Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0842652601

COMBINED SCIENCE **0653/43**

Paper 4 (Extended) **October/November 2019**

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 Assessment International Education

1 **(a)** Fig. 1.1 is a diagram of the carbon cycle.
The arrows show the processes involved in the carbon cycle.

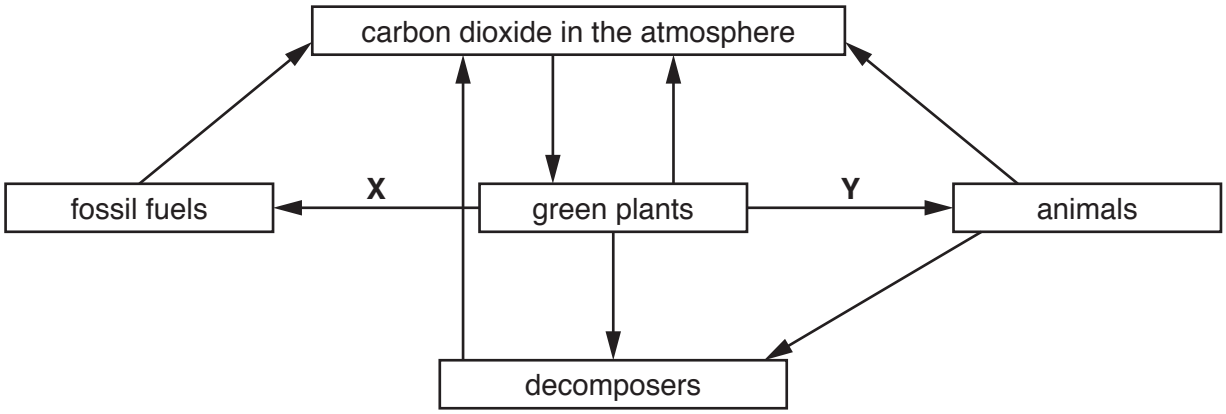


Fig. 1.1

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

X .....

Y .....
[2]

(ii) Use Fig. 1.1 to name the group of organisms which are producers.

..... [1]

(iii) Name a compound found in green plants which contains carbon and is used for the storage of energy.

..... [1]

(b) Some activities of humans can affect the composition of gases of the atmosphere.

The trees in a forest are cut down and burned.

Explain in detail the effect of this deforestation on the oxygen concentration in the atmosphere.

.....

.....

.....

.....

..... [3]

[Total: 7]

2 **(a)** The formula of methanol is CH_3OH.

(i) State why methanol is **not** a hydrocarbon.

.....

..... [1]

(ii) Complete the dot-and-cross diagram of a molecule of methanol.

Show all of the atoms and all of the outer shell electrons.

H C O

[3]

(b) **(i)** During the complete combustion of methanol, the amount of carbon dioxide in the air increases.

Suggest **one** effect of this increase on the environment.

.....

..... [1]

(ii) The products of the complete combustion of methanol are the same as the products of the complete combustion of hydrocarbons.

Construct the balanced symbol equation for the complete combustion of methanol.

State symbols are **not** required.

..... [3]

[Total: 8]

[Turn over

3 **(a)** Fig. 3.1 shows children using a magnifying glass to view a butterfly.

