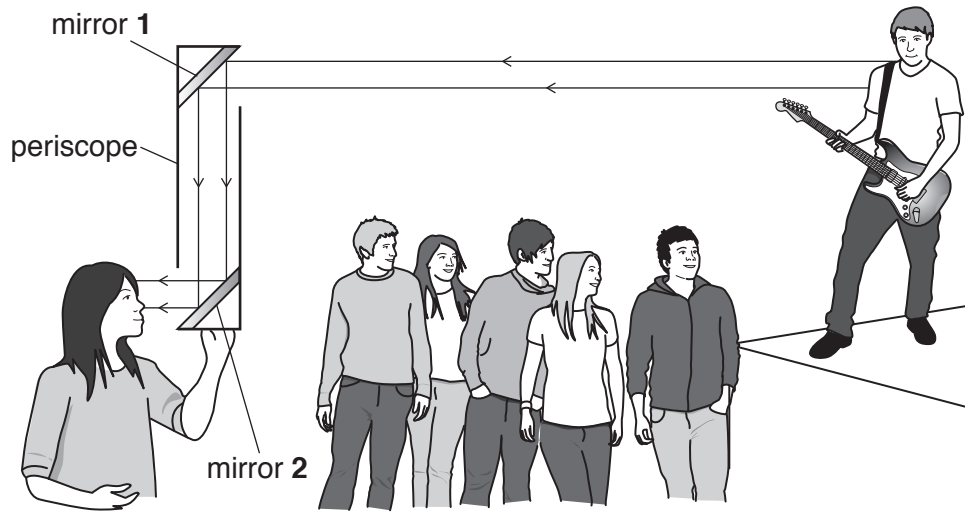


Fig. 3.2

- (i) Describe the characteristics of the image of the guitarist that the girl sees in the periscope.

.....
[2]

- (ii) Fig. 3.3 shows one of the rays of light as it reflects off mirror 2.

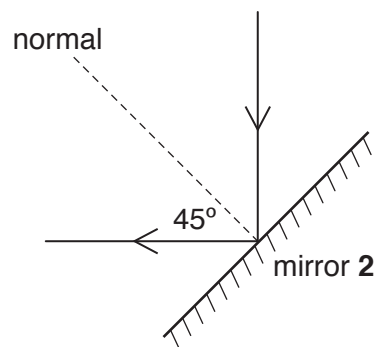


Fig. 3.3 (not to scale)

State the value of the angle of incidence.

.....[1]

- (d) The guitarist investigates the extension of a guitar string made of steel when different tension forces are used to stretch it.

Fig. 3.4 shows the graph of some results obtained from this experiment.

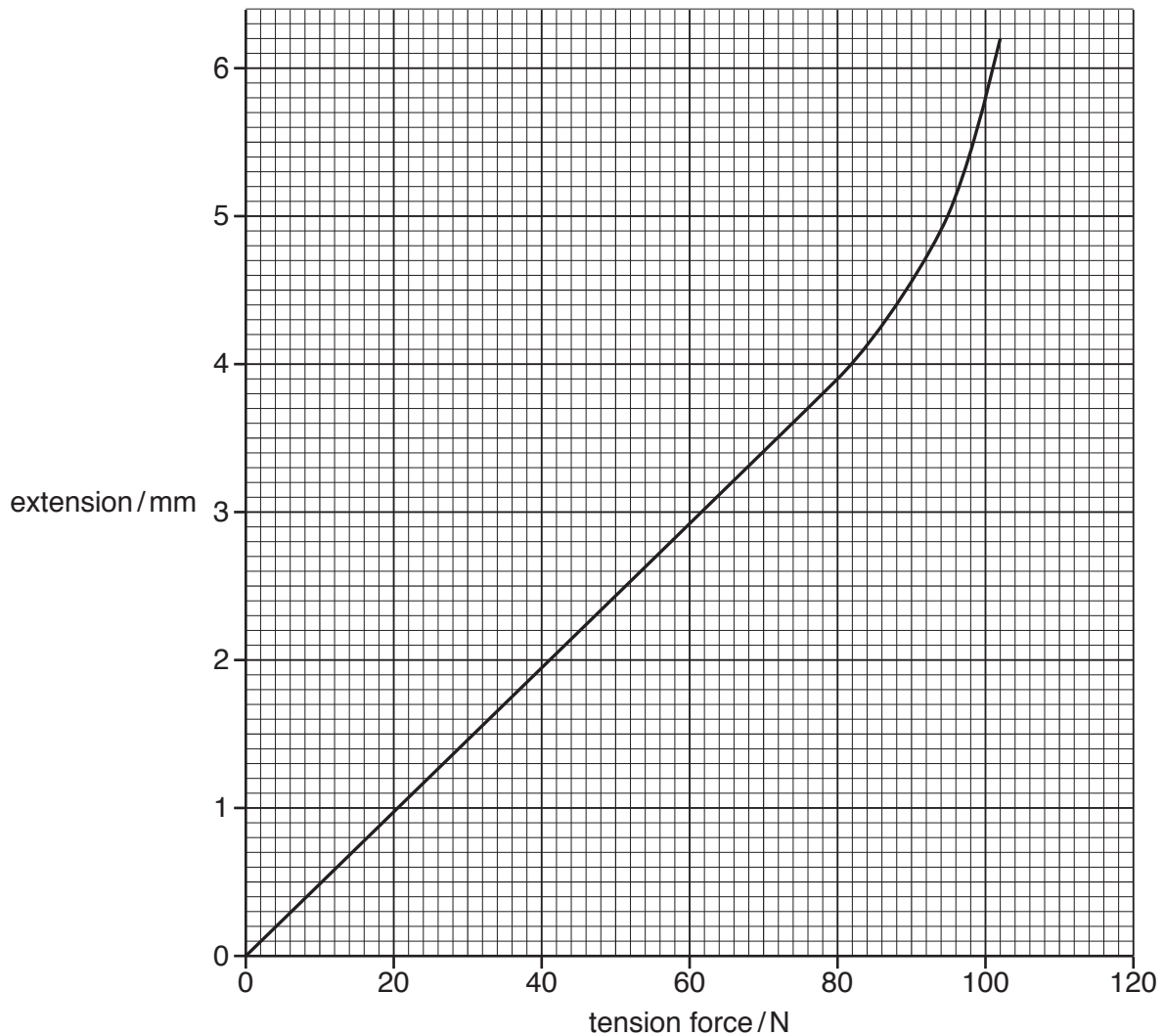


Fig. 3.4

The guitarist adjusts the note played by a guitar string by adjusting the tension in the guitar string. The more the tension force, the higher the note.

- (i) The guitarist must only increase the tension force while the extension remains proportional to the tension force.

Use the graph to suggest the maximum tension force that the guitarist can use.

.....[1]

- (ii) Suggest what would happen to the guitar string if the tension force is increased to 110 N.

Give a reason for your answer.

.....

[1]

- 4 Fig. 4.1 shows diagrams of primrose flowers. The flowers have two slightly different forms, **C** and **D**.

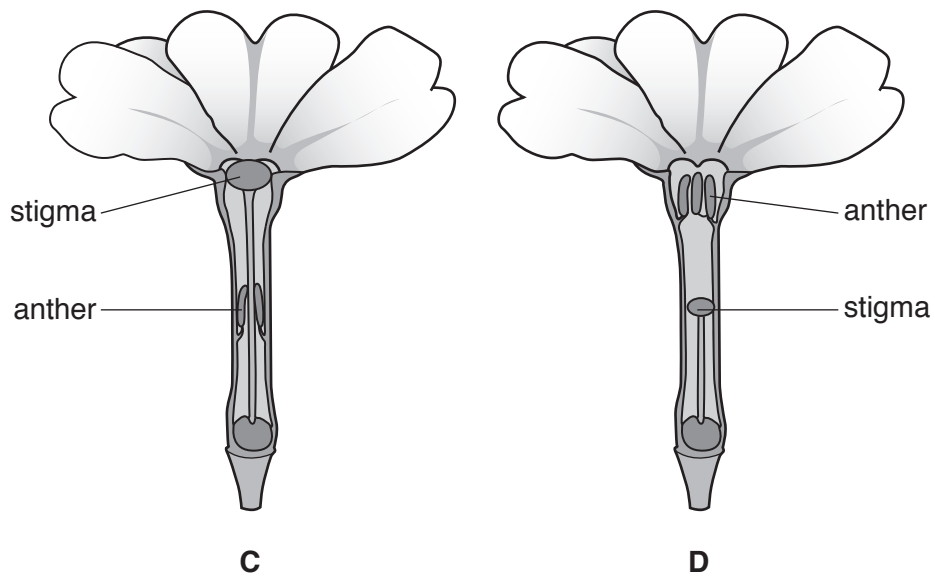


Fig. 4.1

- (a) Describe **two** pieces of evidence from Fig. 4.1 that suggest these primroses are insect-pollinated.

1.

.....

2.

.....

[2]

- (b) Compare the diagrams in Fig. 4.1 and predict which flower, **C** or **D**, is more likely to be pollinated by its own pollen.

Explain your answer.

flower

explanation

.....

.....

.....

[2]

- (c) Cross-pollination is the transfer of pollen from one flower to another flower on a different plant. This leads to the production of seeds.

State **and** explain why the genetic material in the seeds is different from the genetic material in the parent plants.

.....

.....

.....

.....[2]

- (d) The following feeding relationships occur in the field where the primroses grow.

- thrushes feed on snails
- snails feed on primroses
- buzzards feed on thrushes

- (i) Draw a food chain to show the flow of energy through these organisms.

[2]

- (ii) State **all** of the organisms in the food chain which are consumers.

Explain your answer.

consumers

explanation

.....

.....

[2]

5 (a) Ethene is a hydrocarbon.

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

.....
[2]

(ii) Complete Fig. 5.1 to show the structure of **ethene**.



Fig. 5.1

[2]

(iii) State the **two** products of complete combustion of hydrocarbons.

1.
 2.[2]

(b) Natural gas is a fossil fuel.

(i) Name **two** other fossil fuels.

1.
 2.[2]

(ii) Name the main constituent of natural gas.

.....[1]

- 6 Fig. 6.1 shows a fan heater used to heat a room in cold weather.

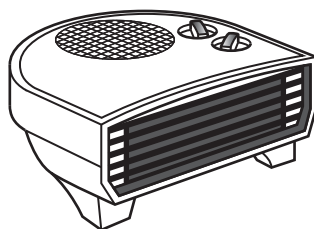


Fig. 6.1

The fan heater is connected to the mains electricity supply.

Fig. 6.2 shows the circuit diagram for the fan heater.

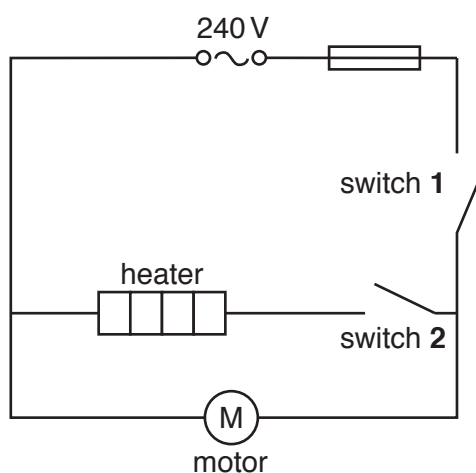


Fig. 6.2

- (a) (i) State the name of the circuit component represented by this symbol.



.....[1]

- (ii) Explain why it is important for this component to be included in the circuit.

.....

.....[1]

- (iii) Deduce which switch or switches must be closed (on) for the heater to work.

.....[1]

- (b) (i) An electrician wants to measure the current through the fan motor.

