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Cambridge IGCSE®

Combined Science (0653) Paper 4

[Structured Questions]

SAMPLE EDITION
2018 QUESTION PAPERS

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IGCSE Combined Science (0653) Product Page

Contents

1 2018 | Feb/Mar | Variant 2 | 0653_m18_qp_42

Topic & Sub-topic Index of Questions

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4133271582

COMBINED SCIENCE **0653/42**

Paper 4 (Extended) **February/March 2018**

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 20.

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 **20** printed pages.

CAMBRIDGE International Examinations

1 Fig. 1.1 shows a diagram of the female reproductive system and some events that take place before and during early pregnancy. The fetus is the name for the developing baby.

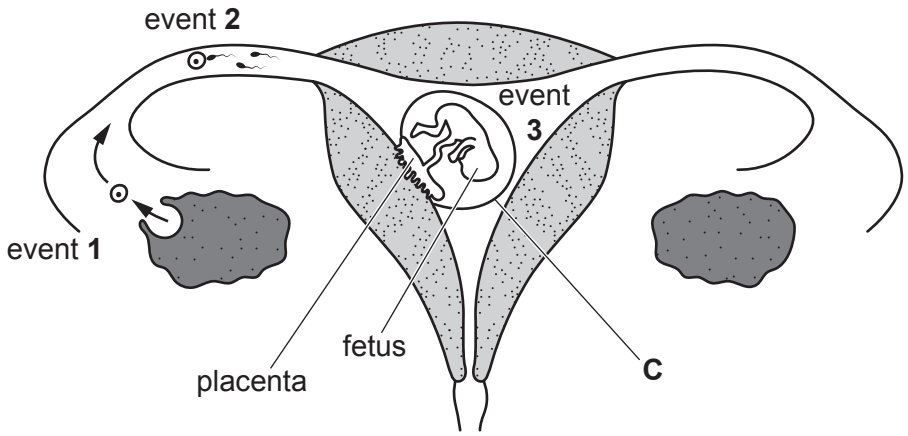

Fig. 1.1

(a) (i) State what happens during events **1** and **2**.

event **1** .....

event **2** .....

[2]

(ii) Name structure **C** in Fig. 1.1 and state its function.

name of **C** .....

function of **C** .....

.....

[2]

(b) Exchange of substances between blood in the fetus and the mother's blood takes place at the placenta. Some materials that are transferred across the placenta are shown.

amino acids **carbon dioxide** **fatty acids** **glucose** **oxygen**

(i) Name **one** substance from the list that shows net movement **from** the fetus into the mother's blood.

.....[1]

(ii) State the source of this substance in the fetus.

.....

.....[1]

(iii) Describe how the blood in the fetus reaches the placenta.

.....[1]

(c) Nicotine and carbon monoxide are taken into the blood when a person smokes.

Carbon monoxide combines with haemoglobin. This prevents oxygen from being carried in the red blood cells.

Suggest why carbon monoxide in the mother's blood is harmful to the fetus.

.....

.....

.....[2]

2 **(a)** Copper is extracted from molten copper chloride using electrolysis.

The apparatus is shown in Fig. 2.1.

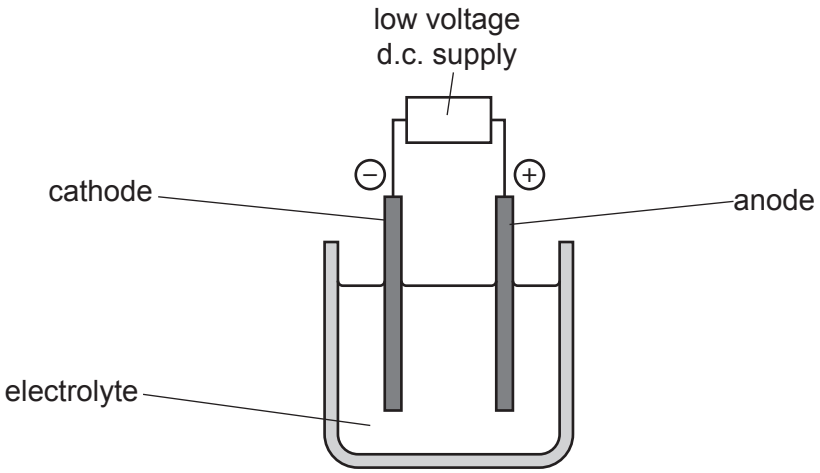

Fig. 2.1

(i) State whether this process for the extraction of copper involves a *chemical change* or a *physical change*.

Explain your answer.

change .....

explanation .....

.....

[1]

(ii) Identify the two ions present in the electrolyte and describe, in terms of electrons, the changes to these ions at the electrodes.

first ion .....

change .....

.....

second ion .....

change .....

.....

[3]

(b) A student finds out that copper can also be extracted by heating copper(II) oxide with carbon.

(i) Name the type of chemical reaction in which copper oxide is changed to copper.

.....[1]

(ii) Construct the balanced symbol equation for this reaction.

.....[2]

(c) Copper is one element in a collection of metals which have high melting points, high densities and form coloured compounds.

Suggest one other property that is shown by these metals and that is not shown by other metals.

.....[1]

3 Fig. 3.1 shows the International Space Station orbiting the Earth.

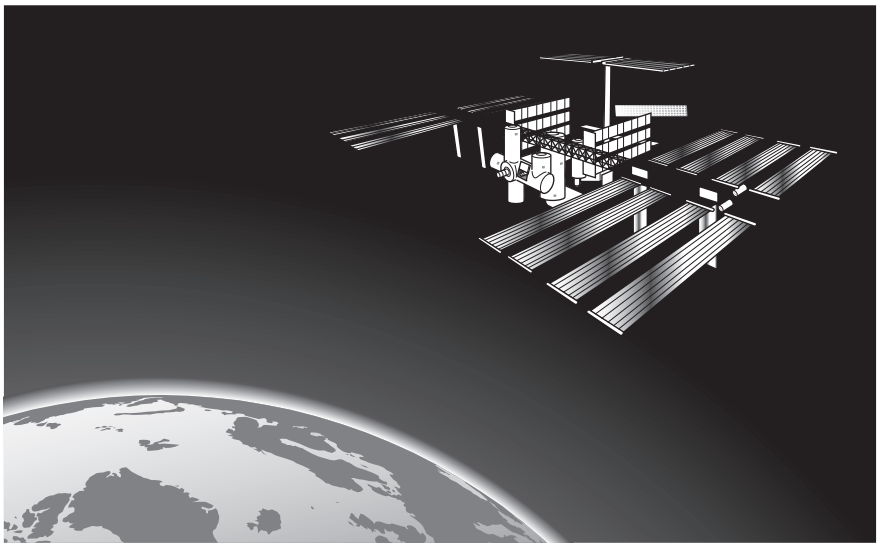

Fig. 3.1

(a) The space station is kept in orbit by the Earth's gravitational field.

Name the effect of the Earth's gravitational field on a mass.

.....[1]

(b) On one of its orbits, the space station travels at a speed of 28 000 km / h and takes 90 minutes to complete one orbit of the Earth.

Calculate the distance travelled by the space station during this orbit.

Show your working.

distance = ... km [2]

(c) The volume of the Earth is $1.08 \times 10^{21}\,m^3$.

The average density of the whole Earth is $5530\,kg/m^3$.

(i) Calculate the mass of the Earth.

State the formula you use and show your working.

formula

working

mass = ... kg [2]

(ii) The average density of the Earth's crust is $2700\,kg/m^3$.

Fig. 3.2 shows the interior structure of the Earth.

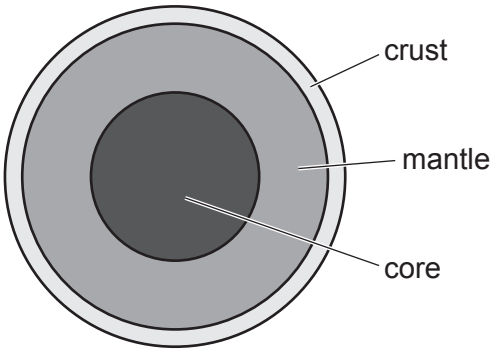

Fig. 3.2

Suggest how the average density of the mantle and core compares with the density of the crust.

Explain your answer.

.....

.....

.....[2]

(iii) The Earth's core has two layers. The outer core is liquid, while the inner core is solid. Both parts are made mostly of iron.

State **two** ways in which the atoms in the outer core will be arranged differently from the atoms in the inner core.

1. .....

.....

2. .....

.....

[2]

(d) Fig. 3.3 shows large solar panels that provide energy for the space station.

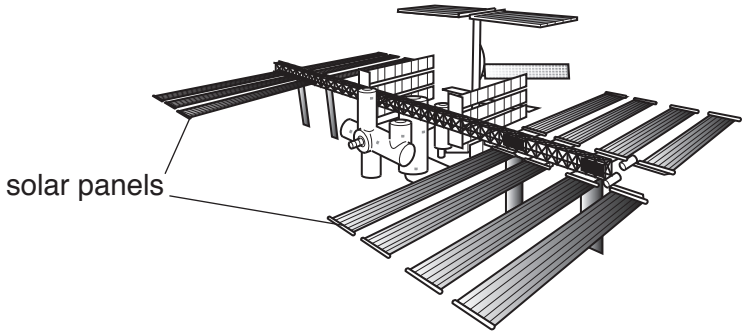

Fig. 3.3

The solar cells are in large panels that face the Sun to gather radiation energy from the Sun. This energy is stored by charging batteries on board the space station.

Complete the sequence of energy conversions that take place.

Radiation from the Sun

to ..... energy in the solar cells

to ..... energy in the batteries. [2]

4 Fig. 4.1 shows a cross-section of a leaf. Cells **P** and **Q** are examples of mesophyll cells in the leaf.

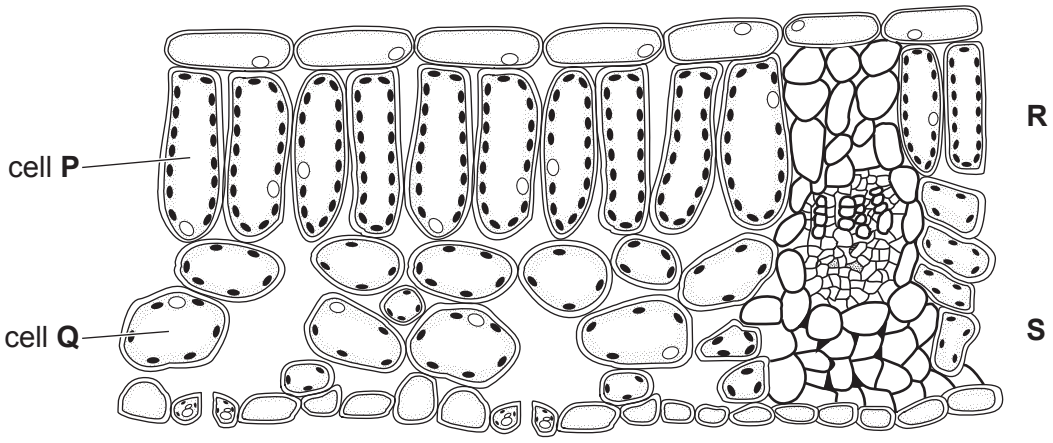

Fig. 4.1

(a) On Fig. 4.1 draw label lines from

1. **R** to the part of any cell which contains the genetic material,
2. **S** to a part of tissue that transports water.

[2]

(b) Cell **P** is able to carry out photosynthesis at a greater rate than cell **Q**.

Use evidence from Fig. 4.1 to support this statement referring to

(i) the position of cell **P** in the leaf compared with cell **Q**,

.....

.....[1]

(ii) the number of chloroplasts in cells **P** and **Q**.

.....

.....

.....[2]

(c) Describe in detail the function of chlorophyll in chloroplasts.

.....

.....

.....[2]

5 **(a)** An atom of bromine is represented by the symbol

$$^{79}_{35}\mathrm{Br}$$

(i) State the number of electrons, neutrons and protons in this atom.

electrons .....

neutrons .....

protons .....

[2]

(ii) Complete Table 5.1 to show the relative charges and approximate relative masses of electrons, neutrons and protons.

Table 5.1

particle	relative charges	approximate relative masses
electrons		
neutrons		
protons		

[2]

(b) Bromine is a non-metallic element.

State the types of bond that form when bromine reacts with sodium and with hydrogen.

Explain your answers in terms of electrons.

sodium and bromine .....

explanation .....

.....

hydrogen and bromine .....

explanation .....

.....

[3]

(c) The Periodic Table on page 20 shows the positions of bromine and the other elements in Group VII.

Predict **one** Group VII element that is displaced from its salts by bromine.

.....[1]

(d) Argon is a noble gas. The noble gases are in Group VIII of the Periodic Table.

(i) State the electronic structure of an atom of argon.

.....[1]

(ii) State one use of argon.

.....[1]

6 Fig. 6.1 shows two people talking to each other using cordless telephones over a link to a communications satellite.

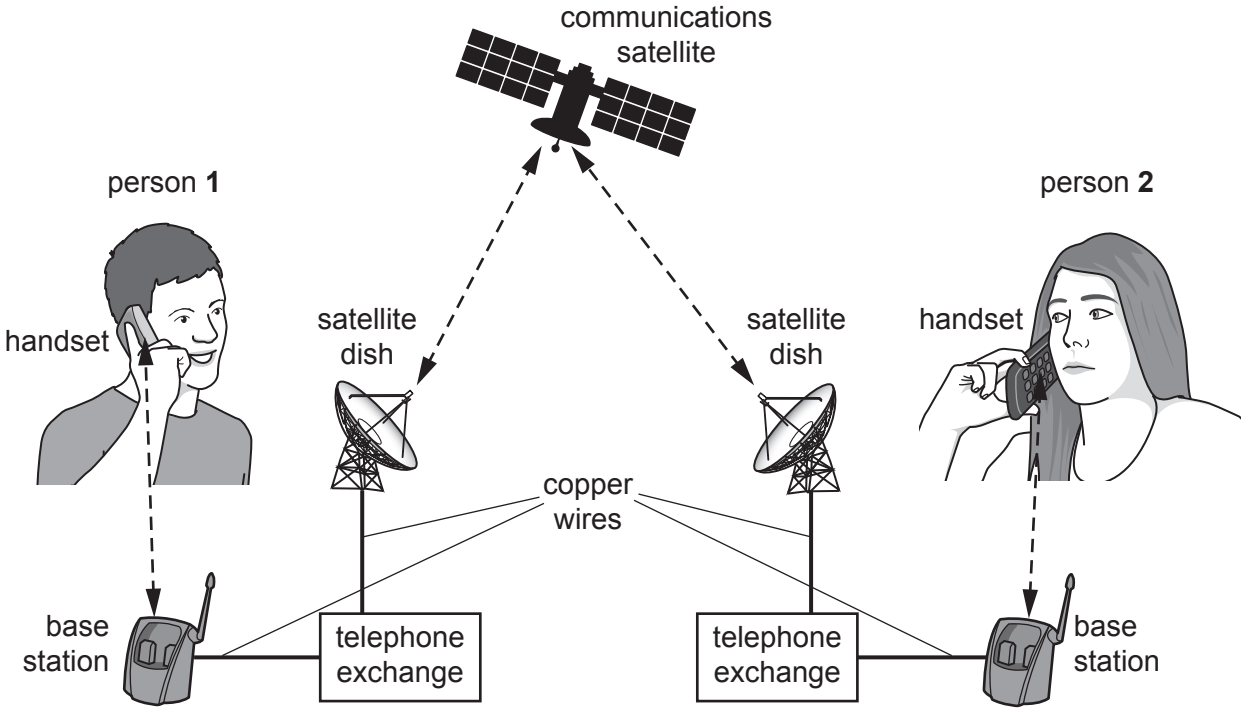

Fig. 6.1

(a) The conversation between the base stations and the satellite dishes is transmitted by electric currents in copper wires. These electric currents change rapidly when each person speaks.

Define *current* and suggest what is happening in terms of particles in a copper wire when a changing current passes through it.

.....

.....

.....[2]

(b) One person is speaking. Information is transmitted at frequencies of 300 Hz and 2.8×10^9 Hz at different stages in the communications system.

Identify the stage at which each of these frequencies is being used, and state the type of wave involved.

(i) A frequency of 300 Hz.

.....

.....[2]

(ii) A frequency of 2.8×10^9 Hz.

.....

.....[2]

(c) When a satellite telephone is used, there is a delay of about 0.1s between one person speaking and the other person hearing.

Explain why this delay happens.

.....

.....

.....[2]

7 **(a)** Breast milk contains all the nutrients needed for a newborn baby.

One mineral contained in milk is iron.

(i) State the role of iron in the body.

.....

.....[1]

(ii) Anaemia occurs due to a shortage of iron in the body.

Describe one symptom of anaemia.

.....[1]

(b) A student uses milk to make yoghurt at home. The stages below show the method he uses.

stage **1** He heats some milk to 90 °C, then allows it to cool.

stage **2** He adds a small amount of yoghurt which he bought in a supermarket. The yoghurt contains live microorganisms.

stage **3** He stirs the mixture then leaves it in an oven set at 45 °C for several hours.

stage **4** When the mixture thickens the yoghurt is ready and the student places it in a fridge.

(i) Explain why the student carries out the following processes in stage **1**.

1. Heating the milk to 90 °C.

.....

2. Allowing the milk to cool.

.....

.....
[2]

(ii) Suggest why the student only needs to use a small amount of the yoghurt in stage **2**.

.....

.....[1]

(iii) Predict whether the student can use some of the yoghurt he has made to repeat stages **1** to **4**.

Explain your answer.

.....

.....[1]

(c) Microorganisms in the yoghurt feed on the sugar in the milk and make lactic acid. The acid affects the proteins in the milk and the yoghurt becomes thick.

Suggest and describe in detail what happens to the protein molecules in the milk.

.....

.....

.....[2]

(d) There is no fibre present in the yoghurt.

(i) Explain why fibre is needed in a balanced diet.

.....

.....[1]

(ii) Suggest a way of including fibre in the yoghurt.

.....[1]

8 Petroleum is separated into useful fractions by fractional distillation.

Process **Y** produces short alkene molecules from longer alkane molecules.

These processes are shown in Fig. 8.1.

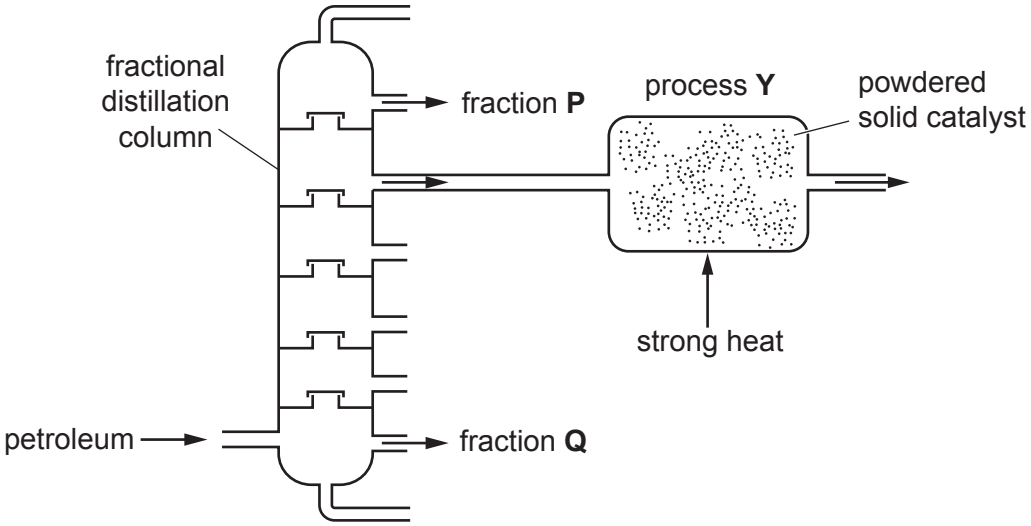

Fig. 8.1

(a) Fraction **P** and fraction **Q** contain different compounds.

Describe **two** of the differences between the compounds in fraction **P** and those in fraction **Q**.

1. .....

.....

2. .....

.....

[2]

(b) Name process **Y**.

.....[1]

(c) The rate of reaction in process **Y** is increased by using a powdered solid catalyst and a high temperature.

(i) State why the catalyst is used in the form of a powder.

.....

.....[1]

(ii) Explain how a high temperature increases the rate of reaction in process **Y**.

Use ideas about particles in your answer.

.....

.....[2]

(d) Bromine is added to two different samples of hydrocarbons **A** and **B**.

Hydrocarbon **A** decolourises the bromine.

Hydrocarbon **B** has no effect on the bromine.

State these two types of hydrocarbon.

A .....

B .....
[1]

(e) The combustion of hydrocarbons produces a gas that turns limewater milky.

(i) State the formula of this gas.

..... [1]

(ii) Suggest **one** concern that people have as the proportion of this gas is increasing in the air.

.....

.....[1]

9 Fig. 9.1 shows the circuit for an immersion heater using electrical energy to heat water. Two electric heating elements are immersed in water inside a large tank.

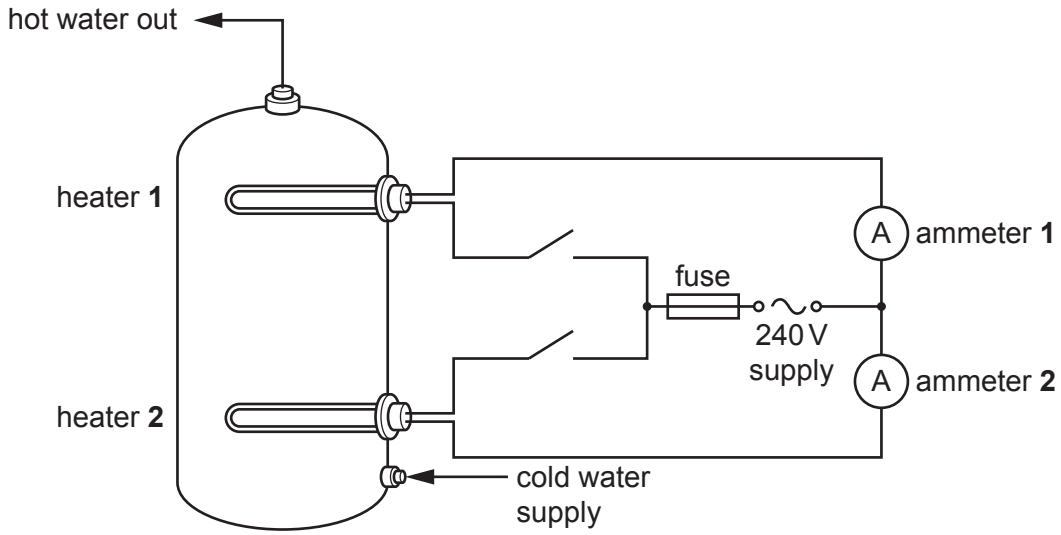

Fig. 9.1

The electrical energy is supplied at 240 V.

When both heaters are switched on, ammeter **1** reads 4 A, and ammeter **2** reads 10 A, giving a total current of 14 A through the fuse.

(a) The fuse in the supply circuit has a value of 20 A printed on it.

Explain why a 20 A fuse is used in this circuit.

.....

.....[1]

(b) Calculate the total resistance of the two heaters.

State the formula you use, and show your working.

formula

working

resistance = ... Ω [2]

(c) Calculate the electrical energy supplied by heater **2** when it is switched on for 8 hours.

State any formula you use, and show your working.

formula

working

energy = ... J [2]

(d) Heater **2** is used to provide a full tank of hot water, while heater **1** is used to provide a small amount of hot water quickly when the water in the tank is cold.

Explain why heater **1** is able to provide a small amount of hot water quickly without heating the whole tankful of water. You may wish to draw a diagram to help your answer.

.....

.....

.....

.....[3]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
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 A*l* aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 C*l* 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 T*l* 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 F*l* 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 dm^3 at room temperature and pressure (r.t.p.).

2 2018 | May/Jun | Variant 1 | 0653_s18_qp_41

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1 **(a)** Table 1.1 shows four substances found in food, and elements they may contain.

Complete Table 1.1 by placing a tick (✓) in the box if the elements shown are contained in the substances.

Table 1.1

substance in food	element			
	carbon	hydrogen	nitrogen	oxygen
carbohydrate				
fat				
protein				
water				

[4]

(b) Health problems can occur if a person does not eat a healthy diet.