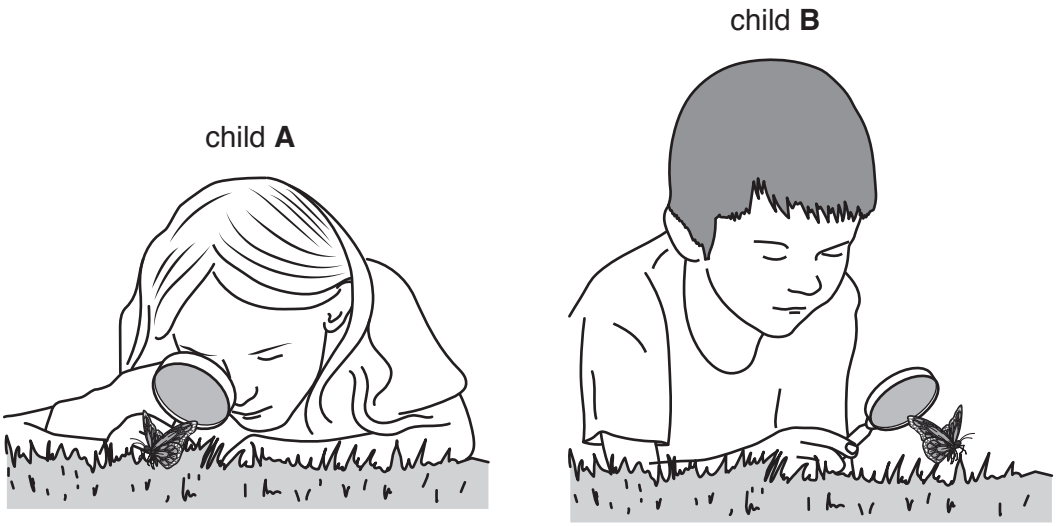


Fig. 3.1

(i) State which child, **A** or **B**, is using the magnifying glass correctly.

Give a reason for your answer.

.....

..... [1]

(ii) The magnified image of the butterfly is a virtual image.

State what is meant by a *virtual image*.

.....

..... [1]

(b) Complete the sentences below using words from the list.

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

amplitude **compressions** **frequency**

longitudinal **pitch** **transverse**

The boy listens to the radio. The radio transmits sound waves through the air to his ears as ..... and rarefactions. These are ..... waves.

He uses the volume control on the radio to make the sound louder, which alters the ..... of the waves. [2]

(c) The girl walks from home to school.

Fig. 3.2 shows a speed–time graph of her journey.

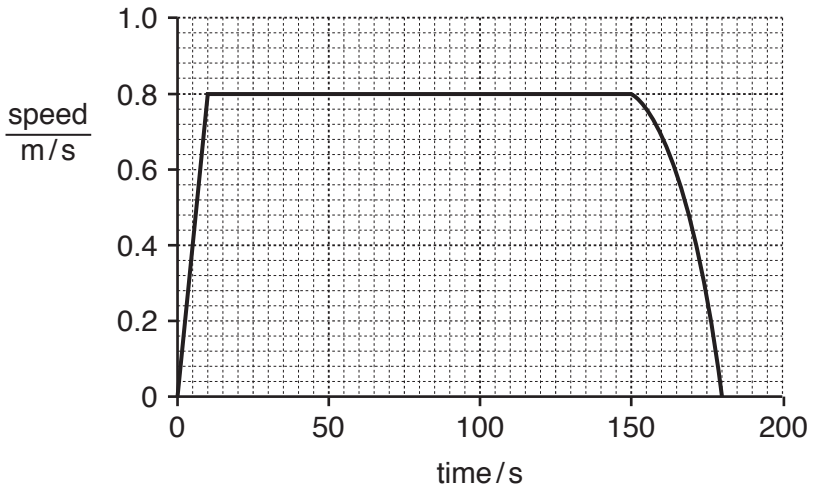


Fig. 3.2

(i) Calculate the distance she travels between 0 s and 150 s.

Show your working.

distance = ... m [3]

(ii) Explain the difference in the shape of the graph between 0 s and 10 s and between 150 s and 180 s.

.....

.....

..... [2]

[Turn over

(d) The boy climbs a hill when he goes to school.

The mass of the boy is 40 kg. The hill is 50 m high.

Calculate the gravitational potential energy gained by the boy when he reaches the top of the hill.

Show your working.

gravitational field strength $g = 10\,\text{N/kg}$

gravitational potential energy gained = ... J [2]

[Total: 11]

Question 4 starts on the next page.

4 **(a)** Define the term *enzyme*.

.....

..... [2]

(b) Enzymes are found in the digestive system where they help in the chemical digestion of food.

Fig. 4.1 shows some digestive enzymes listed in the boxes on the left.

enzyme	substrate	product
amylase	fats	amino acids
lipase	protein	fatty acids and glycerol
protease	starch	simple sugars

Fig. 4.1

(i) On Fig. 4.1:

- draw one straight line to connect each enzyme with its substrate
- draw one straight line to connect each substrate with its product.