Complete the circuit diagram in Fig. 6.3 to show how the electrician should connect a meter to do this.

You should use the correct symbol for the meter to be used, and complete all missing circuit connections.

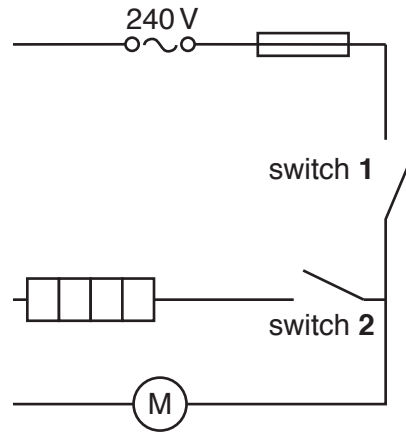


Fig. 6.3

[2]

- (ii) The current through the fan motor is found to be 0.2A when connected to a mains electricity supply of 240 V.

Calculate the resistance of the fan motor.

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

formula

working

resistance = ... unit[3]

- 7 Fig. 7.1 shows a sealed glass jar containing soil and plants. An oxygen sensor is used to find out how the concentration of oxygen in the glass jar changes during the day.

The plants can live in the glass jar for several weeks without opening the jar.

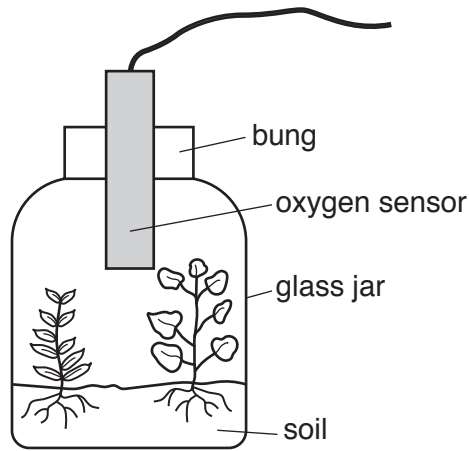
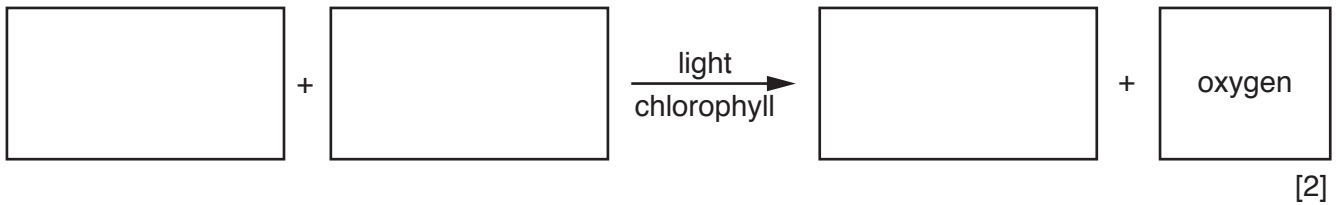


Fig. 7.1

- (a) The plants in Fig. 7.1 produce oxygen during photosynthesis.

Complete the word equation for photosynthesis.



- (b) Fig. 7.2 shows a graph of the oxygen concentration in the glass jar shown in Fig. 7.1 over a 12-hour period on a sunny day.

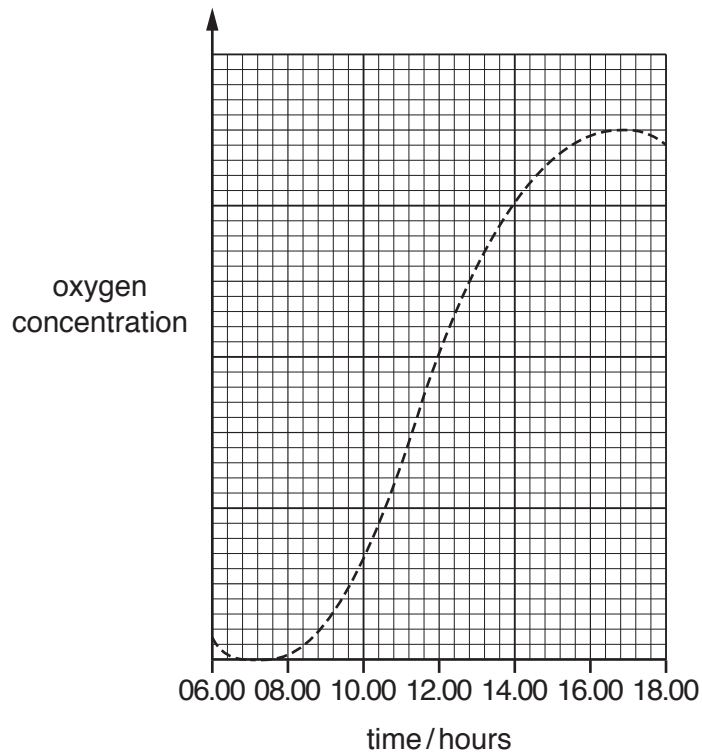


Fig. 7.2

- (i) State a time when the rate of photosynthesis is highest.

Explain your answer.

time

explanation

.....

.....

[2]

- (ii) On a different day the graph follows a similar pattern until 10.00 hours.

After 10.00 hours the weather changes and it becomes darker. This affects the concentration of oxygen in the glass jar.

On Fig. 7.2, add the letter **X** to show a possible value for oxygen concentration at 14.00 hours.

Explain your answer.

.....

.....

.....[2]

- (c) Water is lost as water vapour from leaves by transpiration.

On a very warm day the concentration of water vapour in the air in the glass jar increases.

Describe the effect of this increase in water vapour on the rate of transpiration from the plants in the glass jar.

.....

.....

.....[1]

- 8 (a) An iron nail is left in a beaker of water, as shown in Fig. 8.1a.

Another iron nail is left in dry air in a closed container, as shown in Fig. 8.1b.

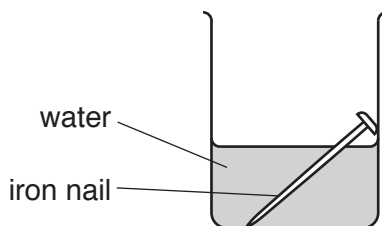


Fig. 8.1a

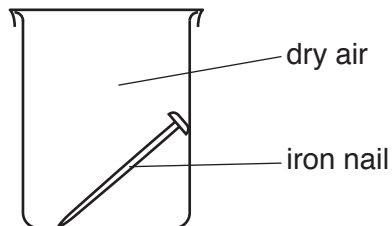


Fig. 8.1b

The iron nail in the water rusts but the iron nail in the dry air does not rust.

- (i) Describe **one** other method of rust prevention.

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

- (ii) Rust is a form of iron oxide.

Name the element that combines with iron to form iron oxide.

.....[1]

- (iii) Suggest **one** change that can be made to the experiment shown in Fig. 8.1a which increases the rate of rusting.

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

(b) A piece of calcium is placed into a beaker of water, as shown in Fig. 8.2.

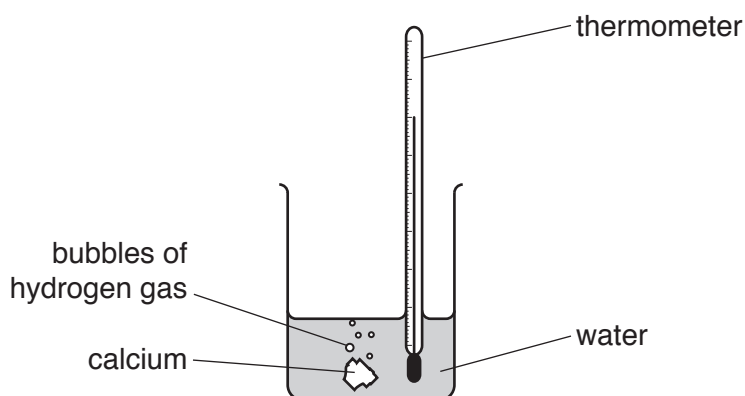
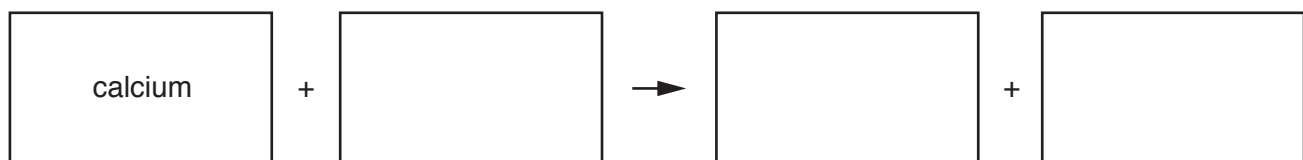


Fig. 8.2

(i) Hydrogen and calcium hydroxide are produced during this reaction.

Complete the word equation for this reaction.



[1]

(ii) During this reaction the temperature in the beaker increases.

State the type of chemical reaction that causes an increase in temperature.

.....[1]

(iii) Explain, in terms of reactivity, why calcium reacts with water more slowly than sodium reacts with water.

.....
[1]

(c) (i) Copper is a metal that has a high melting point and a high density. It forms coloured compounds.

Name the collection of metals in the Periodic Table which includes copper.

.....[1]

(ii) Copper alloys, rather than pure copper, are used to make coins.

Suggest **one** reason, other than cost, for this.

.....
[1]

- 9 Fig. 9.1 shows two horizontal forces acting on a car driving along a road.

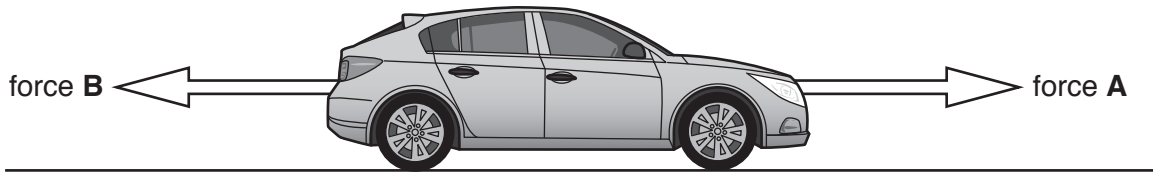


Fig. 9.1

- (a) (i) Force **A** is the driving force produced by the engine.

Name force **B**.

.....[1]

- (ii) The car is travelling at constant speed.

Describe how force **A** compares with force **B**.

.....
[2]

- (b) The car is powered by batteries that can be recharged from solar cells when the batteries run down.

Complete the sequence of energy transfers as the batteries are recharged. Write the types of energy produced in the blank spaces.

..... Nuclear energy in the Sun

→ energy transferred from the Sun to the solar cells

→ energy transferred from the solar cells

→ chemical energy in the batteries. [2]

(c) Fig. 9.2 shows a car crossing a bridge.

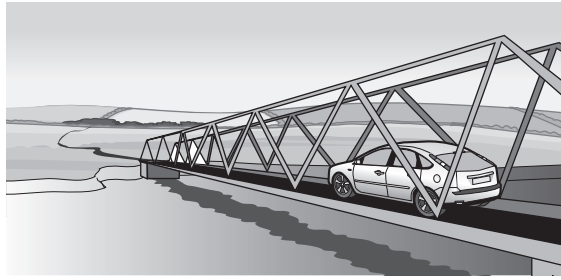


Fig. 9.2

Fig. 9.3 shows a gap in the road surface on the bridge.

