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

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

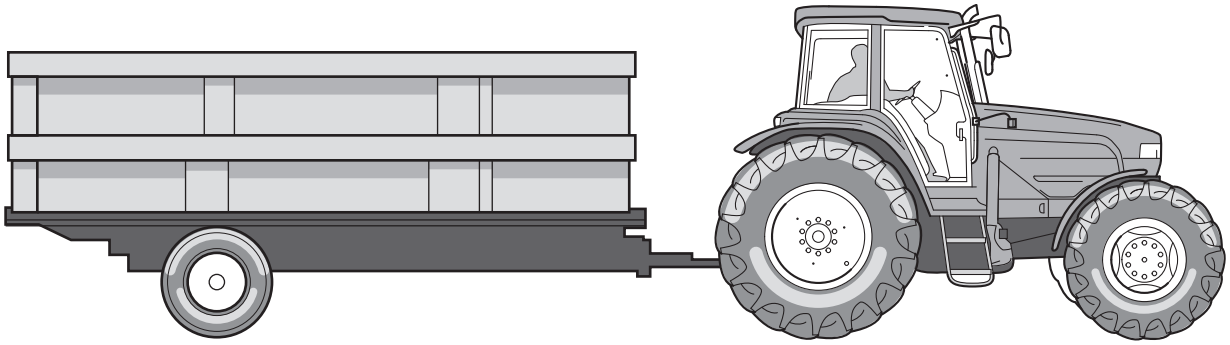

Fig. 1.1

(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.

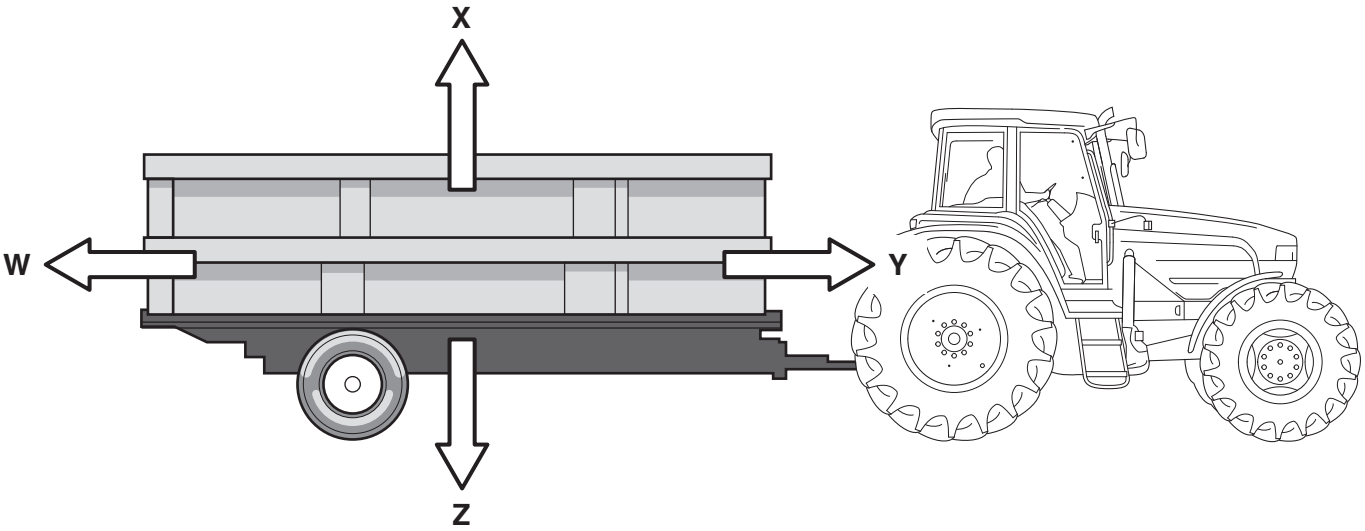

Fig. 1.2

(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.