Describe how a person can improve their diet if they suffer from constipation.

Explain your answer.

.....

.....

.....[2]

(c) A poor diet over a long time can also contribute to coronary heart disease.

Complete the following sentences using the words from the list.

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

cilia **fatty** **mucus** **protein**

smoking **stress** **unhealthy**

Coronary heart disease occurs when the coronary arteries become narrowed by ..... deposits. In addition to a poor diet possible causes of coronary heart disease are ..... and ..... .

[3]

(d) Coronary heart disease can be treated by inserting a stent into a narrowed coronary artery.

Fig. 1.1 shows a stent inside a coronary artery. Blood can flow freely through the stent.

narrowed coronary artery

coronary artery with stent inserted

Fig. 1.1

(i) Describe the effect of the stent on the rate of blood flow through the coronary artery.

Explain your answer.

.....

.....

.....[1]

(ii) Explain how the stent can benefit the heart muscle.

.....

.....

.....

.....[2]

2 **(a)** A student investigates the relative reactivity of different metals.

She places cleaned pieces of each metal in separate metal chloride solutions, as shown in Fig. 2.1.

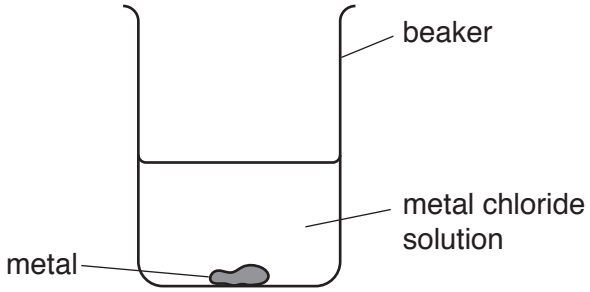


Fig. 2.1

She records her observations in Table 2.1.

Table 2.1

metal	metal chloride solution			
	aluminium chloride	lead chloride	tin chloride	zinc chloride
aluminium	–	✓	✓	✓
lead	✗	–	✗	✗
tin	✗	✓	–	✗
zinc	✗	✓	✓	–

key: ✓ reaction occurs
✗ no reaction
– metal not placed into solution

(i) Explain why the student does not use all combinations of metal and metal chloride solution.

.....

.....

.....[1]

(ii) Deduce the order of reactivity of the four metals, from most reactive to least reactive.

..... most reactive

.....

.....

..... least reactive

[2]

(b) Another metal, magnesium, reacts with dilute hydrochloric acid.

During this reaction, hydrogen gas and a salt are produced.

(i) Name the salt.

.....[1]

(ii) Construct the balanced symbol equation for this reaction.

Include state symbols.

.....[2]

(iii) Complete Fig. 2.2 to show apparatus used to collect the gas produced and measure its volume.

List the additional apparatus needed to measure the rate of this reaction.

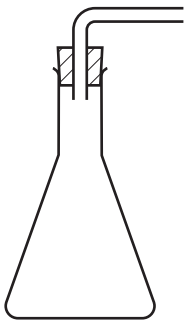


Fig. 2.2

apparatus .....
[2]

(c) An atom of aluminium is represented by:

$$^{27}_{13}Al$$

(i) Define *mass number*.

.....

.....[1]

(ii) Complete Fig. 2.3 to show the electronic structure of an atom of aluminium.

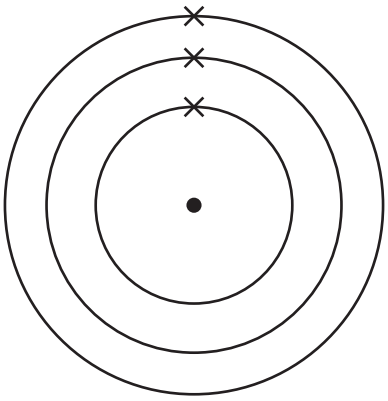


Fig. 2.3

[2]

3 Fig. 3.1 shows an airship carrying a load of weight **W**.

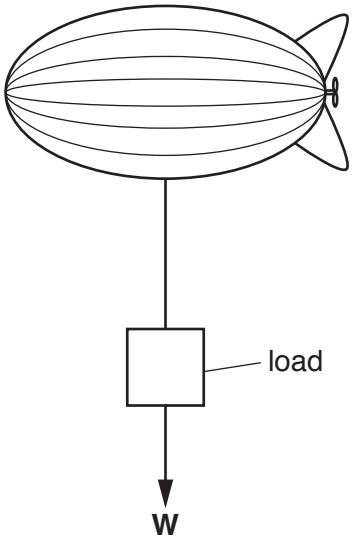


Fig. 3.1

(a) The airship and load are moving along horizontally on a calm day with no wind.

(i) On Fig. 3.1 draw another force arrow to show how the vertical forces acting on the load are balanced. [1]

(ii) At one time in its journey, the airship is moving and all of the forces acting on the airship are balanced.

Describe the motion of the airship at this time.

.....

.....[1]

(b) The airship moves at a constant height.

Fig. 3.2 shows a speed-time graph for part of the journey.

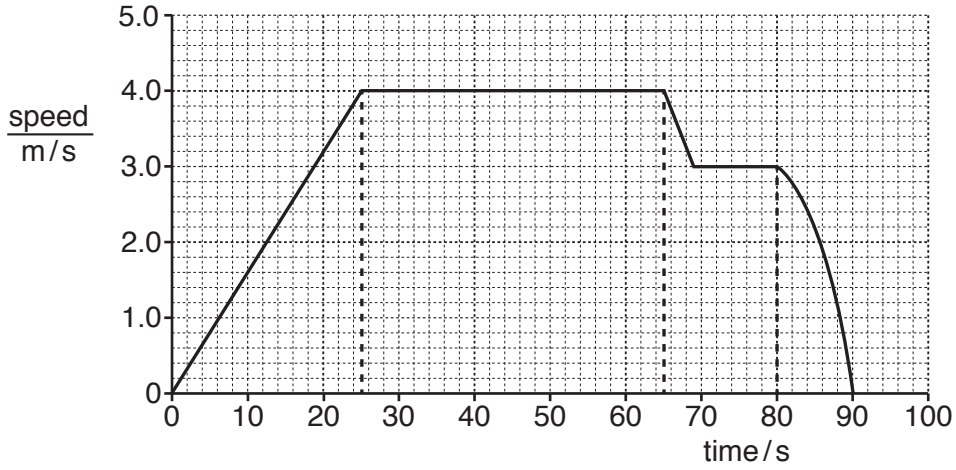


Fig. 3.2

(i) Use terms from the list to complete the statements below.

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

changing acceleration **constant acceleration** **constant speed**

Between 0 s and 25 s the airship travels with

..... .

Between 25 s and 65 s the airship travels with

..... .

Between 80 s and 90 s the airship travels with

..... .

[1]

(ii) Calculate how far the airship travelled in the first 65 s of its journey.

Show your working.

distance = ... m [2]

(c) The load is a solid metal cube of density 7000 kg / m^3. Each side of the cube measures 2.0 m.

Calculate the mass of the metal cube.

State any formula you use and show your working.

mass = ... kg [3]

4 **(a)** Fig. 4.1 shows three leaves **P**, **Q** and **R**. The leaves are of similar size. They are all taken from the same type of plant on a sunny day.

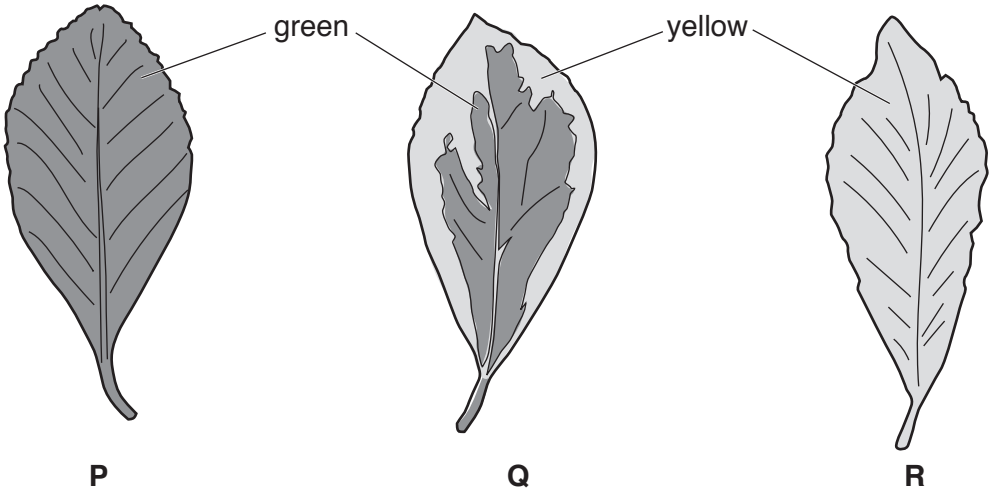


Fig. 4.1

(i) Suggest which leaf traps the most light energy.

Explain your answer.

leaf .....

explanation .....

.....

[1]

(ii) Describe in detail what happens to the light energy that is trapped in the leaves.

.....

.....

.....[2]

(b) All cells of plants need a source of glucose for aerobic respiration.

(i) State the balanced symbol equation for aerobic respiration.

.....[2]

(ii) Suggest how root cells are supplied with glucose.

.....

.....

.....[2]

5 **(a)** Ethene is manufactured by cracking larger hydrocarbon molecules.

(i) State what is meant by a *hydrocarbon*.

.....

.....[2]

(ii) Complete the dot-and-cross diagram in Fig. 5.1 to show the bonding electrons in a molecule of ethene, C_2H_4.

C C

Fig. 5.1

[2]

(iii) Describe a test to distinguish between ethane and ethene.

State the result for each.

test .....

ethane .....

ethene .....

[2]

(b) During the complete combustion of hydrocarbons, carbon dioxide is formed.

(i) The proportion of carbon dioxide in air is increasing.

Explain why this gives cause for concern.

.....

.....[1]

(ii) The combustion of hydrocarbons is an exothermic change.

Explain what is meant by *exothermic*.

Use ideas about energy transformations in your answer.

.....

.....

.....[2]

6 Fig. 6.1 shows a man watching television. He changes the channel with a remote control. The channel he now watches is showing a hot-air balloon high in the sky.

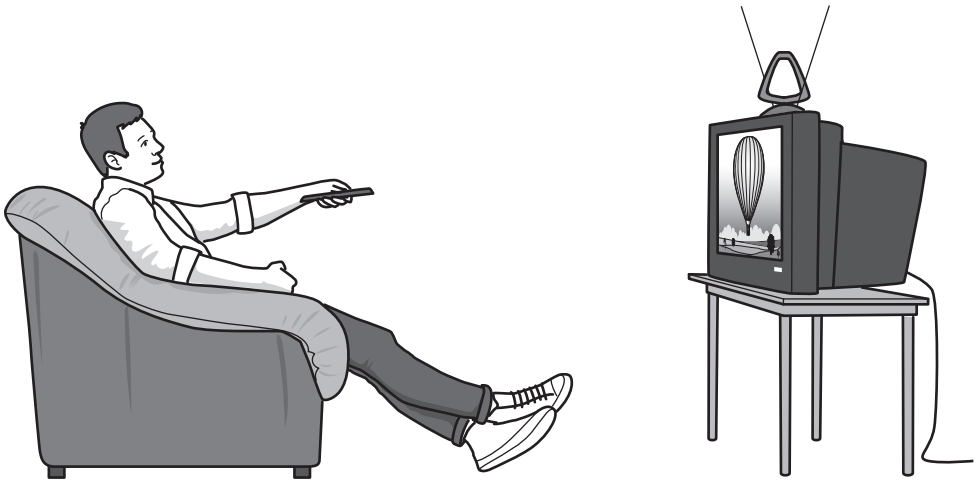


Fig. 6.1

(a) Fig. 6.2 shows an incomplete electromagnetic spectrum.

On Fig. 6.2 write in their correct boxes the names of the parts of the electromagnetic spectrum used for

- television transmission,
- changing the channel,
- watching the television.

Draw a line to link each use to the correct part of the spectrum you have named. One line has been completed for you.

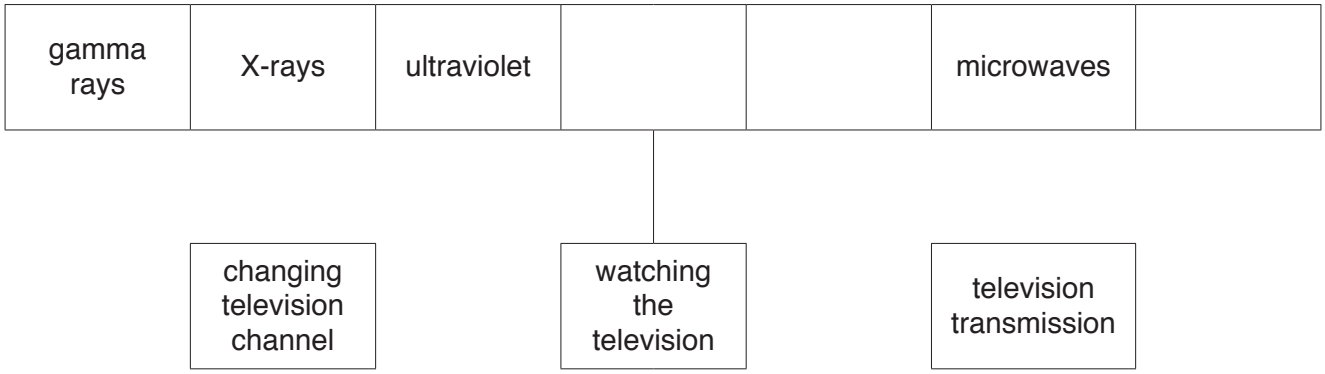


Fig. 6.2

[3]

(b) Fig. 6.3 shows a hot-air balloon being prepared for flight. A fuel burner produces hot gases. The balloon fills with the hot gases and the balloon rises up into the air.

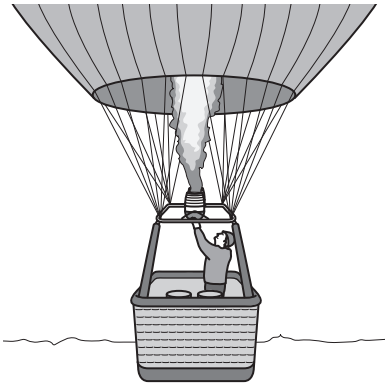


Fig. 6.3

(i) State the name of the method of thermal energy transfer from the fuel burner upwards into the balloon.

.....[1]

(ii) Explain in terms of density changes why this method of thermal energy transfer fills the balloon with the hot gases.

.....

.....

.....

.....[2]

(iii) Explain in terms of the motion of molecules, and the forces and distances between them, why the density of a gas changes on heating.

.....

.....

.....

.....

.....[3]

7 **(a)** Fig. 7.1 shows a food web in a garden.

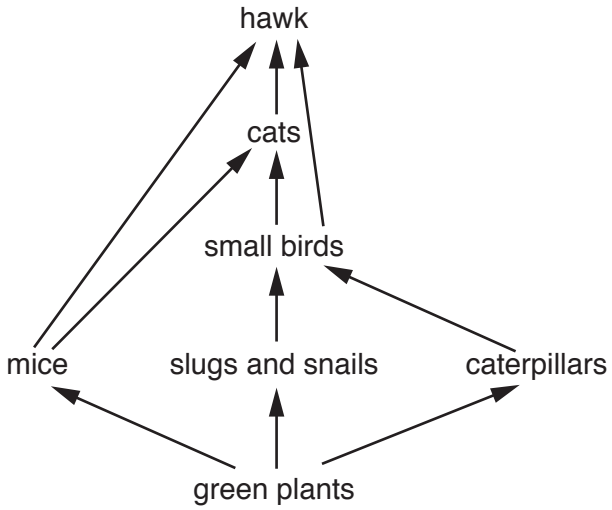


Fig. 7.1

(i) Using information in Fig. 7.1, draw a complete food chain consisting of only **four** organisms.

[2]

(ii) Name **all** organisms that feed at the same trophic level as the small birds.

.....[2]

(b) **(i)** The arrows show the transfer of chemical energy from one organism to another.

State **two** reasons why not all of the energy is transferred from the cat to the hawk.

1. .....

2. .....
[2]

(ii) Explain why there are not usually more than five trophic levels in a food chain.

.....

.....

.....[1]

8 **(a)** A student tries to make lead from a sample of solid lead(II) bromide using the electrolysis apparatus shown in Fig. 8.1.

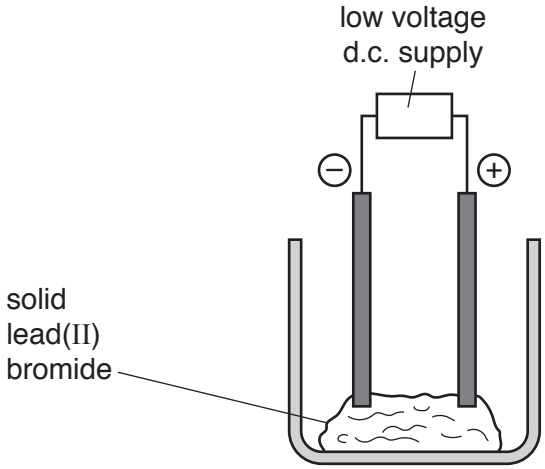


Fig. 8.1

This electrolysis does not work.

(i) Suggest a change that the student can make to the lead(II) bromide so that the electrolysis does work.

.....[1]

(ii) Explain why the electrolysis of solid lead(II) bromide does not work.

Use ideas about ions in your answer.

.....

.....[1]

(b) **(i)** Iron is extracted from its ore using carbon in an industrial process.

Name the industrial reaction vessel used.

.....[1]

(ii) Iron can be extracted from its ore using carbon.

Calcium, a Group II metal, cannot be extracted from its ore using carbon.

Explain this difference.

Use ideas about the reactivity of carbon and metals in your answer.

.....

.....

.....[2]

(c) (i) Metal **X** forms a coloured compound which acts as a catalyst.

Name the collection of metals in the Periodic Table which includes **X**.

.....[1]

(ii) Gas **Y** is an element that is used as an inert atmosphere in lamps.

Name the group of elements in the Periodic Table which includes **Y**.

.....[1]

[Turn over

9 Fig. 9.1 shows a small electric cooker with two hot plates.

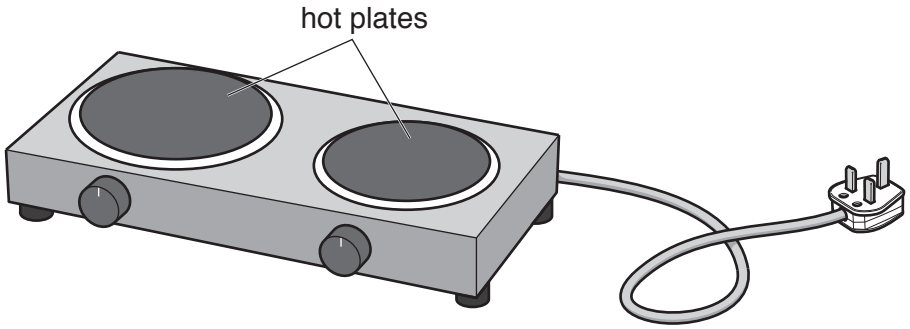


Fig. 9.1

The cooker is connected to a 240 V supply.

The plug contains a fuse with a rating of 13 A.

Each hot plate is controlled by a switch and a variable resistor.

Each hot plate can be turned on and off and controlled without affecting the other hot plate.

(a) (i) In Table 9.1 draw the circuit symbols for each component used in the cooker circuit.

Table 9.1

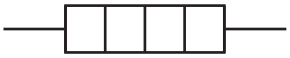
component	fuse	switch	variable resistor
symbol			

[2]

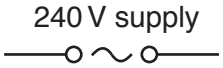
(ii) Name the type of circuit connection that will allow each hot plate to be controlled separately by its own switch.

.....[1]

(iii) Use the information about the cooker to draw a circuit diagram for the cooker.

Use the circuit symbol for a heater to represent a hot plate: 

The circuit diagram has been started for you.



[4]

(b) The larger hot plate is rated at a maximum of 1.5 kW, and the smaller hot plate is rated at a maximum of 1.0 kW.

Show by calculation that the 13 A fuse in the plug will not blow when the cooker is used with both hot plates at maximum rating.

State the formula you use and show your working.

formula

working

[3]

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).

3 2018 | May/Jun | Variant 2 | 0653_s18_qp_42

Topic & Sub-topic Index of Questions

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6720938139

COMBINED SCIENCE **0653/42**

Paper 4 (Extended) **May/June 2018**

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 **21** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

[Turn over

1 **(a)** Fig. 1.1 shows an experiment with a germinating seed. At the start, a seed is pinned to a wall and is placed in the dark.

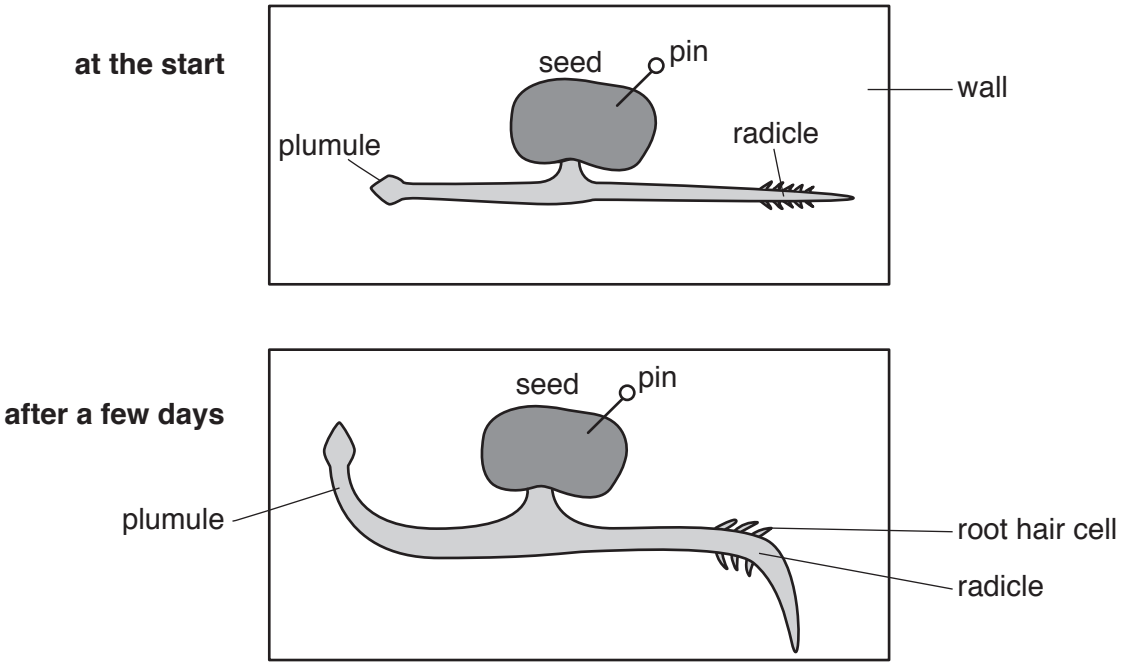


Fig. 1.1

(i) Name the response shown by the seed in Fig. 1.1 after a few days.

.....[1]

(ii) Explain the response of the plumule in Fig. 1.1 after a few days in terms of the action of auxin hormones.

.....

.....

.....[2]

(iii) Describe how the action of auxin hormones is different in the cells of the radicle.

.....

.....[1]

(b) A radicle has root hair cells which are used in water uptake from the soil.

(i) Explain how the shape of the root hair cell helps it with its function of water uptake.

.....

.....

.....[2]

(ii) Explain why water moves into the root hair cell from the soil.

.....

.....

.....[2]

(c) State the tissue which carries water through the plant.

.....[1]

[Turn over

2 **(a)** A student investigates the combustion of a hydrocarbon, as shown in Fig. 2.1.

Gases move through the apparatus in the direction shown by the arrows.

