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.

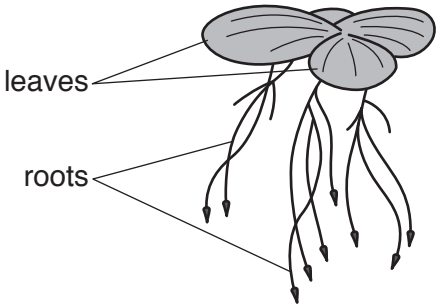


Fig. 1.1

(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.

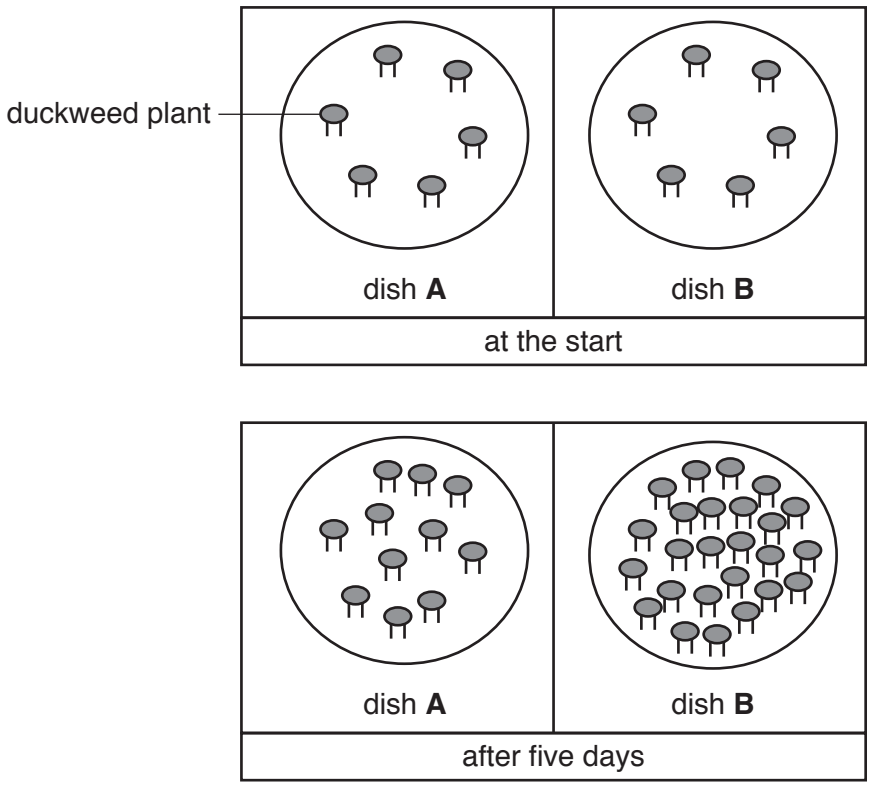


Fig. 1.2

(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.

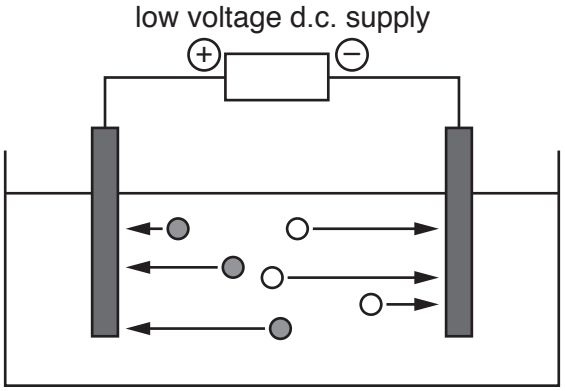


Fig. 2.1

(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.

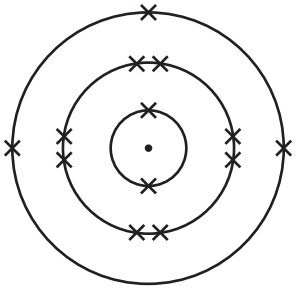


Fig. 5.1

(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.

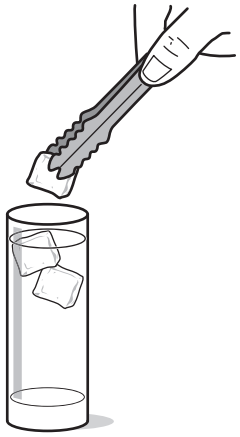


Fig. 6.1

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

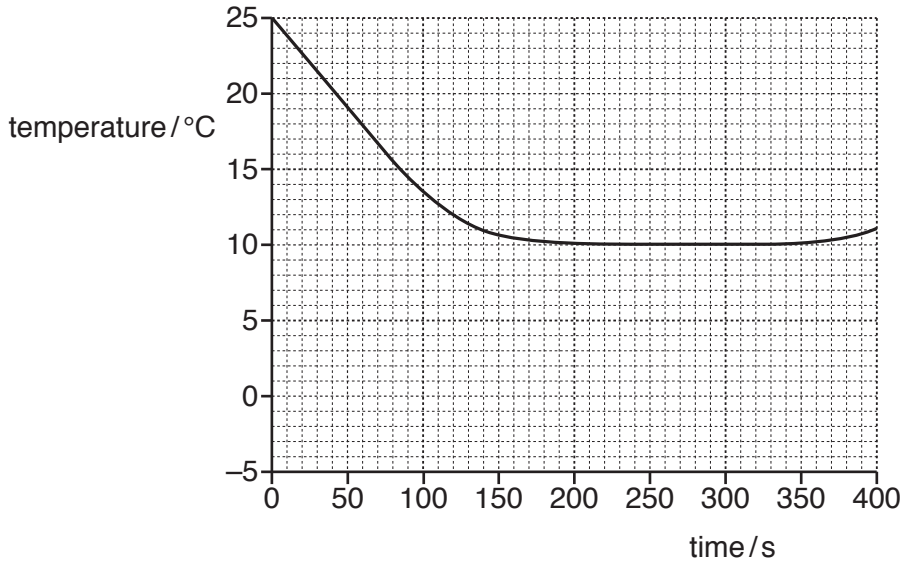


Fig. 6.2

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.