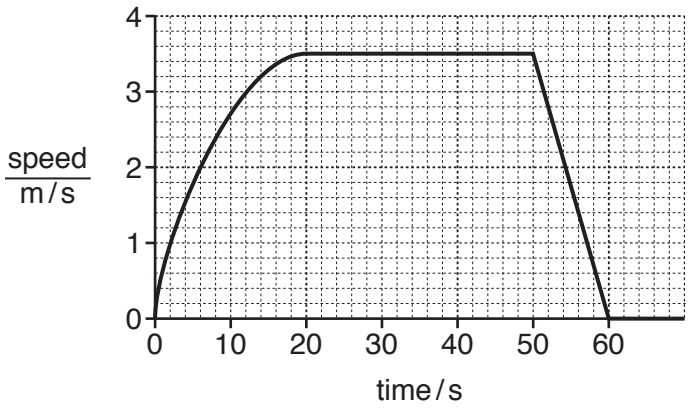

Fig. 1.3

(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.

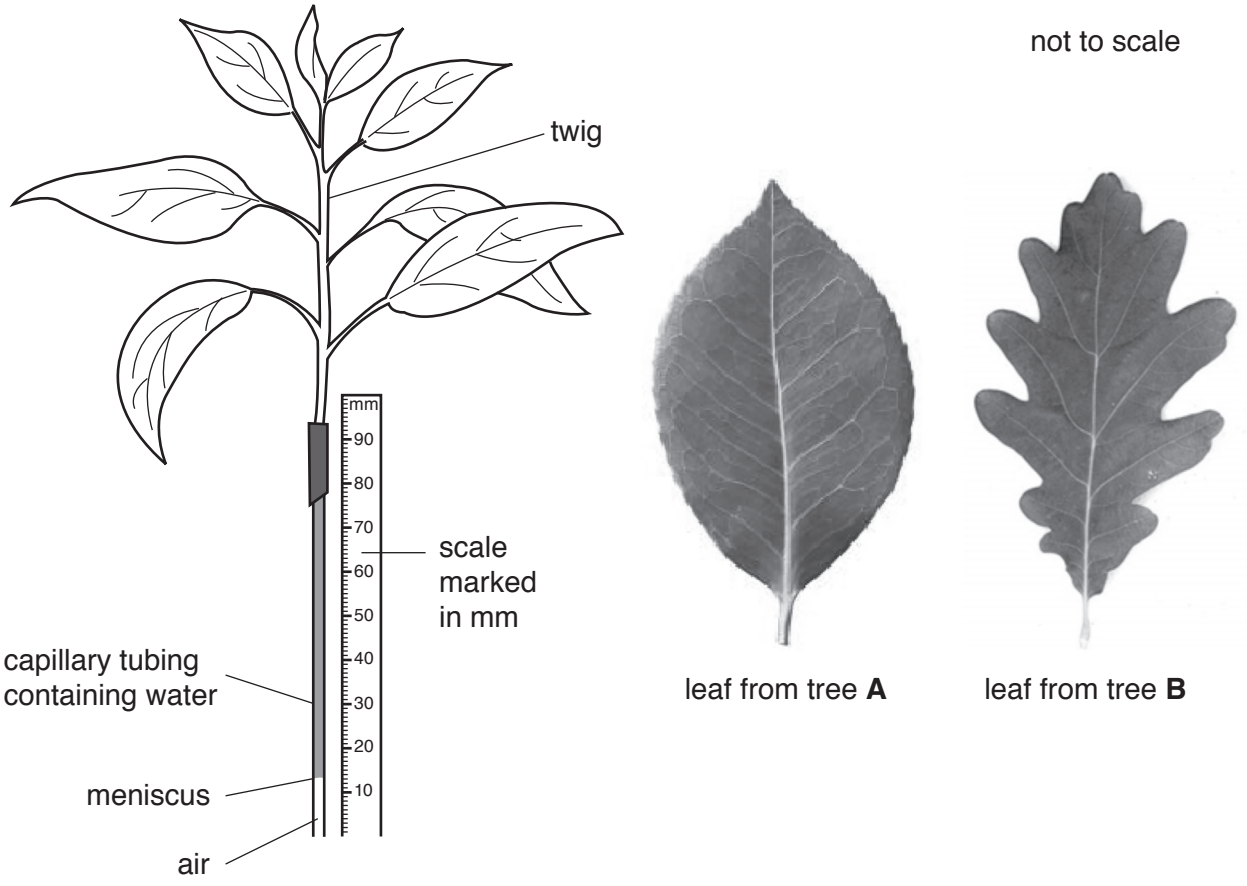

Fig. 3.1

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**.