[3]

(ii) State **one** area of the alimentary canal and its associated organs where protease is secreted.

..... [1]

(c) Explain in detail the activity of a human digestive enzyme at 70 °C.

.....

.....

.....

.....

..... [3]

(d) State **two** functions of hydrochloric acid in gastric juice.

1. .....

.....

2. .....

.....

[2]

[Total: 11]

5 **(a)** The elements in the Periodic Table, shown on page 20, are arranged in groups and periods.

(i) Chlorine is in Period 3.

State the number of elements in Period 3.

..... [1]

(ii) The number of outer shell electrons in the atoms of the elements changes across Period 3.

Describe the relationship between the number of outer shell electrons and the metallic character of these elements.

.....

..... [1]

(b) **(i)** Describe a chemical test for chlorine gas and give the positive result.

test .....

.....

result .....

.....
[2]

(ii) Explain how chlorination makes water safe to drink.

.....

..... [1]

(c) Chlorine gas is bubbled through aqueous potassium bromide.

Describe the colour change during this process.

Use ideas about the reactivity of the halogens to explain your answer.

colour change .....

.....

explanation .....

.....

.....
[2]

(d) Chlorine gas can be obtained by the electrolysis of molten potassium chloride using inert electrodes.

(i) Name the electrode at which chlorine forms.

..... [1]

(ii) Describe how chloride ions are changed into chlorine atoms.

.....

.....

..... [2]

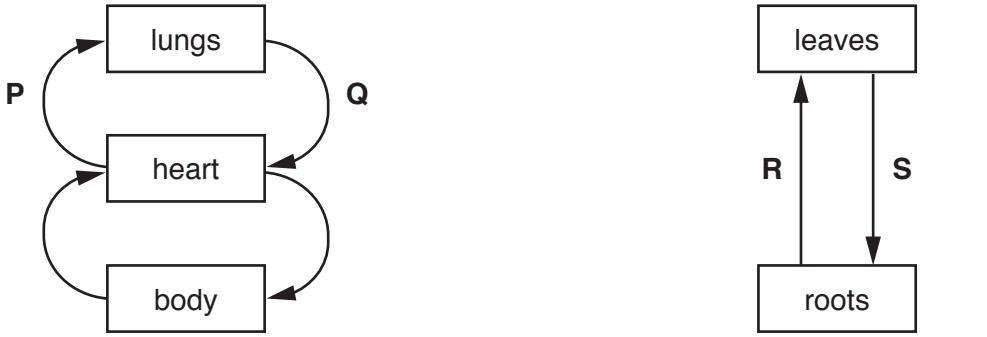
(iii) State the **other** product of this electrolysis.

..... [1]

[Total: 11]

[Turn over

6 Fig. 6.1 shows simple diagrams of the human and plant transport systems. The arrows show the direction of flow of substances.



human transport system

plant transport system

Fig. 6.1

(a) (i) Use Fig. 6.1 to explain why the human circulation is described as a *double circulation*.

.....

.....

.....

..... [2]

(ii) State **two** ways in which the composition of the blood flowing in direction **P** is different from the blood flowing in direction **Q**.

1. .....

2. .....

[2]

(b) (i) Name the tissue which transports food substances in direction **S**.

.....[1]

(ii) Explain why food is transported in direction **S**.

.....

.....

[1]

(iii) Water passes through the roots to the leaves in direction **R** in the xylem.

Some of the water from the xylem replaces water lost during transpiration.

Explain in detail why the rate of transpiration decreases when the humidity of the air increases.

.....

.....

..... [2]

(iv) State **one other** function of the xylem apart from transport.

.....

..... [1]

[Total: 9]

7 **(a)** In hot climates, some foods such as milk must be kept cool to ensure they stay fresh.

Fig. 7.1 shows a cooler made of pottery used to keep a bottle of milk cool.