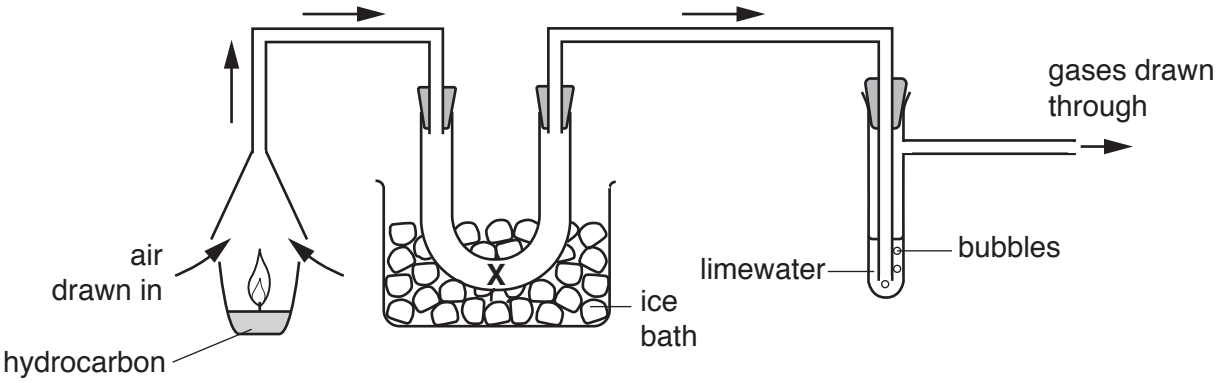


Fig. 2.1

The student thinks that carbon dioxide and water are formed when the hydrocarbon burns.

(i) Suggest a chemical that the student uses at position **X** to test for the presence of water.

State the observation that shows that water is present.

chemical .....

observation .....

.....

[2]

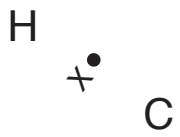
(ii) Limewater contains calcium hydroxide, $Ca(OH)_2$.

Calcium hydroxide reacts with carbon dioxide to form calcium carbonate, $CaCO_3$.

Write the symbol equation with state symbols for this reaction.

.....[2]

(b) **(i)** Complete the dot-and-cross diagram for the hydrocarbon C_2H_4, showing the bonding electrons.



[2]

(ii) Carbon and hydrogen are non-metallic elements.

State the type of chemical bond that forms between these two elements.

.....[1]

(c) An atom of carbon is represented by:

$$^{12}_{6}C$$

State the electronic structure of carbon.

..... [1]

3 Fig. 3.1 and Fig. 3.2 show two circuit diagrams each connected to operate an electric motor and a lamp.

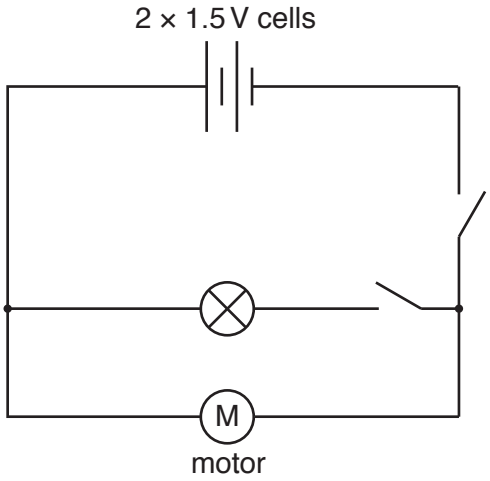


Fig. 3.1

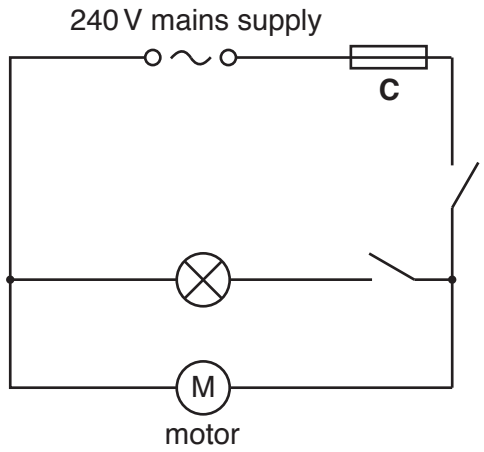


Fig. 3.2

(a) Identify component **C and** explain why it is necessary in the circuit in Fig. 3.2, but not in the circuit in Fig. 3.1.

component **C** .....

explanation .....

.....

.....

.....[3]

(b) **(i)** In Fig. 3.1, when the motor is switched on, but the lamp is not, a current of 0.2 A flows through the motor.

Calculate the resistance of the motor.

State the formula you use and show your working.

formula

working

resistance = ... Ω [2]

(ii) In Fig. 3.2, the motor has a power rating of 20 W and the lamp has a power rating of 100 W.

Calculate the current in the main circuit when both the motor and the lamp are switched on.

State the formula you use and show your working.

formula

working

current = ... A [3]

(c) A lamp is placed in front of a mirror. A student tries to look at the reflection of the lamp in the mirror, as shown in Fig. 3.3.

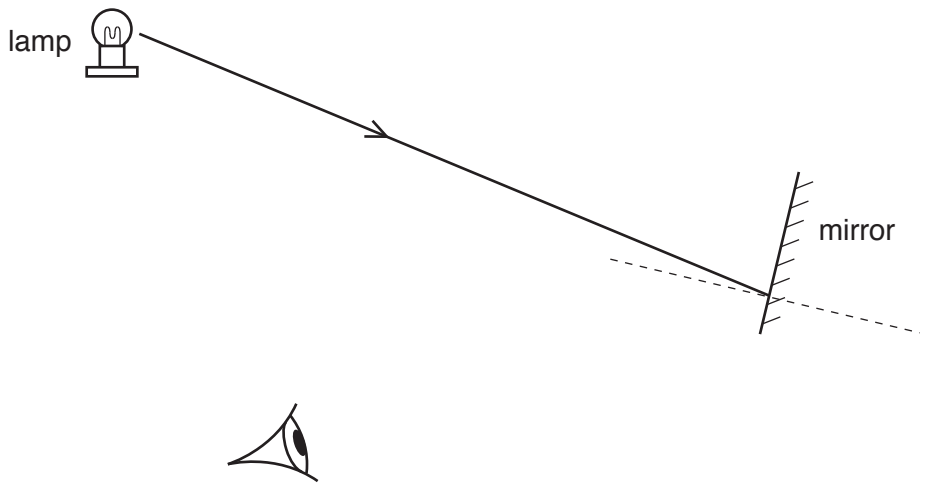


Fig. 3.3

On Fig. 3.3, complete the ray diagram to show whether the student can see the image of the lamp in the mirror or not. [1]

4 **(a)** During inspiration air passes through different parts of the airway to reach the alveoli.

Use the list of words to show the correct order of structures through which the air passes.

bronchiole **bronchus** **diaphragm** **heart**

oesophagus **rib** **trachea**

nose

↓

.....

.....

.....

↓

alveoli

[1]

(b) Fig. 4.1 shows drawings of the alveoli in healthy lungs. Fig. 4.1 also shows the alveoli of a person with a lung infection such as bronchitis.

alveoli of a healthy person alveoli of a person with bronchitis

Fig. 4.1

People who smoke are more likely to suffer from bronchitis.

Describe how cigarette smoke encourages bronchitis by its effect on

1. the amount of mucus produced by cells lining the airway,

.....

.....

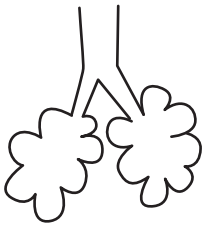
2. the cilia on the surface of cells lining the airway.

.....

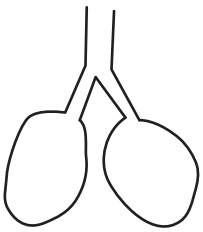
.....

[3]

(c) Fig. 4.2 shows a drawing of the alveoli in healthy lungs. Fig. 4.2 also shows the alveoli of a person with emphysema, a lung disease caused by smoking.



alveoli in healthy lungs



alveoli of a person with emphysema

Fig. 4.2

Suggest how the rate of gas exchange is affected in a person with emphysema.

Explain your answer.

.....

.....[1]

(d) Smoking is also a possible cause of coronary heart disease.

(i) Describe changes in the heart which cause coronary heart disease.

.....

.....

.....[2]

(ii) List **two** other possible causes of coronary heart disease.

1. .....

2. .....
[2]

5 **(a)** A student adds magnesium powder to dilute hydrochloric acid.

She then uses a balance to investigate the rate of this reaction, as shown in Fig. 5.1.

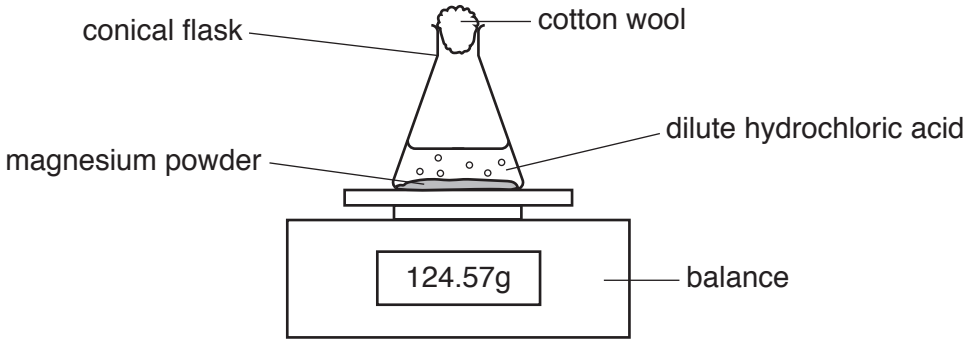


Fig. 5.1

(i) Describe the change in the mass, if any, of the conical flask and its contents.

Explain your answer.

change .....

explanation .....

.....

[2]

(ii) State the effect of increasing the temperature on the rate of this reaction.

Explain your answer.

effect .....

explanation .....

.....

[2]

(iii) Predict the effect of using calcium, rather than magnesium, on the rate of reaction.

Explain your answer using ideas about reactivity.

effect .....

explanation .....

.....

[2]

(b) Magnesium is produced by the electrolysis of molten magnesium chloride.

Magnesium chloride consists of magnesium ions, Mg^{2+}, and chloride ions, Cl^{-}.

(i) Name the electrode at which magnesium forms.

.....[1]

(ii) Describe, in terms of electrons, how chloride ions turn into chlorine atoms in this process.

.....

.....[1]

(iii) Predict the formula of magnesium chloride.

..... [1]

(iv) Magnesium is also produced by heating magnesium oxide with silicon.

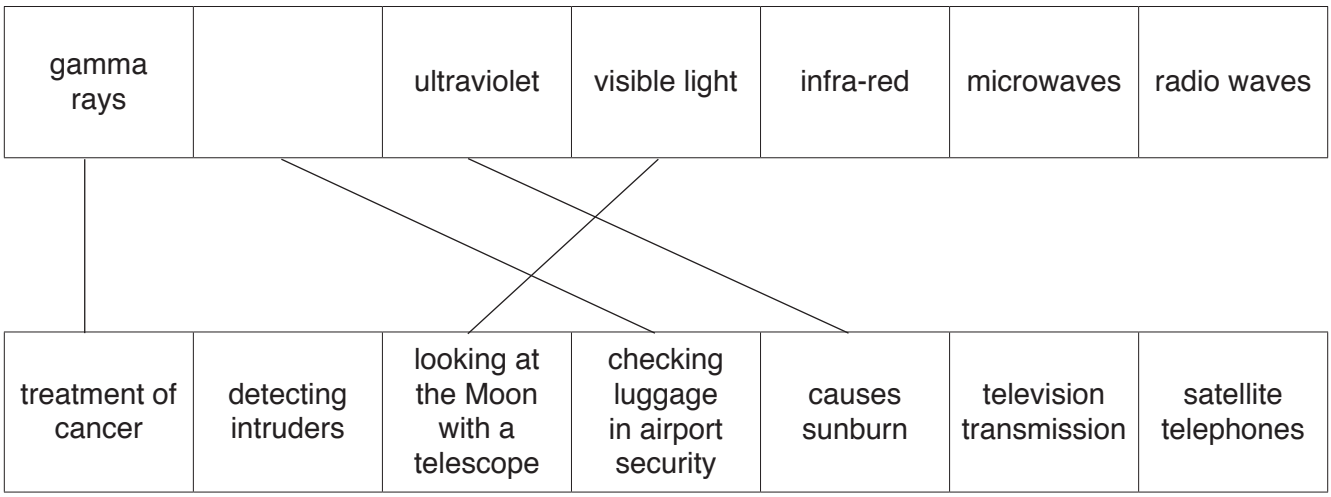
In this process, oxygen is removed from magnesium oxide.

State the type of reaction that leads to the loss of oxygen from a substance.

.....[1]

6 **(a)** Fig. 6.1 shows an incomplete electromagnetic spectrum linked to some uses of different parts of the electromagnetic spectrum.

electromagnetic spectrum



uses

Fig. 6.1

(i) On Fig. 6.1 complete the empty box in the electromagnetic spectrum. [1]

(ii) On Fig. 6.1 draw **three more** lines so that each type of electromagnetic wave is linked to a use of that type.

Four lines have already been done for you. [1]

(b) Infra-red radiation is also used in remote controls for television sets and other electronic devices in the home.

An astronaut on a space walk outside the International Space Station uses the same type of remote control to operate an electronic device in space.

Explain why it is possible for a remote control to work in space.

.....

.....[1]

(c) Fig. 6.2a and Fig. 6.2b show an experiment to investigate the transfer of thermal energy (heat).

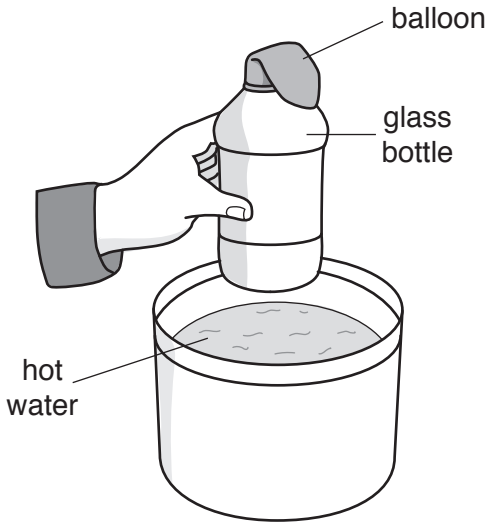


Fig. 6.2a

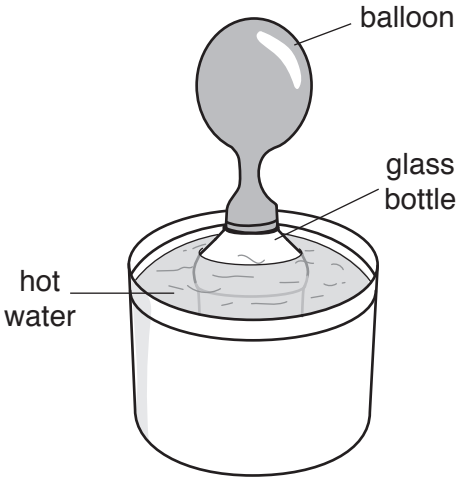


Fig. 6.2b

Fig. 6.2a shows the apparatus before the glass bottle is lowered into the hot water.

Fig. 6.2b shows the apparatus after the bottle has been in the water for 5 minutes.

The bottle and the air inside are slowly heated as thermal energy is conducted through the glass and warms the air inside. As the bottle is heated, the balloon fills with air.

(i) Suggest why the heating of the air in the bottle is slow.

.....[1]

(ii) Explain in terms of the arrangement and the speed of molecules why the balloon above the glass bottle fills with warm air as the air is heated.

.....

.....

.....

.....

.....[3]

7 Fig. 7.1 shows a simplified version of the carbon cycle. The numbers represent processes involved in the cycle.

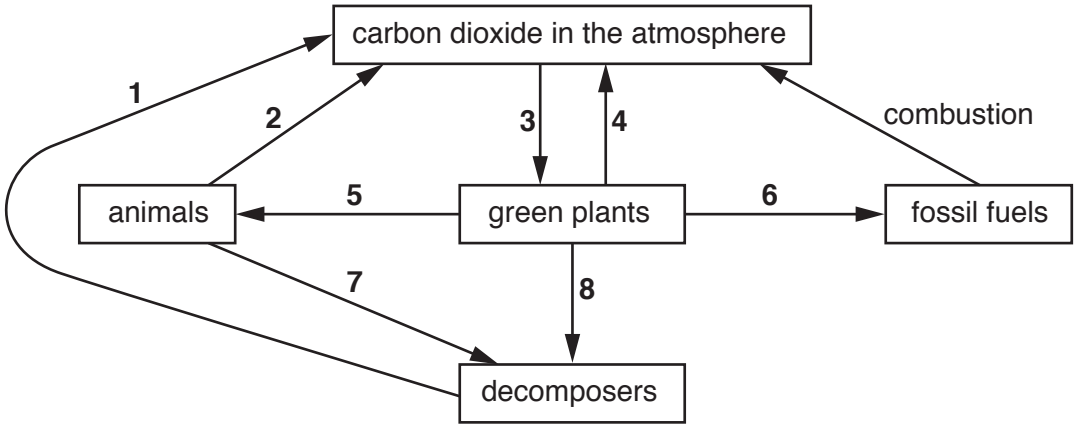


Fig. 7.1

(a) (i) State the source of the energy input to the carbon cycle.

.....[1]

(ii) Name process **7**.

.....[1]

(iii) Using Fig. 7.1 state the numbers which represent respiration.

.....[1]

(b) (i) Name process **3**.

.....[1]

(ii) With reference to process **3**, explain the effect of deforestation on the carbon dioxide concentration in the atmosphere.

.....

.....

.....

.....[2]

(c) The gas sulfur dioxide is released into the atmosphere during the combustion of fossil fuels.

Explain the consequences of adding sulfur dioxide to the atmosphere.

.....

.....

.....

.....[3]

8 **(a)** **(i)** Elements are arranged in the Periodic Table in atomic number order.

State the relationship between the group number of an element and the number of outer-shell electrons in an atom of the element.

.....[1]

(ii) Describe the relationship between the number of outer-shell electrons and the metallic/non-metallic character of an element.

.....

.....[1]

(b) Rubidium is a Group I metal below potassium in the Periodic Table.

Rubidium is a solid at room temperature, 20 °C.

Potassium melts at 63 °C and reacts vigorously with water.

(i) Suggest the melting point of rubidium.

..... °C [1]

(ii) Compare the reactivities of rubidium and of potassium with cold water.

.....

.....[1]

(c) Explain the use of chlorine in water purification.

.....

.....[1]

(d) The reaction between sodium and chlorine is exothermic.

Sodium chloride is formed in this reaction.

(i) State what is meant by *exothermic*.

Use ideas about energy transformations in your answer.

.....

.....[2]

(ii) Suggest **one** substance that reacts safely with dilute hydrochloric acid to form sodium chloride.

.....[1]

9 Fig. 9.1 shows a crane carrying a load.

The crane is floating in the sea on a calm day.

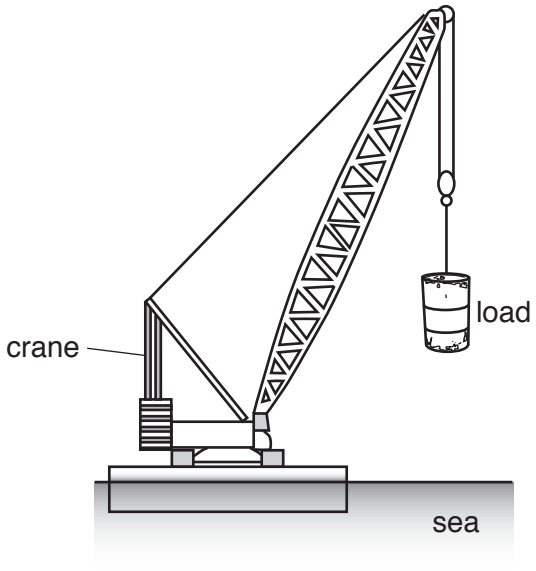


Fig. 9.1

(a) (i) The load is stationary.

On Fig. 9.1 draw two force arrows to show the vertical forces acting on the load. [2]

(ii) One of the forces acting on the load is called *tension*.

Name the other force acting on the load.

.....[1]

(b) The crane lifts the load vertically upwards from the sea bed to a position above the sea surface.

Fig. 9.2 shows a speed-time graph for the load during this operation.

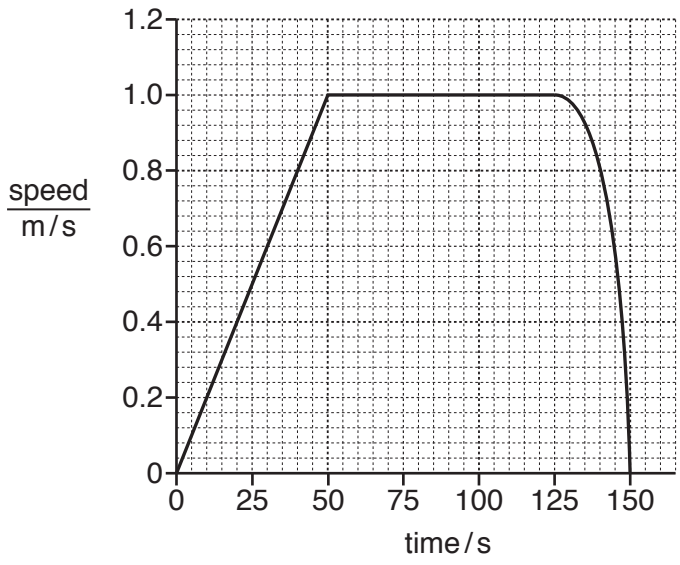


Fig. 9.2

(i) Use terms from this list to complete the statements below.

changing acceleration **constant acceleration** **constant speed**

Between 0 s and 50 s the load travels with

..... .

Between 50 s and 125 s the load travels with

..... .

Between 125 s and 150 s the load travels with

..... .

[1]

(ii) The load reaches the sea surface after 125 s.

Use Fig. 9.2 to calculate the depth of the sea from the sea bed to the sea surface.

Show your working.

depth of sea = ... m [2]

(iii) The total work done by the crane in 150 s is 2 000 000 J.

Calculate the average power output of the crane during this time.

State the formula you use and show your working.

formula

working

power output = ... W [2]

(c) The load being lifted by the crane is a container full of sea water.

The volume inside the container is 5000 dm^3. The density of sea water is 1025 kg/m^3.

Calculate the mass of sea water being lifted.

State the formula you use and show your working.

formula

working

mass = ... kg [3]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).

4 2018 | May/Jun | Variant 3 | 0653_s18_qp_43

Topic & Sub-topic Index of Questions

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

COMBINED SCIENCE **0653/43**

Paper 4 (Extended) **May/June 2018**

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 20.

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 **20** printed pages.

CAMBRIDGE International Examinations

1 **(a)** Fig. 1.1 shows a diagram of a duckweed plant. Duckweed is found in lakes. The green leaves float on the top of the water and the roots reach down into the water.

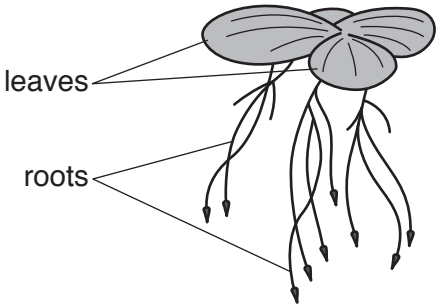


Fig. 1.1

(i) Photosynthesis takes place in the leaves of the duckweed.

State the balanced symbol equation for photosynthesis.

.....[2]

(ii) Air is trapped between the cells in the leaves of the duckweed.

Suggest how this is an advantage to the survival of the duckweed.

.....

.....

.....[2]

(b) An investigation is carried out to find the effect of increased concentration of nitrate ions on the growth of a duckweed population.

At the start, dishes **A** and **B** each contain lake water and six duckweed plants. Nitrate ions are added to dish **B** and both dishes are left for five days.

The results are shown in Fig. 1.2.