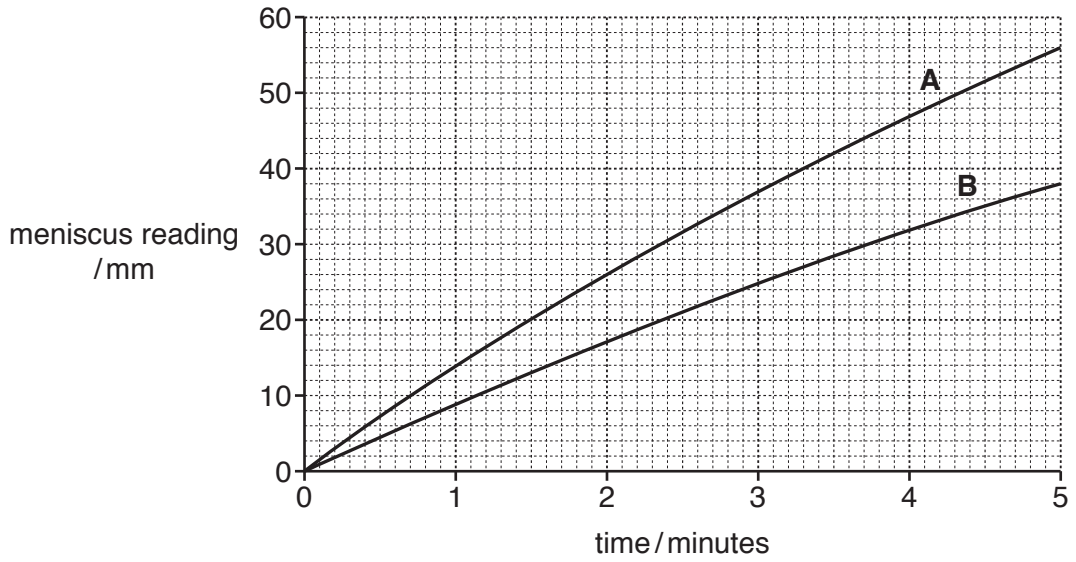

Fig. 3.2

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.

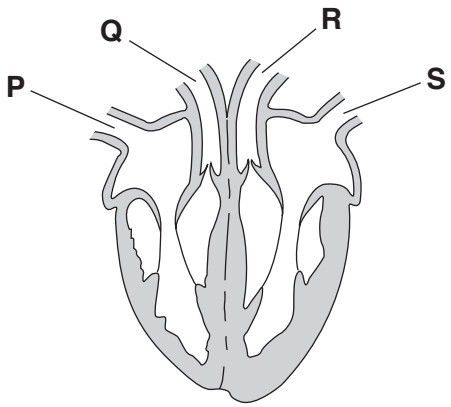

Fig. 4.1

(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.

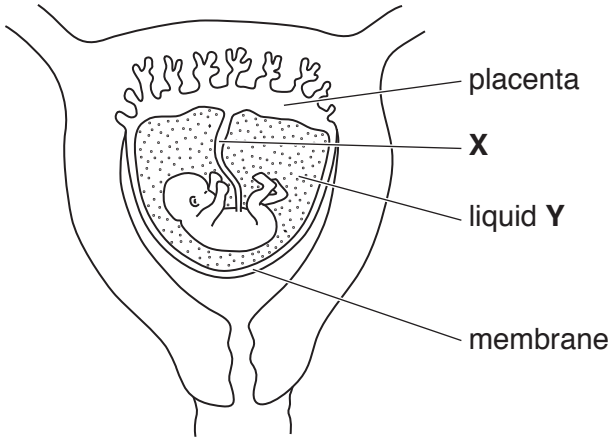

Fig. 4.2

(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.

