UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/22**

Paper 2 (Core) **May/June 2011**

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 a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

This document consists of **19** printed pages and **1** blank page.

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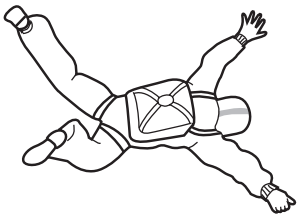
For Examiner's Use

1 A man wearing a parachute jumps from an aeroplane.



There is an upward force and a downward force acting on the man as he begins to fall. After a time his speed of fall becomes constant.

(a) (i) Name the force which acts downwards on the parachute jumper.

..... [1]

(ii) Explain in terms of forces why the man's speed of fall becomes constant.

.....

.....

..... [2]

(b) After a while the parachute jumper opens his parachute. The speed-time graph in Fig. 1.1 shows his fall from the aeroplane until he reaches the ground.

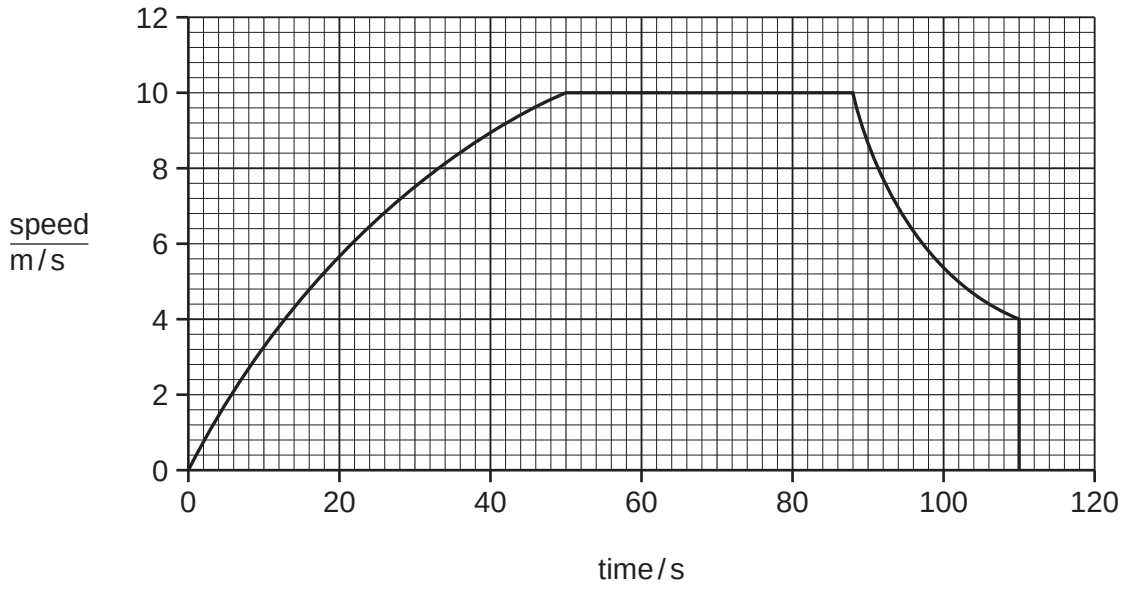


Fig. 1.1

(i) Mark on the graph with the letter **X** a point at which the man's speed is constant. [1]

(ii) Mark on the graph with the letter **Y** the point at which the parachute is opened. [1]

(iii) Mark on the graph with the letter **Z** the point at which the man reached the ground. [1]

For Examiner's Use

2 **(a)** Draw lines to link each description to the correct part of a cell.

description	part of a cell
contains DNA	cell wall
controls what enters and leaves the cell	nucleus
is partially permeable	cell surface membrane
is fully permeable	

[4]

(b) Many metabolic reactions take place in the cytoplasm of cells.

(i) What is the name given to the chemicals that catalyse these metabolic reactions?

..... [1]

(ii) Explain why the metabolic reactions cannot take place if the temperature of the cell becomes very high.

.....

..... [1]

(c) Human bones contain cells surrounded by the mineral calcium phosphate.

A study was carried out in Brazil into the mineral content of the leg bones of school children between the ages of 10 and 19 years. The mineral content was measured as the mass of mineral per cm^3 of bone. Some of the results are shown in Fig. 2.2.