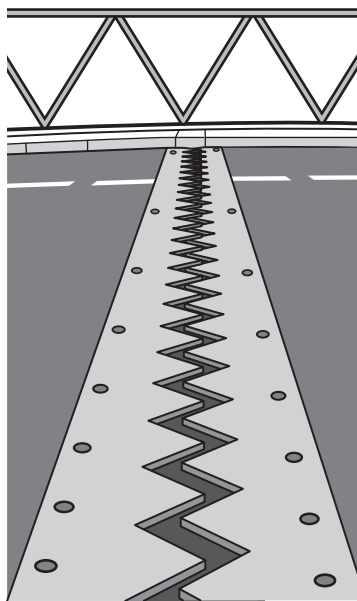


Fig. 9.3

- (i) On a hot sunny day the temperature of the bridge rises. Describe what will happen to the gap as the temperature rises.

Give a reason for your answer.

.....

 [2]

- (ii) Use words from the list below to complete the blanks in the sentence that follows.

Each word may be used once, more than once, or not at all.

boils evaporates faster larger melts slower smaller

After rain, the road surface is wet with water which slowly

as the molecules escape from the water surface. [2]

- (iii) On a cold winter's day, the temperature is -5°C .

Water vapour in the air freezes onto the road surface as ice.

On Fig. 9.4 draw a line to link the correct arrangement of molecules in water vapour to the correct arrangement of molecules in ice.

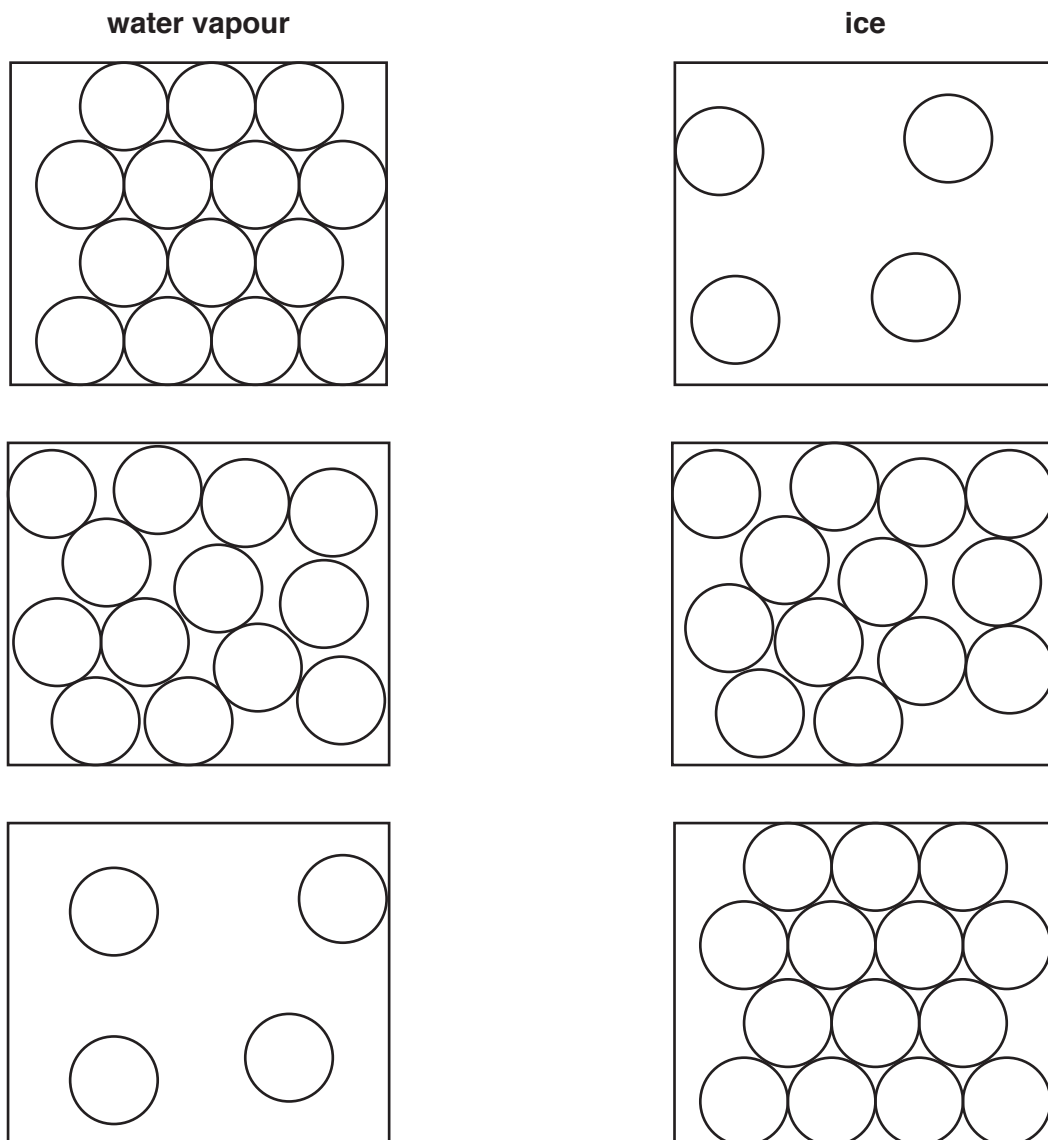


Fig. 9.4

[1]

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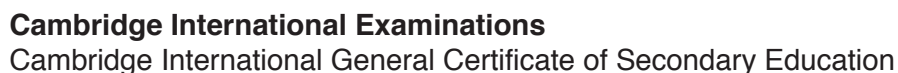
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The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	VIII
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —		114 Fl flerovium —		116 Lv livermorium —		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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



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0653/32

October/November 2017

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

A copy of the Periodic Table is printed on page 20.

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

This document consists of **20** printed pages.

- 1 (a) Use the following numbers or words to complete the sentences about the menstrual cycle.

Each number or word may be used once, more than once or not at all.

4 14 28 blood enzymes fertilised
 hormones nerves ovary oviduct
 pancreas pollinated uterus

The menstrual cycle starts when the lining of the uterus breaks down and leaves the body along with some

A new lining of the uterus is made and starts to become thicker. At the same time an egg starts to mature in the

The egg is released around day

The lining of the uterus continues to thicken to prepare for a
 egg.

[4]

- (b) Fig. 1.1 shows a flow chart of how identical twins occur.

A fetus is the name given to a developing baby in the later stages of pregnancy.

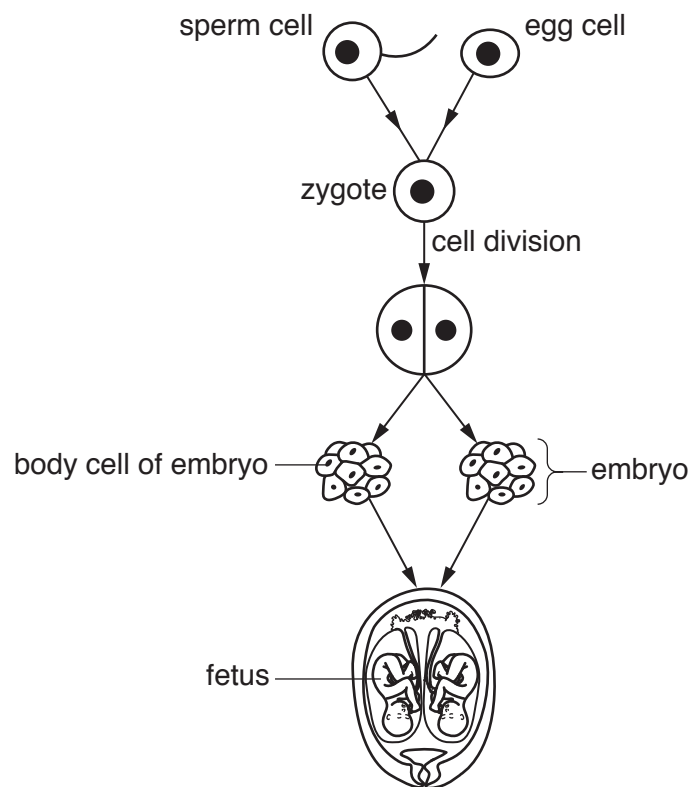


Fig. 1.1

Use Fig. 1.1 to name

1. a haploid cell, ...

2. a diploid cell.

[2]

- (c) Fig. 1.1 shows how the genetic material in the nuclei of the cells is passed from the egg and sperm to the fetus.

Use the information in Fig. 1.1 to compare the genetic material in the body cells of the twins.

Explain your answers.

.....

.....

.....[2]

- 2 A student places four pieces of metal, at the same time, into separate beakers containing dilute hydrochloric acid, HCl .

The four metals react with the acid to produce the same gas, but at different rates.

The gas is collected in test-tubes, as shown in Fig. 2.1.

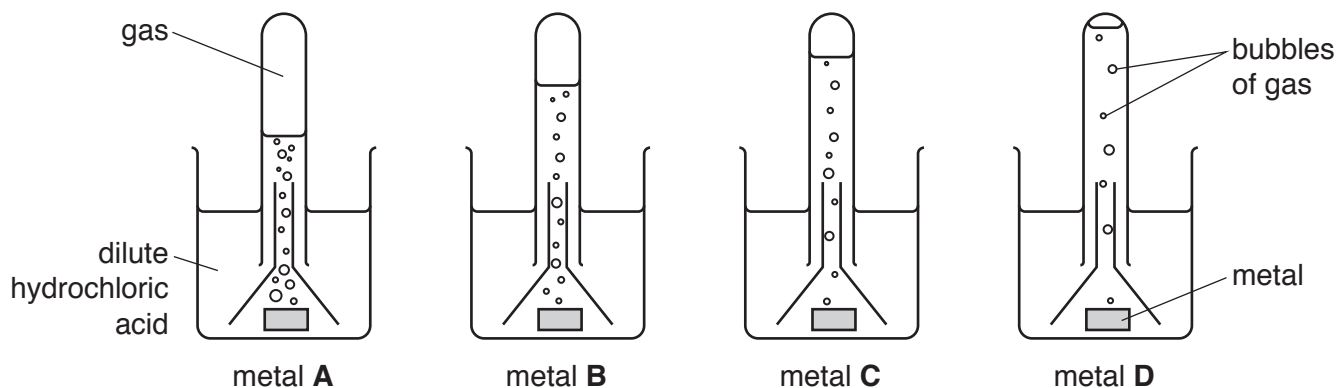


Fig. 2.1

The four metals are calcium, iron, magnesium, and zinc.

- (a) (i) Using the information in Fig. 2.1 and your knowledge of the reactivity series, identify metals **A**, **B**, **C** and **D**.

metal **A**

metal **B**

metal **C**

metal **D**

[2]

- (ii) Name the gas made in the reaction between magnesium and dilute hydrochloric acid.

.....[1]

- (iii) State the effect of increasing the temperature of the acid on the rate of reaction with the metals.

.....[1]

- (iv) Suggest **one** other way of changing the rate of reaction.

.....[1]

- (b) When iron reacts with dilute hydrochloric acid, a solution of an iron salt is made.

The student thinks that this salt contains iron(II) ions.

Another student thinks that the salt contains iron(III) ions.

They add dilute sodium hydroxide solution to a sample of the iron salt solution.

Describe the observations that are expected for iron(II) ions and for iron(III) ions.

iron(II) ions

iron(III) ions

[2]

- (c) Iron is a transition metal.

- (i) Suggest **two** properties of iron that are **not** properties of Group I metals.

1.

2.

[2]

- (ii) Explain why iron is used in the form of alloys, rather than as pure iron, for kitchen knives.

.....

.....