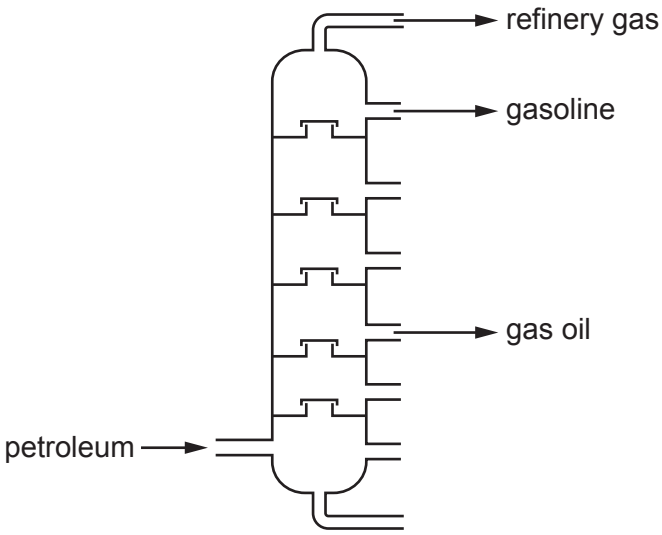

Fig. 5.1

(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.

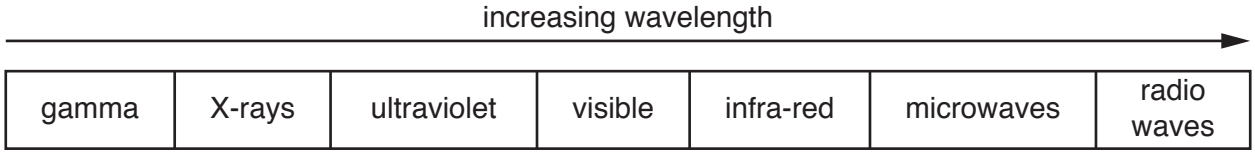

Fig. 6.2

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.

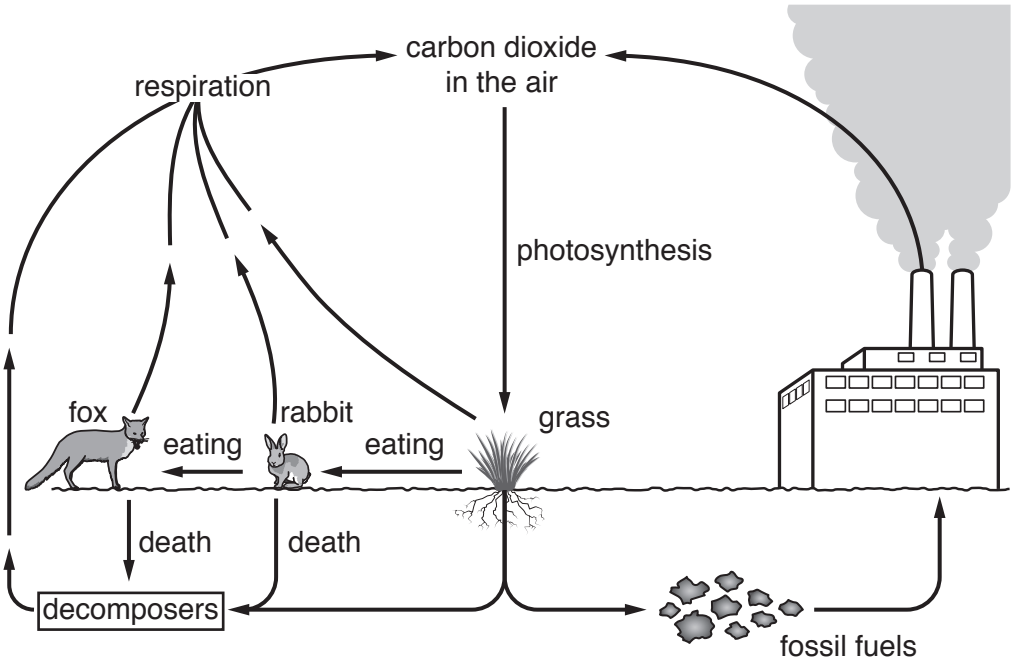

Fig. 7.1

(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.