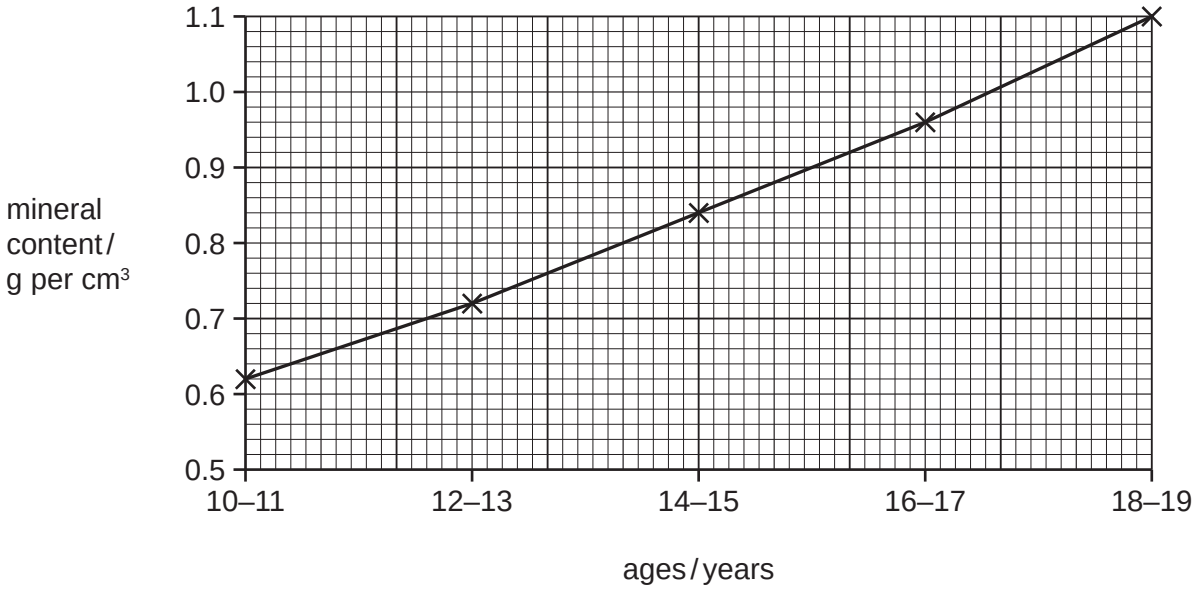


Fig. 2.2

(i) Describe how the mineral content of bone changes between the ages of 10 and 19 years.

.....

.....

..... [2]

(ii) Use the information in Fig. 2.2 to explain why a teenager should have a diet containing plenty of dairy products such as milk and cheese.

.....

.....

..... [2]

(iii) Bone also contains a protein called collagen. Vitamin C is required to make collagen.

Name **one** food that contains large amounts of vitamin C.

..... [1]

[Turn over

For Examiner's Use

3 A student investigated the reactivity of four metals **A**, **B**, **C** and **D**, by comparing the rate at which these metals reacted in dilute acid.

Fig. 3.1 shows what the student observed during the experiment.

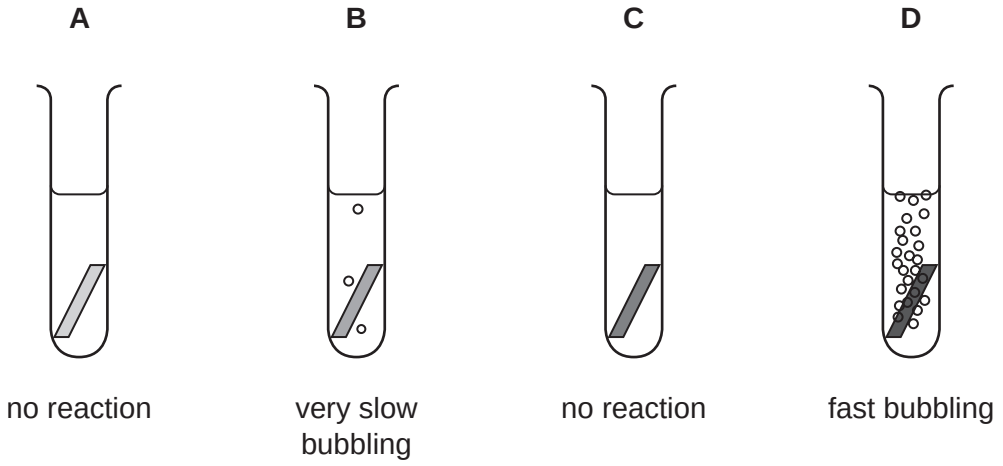


Fig. 3.1

(a) (i) Predict and explain what would be observed if a lighted splint is held in the mouth of the test-tube in which metal **D** is reacting.