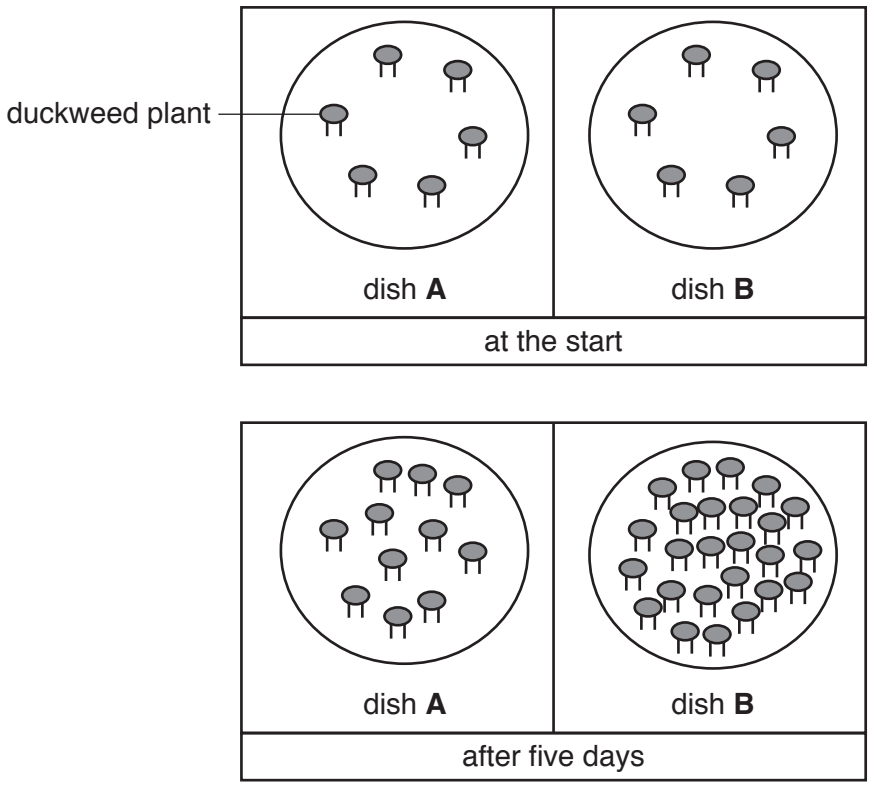


Fig. 1.2

(i) Use the information in Fig. 1.2 to describe the difference between the results in dishes **A** and **B** after five days.

.....

.....

.....

.....[2]

(ii) State a conclusion that can be drawn from the results seen in Fig. 1.2.

.....

.....[1]

(c) Some fertiliser containing nitrate ions accidentally enters a lake which has a small number of duckweed plants on the surface.

(i) Predict how the surface of the lake changes over the next few weeks.

.....

.....[1]

(ii) The plants beneath the surface of the lake die. The fish in the lake die too.

Describe the role of the lake bacteria in these events.

.....

.....

.....

.....

.....[3]

2 **(a)** An aqueous solution of an ionic compound is electrolysed using inert electrodes.

The apparatus is shown in Fig. 2.1.

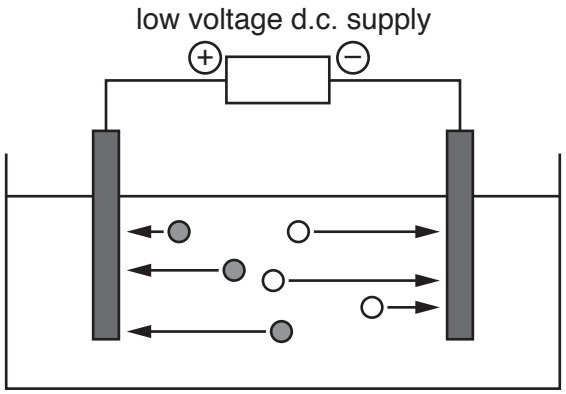


Fig. 2.1

(i) On Fig. 2.1, add label lines to identify

- **one** metal ion,
- **one** non-metal ion,
- the electrolyte,
- the anode.

[3]

(ii) State, in terms of electrons, what happens during electrolysis to

the positive ions, ...

the negative ions. .....

[2]

(b) Sodium cannot be extracted by the electrolysis of aqueous sodium chloride.

Describe how sodium is extracted from sodium chloride.

.....

.....

.....[2]

(c) Iron is obtained from iron ore in the blast furnace.

(i) A substance is used in the blast furnace as a fuel to produce a high temperature.

Name this substance.

.....[1]

(ii) Name **one** reducing agent that reacts with iron oxide in the blast furnace to form iron.

.....[1]

3 Fig. 3.1 shows a small quadcopter (drone with four rotors) being operated by radio control.

Fig. 3.1

(a) The drone is hovering above the ground with its rotors turning, but the drone is not moving. Fig. 3.1 shows one of the forces acting on the drone.

(i) On Fig. 3.1 draw an arrow for a second force needed if the drone is not moving. [1]

(ii) The radio control is used to stop the rotors turning.

Describe the resulting motion of the drone.

.....

.....

.....[2]

(iii) Give a reason for your answer to **(a)(ii)** in terms of forces.

.....

.....[1]

(b) The drone has a mass of 5 kg. It takes off from the ground and climbs vertically upwards to a height of 50 m.

(i) Calculate the gravitational potential energy gained by the drone.

(gravitational field strength, g = 10 N / kg)

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

formula

working

potential energy gained = ... unit .....[3]

(ii) The drone is powered by batteries that drive electric motors to turn the rotors.

Complete the sequence of energy changes as the drone takes off and climbs to a height of 50 m above the ground.

..... energy

→ ..... energy

→ ..... energy

→ gravitational potential energy [2]

(c) The radio control sends radio signals to control the drone.

(i) State the type of wave that includes radio waves.

.....[1]

(ii) The radio signals used travel at 3.0×10^8 m/s and have a frequency of 35×10^6 Hz.

Calculate the wavelength of these radio waves.

State the formula you use and show your working.

formula

working

wavelength = ... m [2]

4 Fig. 4.1 shows a wind-pollinated flower.

Fig. 4.1

(a) Name structures **A** and **B** and explain how they make the flower suited to wind pollination.

A .....

explanation .....

.....

B .....

explanation .....

.....
[4]

(b) All parts of the flower in Fig. 4.1 are pale green.

Suggest why bright colours are **not** needed in these flowers.

.....

.....[1]

(c) The plant which produces the flower in Fig. 4.1 reproduces by sexual reproduction.

Define the term *sexual reproduction*.

.....

.....

.....

.....[2]

5 **(a)** The electronic structure of an atom of element **E** is shown in Fig. 5.1.

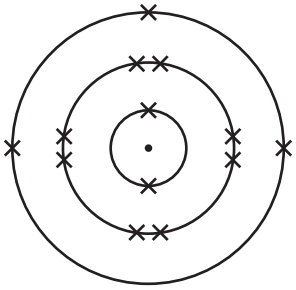


Fig. 5.1

(i) Use Fig. 5.1 to deduce the atomic number of element **E**.

Explain how the information in Fig. 5.1 is used.

atomic number .....

explanation .....

.....

[1]

(ii) Use the Periodic Table on page 20 to name element **E**.

.....[1]

(b) An atom of chlorine is represented by:

$$^{37}_{17}Cl$$

(i) State the mass number and the number of neutrons in this atom.

mass number .....

number of neutrons .....

[2]

(ii) The electronic structure of this atom of chlorine is 2, 8, 7.

Complete Fig. 5.2 to show the electronic structure of a chloride **ion**.

Fig. 5.2 [1]

(iii) Explain why chlorine is shown in the Periodic Table, but sodium chloride is not.

.....

.....[1]

(c) An aqueous solution is tested to find out if chloride ions are present.

Describe the test **and** state the positive result.

test .....

result .....
[2]

6 Fig. 6.1 shows ice cubes being added to a drink at 25 °C to cool the drink down.

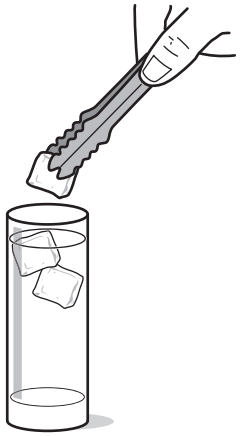


Fig. 6.1

(a) Fig. 6.2 shows a graph of the temperature change in the drink with time after the ice cubes are added.

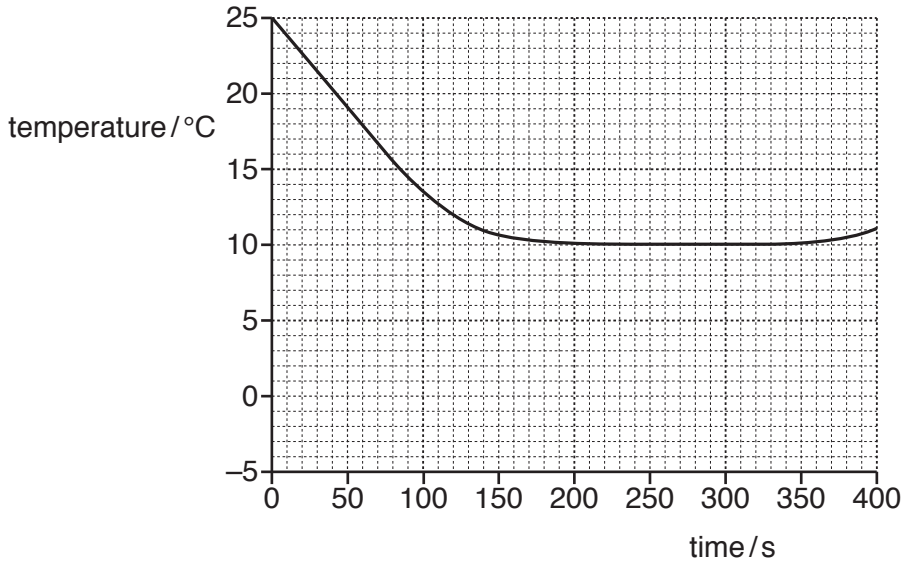


Fig. 6.2

The ice cubes are at a temperature of –5 °C when they are added to the drink. The melting point of ice is 0 °C.

On Fig. 6.2, sketch a graph to represent the temperature change of the water molecules that start in the ice cubes over the same time. [3]

(b) As the ice melts at the top of the drink, the cold liquid formed sinks to the bottom. This makes warmer liquid come up to the surface where the ice is floating.

(i) State the name of the method of thermal energy transfer that is happening as the cold liquid sinks, and warmer liquid rises.

.....[1]

(ii) Explain why this circulation of liquid occurs as the ice melts.

.....

.....

.....[1]

7 **(a)** Fig. 7.1 shows a diagram of the human gas exchange system.

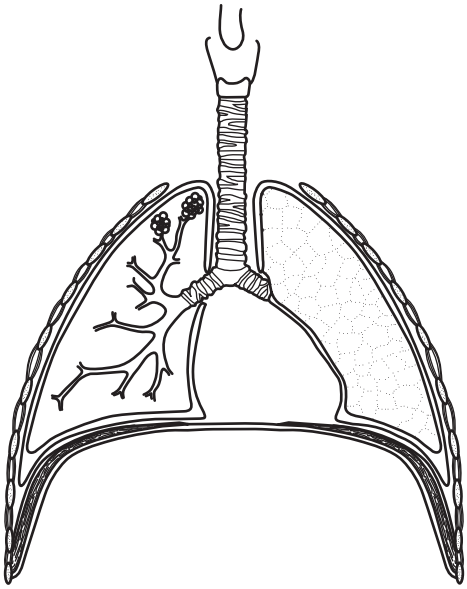


Fig. 7.1

On Fig. 7.1 use label lines to identify

(i) the larynx, [1]

(ii) a bronchiole. [1]

(b) Fig. 7.2 shows a diagram of an alveolus in the lungs.

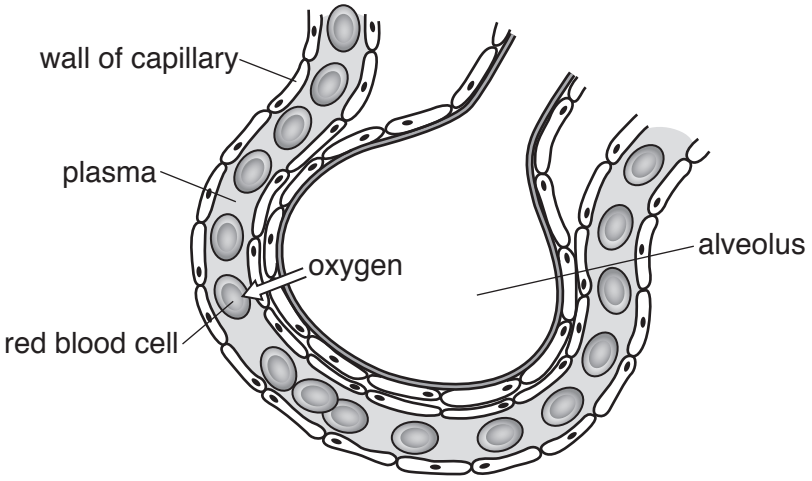


Fig. 7.2

(i) Describe **two** features of a gas exchange surface which are visible in Fig. 7.2.

1. .....

2. .....

[2]

(ii) Oxygen diffuses into the blood at the alveoli.

Explain why oxygen diffuses from the alveoli into the blood.

.....

.....

.....[1]

(c) Describe how the gas exchange system is protected by mucus and cilia.

mucus .....

.....

cilia .....

.....

[2]

(d) The blood leaving the heart from the left ventricle has a greater pressure than the blood leaving the right ventricle.

Explain why this difference in pressure is needed.

.....

.....

.....

.....[2]

8 Petroleum is a fossil fuel.

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

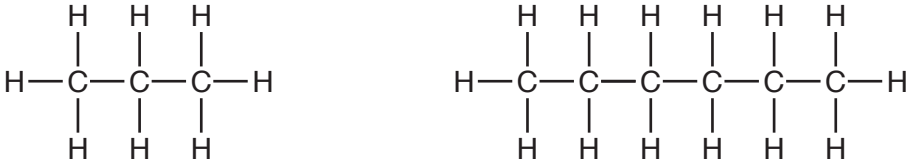
1. .....

2. .....
[1]

(ii) Name the industrial process used to separate the substances in petroleum.

.....[1]

(b) The structures of two hydrocarbon molecules are shown in Fig. 8.1.



A **B**

Fig. 8.1

(i) Construct the balanced symbol equation for the complete combustion of hydrocarbon **A**.

.....[2]

(ii) State the formula of hydrocarbon **B**.

..... [1]

(iii) State which of these two hydrocarbons has the higher boiling point.

Explain your answer.

hydrocarbon .....

explanation .....

.....

.....
[2]

(c) The formula of hydrocarbon **C** is C_2H_4.

(i) Name the process used to manufacture hydrocarbon **C** from larger hydrocarbon molecules.

.....[1]

(ii) Draw the dot-and-cross diagram to show the bonding electrons in a molecule of hydrocarbon **C**.

C C

[2]

9 Fig. 9.1 shows an electric toaster used for toasting bread slices in a hotel dining room.

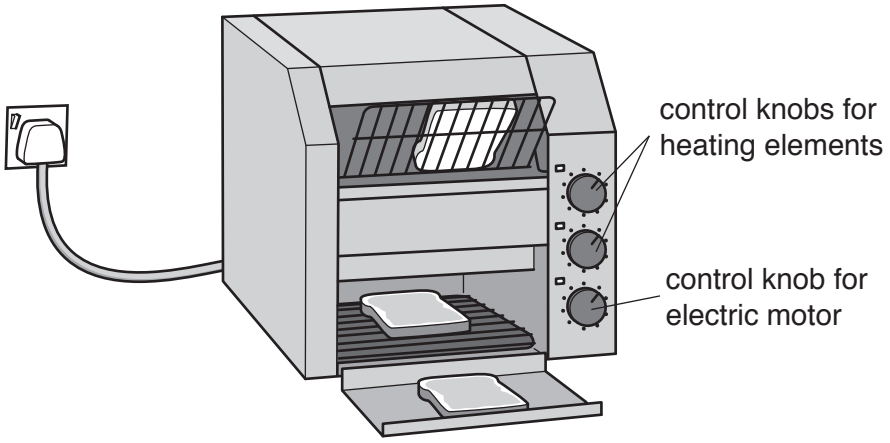


Fig. 9.1

The two heating elements inside, one to toast each side of the bread, are connected in parallel. They are each controlled by a switch.

An electric motor carries the bread slices on a moving rack between the heating elements. The motor is controlled by a third switch and is connected in parallel with the heating elements.

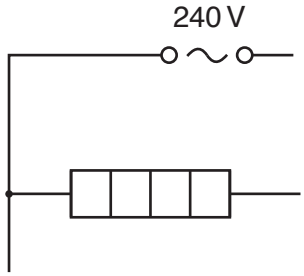
The plug at the end of the cable has a fuse inside, and is plugged into a 240 V mains supply.

(a) The circuit symbols for each of these components used in the toaster circuit are:

electric motor fuse heating element switch

Use the information about the toaster to draw a circuit diagram for the toaster.

The circuit diagram has been started for you.



[4]

(b) The two heating elements are each rated at 240 V, 1.2 kW. The electric motor is rated at 240 V, 100 W. The plug has a 10 A fuse fitted.

Show by calculation that the fuse in the plug is not adequate when both heating elements and the motor are in operation.

Show your working.

[3]

(c) A smoke alarm is fitted in the dining room in case the toaster causes a fire.

When it goes off, the smoke alarm has to make a loud high-pitched sound that everyone can hear. The highest frequency of sound some older residents can hear is 5 kHz below the top of the normal human hearing range.

Suggest a frequency for the high-pitched sound from the smoke alarm that all residents should be able to hear.

Give a reason for your answer.

suggested frequency ..... kHz

reason .....

.....

.....

[2]

The Periodic Table of Elements

Key

atomic number
atomic symbol
name
relative atomic mass

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group VIII
						1 H hydrogen 1						2 He helium 4
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5 2018 | Oct/Nov | Variant 1 | 0653_w18_qp_41

Topic & Sub-topic Index of Questions

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

6906613534

COMBINED SCIENCE **0653/41**

Paper 4 (Extended) **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

CAMBRIDGE International Examinations

[Turn over

1 **(a)** Fig. 1.1 shows a diagram of an alveolus.

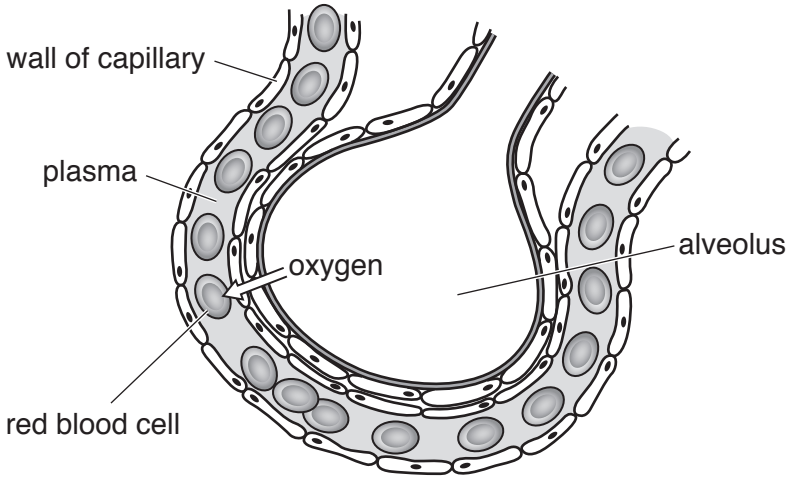

Fig. 1.1

(i) On Fig. 1.1 draw an arrow to show the direction of movement of carbon dioxide at the alveolus during gas exchange. [1]

(ii) Explain why oxygen molecules diffuse from the alveolus into the blood.

.....

.....[1]

(iii) Describe **two** ways in which the structure of the alveolus in Fig. 1.1 makes it suitable for gas exchange.

1. .....

.....

2. .....

.....

[2]

(b) Describe how a growing baby in the uterus of a pregnant woman obtains glucose.

.....

.....

.....[2]

(c) Fig. 1.2 shows apparatus which is used to study the contents of cigarette smoke. A pump draws air through the apparatus.

When the cigarette is lit, the smoke produced travels through the apparatus.

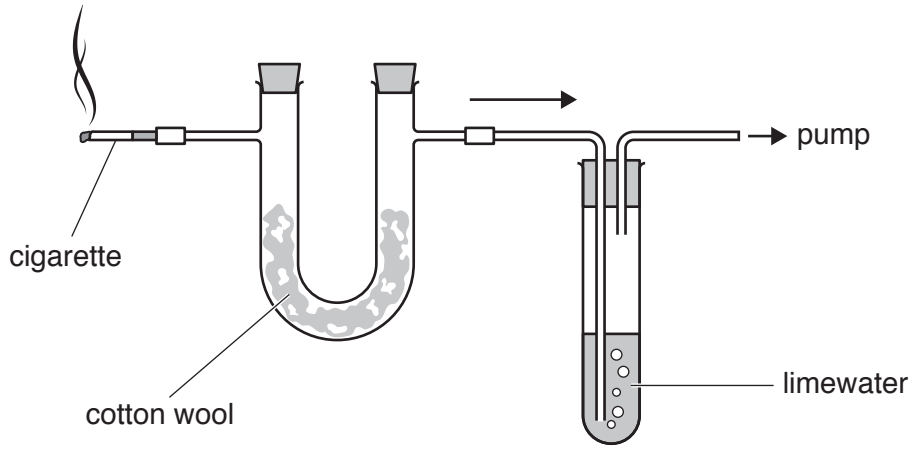

Fig. 1.2

(i) The limewater turns milky.

Explain why this happens.

.....

.....[1]

(ii) Tar from the cigarette is left on the cotton wool.

Describe **one** effect of tar on the gas exchange system.

.....

.....[1]

(iii) Cigarette smoke damages the cilia that line the airway.

Explain why this is harmful.

.....

.....

.....[2]

(iv) The lit cigarette also produces carbon monoxide gas.

Explain why this is a harmful gas when inspired.

.....

.....

.....[2]

2 **(a)** **(i)** Name the type of bonding in a water molecule.

.....[1]

(ii) Describe how electrons are involved in the bonds in a water molecule.

.....

.....[1]

(iii) Draw a dot-and-cross diagram of a water molecule.

Show all of the outer shell electrons.

H O H

[2]

(b) A student dissolves copper chloride in water.

He then passes an electric current through the aqueous copper chloride using the apparatus shown in Fig. 2.1.

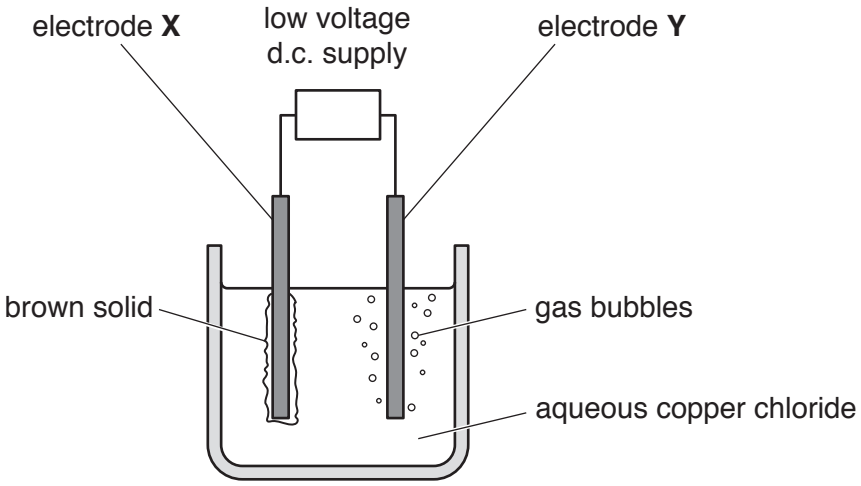

Fig. 2.1

(i) Name electrode **X** and electrode **Y**.

electrode **X** .....

electrode **Y** .....

[2]

(ii) During this process particles move to the electrodes. A brown solid and gas bubbles form at the electrodes.

Identify the particles

1. moving to electrode **X**,

.....

2. moving to electrode **Y**.

.....

[2]

(c) Predict the electrode products when an electric current is passed through molten lead oxide.

product at negative electrode .....

product at positive electrode .....

[2]

3 Fig. 3.1 shows a train made up of a steam engine and a passenger coach.

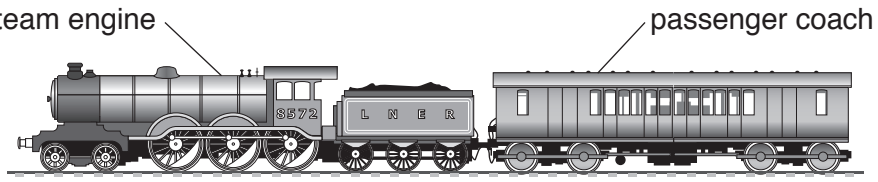

Fig. 3.1

(a) The train is travelling at a constant speed along a level track. Fig. 3.2 shows the four forces **W**, **X**, **Y** and **Z** acting on the train.