.....[1]

3 Fig. 3.1 shows a helicopter hovering above the ground.

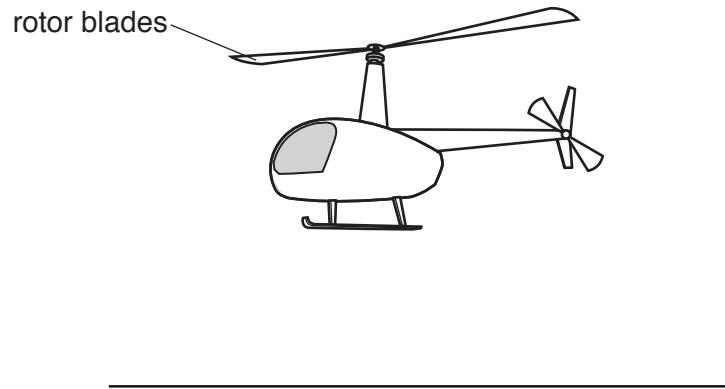


Fig. 3.1

- (a) The helicopter stays in one place as it hovers. The turning rotor blades provide the uplift force to keep it in the air.

On Fig. 3.1 draw two force arrows to show the vertical forces acting on the helicopter.

Label each arrow with the name of the force acting on the helicopter. [3]

- (b) The helicopter uses fuel to power its engines which turn the rotor blades. The pilot increases the speed of the rotor blades and the helicopter climbs vertically to a height of 1000 m. It then hovers again at this height.

Complete the sequence of energy transfers for the helicopter below.

..... energy in the fuel

→ energy of the rotor blades

→ **kinetic** energy of the climbing helicopter

→ energy of the helicopter at 1000 m. [3]

(c) The helicopter starts to move forward.

It increases speed for 20 s until it reaches a constant speed of 50 m/s.

It continues at this speed for 100 s.

It then slows down for 10 s to hover in one place again.

(i) On the grid in Fig. 3.2, plot a speed-time graph of the helicopter journey, which lasts 130 s.

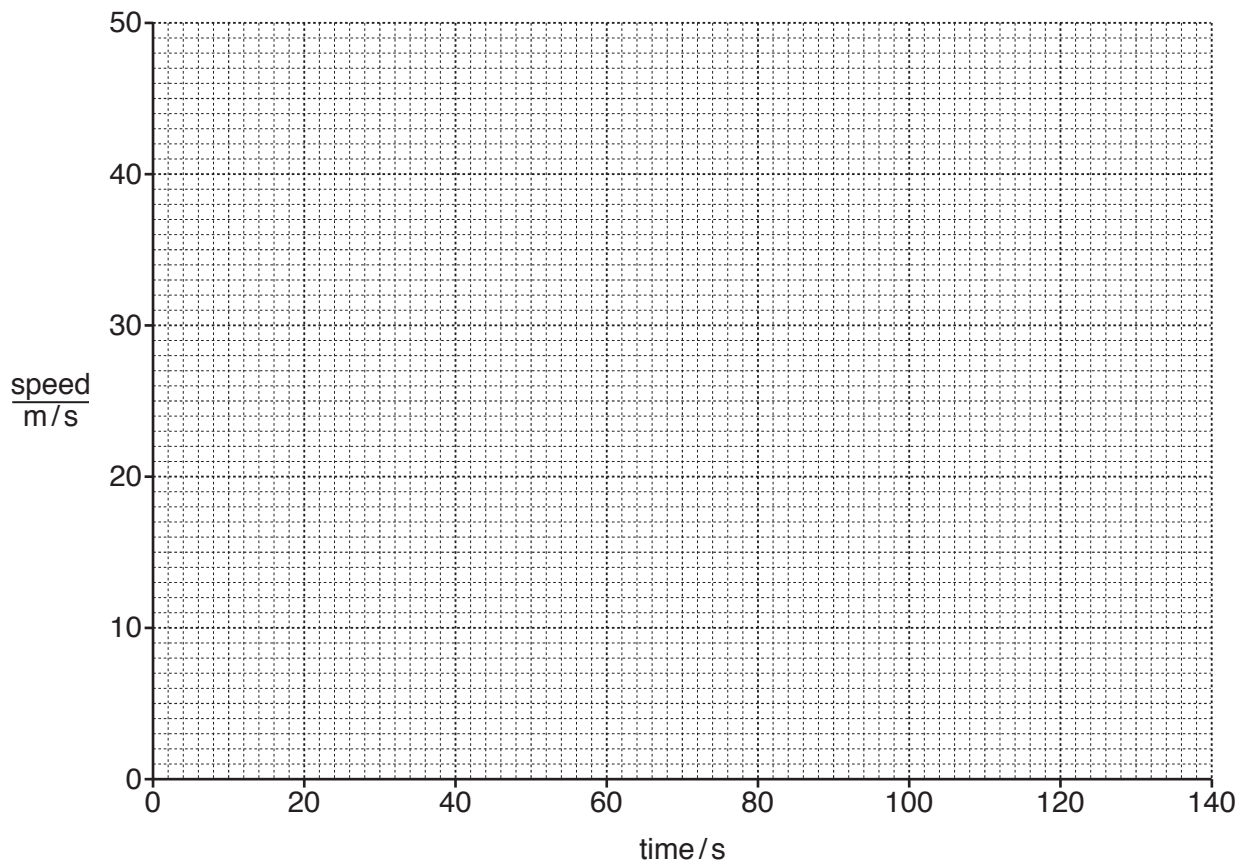


Fig. 3.2

[2]

(ii) Calculate the distance moved by the helicopter while flying at constant speed.

Show your working.

working

distance = ... m [2]

- 4 A student does an experiment to investigate the germination of barley seeds. The treatment of the seeds before the experiment is shown in Table 4.1.

Table 4.1

seed	treatment of seeds before the experiment	pH of soaking solution
A	boiled in water for 10 minutes	7
B	soaked at room temperature for a few hours	3
C	soaked at room temperature for a few hours	7

- After treatment, a piece of each seed is placed on an agar plate containing starch.
- After two days a test solution is added to the plate. This solution changes colour when starch is present.

The results are shown in Fig. 4.1.

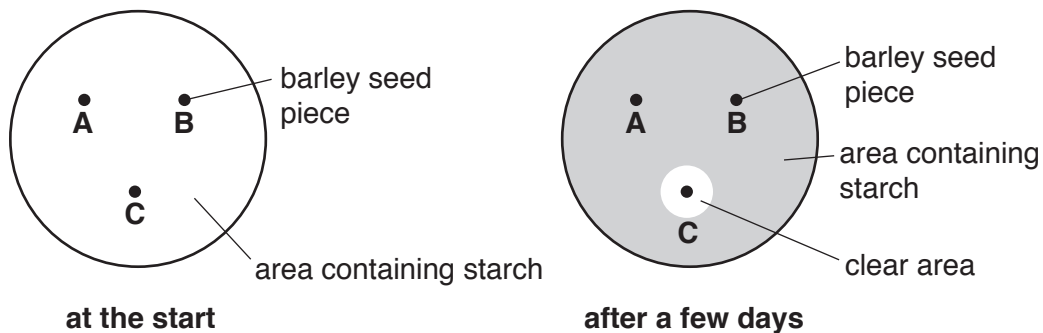


Fig. 4.1

- (a) Name the test solution and the colour change that occurs when starch is present.

name of solution

colour change

[2]

- (b) The student thinks that an enzyme is produced by the barley seed **C** which causes the starch to be broken down in the clear area.

Explain how the results for seed **A** and seed **B**, shown in Fig. 4.1, support this idea.

seed **A**

.....

.....

seed **B**

.....

.....

[3]

- (c) The breaking down of starch is an example of chemical digestion.

Explain why chemical digestion is necessary in the human alimentary canal.

.....

.....

.....[2]

- (d) In the human alimentary canal, food is broken down by both chemical and mechanical digestion. The teeth are involved in mechanical digestion.

Fig. 4.2 shows one type of tooth found in the human mouth.

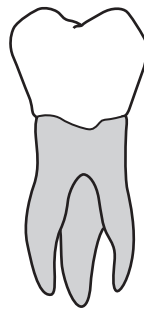


Fig. 4.2

Name this type of tooth and explain how the structure of the tooth makes it suitable for its function.

name

explanation

.....

.....

[3]

- 5 (a) The Periodic Table lists all of the elements in atomic number order.

Define *atomic number*.

.....
[1]

- (b) Part of the Periodic Table is shown in Fig. 5.1. The letters in this table are **not** the symbols of the elements.

I	II											III	IV	V	VI	VII	VIII
																B	C
D																E	
F					G		H										

Fig. 5.1

- (i) Use the letters in Fig. 5.1 to identify

one element that is an unreactive gas, ...

the element with the lowest mass (nucleon) number

[2]

- (ii) State the type of chemical bond that forms between element **D** and element **E**.

.....[1]

- (iii) Element **F** and element **B** combine in an exothermic reaction.

State what is meant by *exothermic*.

.....
[1]

- (c) Chlorine gas is bubbled through a solution of potassium bromide, as shown in Fig. 5.2.

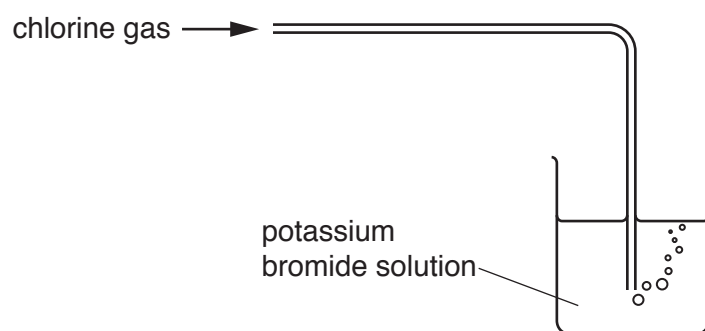


Fig. 5.2

- (i) State the colour of chlorine gas.

.....[1]

- (ii) The solution of potassium bromide turns from colourless to orange-brown.

Name the orange-brown substance.

.....[1]

- (d) A student tries to produce chlorine gas using the apparatus shown in Fig. 5.3.

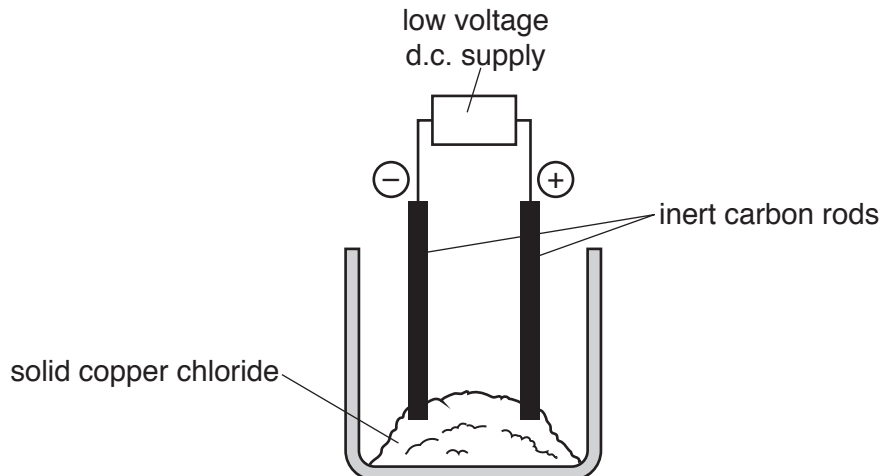


Fig. 5.3

No chlorine gas is made.

- (i) Name the process that the student is trying to use.

.....[1]

- (ii) Suggest **one** change that the student must make to produce chlorine gas.

.....

.....[1]

- 6 Fig. 6.1 shows a radiator which uses hot water to provide heating for people sitting in a room watching television.