.....

.....

..... [2]

(ii) Explain briefly why the student's observations did **not** allow her to place **all four** metals into order based on their reactivity.

.....

..... [1]

(b) Fig. 3.2 shows the apparatus the student used to react dilute sulfuric acid with copper carbonate powder.

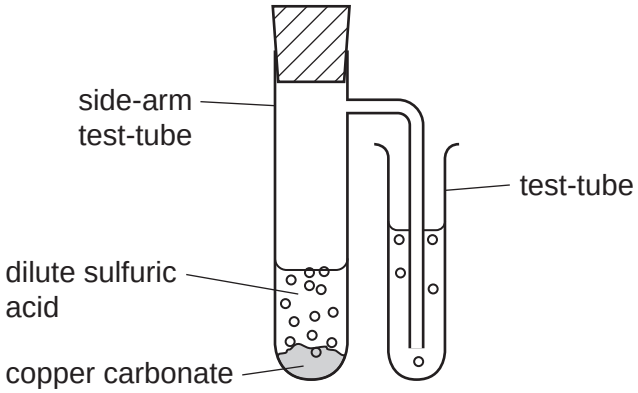


Fig. 3.2

The student's observations are listed below.

1 All of the copper carbonate reacted and dissolved.

2 A gas was given off which turned the solution in the smaller test-tube cloudy.

3 A blue solution remained in the side-arm test-tube.

(i) Suggest the name of the solution in the smaller test-tube.

..... [1]

(ii) Complete the **word** equation for the reaction in the side-arm test-tube.

copper carbonate + sulfuric acid → ☐ + ☐ + ☐

[2]

For Examiner's Use

4 **(a)** Fig. 4.1 shows a room heated by a convector heater, placed in the middle of the floor.

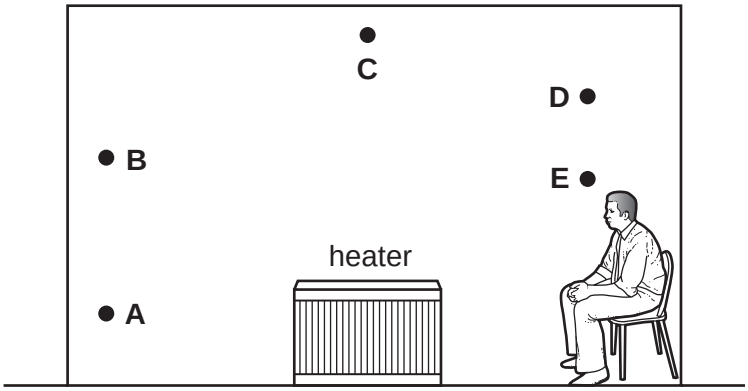


Fig. 4.1

(i) On Fig. 4.1 draw the convection currents of air produced by the heater. Use arrows to show their direction. [2]

(ii) State which labelled part of the room will be the

coldest, ...

hottest. .....

Explain your answers.

.....

.....

..... [3]

(b) The heater uses electricity and is plugged into a socket along with some other electrical devices.

Fig. 4.2 shows the socket.

State and explain **one** electrical danger that is visible.

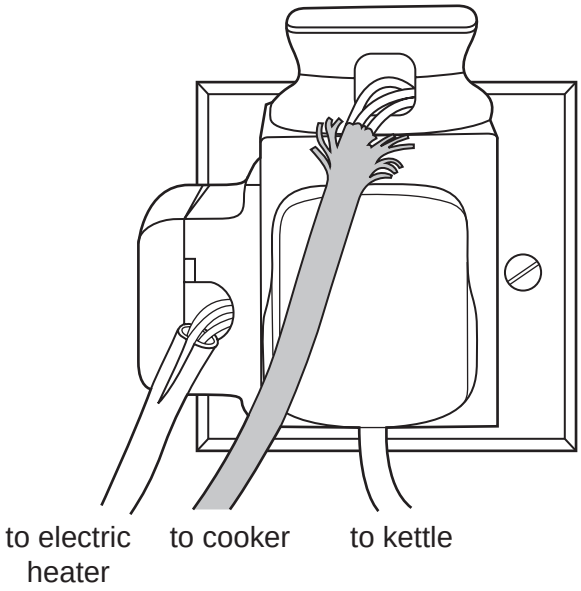


Fig. 4.2

danger .....