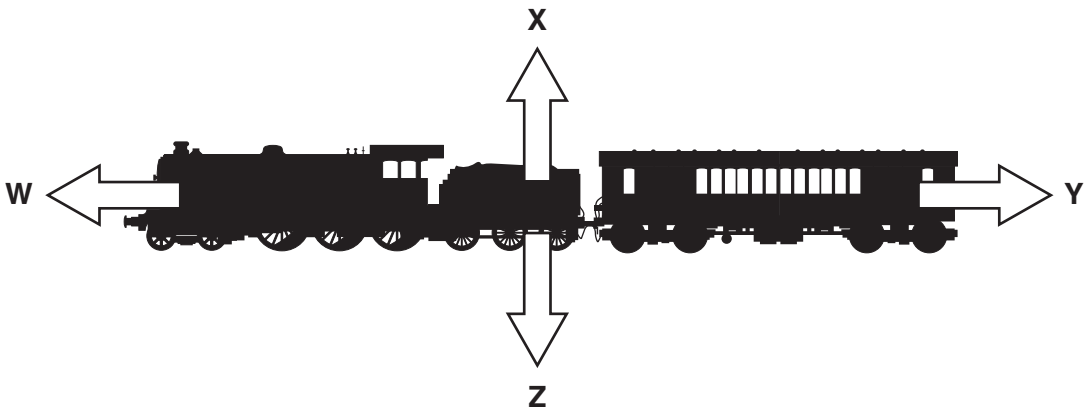

Fig. 3.2

(i) Name force **Z**.

.....[1]

(ii) The force arrows on Fig. 3.2 do not show the sizes of the forces.

State whether or not the driver has made force **W** equal in size to force **Y**.

Explain your answer.

.....

.....[1]

(b) Fig. 3.3 shows a speed–time graph of the train as it travels between two stations.

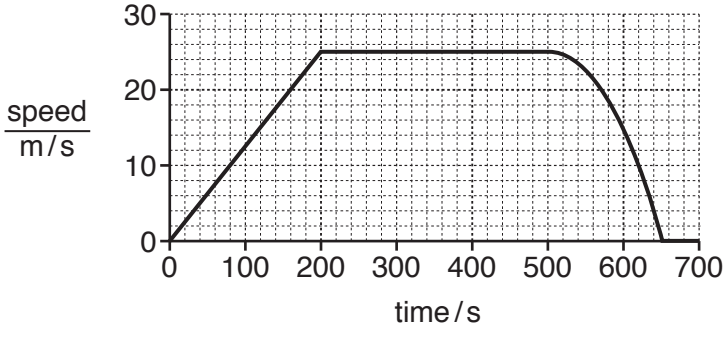

Fig. 3.3

(i) Force **W** in Fig. 3.2 is 200 000 N when the engine is pulling the train at 25 m / s.

Calculate the useful work done by the engine while the train is travelling at 25 m / s in the journey shown in Fig. 3.3.

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

formula

working

work done = ... unit ..... [3]

(ii) Describe the motion of the train after 500 s until it stops.

.....

.....

.....[2]

(iii) Use Fig. 3.3 to calculate the distance, in km, travelled by the train in the first 200 s of its journey.

Show your working.

distance = ... km [2]

(iv) After 500 s on this journey, the train travels a further 2.8 km until it stops at the next station.

Calculate the total distance in kilometres between the two stations.

Show your working.

total distance = ... km [1]

4 Fig. 4.1 shows an aquatic food web.

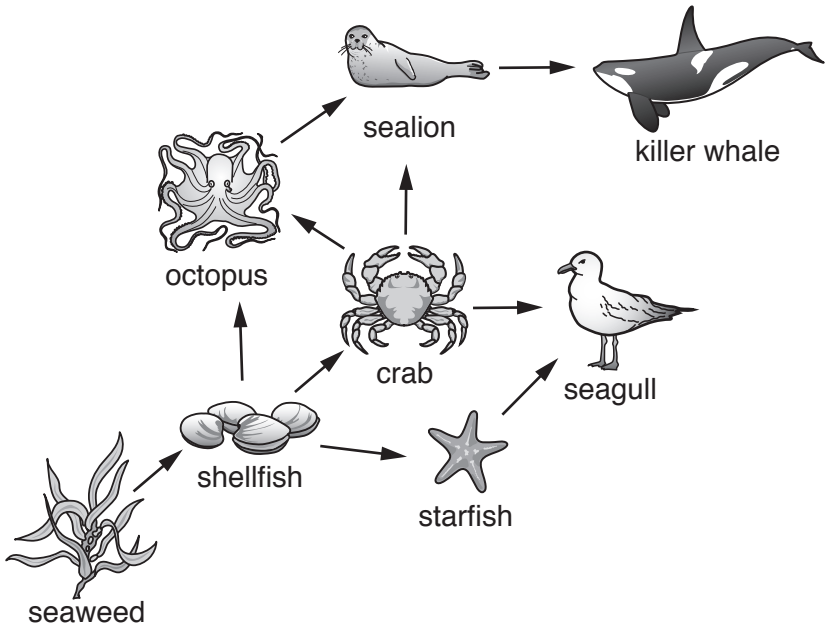

Fig. 4.1

The food web in Fig. 4.1 is made from interconnected food chains.

(a) (i) Write the food chain, contained in Fig. 4.1, which has the greatest number of trophic levels.

[2]

(ii) Suggest why the food chain you have written in **(a)(i)** is unusual.

.....[1]

(b) Chemical energy is lost at each trophic level in a food chain. One reason for this is respiration in the cells of the organisms.

List **two** uses of the energy released by respiration in the bodies of **all** of the organisms shown in Fig. 4.1.

1. .....

2. .....
[2]

(c) Describe **two** other ways in which energy is wasted when the killer whale eats the sealion.

1. .....

.....

2. .....

.....
[2]

5 **(a)** Calcium sulfate is an insoluble salt.

(i) Name two compounds that react together to form calcium sulfate.

1. .....

2. .....
[2]

(ii) Suggest the separation method that is used to separate an insoluble salt from an aqueous reaction mixture.

Explain how this separation method removes the solid from the liquid.

method .....

explanation .....

.....

.....
[2]

(b) Calcium is in Group II in the Periodic Table.

(i) Complete the following sentences using words from the list.

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

good **high** **low** **poor**

Calcium is a ..... electrical conductor.

Calcium has a ..... melting point.
[1]

(ii) State the electronic structure of a calcium atom.

.....[1]

(c) Caesium is below potassium in Group I of the Periodic Table.

Potassium melts at 63 °C and it reacts rapidly with water.

Caesium is a solid at room temperature (25 °C).

(i) Compare the rate of the reaction between caesium and water with the rate of reaction between potassium and water.

.....

.....[1]

(ii) Suggest the melting point of caesium.

..... °C [1]

(d) Describe the reaction, if any, which occurs when copper is mixed with aqueous potassium chloride.

Explain your answer.

reaction .....

explanation .....

.....

[1]

6 Fig. 6.1 shows a liquid-in-glass thermometer at room temperature.

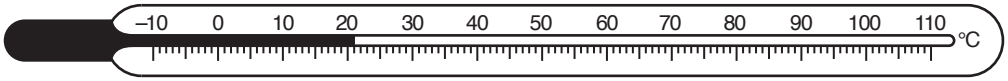

Fig. 6.1

(a) State the property of a liquid that is used in a thermometer when measuring temperature.

.....[1]

(b) Table 6.1 gives a list of the melting points and boiling points of five substances that are used in liquid-in-glass thermometers.

Table 6.1

substance	melting point /°C	boiling point /°C
ethanol	–114	78
gallium	30	2403
glycol	–12	198
mercury	–39	357
water	0	100

(i) Ammonia has a melting point of –78 °C and a boiling point of –33 °C.

Explain why ethanol would be the most suitable for use in a liquid-in-glass thermometer to measure both the melting point and the boiling point of ammonia.

.....

.....[1]

(ii) Explain why a thermometer that uses liquid gallium has to be kept in a warm container, well above room temperature.

.....

.....

.....[2]

(c) An infra-red thermometer measures temperature in a different way. The wavelength of the infra-red radiation emitted by a hot body changes with temperature.

An infra-red thermometer measures the wavelengths of infra-red radiation emitted and converts these to temperature readings.

(i) The wavelength of the infra-red radiation emitted decreases as the temperature of the hot body increases.

Predict what happens to the frequency of the infra-red radiation as the temperature of the hot body increases.

Explain your answer.

prediction .....

explanation .....

.....

[2]

(ii) In the infra-red thermometer, the radiation is focused onto the detector by a thin converging lens.

On Fig. 6.2 complete the ray diagram to show how this happens.

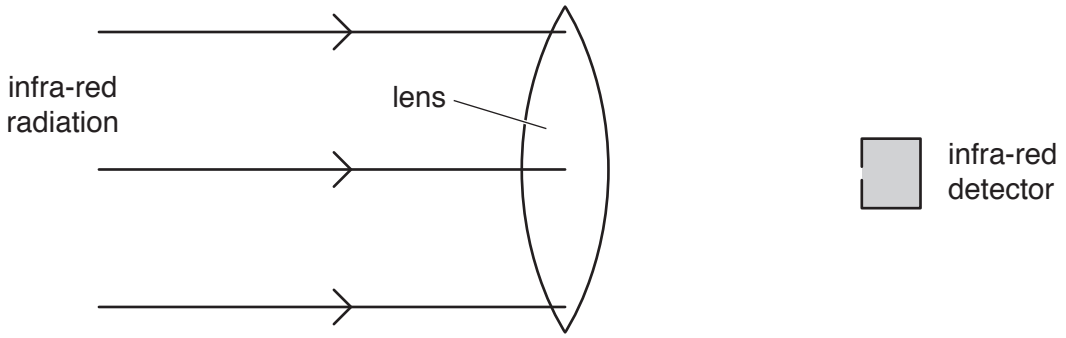

Fig. 6.2

[1]

7 A student is investigating photosynthesis in an aquatic plant.

(a) Complete the balanced symbol equation for photosynthesis.

..... + ...CO_2 ⟶ ..... + ...O_2 [2]

(b) Fig. 7.1 shows the apparatus that the student uses in the investigation.

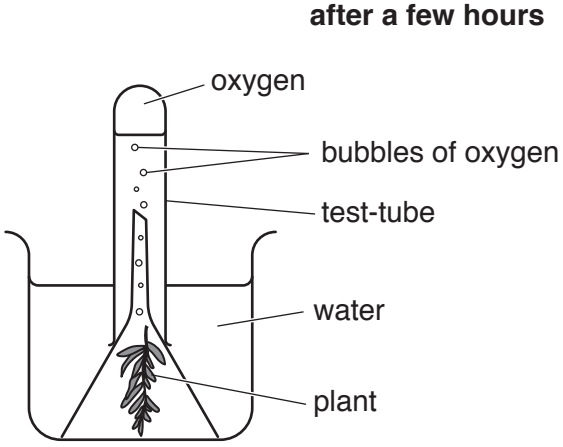

Fig. 7.1

The test-tube is full of water at the start. The apparatus is placed on a laboratory bench and left for a few hours.

Explain why the water in the test-tube moves downwards in the test-tube in Fig. 7.1.

.....

.....[1]

(c) The investigation is repeated in conditions of much greater light intensity.
The apparatus is left for the same length of time as before.

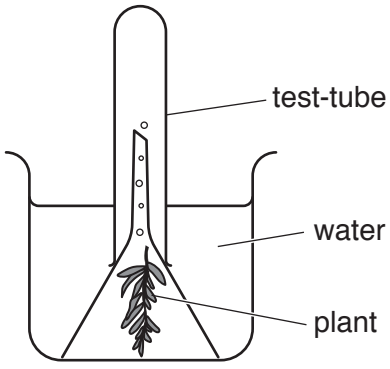

Fig. 7.2

(i) On Fig. 7.2 draw a line to suggest the new level of water in the test-tube. [1]

(ii) Explain your answer to **(c)(i)**.

.....

.....[1]

(d) (i) Explain why acid rain reduces the rate of photosynthesis in plants.

.....

.....[1]

(ii) Describe **two** measures that can be taken to reduce acid rain.

1. .....

2. .....
[2]

8 Useful substances are obtained from petroleum using the processes shown in Fig. 8.1.

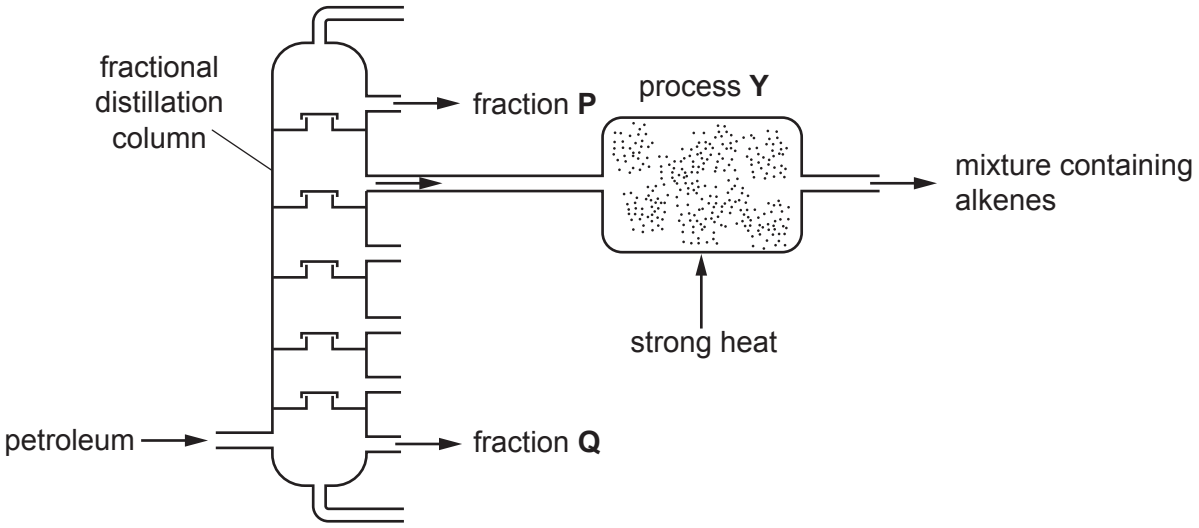

Fig. 8.1

(a) Compare the sizes of the molecules and the strengths of the intermolecular attractive forces between molecules in fraction **P** and in fraction **Q**.

sizes of molecules .....

.....

intermolecular attractive forces .....

.....

[2]

(b) Fraction **P** contains propane, C_3H_8.

Construct the balanced equation for the complete combustion of propane.

.....[2]

(c) Process **Y** produces alkene molecules from large alkane molecules.

(i) State how the molecular structure of alkenes differs from the molecular structure of alkanes.

.....

.....[1]

(ii) Describe a chemical test that is used to distinguish between propane and propene.

State the observation for propane and for propene.

test .....

propane observation .....

.....

propene observation .....

.....

[2]

9 Fig. 9.1 shows a dishwasher (an electric dishwashing machine).

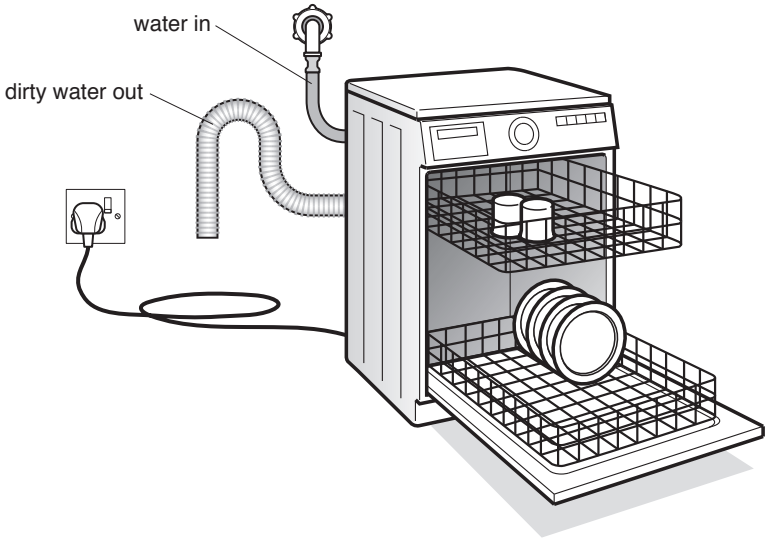

Fig. 9.1

The dishwasher uses electrical energy to

- power a heater to heat the water used,
- power **two** motors, one to wash the dishes, and another to pump water out of the machine,
- light a small lamp to indicate that the heater is switched on.

The circuit symbols for a heater and a motor are:

heater motor

Fig. 9.2 shows part of the circuit diagram for the dishwasher.

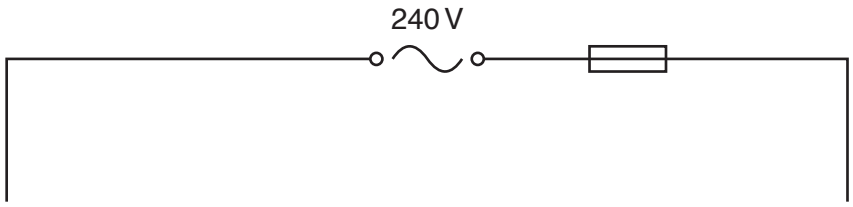

Fig. 9.2

Each of the motors and the heater has a switch in series. The heater and each motor are turned on at different times.

(a) (i) Name the type of circuit connection needed.

.....[1]

(ii) On Fig. 9.2 complete the circuit diagram for the dishwasher. [4]

(b) (i) The heater is rated at 2.4 kW. The power consumption in the indicator lamp can be ignored.

Calculate the current through the heater.

State the formula you use and show your working.

formula

working

current = ... A [2]

(ii) Each motor running at maximum power takes a current of 1.2 A.

Find the maximum current taken from the 240 V mains when the heater and both motors are working at maximum power. The current in the indicator lamp can be ignored.

current = ... A [1]

(iii) Suggest a suitable value for the fuse in the main circuit.

Give a reason for your answer.

value = ... A

reason .....

.....

.....

[2]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).

6 2018 | Oct/Nov | Variant 2 | 0653_w18_qp_42

Topic & Sub-topic Index of Questions

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8893797382

COMBINED SCIENCE **0653/42**

Paper 4 (Extended) **October/November 2018**

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 **23** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

1 Fig. 1.1 shows a farm tractor pulling a trailer.

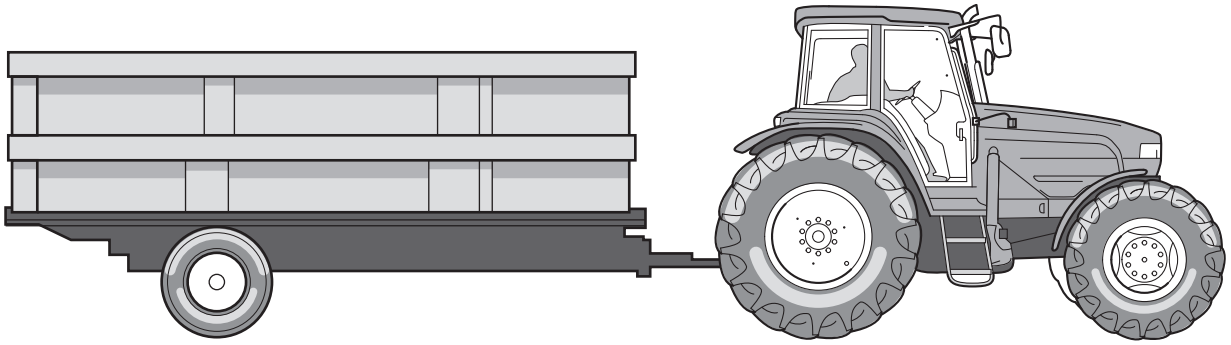

Fig. 1.1

(a) The tractor and trailer are moving across a level field. Fig. 1.2 shows the four forces **W**, **X**, **Y** and **Z** acting on the trailer.

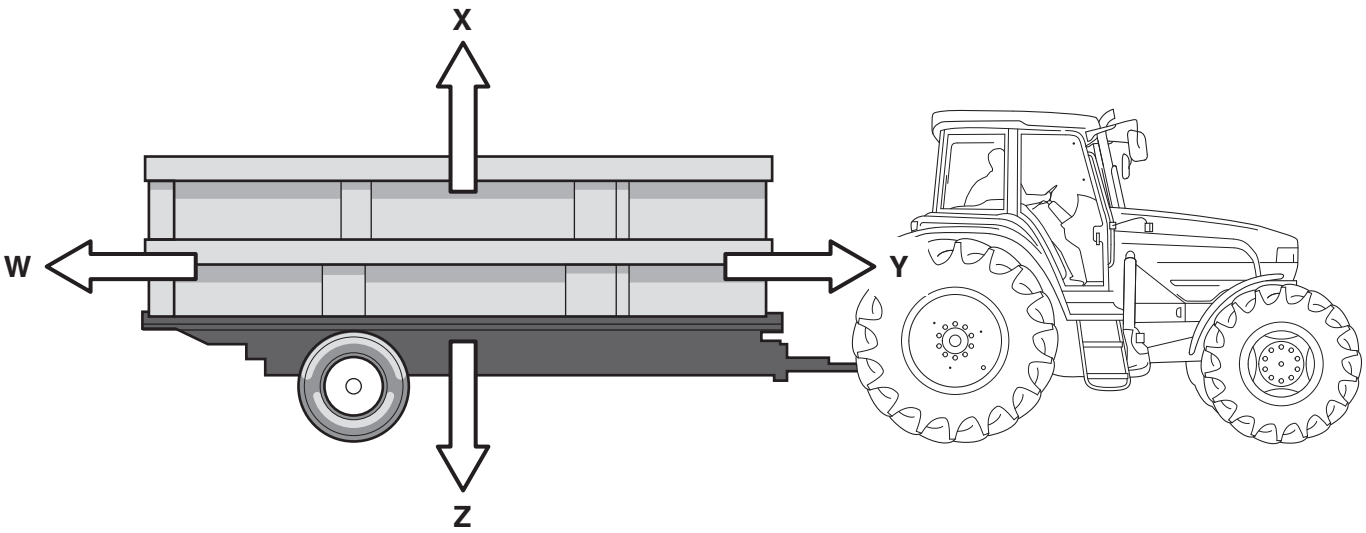

Fig. 1.2

(i) State the letter corresponding to the gravitational force acting on the trailer.

..... [1]

(ii) The tractor and trailer are moving at a constant speed.

Force **W** has a value of 2000 N.

State the value of force **Y**. Explain your answer.

force **Y** = ... N

explanation .....

.....
[2]

(b) The tractor leaves the trailer on the field and drives to the farmyard.

Fig. 1.3 shows a speed–time graph of the tractor as it travels from the field to the farmyard.

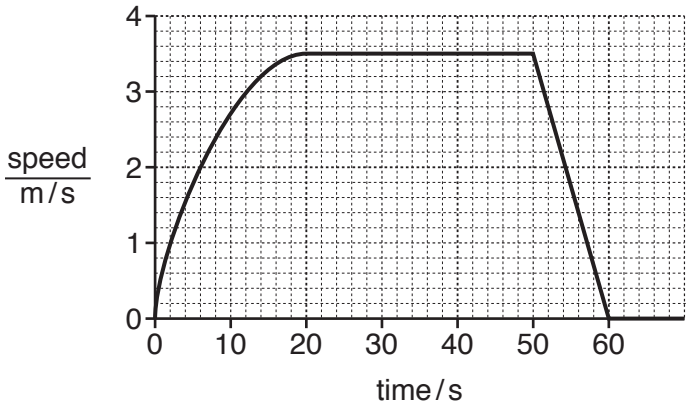

Fig. 1.3

(i) On Fig. 1.3, label with a letter **C** a point in the journey when the tractor is travelling with constant acceleration. [1]

(ii) The tractor travels 46 m in the first 20 s of this journey.

Use this information, and information from the graph in Fig. 1.3, to calculate the distance from the field to the farmyard.

Show your working.

distance = ... m [3]

(c) The tractor, without the trailer, requires a force of 1500 N to move a distance of 50 m at constant speed.

(i) Calculate the useful work done on the tractor when it moves 50 m at this constant speed.

State the formula you use and show your working.

formula

working

work done = ... J [2]

(ii) The power input to the tractor is 25 kW for 15 s as the tractor moves the distance of 50 m.

Calculate the energy used by the tractor in this time.

State the formula you use and show your working.

formula

working

energy = ...J [2]

(iii) Use your answers to **(c)(i)** and **(c)(ii)** to calculate the efficiency of the tractor as it moves a distance of 50 m.