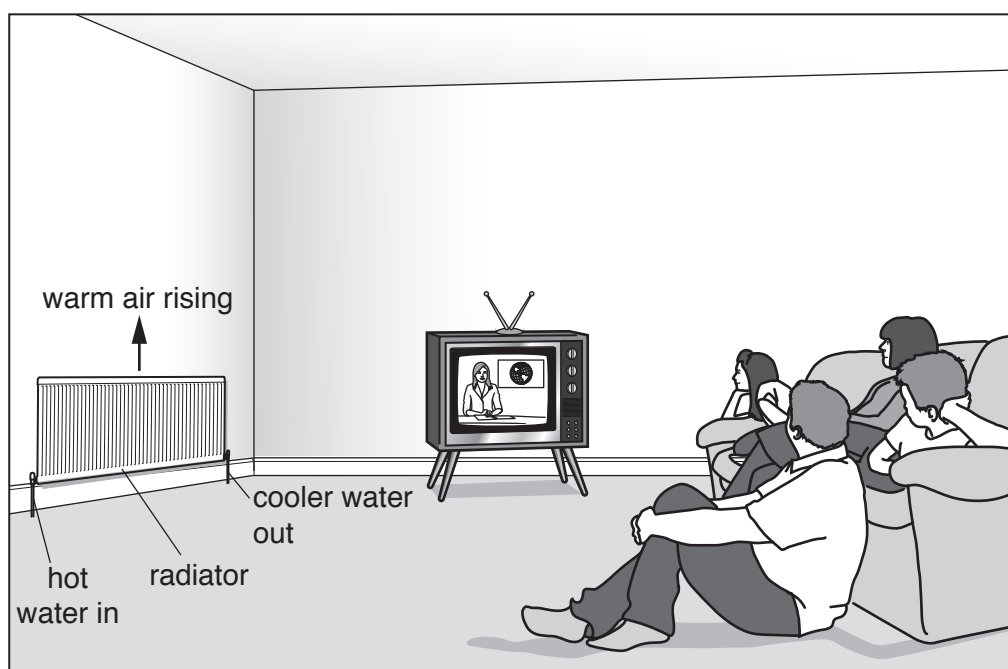


Fig. 6.1

- (a) (i) Name the method of thermal energy transfer from the hot water inside the radiator, through the radiator, to the air outside the radiator.

.....[1]

- (ii) Suggest a suitable material for making the radiator so that this thermal energy transfer is efficient.

.....[1]

- (b) (i) On Fig. 6.1 complete a sequence of **five** arrows to show how the warm air from the radiator is able to transfer thermal energy to the people sitting in the room and return as cool air to the radiator. [2]

- (ii) State the term used to describe this type of thermal energy transfer.

.....[1]

- (c) Television signals use electromagnetic waves.

Fig. 6.2 shows an incomplete electromagnetic spectrum.

gamma		ultra-violet	visible	infra-red	micro-waves	radio

Fig. 6.2

- (i) On Fig. 6.2, in the first row of the table, write the name of the missing type of electromagnetic waves in the blank box. [1]
- (ii) The aerial on the television set receives a signal from a television transmitter on a nearby hill.

On Fig. 6.2 in the second row of the table place a tick in the box under the electromagnetic waves used by this television set. [1]

- (d) The screen of the television set is very dusty. A man uses a cloth to clean the screen, but he notices that the dust is attracted back to the screen.

His friend tells him that this is due to an electrostatic charge on the screen.

Describe one or more experiments that the friend could do to show the man

- how electrostatic charges are produced,
- that there are two types of electric charge.

You may wish to include diagrams to help your answer.

.....

.....

.....

.....

.....[3]

7 (a) During transpiration water is lost from the leaves of a plant.

An experiment is carried out to compare the transpiration rates of the upper and lower surfaces of leaves of three similar plants, **N**, **U** and **B**, using the apparatus shown in Fig. 7.1.

The leaves of two plants are treated with petroleum jelly, a waterproof substance which prevents evaporation from the surface of the leaf.

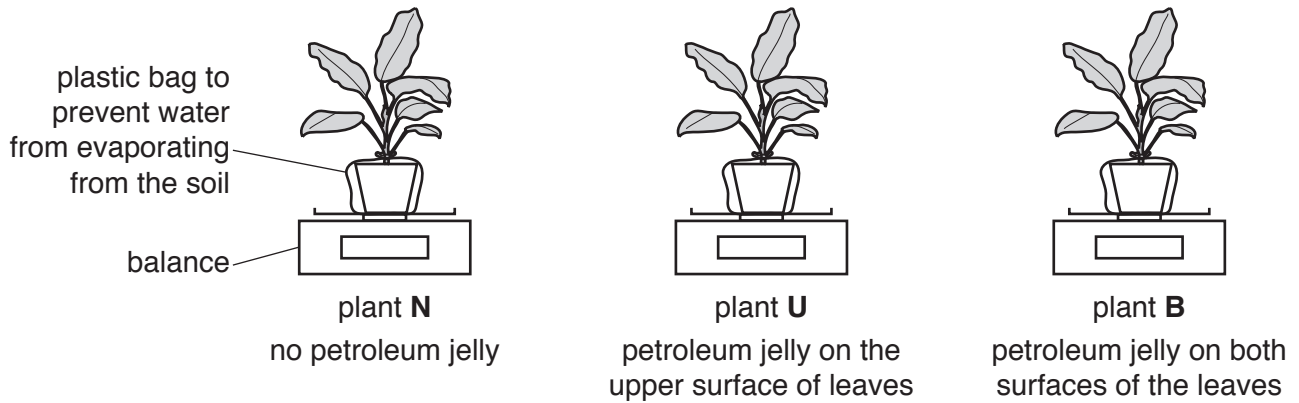


Fig. 7.1

The masses of plants **N**, **U** and **B** are measured.

After six hours the mass of each plant is measured again and the mass of water lost from each plant is calculated.

The results are shown in Fig. 7.2.

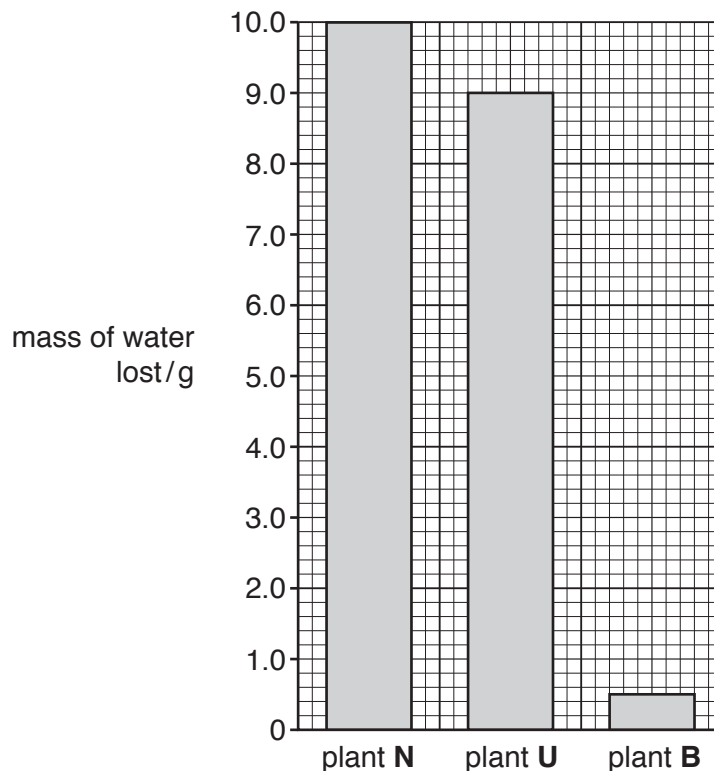


Fig. 7.2

- (i) Use the results in Fig. 7.2 to state which surface of the leaf, upper or lower, loses more water.

Explain your answer.

surface

explanation

.....

.....

.....

[2]

- (ii) Explain your conclusion to (i) in terms of leaf structure.

.....

.....

.....[2]

- (b) Water is taken in at the roots and travels upwards to the leaves through the stem.

Fig. 7.3 shows the tissues found in a cross-section of a plant stem.

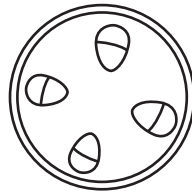


Fig. 7.3

Label the tissue that transports water with the correct name.

[2]

- (c) Water is one of the raw materials needed for photosynthesis.

Complete the word equation for photosynthesis.



[1]

- (d) Green plants are producers which rely on the Sun to provide light energy for photosynthesis.

Explain why carnivores cannot survive without producers.

.....

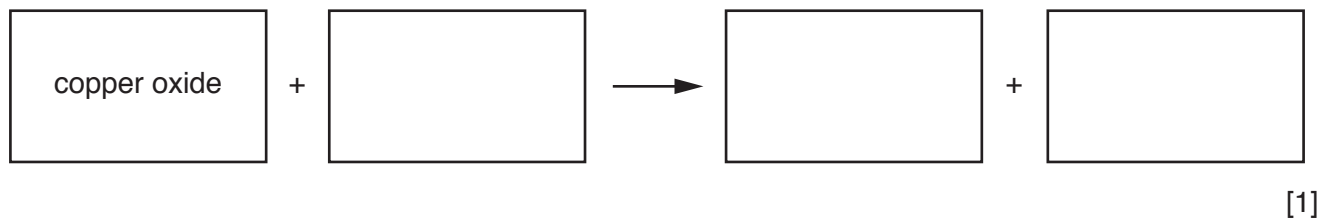
.....

.....[2]

- 8 (a) (i) Copper is extracted when copper oxide is heated with carbon.

Carbon dioxide is produced and released into the air.

Complete the word equation for this reaction.



- (ii) Fossil fuels also release carbon dioxide during combustion.

Suggest **one other** process that releases carbon dioxide into the air.

.....[1]

- (iii) Natural gas is a fossil fuel.

Name one **solid** fossil fuel and one **liquid** fossil fuel.

solid

liquid[2]

- (b) Fig. 8.1 shows the structure of a molecule of compound X.

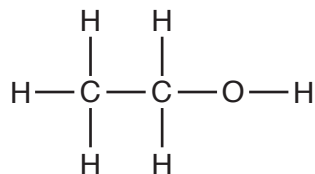


Fig. 8.1

- (i) Name compound X.

.....[1]

- (ii) State what is meant by a *hydrocarbon*.

.....[1]

- (iii) Explain why compound X is **not** a hydrocarbon.

.....[1]

- 9 In a theatre, spotlights are used to shine a beam of light on one person on the stage.

Fig. 9.1 shows a spotlight shining a parallel beam of light on a singer.



Fig. 9.1

- (a) Fig. 9.2 shows a powerful lamp shining through a narrow hole in front of a lens inside the spotlight.

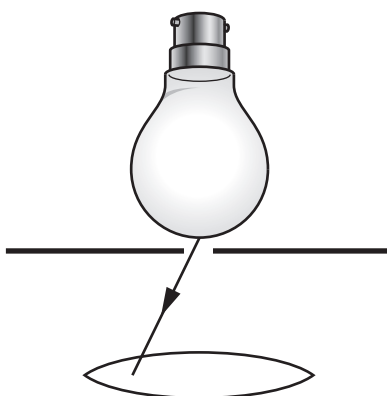


Fig. 9.2

- (i) On Fig. 9.2 use a ruler to draw three rays that come through the narrow hole, pass through the lens and emerge parallel to each other to form a narrow beam of light.

One ray has been started for you.

[2]

- (ii) Name the distance from the narrow hole to the lens.

.....[1]

- (b) Fig. 9.3a shows the way the lamps in two spotlights are connected to a power supply. The circuit contains a dimmer control so that the brightness of the lights can be changed.

Fig. 9.3b shows part of the circuit diagram for this.