.....

explanation .....

..... [2]

(c) Most of the electricity used by the heater is generated using the combustion of fossil fuels.

Some electricity is generated using nuclear fuel.

(i) State **one** advantage of generating electricity from nuclear fuel.

.....

..... [1]

(ii) State **one** disadvantage of generating electricity from nuclear fuel.

.....

..... [1]

For Examiner's Use

5 **(a)** Name the part of a flower that carries out each of the following functions.

(i) attracts insects to the flower ..... [1]

(ii) makes pollen ..... [1]

(b) **(i)** The cells in the petals of most flowers do not contain chlorophyll. They are supplied with sugar that is made in the leaves.

Describe how sugar is made in the leaves of a plant.

.....

.....

.....

..... [3]

(ii) Suggest **one** reason why the cells in flowers need sugars.

..... [1]

For Examiner's Use

6 Fig. 6.1 shows crude oil and natural gas trapped in underground rocks. The diagram is not drawn to scale.

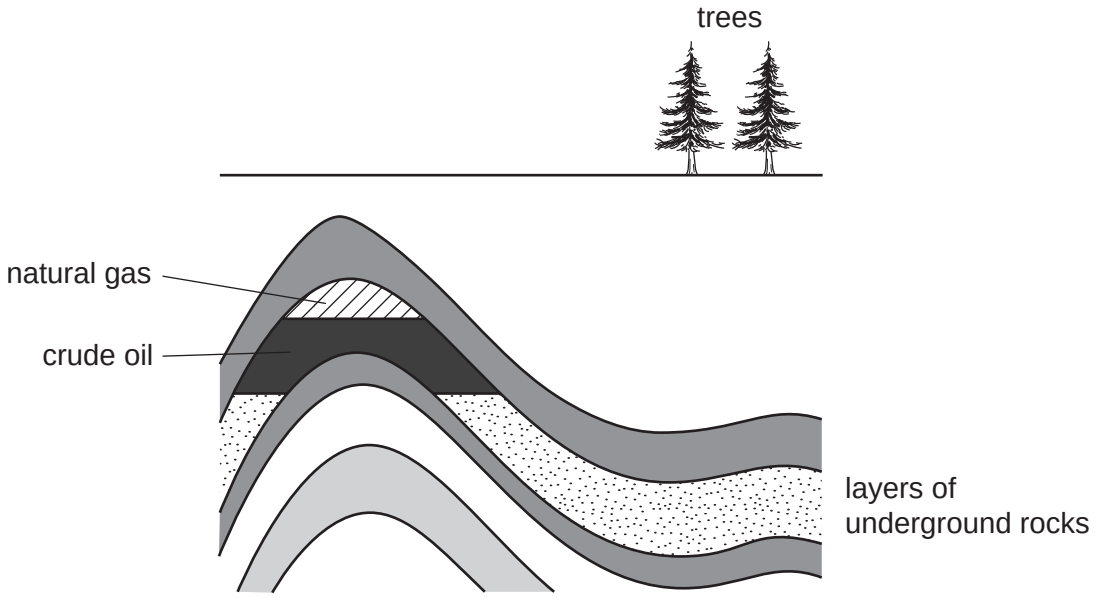


Fig. 6.1

(a) Wood obtained from trees and compounds obtained from crude oil and natural gas can be used as fuels.

(i) Name a solid fossil fuel. ..... [1]

(ii) State **two** reasons why crude oil and natural gas are examples of *fossil fuels* but wood is not.

1 .....

.....

2 .....

..... [2]

(b) Hexane, C_6H_{14}, is one of a very large number of different hydrocarbons which are found in crude oil.

Gasoline (car fuel) is a mixture of hydrocarbons which contains a large amount of hexane.

(i) Name the process which is used to separate gasoline from crude oil.

..... [1]

(ii) Suggest **one** reason why crude oil is **not** put into the fuel tanks of cars.

.....

..... [1]

(c) In a car, gasoline and air are taken into the engine and a mixture of waste (exhaust) gases is released into the atmosphere.

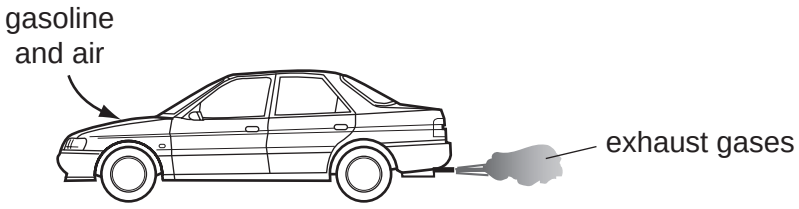


Table 6.1 shows some of the gases in a car's exhaust.