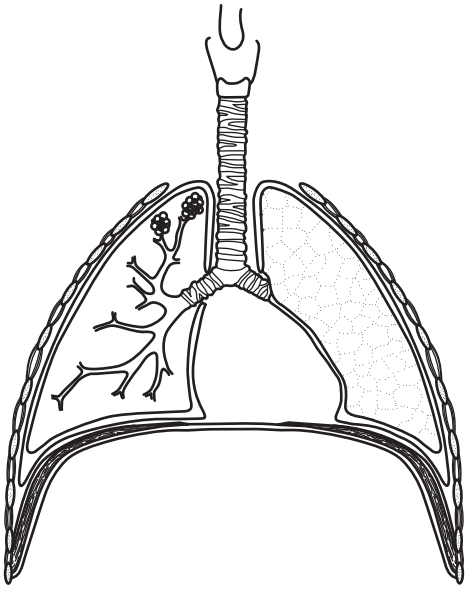


Fig. 7.1

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.

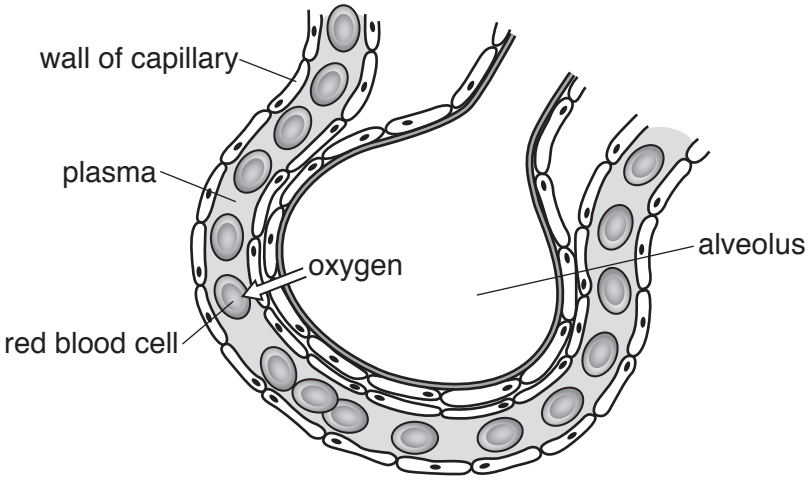


Fig. 7.2

(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.

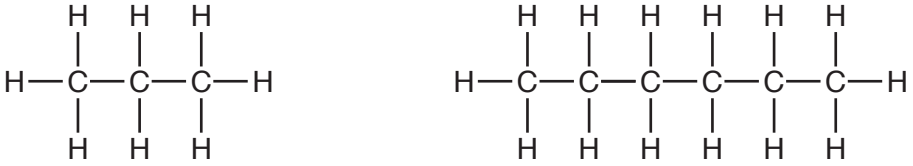
1. .....

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.

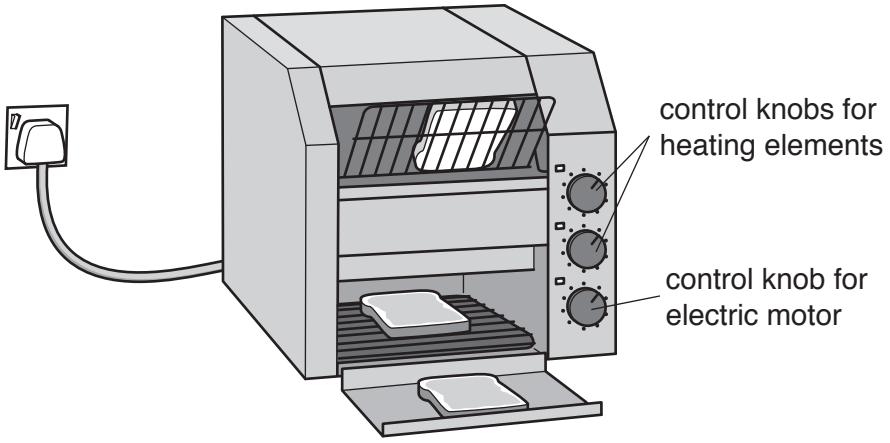


Fig. 9.1

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.

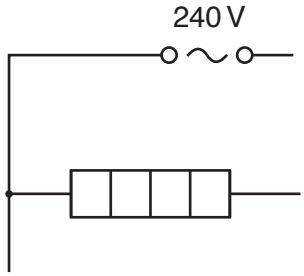
The plug at the end of the cable has a fuse inside, and is plugged into a 240 V mains supply.

(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

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.).