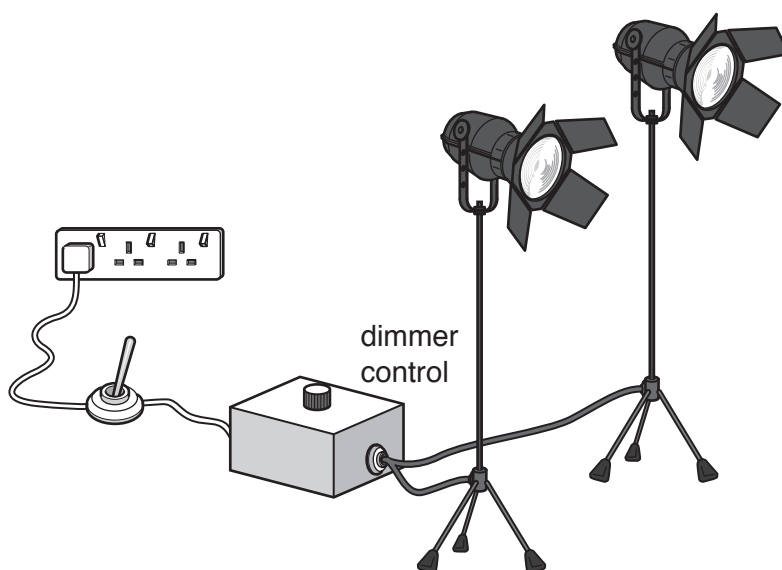


Fig. 9.3a

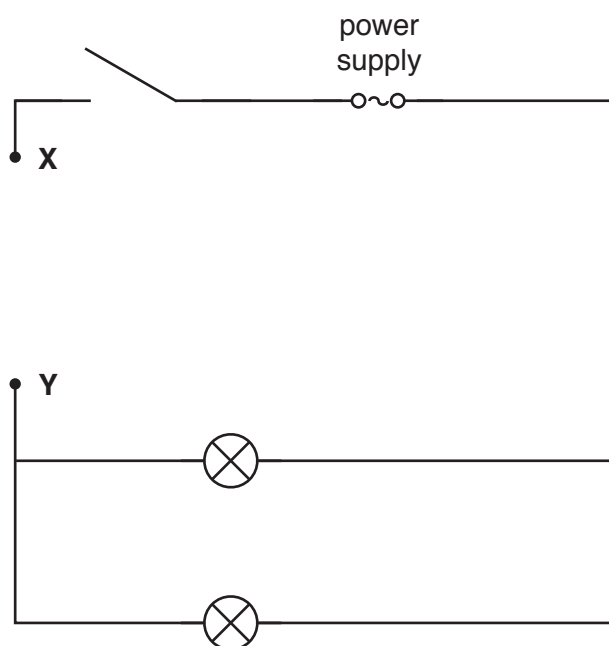


Fig. 9.3b

- (i) The dimmer control contains a variable resistor.

On Fig 9.3b complete the circuit diagram by connecting the variable resistor into the circuit between **X** and **Y** using the correct circuit symbol. [1]

- (ii) The current from the power supply is 20A.

State the conclusion that can be drawn about the size of the current through each lamp.
Give a reason for your answer.

conclusion

reason

..... [2]

- (iii) The filament of one of the lamps breaks.

State what will happen to the other lamp. Give a reason for your answer.

.....

.....

..... [1]

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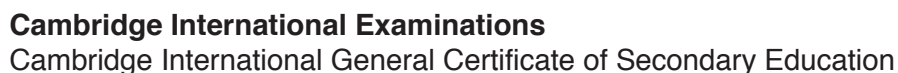
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The Periodic Table of Elements

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3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

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



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0653/33

October/November 2017

1 hour 15 minutes

No Additional Materials are required.

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.

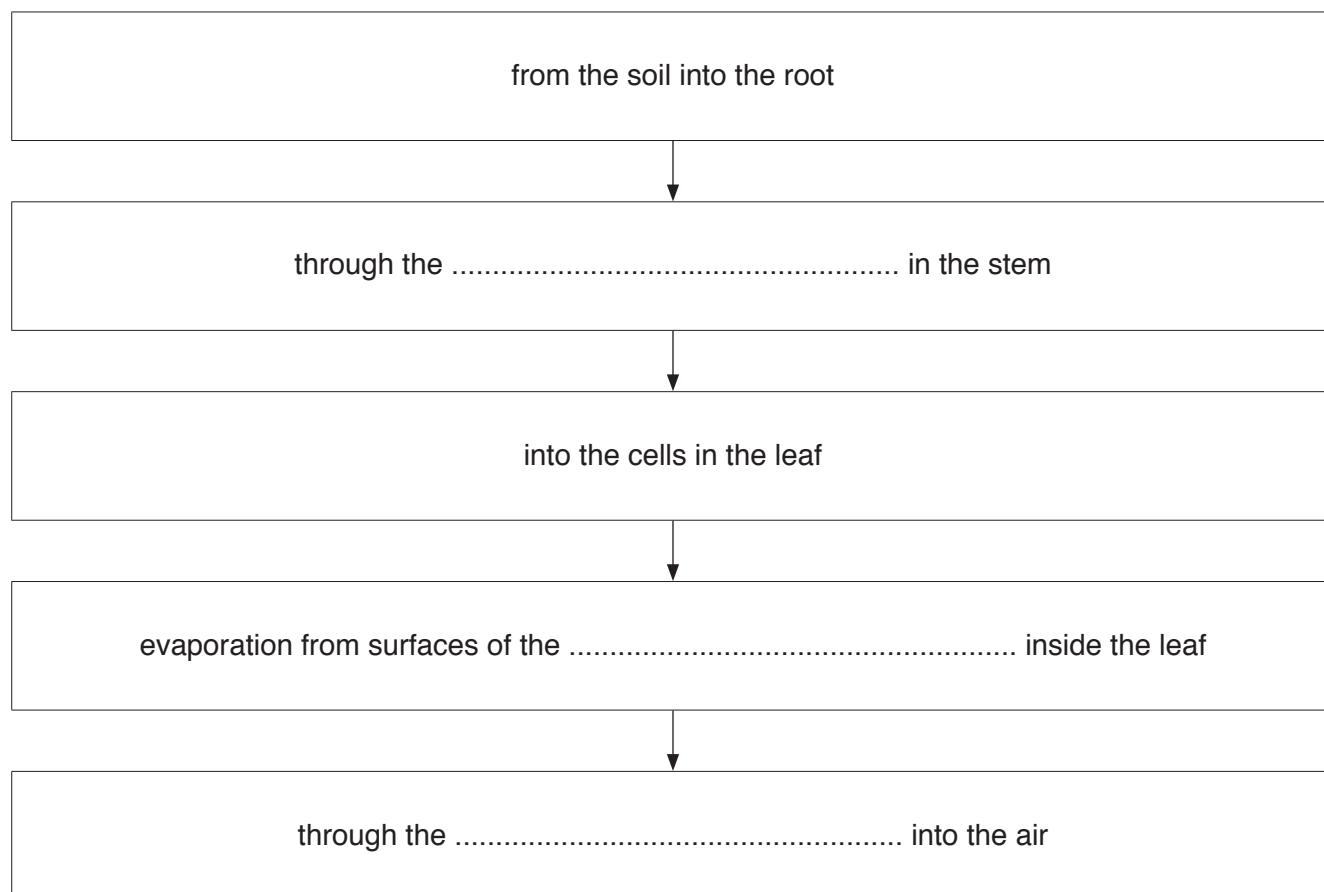
The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **21** printed pages and **3** blank pages.

- 1 (a) Use the following words or phrases to complete the flow chart about a possible pathway taken by water through a plant from the soil to the air.

Each word or phrase may be used once, more than once or not at all.

cuticle epidermal cells mesophyll cells phloem
 root hair cells stomata tubes xylem



[3]

- (b) State **two** functions of water in plants.

1.

2.

[2]

- (c) A supply of water is needed by humans too. Most of the plasma in the blood is made up from water. The plasma carries the blood cells around the body.

State **two** other substances that are transported by the plasma.

1.

2.

[2]

(d) The haemoglobin in red blood cells contains iron.

(i) State the role of haemoglobin in the blood.

.....[1]

(ii) Explain why a menstruating woman needs to make sure she takes enough iron in her diet.

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

(iii) Describe **one** symptom of iron deficiency in the body.

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

- 2 (a) Some iron objects are shown in Fig. 2.1.

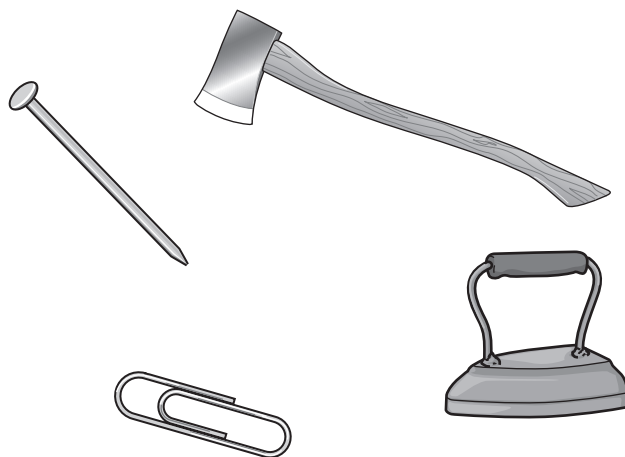


Fig. 2.1

- (i) State **two** physical properties of all metals.

1.

2.

[2]

- (ii) Iron is a transition metal.

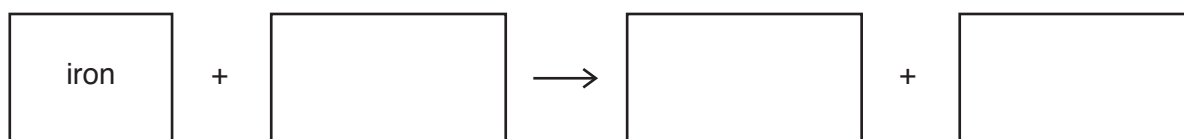
State **one** physical property of transition metals that is **not** a physical property of Group I metals.

.....[1]

- (b) A student adds some iron nails to dilute sulfuric acid.

Iron sulfate and hydrogen gas are produced.

- (i) Complete the word equation to show this reaction.



[1]

- (ii) The student tests another dilute acid with aqueous silver nitrate.

A white solid forms.

Deduce the anion present and name the acid.

anion

acid

[2]

- (c) The atomic number of iron is 26.

Explain what is meant by *atomic number*.

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

- 3 Fig. 3.1 shows four forces, **P**, **Q**, **R** and **S**, acting on a submarine. The submarine is travelling underwater and moving to the right at constant speed.