State the formula you use and show your working.

formula

working

efficiency = ...[2]

2 Magnesium chloride is a soluble salt. It is made when dilute hydrochloric acid reacts with magnesium carbonate.

Magnesium carbonate is insoluble in water.

(a) (i) Excess magnesium carbonate powder is mixed with dilute hydrochloric acid.

Suggest methods for

1. removing unreacted magnesium carbonate from the reaction mixture,

.....

2. obtaining solid magnesium chloride from the solution.

.....
[2]

(ii) The reaction is repeated using the same mass of larger pieces of magnesium carbonate instead of powder.

Describe the effect of this change on the rate of the reaction.

.....

.....[1]

(iii) Describe the effect of using the same volume of more concentrated hydrochloric acid on the rate of this reaction.

Explain your answer.

effect .....

explanation .....

.....
[2]

(b) When the magnesium carbonate reacts with dilute hydrochloric acid, the temperature rises.

State the name given to chemical reactions that cause the temperature to rise, and explain this observation.

Use ideas about energy changes in your answer.

reaction .....

explanation .....

.....
[2]

(c) When magnesium carbonate reacts with dilute hydrochloric acid, a colourless gas and a colourless salt solution are formed.

(i) Complete the balanced equation for this reaction.

$MgCO_3$ + ...HCl ⟶ ..... + ... + ... [2]

(ii) Describe a test for aqueous chloride ions.

State the result that shows chloride ions are present.

test .....

result .....

.....
[2]

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3 Pollen is used by flowering plants to reproduce by sexual reproduction.

(a) Pollen has a haploid nucleus.

State what is meant by the terms

1. *haploid*, ...

.....

2. *nucleus*. .....

.....

[2]

(b) Table 3.1 shows some statements about flowers.

Put a tick (✓) next to **all** statements that are characteristics of wind-pollinated flowers.

Table 3.1

statement	tick (✓) if correct
small green or brown flowers	
produce nectar	
anthers inside the flower	
stigma outside the flower	
light, smooth pollen grains	
produce scent	

[3]

(c) The apparatus shown in Fig. 3.1 is used to compare the transpiration rates of twigs (small branches) from two different species of trees, **A** and **B**. The twigs are of a similar size and they have the same number of leaves.

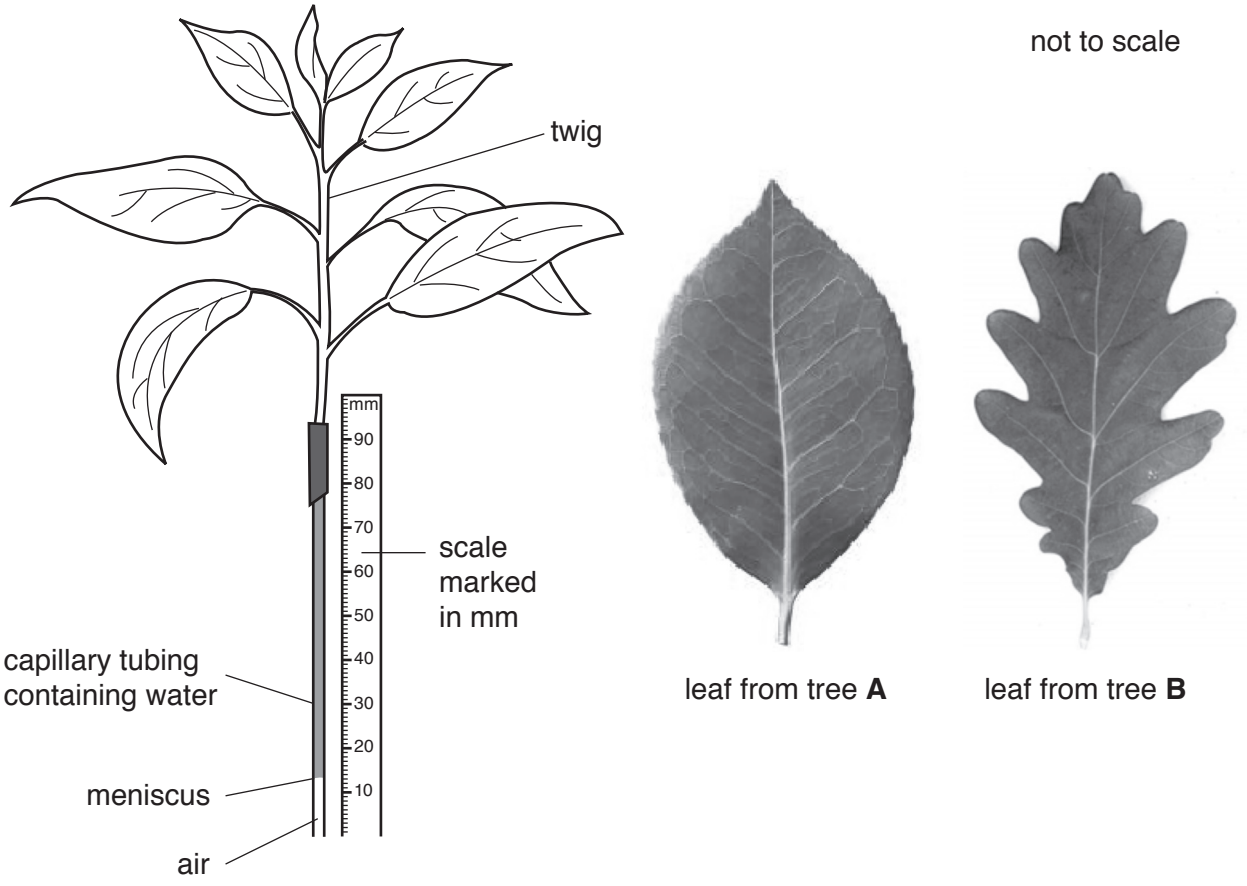

Fig. 3.1

As water vapour is lost from the leaves by transpiration, water is drawn up the tube and the meniscus (the bottom of the column of water) moves upwards.

Readings are taken of the position of the meniscus every minute for five minutes.

Fig. 3.2 shows a graph of the results for tree **A** and for tree **B**.

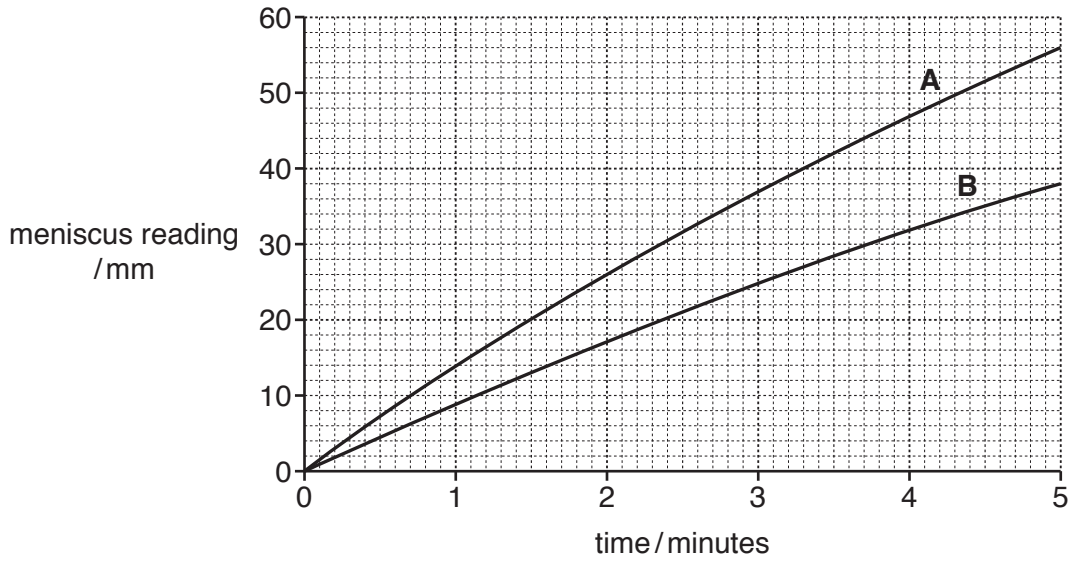

Fig. 3.2

Suggest **two** differences between the leaves of trees **A** and **B** that could explain the difference in the rate of transpiration.

1. .....

.....

2. .....

.....

[2]

(d) The experiment is repeated with the twig from tree **B** later on in the day when the humidity of the air has increased.

(i) On Fig. 3.2 draw a line to show a possible graph of the results. Label this line **C**. [1]

(ii) Explain your response to **(d)(i)**.

.....

.....[1]

4 Fig. 4.1 is a diagram of the internal structure of the heart.

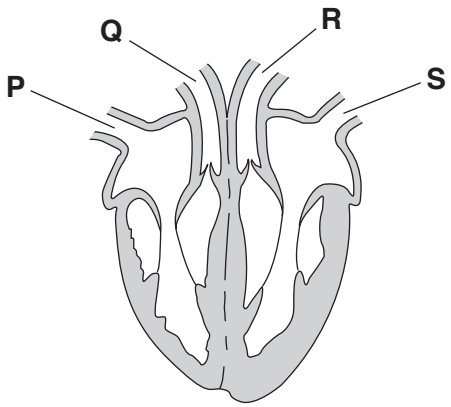

Fig. 4.1

(a) The letters **P**, **Q**, **R** and **S** on Fig. 4.1 show the blood vessels entering and leaving the heart.

State the letters which identify the veins.

.....[1]

(b) Use words or phrases from the list to complete the following sentences.

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

greater **lower** **atrium** **left** **right**

shorter **ventricle** **valve**

Blood flows to the lungs from the ..... side of the heart. Blood flowing to the lungs has a ..... pressure than blood leaving the ..... side of the heart. This is because the blood travels a ..... distance to the lungs. [3]

(c) Fig. 4.2 shows a fetus (growing baby) in a mother's uterus during pregnancy.

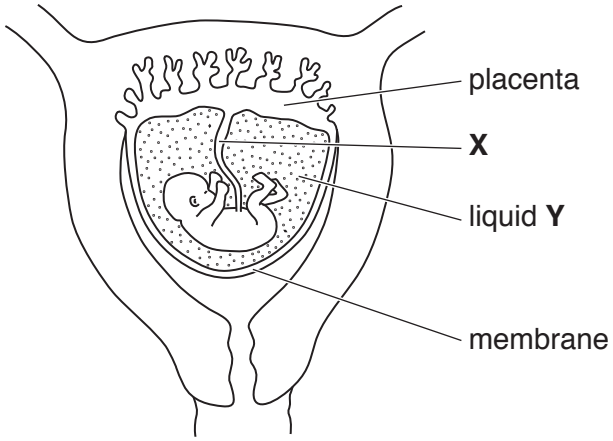

Fig. 4.2

(i) Name **X** and **Y** shown on Fig. 4.2.

X .....

Y .....
[2]

(ii) When the membrane breaks, liquid **Y** is lost. Occasionally this happens too early in the pregnancy.

Suggest **and** explain how this affects the fetus.

.....

.....

.....[2]

(iii) The fetus obtains the materials it needs from the placenta.

State **one** substance which diffuses

1. from the mother's blood into the placenta,

.....

2. from the placenta into the mother's blood.

.....
[2]

5 **(a)** Ethane, C_2H_6, is an alkane.

(i) State the type of bonding between atoms in a molecule of ethane.

.....[1]

(ii) Complete the structure of a molecule of ethane.

H——C

[2]

(b) Petroleum is separated into useful products by the process shown in Fig. 5.1.

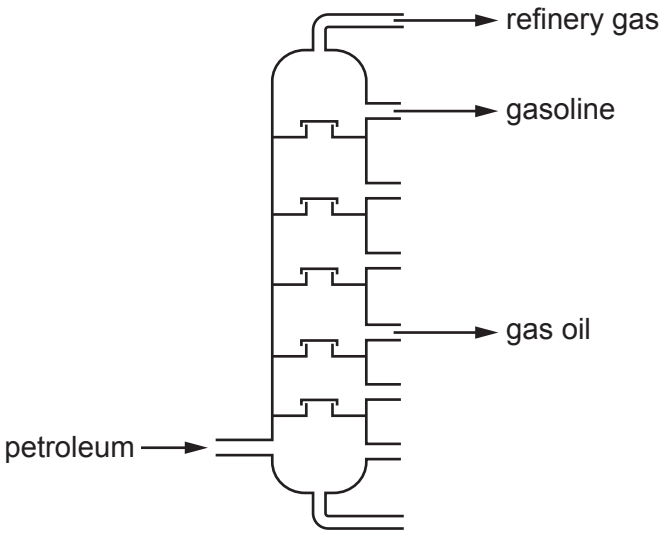

Fig. 5.1

(i) Name this process.

.....[1]

(ii) Compare the molecules in gasoline to the molecules in gas oil.

Use ideas about boiling point ranges, molecular sizes and intermolecular attractive forces in your answer.

.....

.....

.....

.....

.....[3]

(c) Ethene, C_2H_4, is an alkene.

Name the process used to make ethene from fractions obtained from petroleum.

.....[1]

(d) The atomic number of carbon is 6.

State the electronic structure of a carbon atom.

..... [1]

6 **(a)** A liquid is able to flow and will take the shape of its container. A solid does not have this property.

Explain, in terms of the motion of molecules and the distances and forces between them, why this property is different between liquids and solids.

.....

.....

.....

.....

.....

.....[3]

(b) When a liquid is heated, it expands.

Name a measuring instrument that makes use of this property of liquids.

.....[1]

(c) Fig. 6.1 shows a hot drink in a cup left to cool down.

Fig. 6.1

The statements below describe ways in which the drink loses thermal energy as it cools.

Put a tick (✓) in the box alongside any **correct** statement.

Put a cross (✗) in the box alongside any **incorrect** statement.

conduction through the sides and base of the cup	☐
convection as air above the cup is heated and the warm air moves upwards	☐
ultraviolet radiation in all directions	☐
evaporation as the faster molecules in the liquid escape from the surface of the liquid	☐

[2]

(d) Astronomers use telescopes to study stars. Stars are extremely hot bodies that lose energy by emitting electromagnetic radiation into space.

(i) Explain why stars can only lose energy by radiation, and not by conduction or convection.

.....

.....[1]

(ii) Fig. 6.2 shows the electromagnetic spectrum.

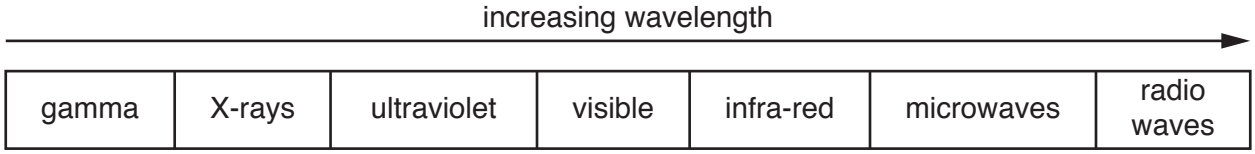

Fig. 6.2

Stars emit all types of radiation.

The energy carried by electromagnetic waves increases as the frequency increases.

Explain why gamma radiation enables stars to lose energy most rapidly.

.....

.....[1]

7 Fig. 7.1 shows a simplified version of the carbon cycle. The element carbon is present in different molecules as it moves through the cycle.

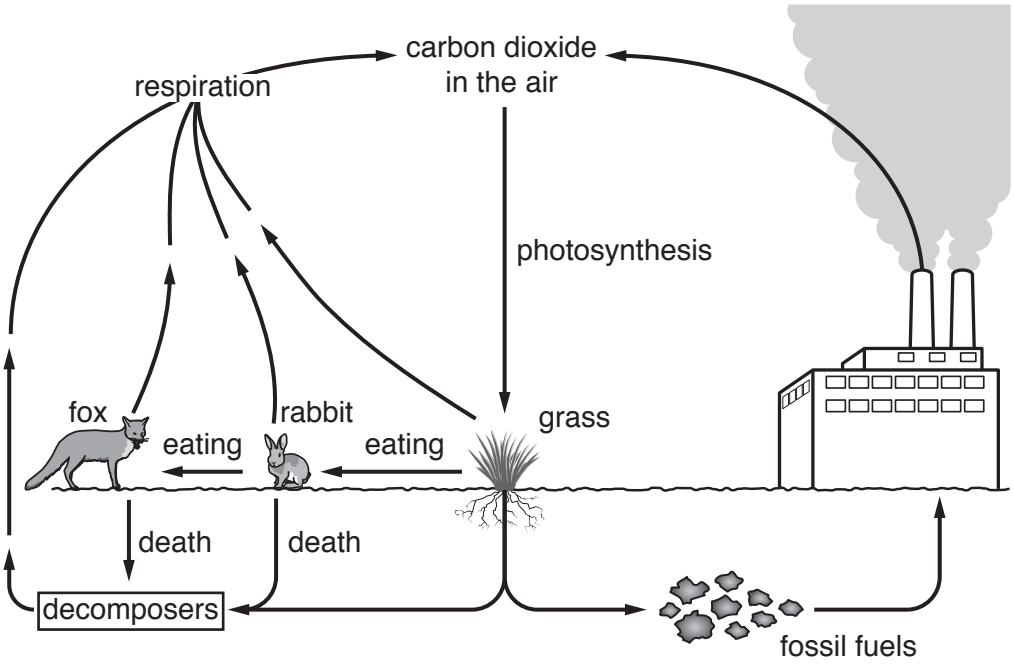

Fig. 7.1

(a) The element carbon is transferred from carbon dioxide in the atmosphere to the grass.

Suggest a compound in the grass which contains carbon.

.....[1]

(b) State the balanced symbol equation for respiration.

.....[2]

(c) A food chain from Fig. 7.1 is shown.

grass ⟶ rabbit ⟶ fox

(i) The arrows represent the transfer of chemical energy.

Describe **two** ways in which energy is lost during the transfer between the rabbit and the fox.

1. .....

2. .....
[2]

(ii) Describe how the element carbon is released as carbon dioxide from the body of the fox after it dies.

.....

.....

.....[2]

8 **(a)** A teacher tries to use the apparatus shown in Fig. 8.1 to demonstrate the electrolysis of lead(II) bromide.

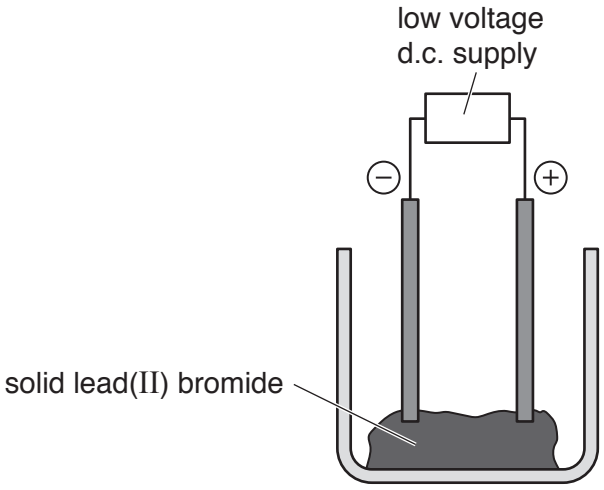

Fig. 8.1

Explain why this electrolysis does not work.

Use ideas about physical states and ions in your answer.

.....

.....

.....

.....

[2]

(b) A student electrolyses aqueous copper bromide using the apparatus shown in Fig. 8.2.

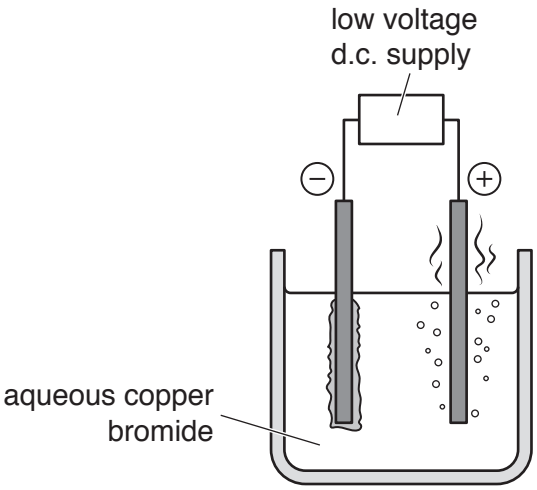

Fig. 8.2

(i) In this process metallic copper is formed.

Copper is a transition metal. It forms coloured compounds.

Describe **one other** property of a **transition** metal.

.....[1]

(ii) Identify the ions that move to each electrode to form the product.

anode .....

cathode .....
[2]

(c) Iron is extracted from iron(III) oxide, Fe_2O_3, in the blast furnace.

(i) State the fuel used in the blast furnace.

.....[1]

(ii) State **one** substance that reduces iron(III) oxide in the blast furnace.

.....[1]

[Turn over

9 Fig. 9.1 shows a circuit diagram for an investigation into how the resistance of a lamp changes with the current in the lamp.

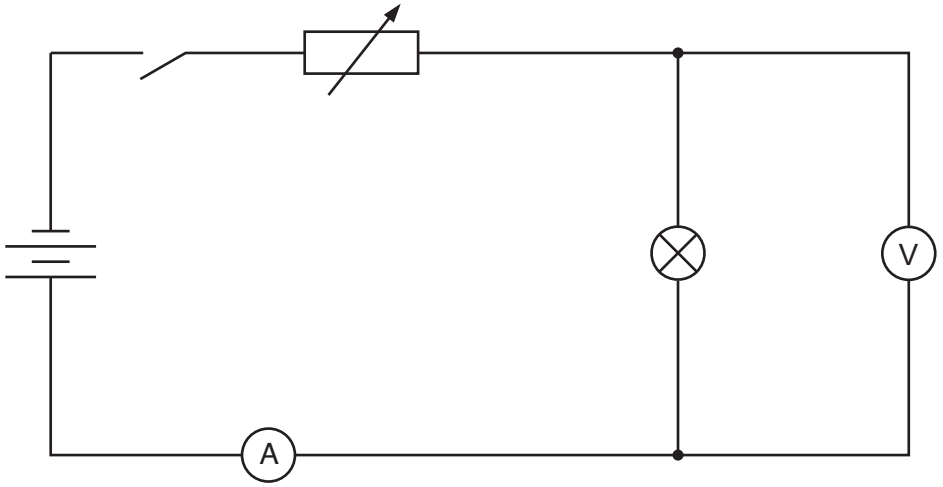

Fig. 9.1

(a) Explain why the variable resistor has been included in the circuit.

.....

.....[1]

(b) Table 9.1 shows some results from the investigation.

Table 9.1

experiment	voltmeter reading / V	ammeter reading / A	resistance of lamp / Ω
1	6.0	0.54	11
2	4.0	0.46	8.7
3	3.0	0.40	7.5
4	2.0	0.32	6.3

The lamp becomes less bright as the voltage reading decreases from 6.0 V to 2.0 V.

Explain why this happens.

.....

.....

.....[2]

(c) (i) On Fig. 9.1 add a second identical lamp in parallel with the first. [1]

(ii) Experiment **5** is now carried out with the second identical lamp in the circuit in parallel with the first lamp.

The total current in the circuit is now 0.76A.

State the current in the first lamp. Give a reason for your answer.

current = ... A

reason .....

.....

.....

[2]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).

7 2018 | Oct/Nov | Variant 3 | 0653_w18_qp_43

Topic & Sub-topic Index of Questions

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5519886577

COMBINED SCIENCE **0653/43**

Paper 4 (Extended) **October/November 2018**

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 **21** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

1 **(a)** Fig. 1.1 is a diagram of a cell which lines the human airway.

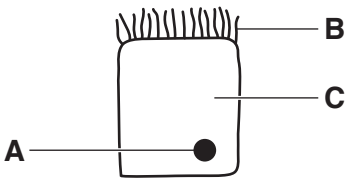

Fig. 1.1

Table 1.1 shows the names and functions of parts of the cell shown in Fig. 1.1.

Complete Table 1.1.

Table 1.1

letter	name	functions
A	nucleus	controls the activities of the cell
B		
C		

[4]

(b) Fig. 1.2 shows a drawing of a wind-pollinated flower.

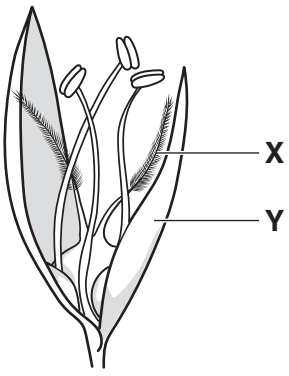

Fig. 1.2

(i) Describe how the structure of **X** is adapted to its function.