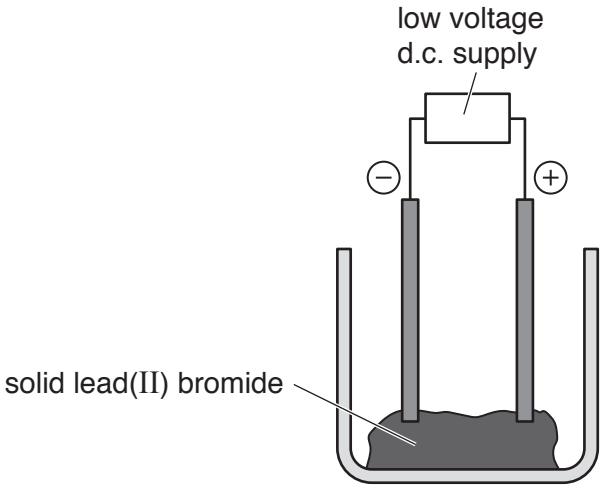

Fig. 8.1

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.

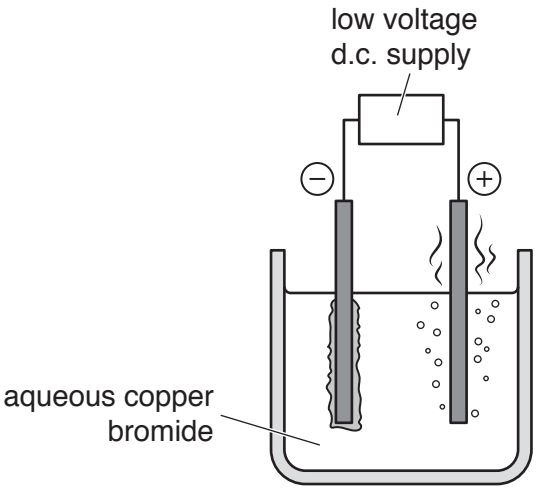

Fig. 8.2

(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.

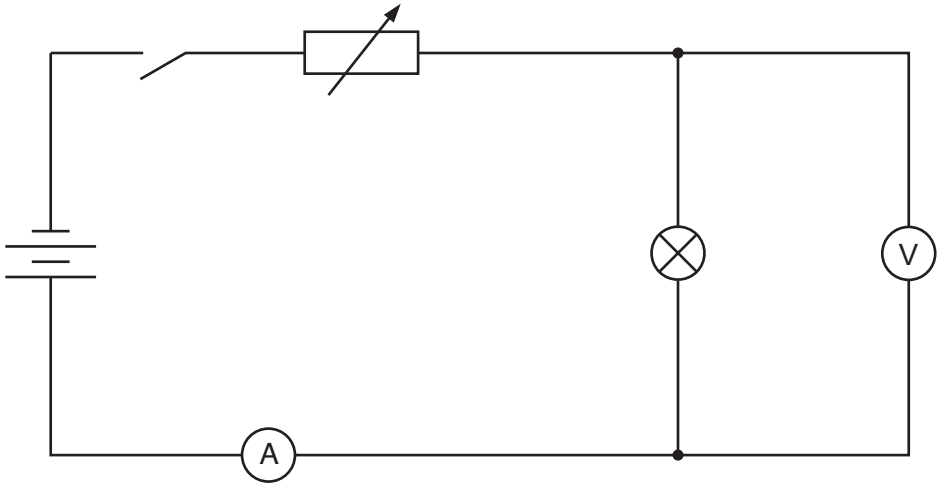

Fig. 9.1

(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.).