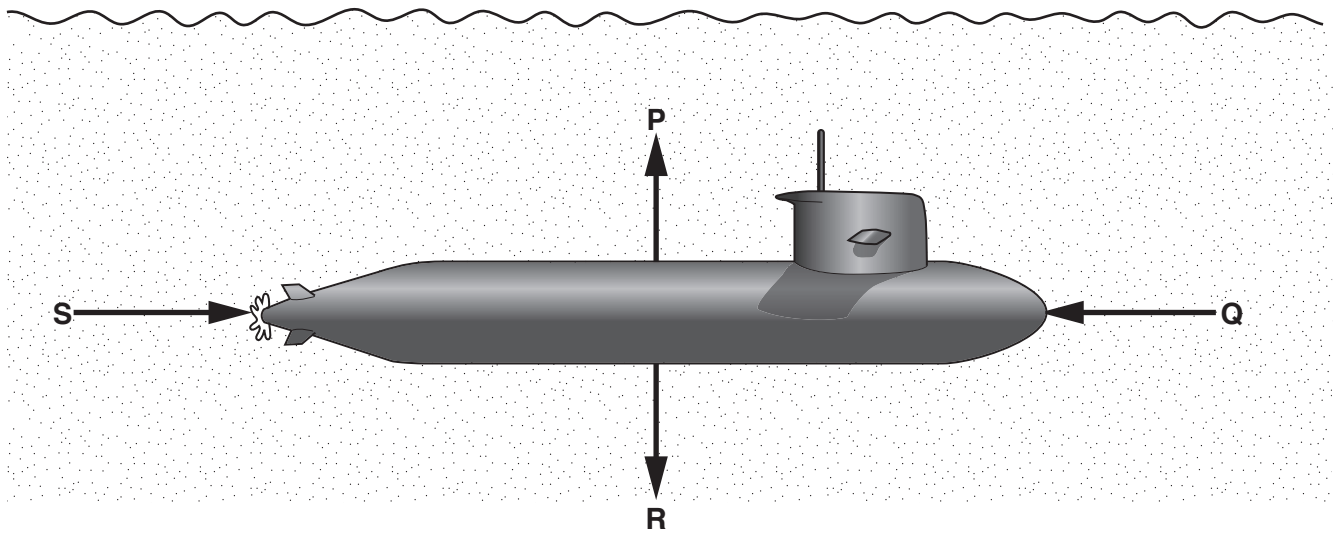


Fig. 3.1

- (a) In Table 3.1 complete the names of the forces **P**, **Q**, **R** and **S**.

Table 3.1

P	uplift
Q	
R	
S	driving force

[2]

- (b) The submarine is travelling at a constant depth.

State how the magnitude of force **P** compares to force **R**.

.....[1]

- (c) The submarine captain cannot use a radio transmitter underwater.

The captain orders the crew to take the submarine to the surface so he can use a radio transmitter.

- (i) State which force must be increased to bring the submarine to the surface.

.....[1]

- (ii) Fig. 3.2 shows an incomplete electromagnetic spectrum. On Fig. 3.2 add radio waves in their correct place.

gamma			visible light		micro- waves	
-------	--	--	------------------	--	-----------------	--

Fig. 3.2

[1]

- (iii) Electromagnetic waves do not pass easily through sea water. Suggest a different kind of wave that can travel in water and might be used to send a signal.

.....[1]

- (d) When submerged, the submarine has to use an energy source that does not depend upon the Sun or on burning a fuel.

Suggest a suitable energy source that can be carried in a submarine in order to power the submarine underwater.

.....[1]

- (e) Use steps 1 to 3 below to calculate the average speed of the submarine in metres per second (m/s) if it travels 30 kilometres in 1 hour.

Step 1: convert 30 kilometres to metres.

..... m

Step 2: convert 1 hour to seconds.

..... s

Step 3: calculate the speed in metres per second.

speed = ... m/s
[2]

- 4 Fig. 4.1 shows a diagram of the alimentary canal. The main areas where digestion takes place are labelled.

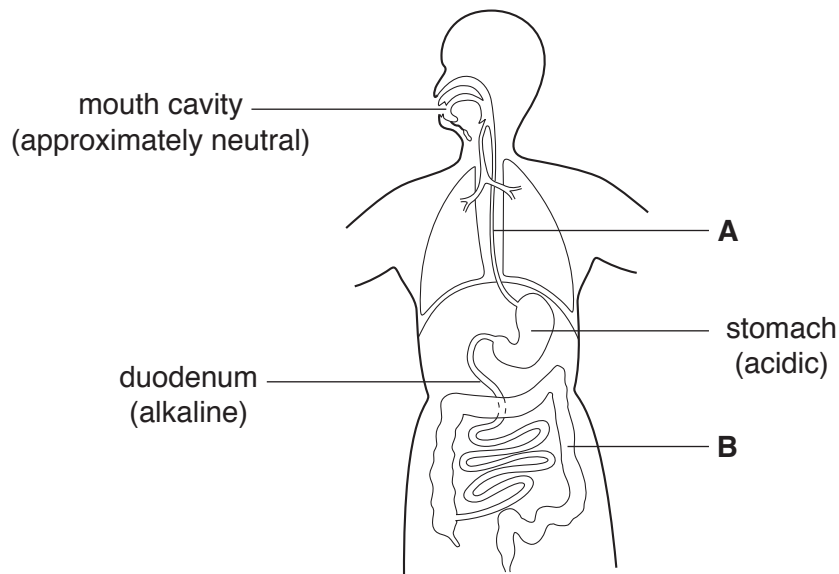


Fig. 4.1

- (a) Name structures **A** and **B** shown in Fig. 4.1.

A

B

[2]

- (b) A student is investigating human digestive enzymes.

He has three test-tubes, **1**, **2** and **3**, containing protein solution at different pH values. He then adds the same enzyme to all three test-tubes and keeps them at 35 °C.

The protein solution is cloudy at the start of the experiment. If the protein in the solution is broken down the solution becomes clear and colourless.

The results are shown in Fig. 4.2.

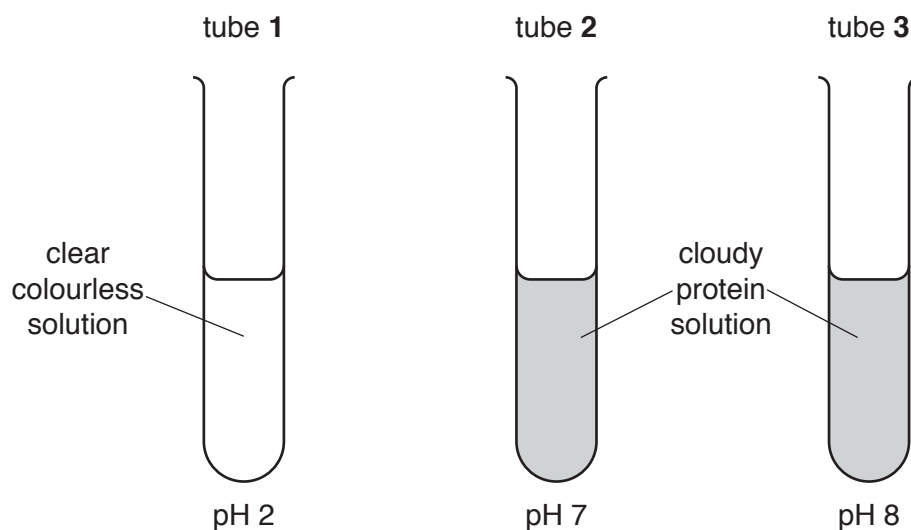


Fig. 4.2

- (i) Use the information in Fig. 4.1 to identify the likely source of the digestive enzyme that produces the result in tube **1** in Fig. 4.2.

Explain your answer.

source of enzyme

explanation

.....

.....

.....

[3]

- (ii) Suggest why a temperature of 60 °C is **not** suitable for this experiment.

.....

.....[1]

- (iii) Explain why the change that takes place in tube **1** is an example of chemical digestion.

.....

.....

.....[2]

- (iv) Describe **one** example of mechanical digestion.

.....

.....[1]

- 5 (a) Pure water can be separated from sea water using the apparatus shown in Fig. 5.1.

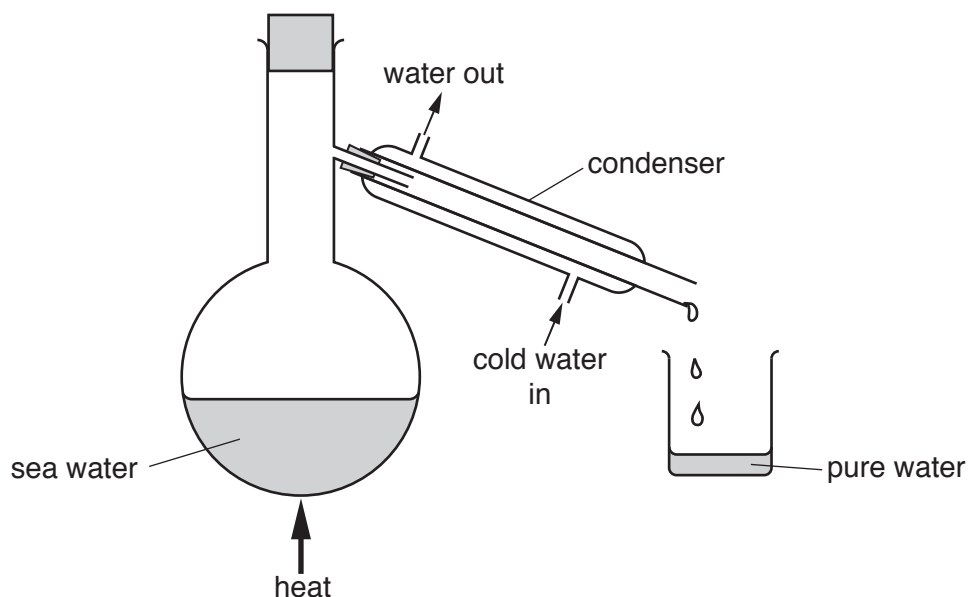


Fig. 5.1

- (i) Name this process.

.....[1]

- (ii) Describe the change in the temperature of the pure water as it passes through the condenser.

.....[1]

- (b) The purification of a water supply involves filtration and chlorination.

Explain how filtration and chlorination purify the water supply.

filtration

.....

chlorination

.....

[2]

(c) Petroleum is separated into different fractions, as shown in Fig. 5.2.

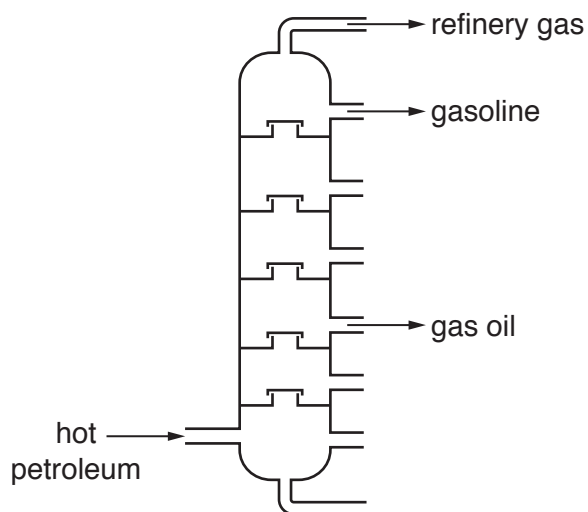


Fig. 5.2

(i) State **one** use for refinery gas and **one** use for gas oil.

refinery gas

gas oil

[2]

(ii) Gasoline is a mixture of hydrocarbons.

Explain what is meant by a *hydrocarbon*.

.....

.....[2]

(d) The structures of six compounds are shown in Fig. 5.3.

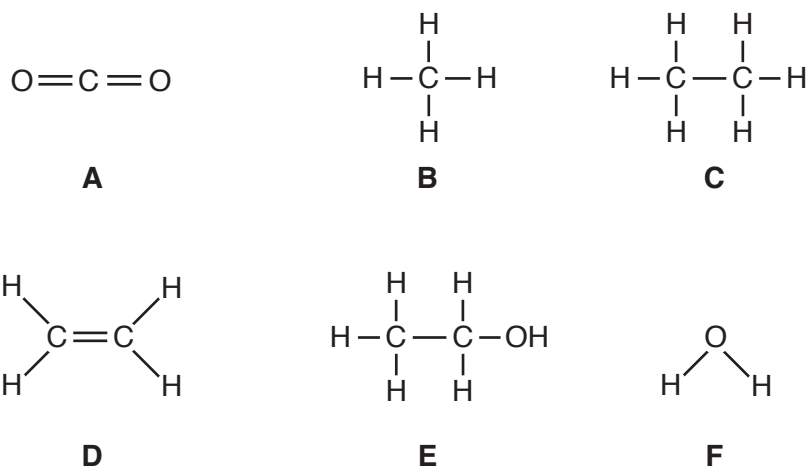


Fig. 5.3

(i) Using letters **A** to **F**, identify the two products of the complete combustion of hydrocarbons.