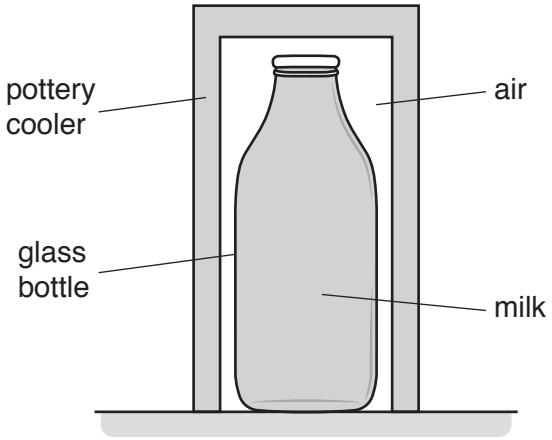


Fig. 7.1

The cooler is soaked with cold water and placed over the glass bottle containing milk.

The cooler slowly dries.

As the water evaporates, the temperature of the cooler falls below the temperature of the surroundings.

(i) Describe in terms of molecules of water how this process results in the temperature of the cooler decreasing.

.....

.....

.....

..... [2]

(ii) Explain in terms of the motion of the molecules why the water evaporates more quickly when the temperature of the surroundings is higher.

.....

.....

.....

.....

..... [2]

(iii) The temperature of the milk in the glass bottle also decreases.

Describe in terms of molecular movement how thermal energy is transferred from the milk through the glass bottle by conduction.

.....

.....

.....

..... [2]

(b) Fig. 7.2 shows a solar-powered freezer used in sunny climates. The freezer can also use a mains supply at night.

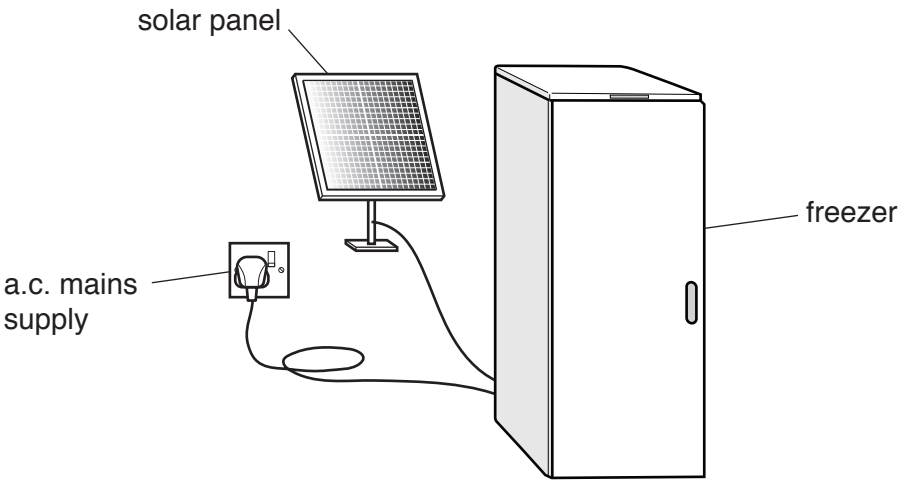


Fig. 7.2

The solar panel provides a 12 V supply to power the freezer.

At night, the mains supply powers the appliance at 240 V instead of the solar panel.

The power supplied is only 80 W when operating at 240 V and is 90 W when operating at 12 V.

The freezer has two fuses, one marked 10 A, the other marked 1 A.

Suggest why the freezer needs two separate fuses with these different values.

Show calculations as part of your answer.

.....

.....

..... [4]

[Total: 10]

8 **(a)** Magnesium reacts with dilute hydrochloric acid.

(i) Explain in detail why the rate of this reaction increases when the concentration of the acid increases.

.....

.....

.....

.....

..... [3]

(ii) State **one other** change that increases the rate of this reaction.

..... [1]

(iii) The reaction between magnesium and hydrochloric acid is exothermic.

Explain why an *exothermic* reaction releases heat.

Use ideas about energy, bond breaking and bond forming in your answer.

.....

.....

.....

..... [2]

(b) Iron is extracted from iron oxide in a blast furnace.

Explain why magnesium **cannot** be extracted from magnesium oxide in a blast furnace.