Table 6.1

substance in exhaust gases
carbon dioxide
carbon monoxide
nitrogen
nitrogen dioxide
oxygen
water vapour

(i) State the approximate percentage of oxygen gas in unpolluted air.

..... [1]

(ii) Explain why the mixture of exhaust gases contains less gaseous oxygen than is present in the air taken into the engine.

.....

..... [1]

(iii) A car engine is running inside a building without a good supply of fresh air.

Explain why people near the car could be in danger.

.....

.....

..... [2]

(d) Fig. 6.2 shows the balanced equation for the complete combustion of methane. The reactants and products are shown using displayed (graphical) chemical formulae.

For Examiner's Use

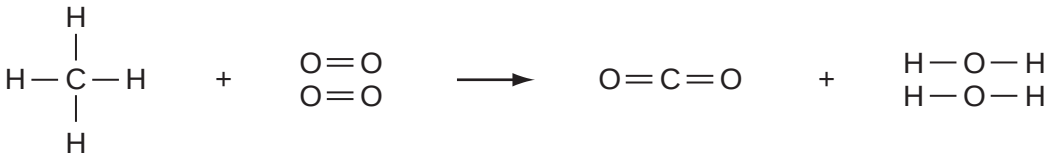


Fig. 6.2

Re-write the equation in Fig. 6.2 using molecular formulae.

The equation has been started for you.

CH_4 + ... ⟶ ..... + ... [3]

For Examiner's Use

7 **(a)** The diagrams below show the symbols for three parts of an electric circuit in a torch.

(i) On the line below each diagram state the name of the part.

....

[3]

(ii) Draw a circuit diagram to show how these three parts are connected in a torch.

[2]

(b) Fig. 7.1 shows

- three types of electromagnetic wave,
- a use for each type of wave.

Draw a straight line from each type of wave to the correct use.

type of wave	use of wave
X-ray	cooking
radio wave	long distance communication
infra-red	viewing broken bones

Fig. 7.1

[1]

8 Guanacos are relatives of camels and live in the Andes mountains in South America. They feed on grasses and other plants. They are killed and eaten by pumas.

For Examiner's Use

Fig. 8.1 shows a guanaco.

Fig. 8.1

(a) For each statement below, choose the correct ecological term from the list.

community **consumer** **decomposer** **ecosystem**

habitat **population** **producer**

definition	ecological term
all the guanacos that live in a particular area	
all the species of animals and plants that live in a particular area	
an organism, such as a guanaco or a puma, that feeds on other organisms	

[3]

(b) Guanacos can live at very high altitudes, above 4000 metres. There is less oxygen in the air than at sea level.

(i) Describe how oxygen from the air enters the blood of a mammal, such as a guanaco.

.....

.....

..... [2]

(ii) The blood of a guanaco contains four times as many red blood cells per cm^3 as the blood of a human. This helps the guanaco to survive in its environment.

Suggest an explanation for this.

.....

.....

..... [2]

(c) Guanacos are an endangered species.

Several countries in South America have conservation programmes to try to increase the numbers of guanacos.

Suggest why it is important to conserve guanacos.

.....

.....

..... [2]

For Examiner's Use

9 **(a)** Fig. 9.1 shows a smoke detector that uses the isotope americium-241, which emits alpha radiation.