.....

.....

.....[2]

(ii) Structure **Y** is not brightly coloured.

Explain why a bright colour is not necessary for structure **Y**.

.....

.....

.....[2]

2 **(a)** Carbon dioxide is a product of the thermal decomposition of calcium carbonate.

(i) Complete the dot-and-cross diagram of a molecule of carbon dioxide to show the bonding electrons between atoms.

O C

[2]

(ii) Name this type of chemical bonding.

.....[1]

(iii) Describe a chemical test for carbonate ions in an aqueous solution.

State the observations that show a positive result.

test:

step 1 .....

step 2 .....

observations .....

.....

[2]

(iv) The thermal decomposition of calcium carbonate is an endothermic change.

Describe what is meant by *endothermic*.

Use ideas about chemical energy and heat (thermal energy) in your answer.

.....

.....[1]

(b) The atomic number of calcium is 20.

(i) Complete Fig. 2.1 to show the electronic structure of a calcium atom.

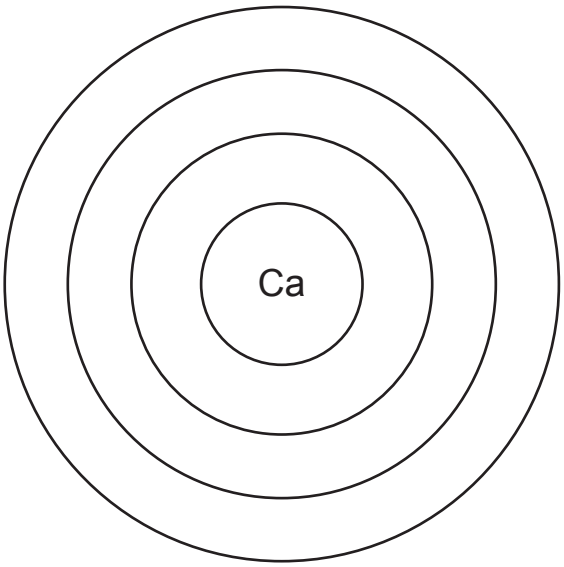

Fig. 2.1

[1]

(ii) The symbol of a calcium ion is Ca^{2+}.

Describe, in terms of electrons, how this ion is formed from a calcium atom.

.....

.....[2]

3 Fig. 3.1 shows a man pushing a shopping trolley.

Fig. 3.1

Fig. 3.2 shows a speed–time graph of the trolley as the man pushes it to the checkout.

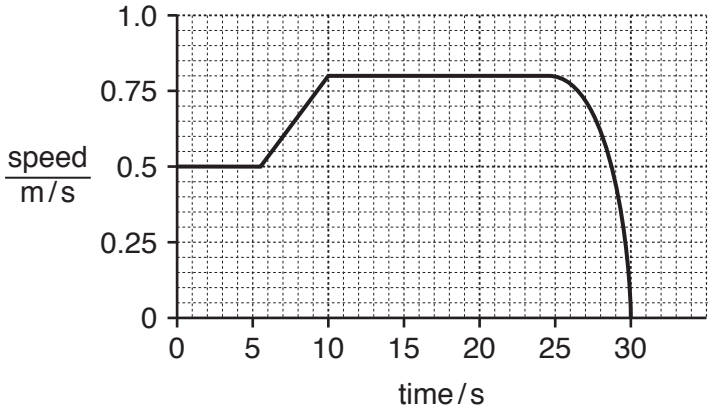

Fig. 3.2

(a) (i) On Fig. 3.2, label with a letter **C** a point in the journey when the trolley is travelling with constant acceleration. [1]

(ii) The trolley travels 20 m to the checkout.

Use information from the graph to calculate the average speed of the trolley on this journey.

Show your working.

average speed = ... m/s [2]

(b) Fig. 3.3 shows the four forces acting on the trolley as it moves.

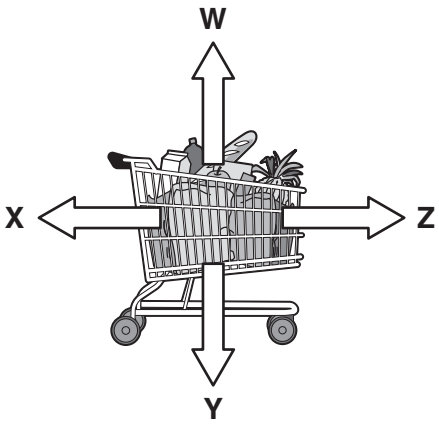

Fig. 3.3

(i) State the letter corresponding to the force exerted by the man on the trolley.

.....[1]

(ii) Use Fig. 3.2 to describe how the relative sizes of forces **X** and **Z** change between 20 s and 30 s.

.....

.....[2]

(c) The man provides the energy to push the trolley to the checkout. The trolley and its contents have a mass of 20 kg.

Calculate the kinetic energy of the trolley between 10 s and 25 s.

State the formula you use and show your working.

formula

working

kinetic energy = ... J [2]

(d) As the trolley is moved to the checkout, 2400 J is required to do work against forces resisting the motion.

The efficiency of the man's body providing this energy to the trolley is 20%.

Calculate the total energy used by the man's body to do this work.

State the formula you use and show your working.

formula

working

energy = ... J [2]

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4 Rainforest is often cleared for agriculture by cutting down the trees and burning them. This process is called 'slash and burn'. The burning of the trees produces a smoky haze made from very small carbon particles suspended in the air.

Fig. 4.1 is a picture of clearing land by slash and burn.

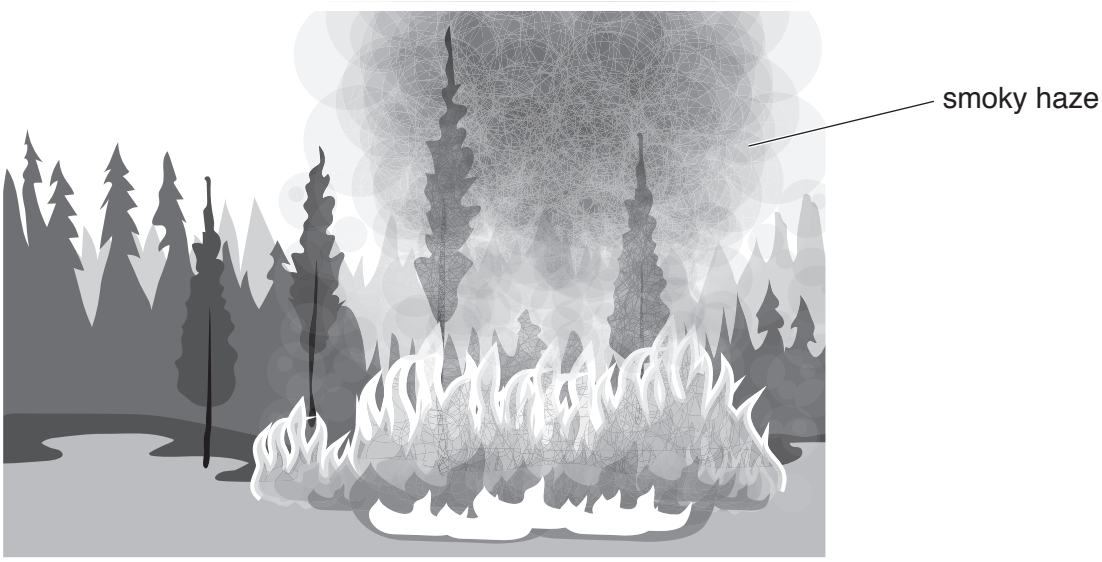


Fig. 4.1

(a) Suggest how the gas exchange system of a human could be affected by inspiring a large volume of the air containing the carbon particles.

.....

.....[1]

(b) **(i)** Some of the suspended carbon particles land on the leaves of crops and trees covering them with a thin layer of carbon.

Suggest **and** explain how this layer of carbon affects the function of chlorophyll in the leaves.

.....

.....

.....

.....[3]

(ii) The concentration of oxygen in the atmosphere decreases in the area where slash and burn is taking place.

Suggest **two** reasons why this happens.

1. .....

.....

2. .....

.....

[2]

(c) Some human activities cause the concentration of carbon dioxide in the atmosphere to increase.

Use words or phrases from the list to complete the sentences about how this can affect the environment.

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

acid rain **argon** **gamma** **global warming** **infra-red**

methane **nitrogen** **oxygen** **ultraviolet**

Greenhouse gases such as carbon dioxide and ..... absorb ..... radiation given out from the Earth.

When the concentration of carbon dioxide in the atmosphere increases, more of this radiation is absorbed and eventually released into the atmosphere. This increases ..... .

[3]

5 (a) A student investigates the reactivities of four metals, **A**, **B**, **C** and **D**.

He uses pieces of metal which are the same size.

A gas is produced when the metals react with dilute hydrochloric acid.

He uses the apparatus shown in Fig. 5.1 to measure the time taken to collect 25 cm^3 of the gas.

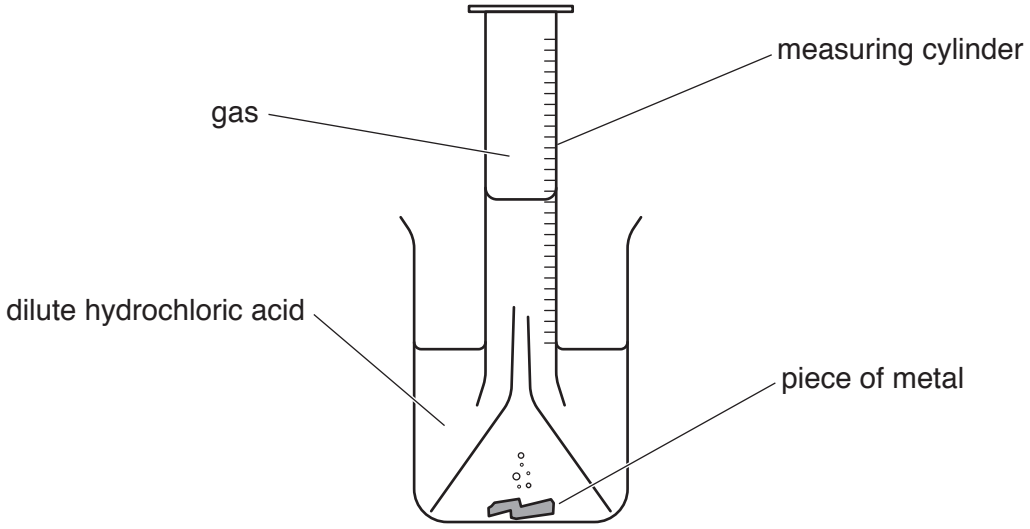


Fig. 5.1

The results of the investigation are shown in Table 5.1.

Table 5.1

metal	time / s
A	25
B	115
C	73
D	305

(i) Using letters **A**, **B**, **C** and **D**, state the order of reactivity of these metals, from most reactive to least reactive.

..... most reactive

.....

.....

..... least reactive

[1]

(ii) Describe and explain the effect of increasing the temperature on the rate of a reaction.

Use ideas about particle movement and particle collisions in your answer.

effect .....

explanation .....

.....

.....

.....

[3]

(b) Iron is extracted from iron ore by reduction in a blast furnace.

Limestone is added to the blast furnace to separate impurities from the iron.

(i) Name **two other** raw materials which are added to the blast furnace.

1. .....

2. .....

[2]

(ii) Explain what is meant by *reduction*.

.....

.....[1]

(c) Aluminium cannot be extracted from its ore by reduction in a blast furnace.

(i) Explain why reduction in a blast furnace cannot be used to extract aluminium from its ore.

.....

.....[1]

(ii) Name the method of extraction of aluminium from its ore.

.....[1]

6 **(a)** The density of water, a liquid, is very different from the density of steam, a gas.

Explain in terms of distances and forces between molecules, and their motion, why the density of water is so much greater than the density of steam.

.....

.....

.....

.....[3]

(b) Fig. 6.1 shows an insulated container of boiling water left to cool on a balance.

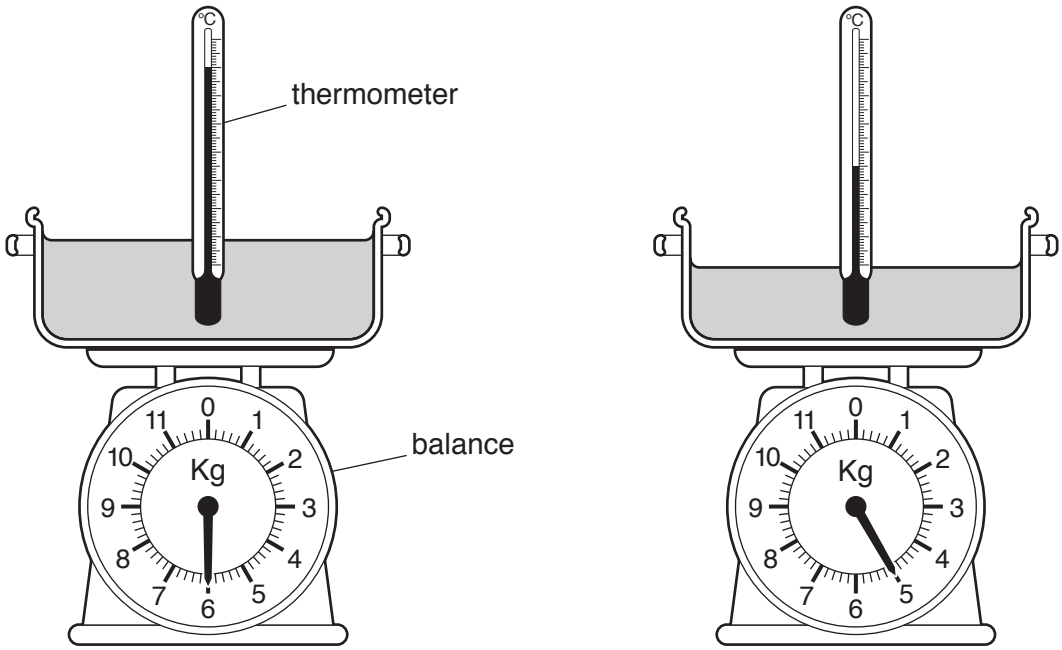


Fig. 6.1

After several hours, the reading on the scale of the balance is shown in Fig. 6.1.

(i) Describe how the evaporation of water from the container is the cause of the cooling of the water.

.....

.....

.....

.....[2]

(ii) The experiment in Fig. 6.1 is repeated with the same volume of boiling water but using the insulated container shown in Fig. 6.2.

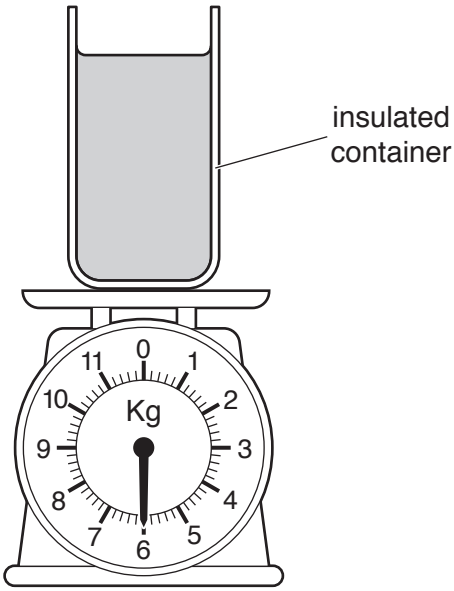


Fig. 6.2

Predict how the results of the second experiment will differ in terms of temperature change **and** mass loss compared with the first experiment.

Give a reason for your answer.

predictions .....

.....

reason .....

.....

[2]

(c) An observer is measuring the temperature of the water in the pan in **(b)**. He says the thermometer looks bent where it goes into the water. He says the thermometer bulb is at **X** on Fig. 6.3.

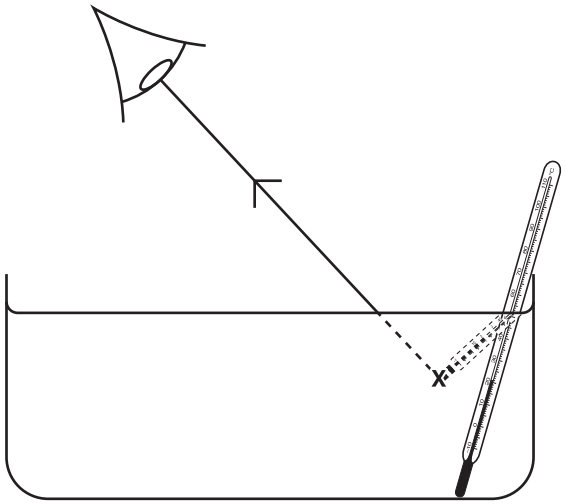


Fig. 6.3

(i) Rays of light change direction when they pass through the surface of the water.

Name this effect .....[1]

(ii) Fig. 6.3 shows where the observer thinks the ray is coming from.

On Fig. 6.3 complete the ray diagram to show where the ray is actually coming from. [1]

7 **(a)** Fig. 7.1 shows the external structures of the heart.

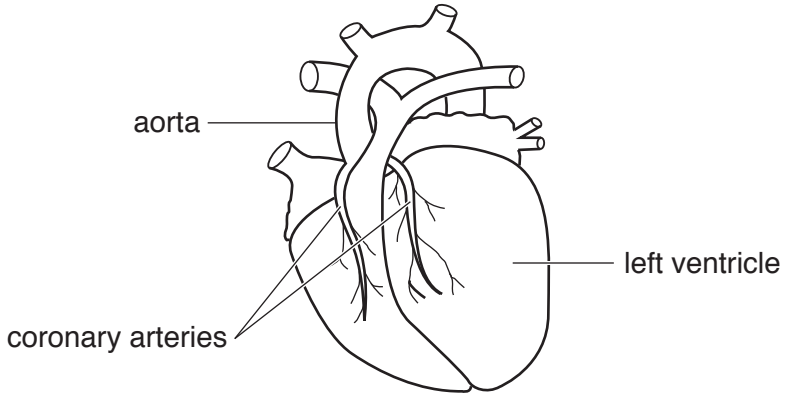


Fig. 7.1

(i) Describe the function of the coronary arteries.

.....

.....[2]

(ii) Coronary heart disease (CHD) occurs when the coronary arteries become narrow.

Describe what causes the narrowing of the arteries.

.....[1]

(iii) Describe **two** ways in which a person can reduce the risk of developing CHD.

1. .....

2. .....

[2]

(b) During exercise energy is released in the muscles by aerobic respiration.

(i) State the balanced symbol equation for aerobic respiration.

.....[2]

(ii) State how the energy released by respiration is used by the muscles.

.....[1]

(iii) State **two** reasons why an increased heart rate is needed for respiration in the muscles during exercise.

1. .....

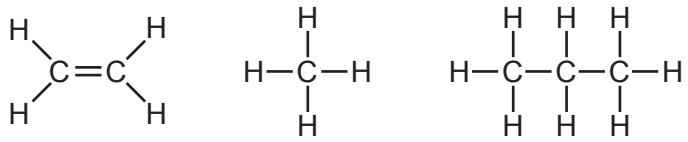
.....

2. .....

.....

[2]

8 Fig. 8.1 shows the structures of three hydrocarbon molecules, **A**, **B**, and **C**.



A **B** **C**

Fig. 8.1

(a) **(i)** Name hydrocarbons **A** and **B**.

A .....

B .....
[2]

(ii) Describe the changes, if any, that are observed when bromine water is added separately to samples of hydrocarbons **A** and **B**.

A .....

B .....
[2]

(iii) Deduce the balanced equation for the complete combustion of hydrocarbon **C**.

..... + ... ⟶ ..... + ... [2]

(b) Hydrocarbon **A** is made in process **Y**, as shown in Fig. 8.2.

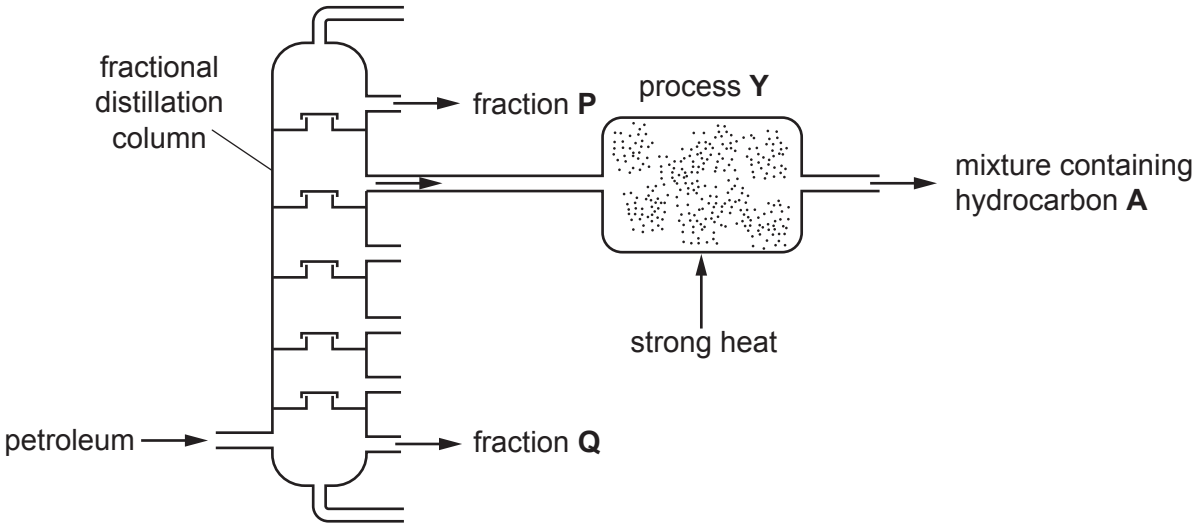


Fig. 8.2

(i) Name process **Y**.

.....[1]

(ii) Describe the difference in the boiling points of fraction **P** and fraction **Q**.

Explain this difference in terms of the sizes of molecules and of intermolecular attractive forces.

difference .....

explanation .....

.....

.....
[2]

9 Fig. 9.1 shows a display refrigerator for storing cold drinks in a shop.

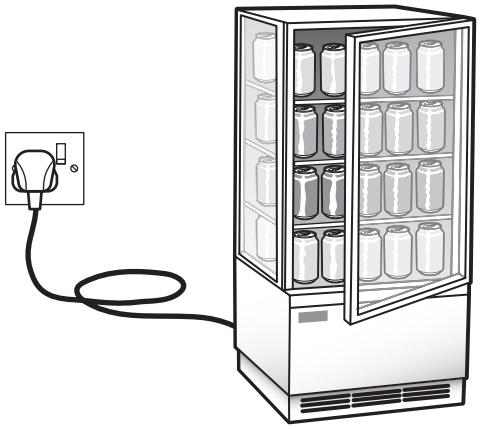


Fig. 9.1

The refrigerator uses electrical energy

- for a lamp to light up the inside of the refrigerator
- to power an electric motor to run the cooler in the refrigerator.

The circuit symbol for an electric motor is: 

Fig. 9.2 shows part of the circuit diagram for the refrigerator.

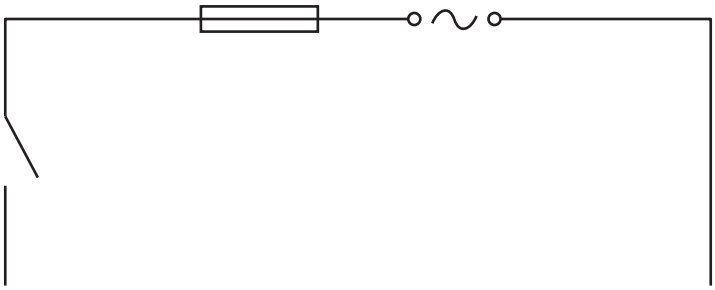
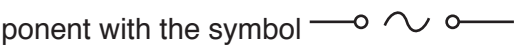


Fig. 9.2

(a) When the shop is closed, the lamp is switched off, but the electric motor needs to continue to run the refrigerator to keep the contents cool.

(i) On Fig. 9.2 complete the circuit diagram for the refrigerator that will allow the lamp to be switched off while the electric motor remains on. [3]

(ii) Name the circuit component with the symbol 

.....[1]

(b) The potential difference across the lamp is 240 V, and its power consumption is 40 W.

The potential difference across the motor is 240 V and its power consumption is 300 W.

Calculate the total current from the supply through the refrigerator.

State the formula you use and show your working.

formula

working

current = ... A [3]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).