..... and [1]

(ii) Using letters **A** to **F**, identify the main constituent of natural gas.

..... [1]

- 6 Fig. 6.1a shows an insulated bag used to carry frozen food. The bag keeps the food below the melting point of ice.

Fig. 6.1b shows the structure of the walls of the bag.



Fig 6.1a

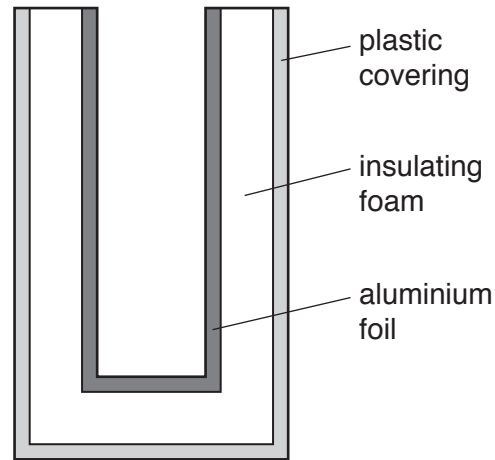


Fig. 6.1b (not to scale)

- (a) State the meaning of *melting point*.

.....
[1]

- (b) The insulating foam is designed to reduce thermal energy transfer through the bag.

- (i) Name two methods of thermal energy transfer that the insulating foam is designed to reduce.

..... and[1]

- (ii) Describe how the insulating foam reduces thermal energy transfer by these two methods.

.....

[2]

- (c) The aluminium foil is designed to reduce thermal energy transfer by radiation.

Name the part of the electromagnetic spectrum mainly involved in thermal energy transfer by radiation.

.....[1]

- (d) A box of ice cream is carried in the bag.

The ice cream weighs 1900g, and has a volume of 2000 cm³.

Calculate the density of the ice cream.

State the formula you use and show your working.

formula

working

density = ... g/cm³ [2]

7 Fig. 7.1 shows some processes occurring in a forest growing on a hill.

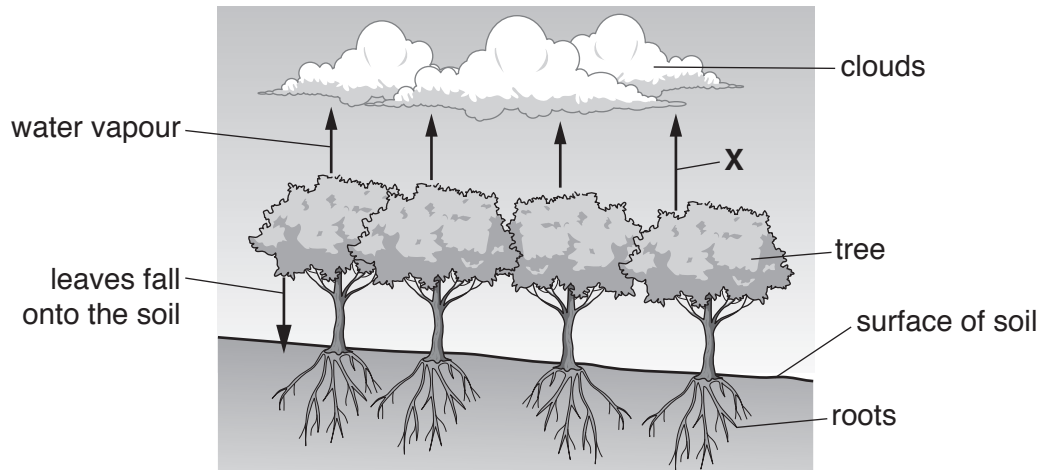


Fig. 7.1

(a) Name the process labelled **X**.

.....[1]

(b) (i) The leaves of the trees contain carbohydrates, for example sugar.

Describe how leaves use a carbon compound in the air to make sugar.

.....

[2]

(ii) When leaves die they fall onto the soil. Decomposers (bacteria and fungi) feed on the dead leaves and use the sugar present in the leaves.

Suggest and explain how the carbon in the sugar is returned to the atmosphere by the decomposers.

.....

[2]

- (c) The trees in the forest shown in Fig. 7.1 are cut down.

Predict **and** explain the effect of clearing the trees on the amount of rain falling on the area.

.....

.....

.....[1]

- (d) A storm occurs higher up the hill and water comes flowing down the hill.

Suggest how the soil in the cleared area will be affected by water from heavy rainfall flowing down the hill.

Explain your answer.

.....

.....

.....[2]

- 8 (a) Molten lead(II) bromide is broken down into simpler substances using the apparatus shown in Fig. 8.1.

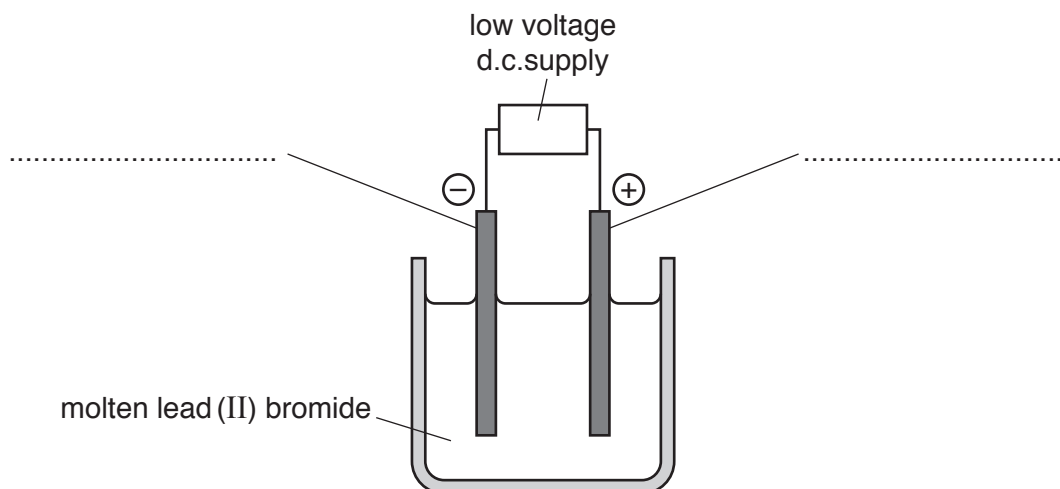
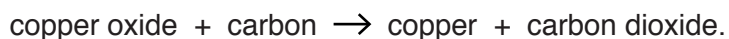


Fig. 8.1

- (i) Use the names of the electrodes to complete Fig. 8.1. [2]
- (ii) Describe the appearance of the substance that forms at the positive electrode.
[1]
- (b) Copper is extracted from copper oxide by heating with carbon.

The equation for this reaction is



State whether the copper oxide is oxidised or reduced during this reaction.

Explain your answer.

.....
[1]

(c) Copper, Cu, does not react with water.

Calcium, Ca, reacts rapidly with water.

Magnesium, Mg, reacts slowly with water.

Potassium, K, reacts very rapidly with water.

Place these four metals in order of reactivity, from most to least reactive.

.....	most reactive
.....	↓
.....	
.....	least reactive

[2]

(d) A student adds excess magnesium to dilute hydrochloric acid.

(i) State **two** changes that the student can make to increase the rate of this reaction.

1.

2.

[2]

(ii) Identify the salt produced during this reaction.

.....[1]

(iii) After the reaction finishes, the student removes the unreacted magnesium from the solution that has formed.

Name the separation technique that the student uses.

.....[1]

9 Fig. 9.1 shows a toy car powered by batteries.

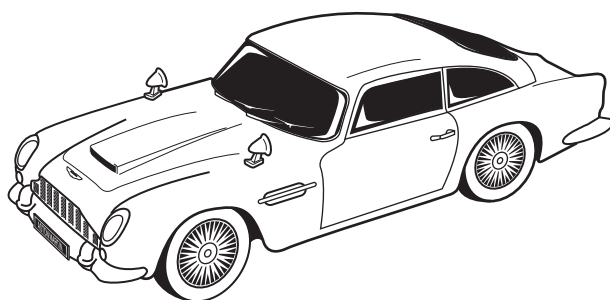


Fig. 9.1

Fig. 9.2 shows part of the circuit diagram for a circuit in the toy car, including the two headlamps which can be switched on when needed.

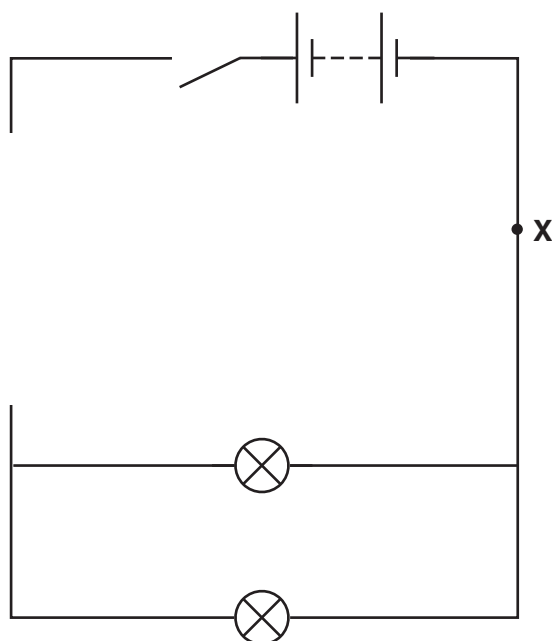


Fig. 9.2

- (a) The car is driven by an electric motor which must be able to operate whenever the switch shown in Fig. 9.2 is on.

On Fig. 9.2 complete the circuit diagram by adding

- the electric motor in parallel with the headlamps, with a wire connecting it to point X on the circuit.

The symbol for an electric motor is .

- a variable resistor connected to the electric motor to control the speed of the motor.
- a separate switch to control both headlamps only.
- any wires needed to complete the circuit connections.

[4]

- (b) The resistance of the variable resistor is decreased in order to speed up the motor.

Suggest why decreasing the resistance will speed up the motor.

.....
[1]

- (c) Complete the sentences below by writing the correct phrase in each space.

Each phrase may be used once, more than once or not at all.

by an ammeter

by an insulator

in parallel

in series

less than

more than

the same as

The headlamps are connected with each other.

When the headlamps are switched off, the current through the motor is

..... the current through the battery.

When the headlamps are switched on, the combined resistance of the motor and

headlamps is the resistance of the motor before the

headlamps are switched on.

[3]

- (d) Some modern cars on the road are powered by batteries.

Fig. 9.3 shows an electric car being charged by connecting it to the mains supply at an outdoor charging point.

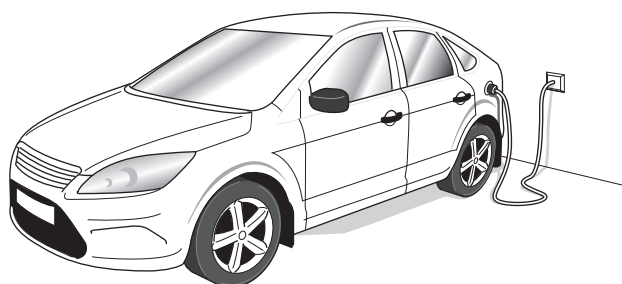


Fig. 9.3

Suggest one important electrical hazard for this charging process.

Suggest a way to make this safer.

hazard

safety improvement

.....
[2]

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The Periodic Table of Elements

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