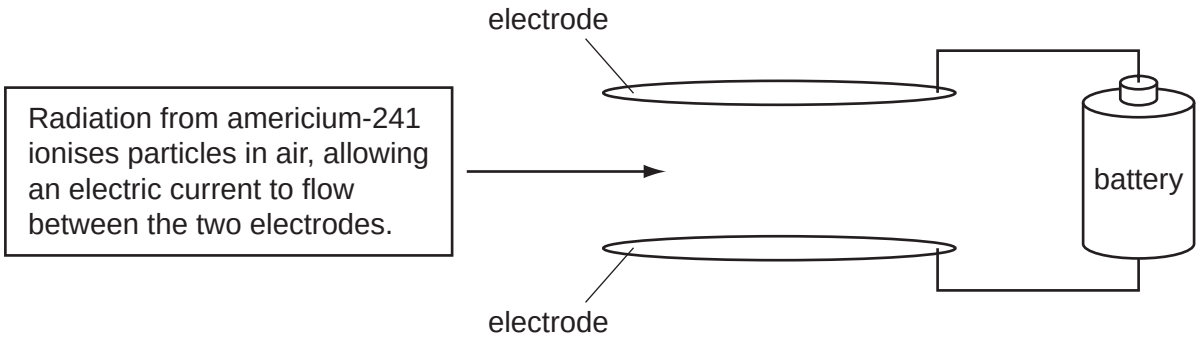


Fig. 9.1

Smoke particles stop radiation from reaching the air particles. This causes the current to stop flowing, causing the alarm to sound.

(i) Explain why beta or gamma radiation sources would **not** be suitable for this smoke detector.

.....

.....

..... [2]

(ii) Explain why alpha radiation is harmful to living organisms, even though it can be easily stopped.

.....

.....

..... [2]

(b) Some radiation in the environment is produced naturally. This is called background radiation.

State **one** major source of background radiation.

..... [1]

(c) Suggest **one** precaution that must be taken when handling radioactive sources.

..... [1]

For Examiner's Use

10 Lithium and its compounds have many important uses.

(a) (i) Use the Periodic Table on page 20 to find the group number and period number of lithium.

group number .....

period number ..... [1]

(ii) Fig. 10.1 shows how the element lithium is stored.

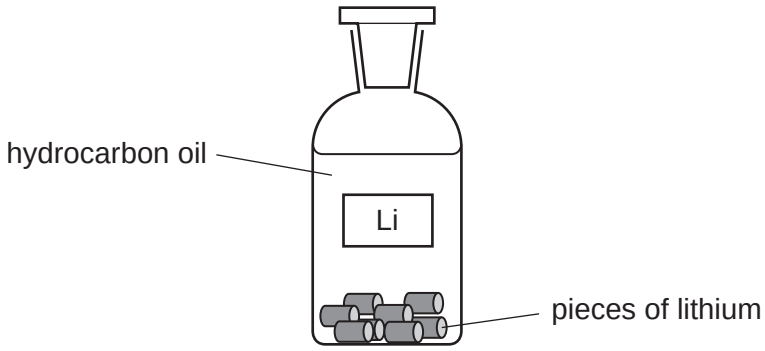


Fig. 10.1

State and explain why it is necessary to store lithium in this way.

.....

.....

..... [2]

(iii) Fig. 10.2 shows a student's attempt to draw the arrangement of all the electrons in a lithium atom.

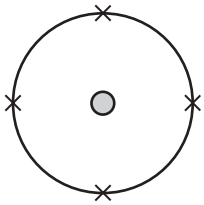


Fig. 10.2

State **two** mistakes that the student has made.

1 .....

.....

2 .....

..... [2]

(iv) Explain whether or not a piece of solid lithium would conduct an electric current.

.....

..... [1]

(b) The uncombined element, lithium, is made when the salt lithium chloride is used in electrolysis.

(i) Lithium chloride is an ionic compound.

State **one** difference between a lithium *ion* and a lithium *atom*.

.....

..... [1]

(ii) Fig. 10.3 shows a simplified diagram of the electrolysis of lithium chloride. In this electrolysis, lithium is formed at the cathode.

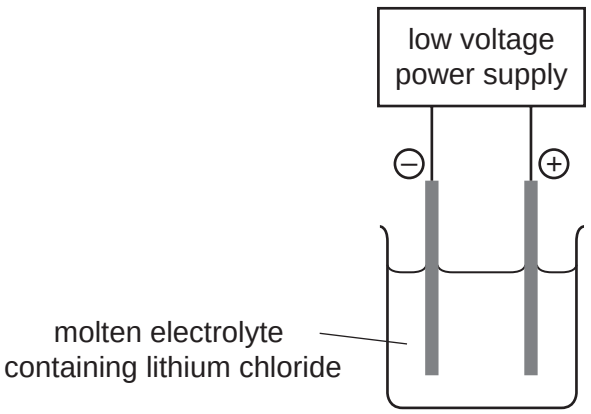


Fig. 10.3

Label the cathode on Fig. 10.3. [1]

(iii) Complete the word equation below which describes the electrolysis of lithium chloride.

lithium chloride ⟶ lithium + ... [1]

DATA SHEET
The Periodic Table of the Elements

I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

Key: a above **X** above b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

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