A Introduction to the Topical Questions Tracker: An Efficient Study Tool

A Topical Questions Tracker is a powerful tool, integrated as an appendix to Yearly Past Papers, enhancing the functionality of utilising Past Papers. This tool allows you to locate specific questions by topic, providing a much more efficient way to study for exams.

A.1 How the Topical Questions Tracker Works

The Topical Questions Tracker is organized according to the latest syllabus of the subject. Each topic includes a comprehensive list of all relevant questions from the yearly past papers. For each question, the tracker provides:

- The paper's code
- The question number
- The sub-question number (if applicable)
- The page number where the question is located, which is hyperlinked for easy navigation

By clicking on the linked page number, you can jump directly to the corresponding page in the document, making it quick and simple to find the exact question you're looking for.

A.2 Advantages of Topical Questions Trackers Over Traditional Past Papers

While traditional Topical Past Papers classify entire questions under a single topic, many questions contain sub-questions that may cover different topics. This can make it difficult to find specific practice material for a particular area of study.

The Topical Questions Tracker overcomes this limitation by categorizing each sub-question individually. This precise classification ensures that each part of the question is assigned to the appropriate topic, providing a more targeted and effective revision tool.

A.3 Efficient Navigation Tips

While the Topical Questions Tracker allows you to jump directly to specific questions by clicking on the linked page numbers, navigating back to the previous page to find the next question can be time-consuming and somewhat frustrating. To streamline this process, you can utilize the 'Previous View' and 'Next View' commands in Adobe Reader.

To access these commands, navigate to the menu and select View » Go to » Previous View or Next View. Alternatively, you can use the shortcut keys for quicker navigation:

- Previous View: ALT + Left Arrow
- Next View: ALT + Right Arrow

These commands enable you to seamlessly move back and forth between the last two pages visited, enhancing your study efficiency by minimizing unnecessary navigation steps.

B Topical Questions Tracker

B.1 Biology

B.1.1 Cells

0653_w18_qp_43 Question: 1 a Page: 138

B.1.2 Biological molecules

0653_m18_qp_42 Question: 7 c Page: 17
0653_s18_qp_41 Question: 1 a Page: 25

B.1.3 Plant nutrition

0653_m18_qp_42 Question: 4 a Page: 11
0653_m18_qp_42 Question: 4 b(i) Page: 11
0653_m18_qp_42 Question: 4 b(ii) Page: 11
0653_m18_qp_42 Question: 4 c Page: 11
0653_s18_qp_41 Question: 4 a(i) Page: 33
0653_s18_qp_41 Question: 4 a(ii) Page: 33
0653_s18_qp_43 Question: 1 a(i) Page: 71
0653_s18_qp_43 Question: 1 a(ii) Page: 71
0653_w18_qp_41 Question: 7 a Page: 104
0653_w18_qp_41 Question: 7 b Page: 104
0653_w18_qp_41 Question: 7 c(i) Page: 104
0653_w18_qp_41 Question: 7 c(ii) Page: 104
0653_w18_qp_41 Question: 7 d(i) Page: 105
0653_w18_qp_43 Question: 4 b(i) Page: 146

B.1.4 Human nutrition

0653_m18_qp_42 Question: 7 a(i) Page: 16
0653_m18_qp_42 Question: 7 a(ii) Page: 16
0653_m18_qp_42 Question: 7 d(i) Page: 17
0653_m18_qp_42 Question: 7 d(ii) Page: 17
0653_s18_qp_41 Question: 1 b Page: 25

B.1.5 Transport in plants

0653_s18_qp_41 Question: 4 b(ii) Page: 33
0653_s18_qp_42 Question: 1 b(i) Page: 47
0653_s18_qp_42 Question: 1 b(ii) Page: 47
0653_s18_qp_42 Question: 1 c Page: 47
0653_w18_qp_42 Question: 3 c Page: 121
0653_w18_qp_42 Question: 3 d(i) Page: 122
0653_w18_qp_42 Question: 3 d(ii) Page: 122

B.1.6 Transport in animals

0653_m18_qp_42 Question: 1 c Page: 5
0653_s18_qp_41 Question: 1 c Page: 25
0653_s18_qp_41 Question: 1 d(i) Page: 26
0653_s18_qp_41 Question: 1 d(ii) Page: 26
0653_s18_qp_42 Question: 4 d(i) Page: 53

0653_s18_qp_42 Question: 4 d(ii) Page: 53
0653_s18_qp_43 Question: 7 d Page: 84
0653_w18_qp_42 Question: 4 a Page: 123
0653_w18_qp_42 Question: 4 b Page: 123
0653_w18_qp_43 Question: 7 a(i) Page: 153
0653_w18_qp_43 Question: 7 a(ii) Page: 153
0653_w18_qp_43 Question: 7 a(iii) Page: 153

B.1.7 Diseases and immunity

0653_m18_qp_42 Question: 7 b(i) Page: 16
0653_m18_qp_42 Question: 7 b(ii) Page: 16
0653_m18_qp_42 Question: 7 b(iii) Page: 16

B.1.8 Gas exchange in humans

0653_s18_qp_42 Question: 4 a Page: 52
0653_s18_qp_42 Question: 4 b Page: 52
0653_s18_qp_42 Question: 4 c Page: 53
0653_s18_qp_43 Question: 7 a(i) Page: 83
0653_s18_qp_43 Question: 7 a(ii) Page: 83
0653_s18_qp_43 Question: 7 b(i) Page: 83
0653_s18_qp_43 Question: 7 b(ii) Page: 84
0653_s18_qp_43 Question: 7 c Page: 84
0653_w18_qp_41 Question: 1 a(i) Page: 92
0653_w18_qp_41 Question: 1 a(ii) Page: 92
0653_w18_qp_41 Question: 1 a(iii) Page: 92
0653_w18_qp_41 Question: 1 c(i) Page: 93
0653_w18_qp_41 Question: 1 c(ii) Page: 93
0653_w18_qp_41 Question: 1 c(iii) Page: 93
0653_w18_qp_41 Question: 1 c(iv) Page: 93
0653_w18_qp_43 Question: 4 a Page: 146

B.1.9 Respiration

0653_s18_qp_41 Question: 4 b(i) Page: 33
0653_w18_qp_42 Question: 7 b Page: 129
0653_w18_qp_43 Question: 4 b(ii) Page: 147
0653_w18_qp_43 Question: 7 b(i) Page: 153
0653_w18_qp_43 Question: 7 b(ii) Page: 153
0653_w18_qp_43 Question: 7 b(iii) Page: 153

B.1.10 Reproduction

0653_m18_qp_42 Question: 1 a(i) Page: 4
0653_m18_qp_42 Question: 1 a(ii) Page: 4
0653_m18_qp_42 Question: 1 b(i) Page: 4
0653_m18_qp_42 Question: 1 b(ii) Page: 4
0653_m18_qp_42 Question: 1 b(iii) Page: 4
0653_s18_qp_42 Question: 1 a(i) Page: 46
0653_s18_qp_42 Question: 1 a(ii) Page: 46
0653_s18_qp_42 Question: 1 a(iii) Page: 46
0653_s18_qp_43 Question: 4 a Page: 78
0653_s18_qp_43 Question: 4 b Page: 78
0653_s18_qp_43 Question: 4 c Page: 78

0653_w18_qp_41 Question: 1 b Page: 92
0653_w18_qp_42 Question: 3 a Page: 120
0653_w18_qp_42 Question: 3 b Page: 120
0653_w18_qp_42 Question: 4 c(i) Page: 124
0653_w18_qp_42 Question: 4 c(ii) Page: 124
0653_w18_qp_42 Question: 4 c(iii) Page: 124
0653_w18_qp_43 Question: 1 b(i) Page: 138
0653_w18_qp_43 Question: 1 b(ii) Page: 139

B.1.11 Organisms and their environment

0653_s18_qp_41 Question: 7 a(i) Page: 38
0653_s18_qp_41 Question: 7 a(ii) Page: 38
0653_s18_qp_41 Question: 7 b(i) Page: 38
0653_s18_qp_41 Question: 7 b(ii) Page: 38
0653_s18_qp_42 Question: 7 a(i) Page: 58
0653_s18_qp_42 Question: 7 a(ii) Page: 58
0653_s18_qp_42 Question: 7 a(iii) Page: 58
0653_s18_qp_42 Question: 7 b(i) Page: 58
0653_s18_qp_42 Question: 7 b(ii) Page: 58
0653_s18_qp_43 Question: 1 b(i) Page: 72
0653_s18_qp_43 Question: 1 b(ii) Page: 72
0653_s18_qp_43 Question: 1 c(i) Page: 73
0653_s18_qp_43 Question: 1 c(ii) Page: 73
0653_w18_qp_41 Question: 4 a(i) Page: 99
0653_w18_qp_41 Question: 4 a(ii) Page: 99
0653_w18_qp_41 Question: 4 b Page: 99
0653_w18_qp_41 Question: 4 c Page: 99
0653_w18_qp_42 Question: 7 a Page: 129
0653_w18_qp_42 Question: 7 c(i) Page: 130
0653_w18_qp_42 Question: 7 c(ii) Page: 130

B.2 Chemistry

B.2.1 Atoms, elements and compounds

0653_m18_qp_42 Question: 5 a(i) Page: 12
0653_m18_qp_42 Question: 5 a(ii) Page: 12
0653_m18_qp_42 Question: 5 b Page: 12
0653_s18_qp_41 Question: 2 c(i) Page: 29
0653_s18_qp_41 Question: 2 c(ii) Page: 29
0653_s18_qp_41 Question: 5 a(ii) Page: 34
0653_s18_qp_42 Question: 2 b(i) Page: 49
0653_s18_qp_42 Question: 2 b(ii) Page: 49
0653_s18_qp_42 Question: 2 c Page: 49
0653_s18_qp_42 Question: 8 a(i) Page: 60
0653_s18_qp_42 Question: 8 a(ii) Page: 60
0653_s18_qp_43 Question: 5 a(i) Page: 79
0653_s18_qp_43 Question: 5 a(ii) Page: 79
0653_s18_qp_43 Question: 5 b(i) Page: 79
0653_s18_qp_43 Question: 5 b(ii) Page: 79
0653_s18_qp_43 Question: 5 b(iii) Page: 80
0653_s18_qp_43 Question: 8 c(ii) Page: 86
0653_w18_qp_41 Question: 2 a(i) Page: 94
0653_w18_qp_41 Question: 2 a(ii) Page: 94
0653_w18_qp_41 Question: 2 a(iii) Page: 94
0653_w18_qp_41 Question: 5 b(i) Page: 100

0653_w18_qp_41 Question: 5 b(ii) Page: 100
0653_w18_qp_42 Question: 5 a(i) Page: 125
0653_w18_qp_42 Question: 5 a(ii) Page: 125
0653_w18_qp_42 Question: 5 d Page: 126
0653_w18_qp_43 Question: 2 a(i) Page: 140
0653_w18_qp_43 Question: 2 a(ii) Page: 140
0653_w18_qp_43 Question: 2 b(i) Page: 141
0653_w18_qp_43 Question: 2 b(ii) Page: 141

B.2.2 Stoichiometry

0653_w18_qp_42 Question: 2 c(i) Page: 118

B.2.3 Electrochemistry

0653_m18_qp_42 Question: 2 a(i) Page: 6
0653_m18_qp_42 Question: 2 a(ii) Page: 6
0653_s18_qp_41 Question: 8 a(i) Page: 39
0653_s18_qp_41 Question: 8 a(ii) Page: 39
0653_s18_qp_42 Question: 5 b(i) Page: 55
0653_s18_qp_42 Question: 5 b(ii) Page: 55
0653_s18_qp_42 Question: 5 b(iii) Page: 55
0653_s18_qp_43 Question: 2 a(i) Page: 74
0653_s18_qp_43 Question: 2 a(ii) Page: 74
0653_s18_qp_43 Question: 2 b Page: 74
0653_w18_qp_41 Question: 2 b(i) Page: 94
0653_w18_qp_41 Question: 2 b(ii) Page: 95
0653_w18_qp_41 Question: 2 c Page: 95
0653_w18_qp_42 Question: 8 a Page: 131
0653_w18_qp_42 Question: 8 b(ii) Page: 132

B.2.4 Chemical energetics

0653_s18_qp_41 Question: 5 b(ii) Page: 35
0653_s18_qp_42 Question: 8 d(i) Page: 61
0653_w18_qp_42 Question: 2 b Page: 117
0653_w18_qp_43 Question: 2 a(iv) Page: 140

B.2.5 Chemical reactions

0653_m18_qp_42 Question: 8 c(i) Page: 19
0653_m18_qp_42 Question: 8 c(ii) Page: 19
0653_s18_qp_42 Question: 5 a(i) Page: 54
0653_s18_qp_42 Question: 5 a(ii) Page: 54
0653_s18_qp_42 Question: 5 b(iv) Page: 55
0653_w18_qp_42 Question: 2 a(ii) Page: 117
0653_w18_qp_42 Question: 2 a(iii) Page: 117
0653_w18_qp_43 Question: 5 a(ii) Page: 149
0653_w18_qp_43 Question: 5 b(ii) Page: 149

B.2.6 Acids, bases and salts

0653_s18_qp_42 Question: 2 a(ii) Page: 48
0653_s18_qp_42 Question: 8 d(ii) Page: 61

0653_w18_qp_41 Question: 5 a(i) Page: 100
0653_w18_qp_41 Question: 5 a(ii) Page: 100
0653_w18_qp_42 Question: 2 a(i)1 Page: 117
0653_w18_qp_42 Question: 2 a(i)2 Page: 117

B.2.7 The Periodic Table

0653_m18_qp_42 Question: 2 c Page: 7
0653_m18_qp_42 Question: 5 c Page: 12
0653_m18_qp_42 Question: 5 d(i) Page: 13
0653_m18_qp_42 Question: 5 d(ii) Page: 13
0653_s18_qp_41 Question: 8 c(i) Page: 40
0653_s18_qp_41 Question: 8 c(ii) Page: 40
0653_s18_qp_42 Question: 8 b(i) Page: 60
0653_s18_qp_42 Question: 8 b(ii) Page: 60
0653_w18_qp_41 Question: 5 c(i) Page: 100
0653_w18_qp_41 Question: 5 c(ii) Page: 100
0653_w18_qp_42 Question: 8 b(i) Page: 132

B.2.8 Metals

0653_m18_qp_42 Question: 2 b(i) Page: 7
0653_m18_qp_42 Question: 2 b(ii) Page: 7
0653_s18_qp_41 Question: 2 a(i) Page: 27
0653_s18_qp_41 Question: 2 a(ii) Page: 27
0653_s18_qp_41 Question: 2 b(i) Page: 28
0653_s18_qp_41 Question: 2 b(ii) Page: 28
0653_s18_qp_41 Question: 2 b(iii) Page: 28
0653_s18_qp_41 Question: 8 b(i) Page: 39
0653_s18_qp_41 Question: 8 b(ii) Page: 39
0653_s18_qp_42 Question: 5 a(iii) Page: 54
0653_s18_qp_43 Question: 2 c(i) Page: 74
0653_s18_qp_43 Question: 2 c(ii) Page: 74
0653_w18_qp_41 Question: 5 d Page: 101
0653_w18_qp_42 Question: 8 c(i) Page: 132
0653_w18_qp_42 Question: 8 c(ii) Page: 132
0653_w18_qp_43 Question: 5 a(i) Page: 148
0653_w18_qp_43 Question: 5 b(i) Page: 149
0653_w18_qp_43 Question: 5 c(i) Page: 149
0653_w18_qp_43 Question: 5 c(ii) Page: 149

B.2.9 Chemistry of the environment

0653_m18_qp_42 Question: 8 e(i) Page: 19
0653_m18_qp_42 Question: 8 e(ii) Page: 19
0653_s18_qp_41 Question: 5 b(i) Page: 34
0653_s18_qp_42 Question: 7 c Page: 59
0653_s18_qp_42 Question: 8 c Page: 60
0653_w18_qp_41 Question: 7 d(ii) Page: 105
0653_w18_qp_43 Question: 4 c Page: 147

B.2.10 Organic chemistry

0653_m18_qp_42 Question: 8 a Page: 18
0653_m18_qp_42 Question: 8 b Page: 18

0653_m18_qp_42 Question: 8 d Page: 19
0653_s18_qp_41 Question: 5 a(i) Page: 34
0653_s18_qp_41 Question: 5 a(iii) Page: 34
0653_s18_qp_42 Question: 2 a(i) Page: 48
0653_s18_qp_43 Question: 8 a(i) Page: 85
0653_s18_qp_43 Question: 8 a(ii) Page: 85
0653_s18_qp_43 Question: 8 b(i) Page: 85
0653_s18_qp_43 Question: 8 b(ii) Page: 85
0653_s18_qp_43 Question: 8 b(iii) Page: 85
0653_s18_qp_43 Question: 8 c(i) Page: 86
0653_w18_qp_41 Question: 8 a Page: 106
0653_w18_qp_41 Question: 8 b Page: 106
0653_w18_qp_41 Question: 8 c(i) Page: 107
0653_w18_qp_41 Question: 8 c(ii) Page: 107
0653_w18_qp_42 Question: 5 b(i) Page: 125
0653_w18_qp_42 Question: 5 b(ii) Page: 126
0653_w18_qp_42 Question: 5 c Page: 126
0653_w18_qp_43 Question: 8 a(i) Page: 154
0653_w18_qp_43 Question: 8 a(ii) Page: 154
0653_w18_qp_43 Question: 8 a(iii) Page: 154
0653_w18_qp_43 Question: 8 b(i) Page: 155
0653_w18_qp_43 Question: 8 b(ii) Page: 155

B.2.11 Experimental techniques and chemical analysis

0653_s18_qp_43 Question: 5 c Page: 80
0653_w18_qp_42 Question: 2 c(ii) Page: 118
0653_w18_qp_43 Question: 2 a(iii) Page: 140

B.3 Physics

B.3.1 Motion, forces and energy

0653_m18_qp_42 Question: 3 b Page: 8
0653_m18_qp_42 Question: 3 c(i) Page: 9
0653_m18_qp_42 Question: 3 c(ii) Page: 9
0653_m18_qp_42 Question: 3 c(iii) Page: 10
0653_s18_qp_41 Question: 3 a(i) Page: 30
0653_s18_qp_41 Question: 3 a(ii) Page: 30
0653_s18_qp_41 Question: 3 b(i) Page: 31
0653_s18_qp_41 Question: 3 b(ii) Page: 31
0653_s18_qp_41 Question: 3 c Page: 32
0653_s18_qp_42 Question: 9 a(i) Page: 62
0653_s18_qp_42 Question: 9 a(ii) Page: 62
0653_s18_qp_42 Question: 9 b(i) Page: 63
0653_s18_qp_42 Question: 9 b(ii) Page: 63
0653_s18_qp_42 Question: 9 c Page: 64
0653_s18_qp_43 Question: 3 a(i) Page: 75
0653_s18_qp_43 Question: 3 a(ii) Page: 75
0653_s18_qp_43 Question: 3 a(iii) Page: 75
0653_s18_qp_43 Question: 3 b(i) Page: 76
0653_s18_qp_43 Question: 3 b(ii) Page: 76
0653_w18_qp_41 Question: 3 a(i) Page: 96
0653_w18_qp_41 Question: 3 a(ii) Page: 96
0653_w18_qp_41 Question: 3 b(i) Page: 97
0653_w18_qp_41 Question: 3 b(ii) Page: 97
0653_w18_qp_41 Question: 3 b(iii) Page: 97

0653_w18_qp_41 Question: 3 b(iv) Page: 98
0653_w18_qp_42 Question: 1 a(i) Page: 113
0653_w18_qp_42 Question: 1 c(i) Page: 115
0653_w18_qp_42 Question: 1 c(ii) Page: 115
0653_w18_qp_42 Question: 1 c(iii) Page: 116
0653_w18_qp_42 Question: 6 a Page: 127
0653_w18_qp_42 Question: 6 b Page: 127
0653_w18_qp_43 Question: 3 a(i) Page: 142
0653_w18_qp_43 Question: 3 a(ii) Page: 142
0653_w18_qp_43 Question: 3 b(i) Page: 143
0653_w18_qp_43 Question: 3 b(ii) Page: 143
0653_w18_qp_43 Question: 3 c Page: 143
0653_w18_qp_43 Question: 3 d Page: 144

B.3.2 Thermal physics

0653_s18_qp_41 Question: 6 b(i) Page: 37
0653_s18_qp_41 Question: 6 b(ii) Page: 37
0653_s18_qp_41 Question: 6 b(iii) Page: 37
0653_s18_qp_42 Question: 6 c(i) Page: 57
0653_s18_qp_42 Question: 6 c(ii) Page: 57
0653_s18_qp_43 Question: 6 a Page: 81
0653_s18_qp_43 Question: 6 b(i) Page: 82
0653_s18_qp_43 Question: 6 b(ii) Page: 82
0653_w18_qp_41 Question: 6 a Page: 102
0653_w18_qp_41 Question: 6 b(i) Page: 102
0653_w18_qp_41 Question: 6 b(ii) Page: 102
0653_w18_qp_42 Question: 1 b(i) Page: 114
0653_w18_qp_42 Question: 1 b(ii) Page: 114
0653_w18_qp_42 Question: 6 c Page: 127
0653_w18_qp_43 Question: 6 a Page: 150
0653_w18_qp_43 Question: 6 b(i) Page: 150
0653_w18_qp_43 Question: 6 b(ii) Page: 151

B.3.3 Waves

0653_m18_qp_42 Question: 6 b(i) Page: 14
0653_m18_qp_42 Question: 6 b(ii) Page: 14
0653_m18_qp_42 Question: 6 c Page: 15
0653_s18_qp_41 Question: 6 a Page: 36
0653_s18_qp_42 Question: 3 c Page: 51
0653_s18_qp_42 Question: 6 a(i) Page: 56
0653_s18_qp_42 Question: 6 a(ii) Page: 56
0653_s18_qp_42 Question: 6 b Page: 56
0653_s18_qp_43 Question: 3 c(i) Page: 76
0653_s18_qp_43 Question: 3 c(ii) Page: 77
0653_s18_qp_43 Question: 9 c Page: 88
0653_w18_qp_41 Question: 6 c(i) Page: 103
0653_w18_qp_41 Question: 6 c(ii) Page: 103
0653_w18_qp_42 Question: 6 d(i) Page: 128
0653_w18_qp_42 Question: 6 d(ii) Page: 128
0653_w18_qp_43 Question: 6 c(i) Page: 152
0653_w18_qp_43 Question: 6 c(ii) Page: 152

B.3.4 Electricity

0653_m18_qp_42 Question: 3 d Page: 10
0653_m18_qp_42 Question: 6 a Page: 14
0653_m18_qp_42 Question: 9 a Page: 20
0653_m18_qp_42 Question: 9 b Page: 20
0653_m18_qp_42 Question: 9 c Page: 21
0653_m18_qp_42 Question: 9 d Page: 21
0653_s18_qp_41 Question: 9 a(i) Page: 41
0653_s18_qp_41 Question: 9 a(ii) Page: 41
0653_s18_qp_41 Question: 9 a(iii) Page: 42
0653_s18_qp_41 Question: 9 b Page: 42
0653_s18_qp_42 Question: 3 a Page: 50
0653_s18_qp_42 Question: 3 b(i) Page: 50
0653_s18_qp_42 Question: 3 b(ii) Page: 51
0653_s18_qp_42 Question: 9 b(iii) Page: 63
0653_s18_qp_43 Question: 9 a Page: 87
0653_s18_qp_43 Question: 9 b Page: 88
0653_w18_qp_41 Question: 9 a(i) Page: 109
0653_w18_qp_41 Question: 9 a(ii) Page: 109
0653_w18_qp_41 Question: 9 b(i) Page: 109
0653_w18_qp_41 Question: 9 b(ii) Page: 109
0653_w18_qp_41 Question: 9 b(iii) Page: 109
0653_w18_qp_42 Question: 9 a Page: 133
0653_w18_qp_42 Question: 9 b Page: 133
0653_w18_qp_42 Question: 9 c(i) Page: 134
0653_w18_qp_42 Question: 9 c(ii) Page: 134
0653_w18_qp_43 Question: 9 a(i) Page: 156
0653_w18_qp_43 Question: 9 a(ii) Page: 157
0653_w18_qp_43 Question: 9 b Page: 157

B.3.5 Space physics

0653_m18_qp_42 Question: 3 a Page: 8
0653_w18_qp_42 Question: 1 a(ii) Page: 113