.....

..... [1]

[Total: 7]

[Turn over

9 Fig. 9.1 shows an electrically-powered bicycle.

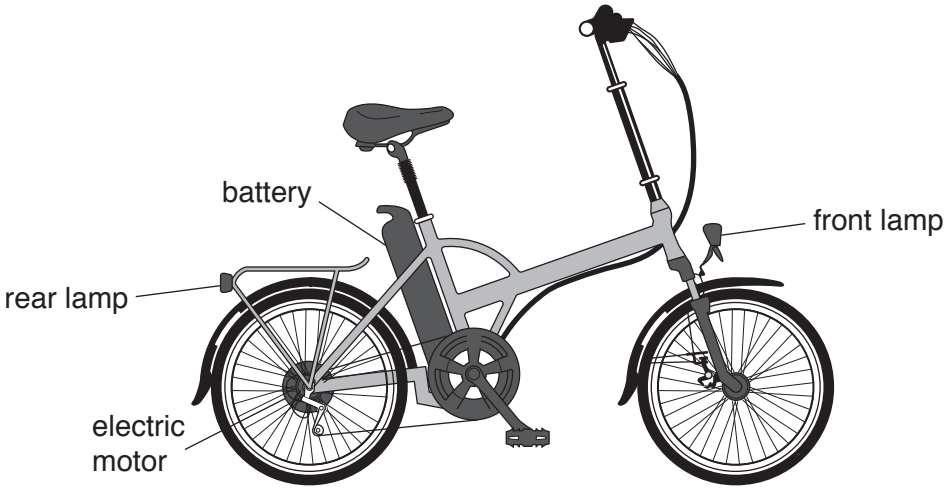


Fig. 9.1

Fig. 9.2 shows part of the circuit diagram for the lamps and electric motor on the bicycle.

The switch shown on the diagram controls only the motor and a variable resistor.

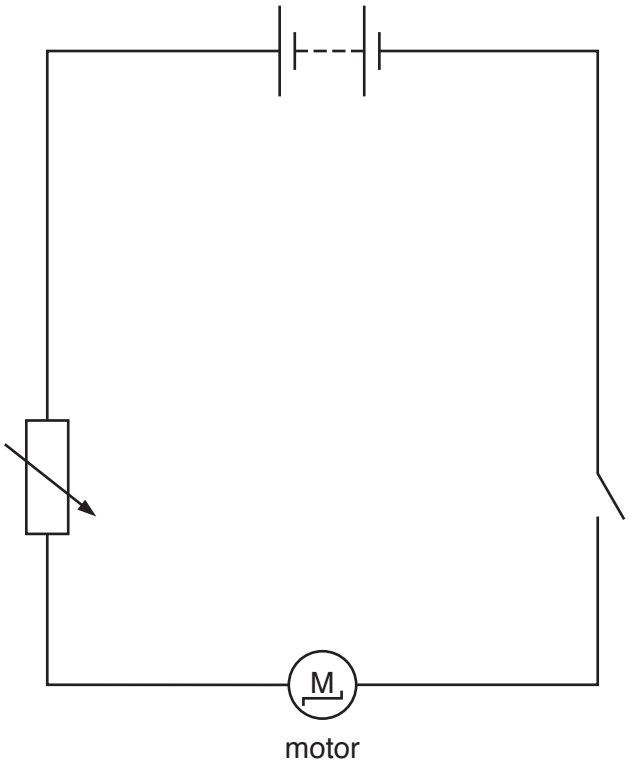


Fig. 9.2

(a) A second switch controls the two lamps, which are connected in parallel with the motor. The two lamps are also connected in parallel with each other.

Complete the circuit diagram on Fig. 9.2 to show how the second switch and the two lamps are connected into the circuit. [3]

(b) When both lamps are fully lit, the front lamp has a current of 2.0 A and the rear lamp has a current of 1.0 A.

The battery consists of eight cells, each with an e.m.f. of 1.5 V.

Use the data to calculate the combined resistance of the lamps when both are fully lit.

Show your working.

resistance = ... Ω [3]

[Total: 6]

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.).