

--

--	--	--	--	--

--	--	--	--

0653/41

October/November 2018

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

A copy of the Periodic Table is printed on page 20.

The number of marks is given in brackets [] at the end of each question or part question.

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

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

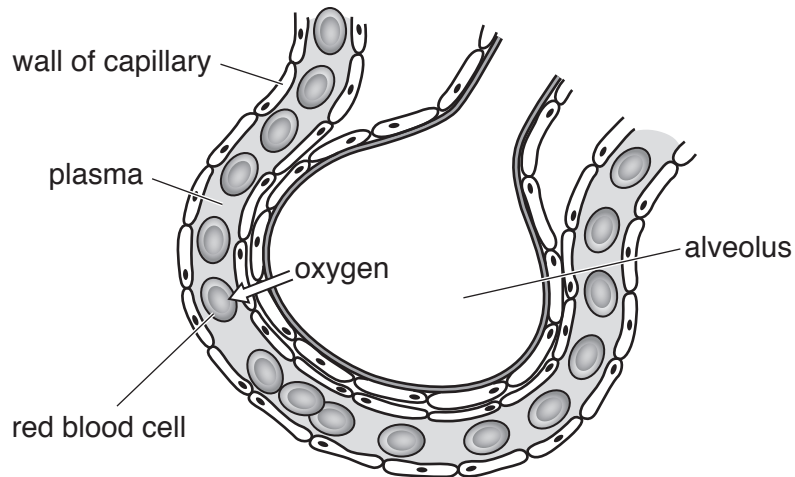


Fig. 1.1

- (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.

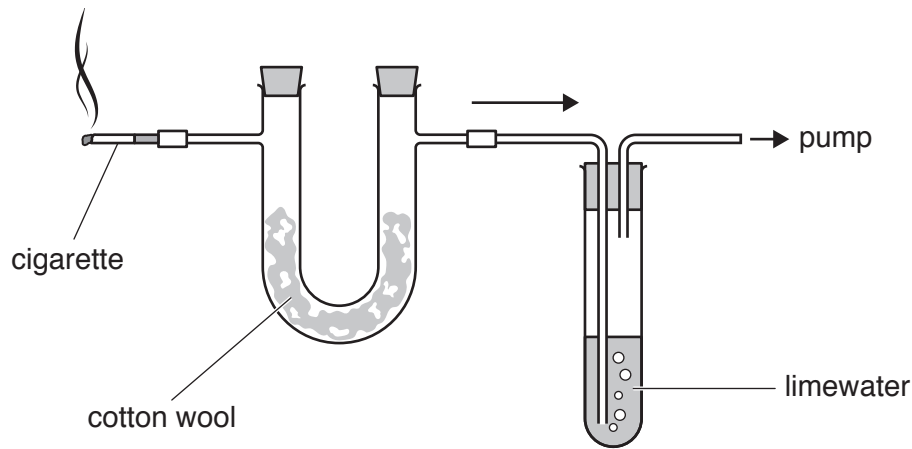


Fig. 1.2

- (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.



[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.

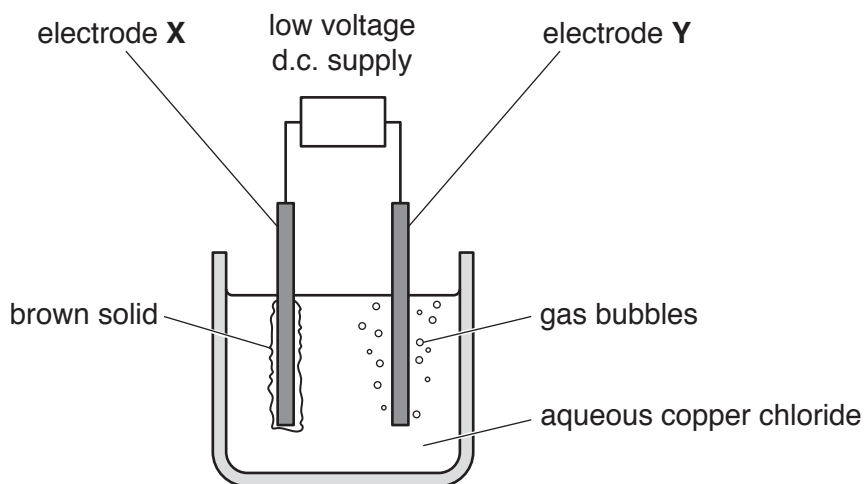


Fig. 2.1

- (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.

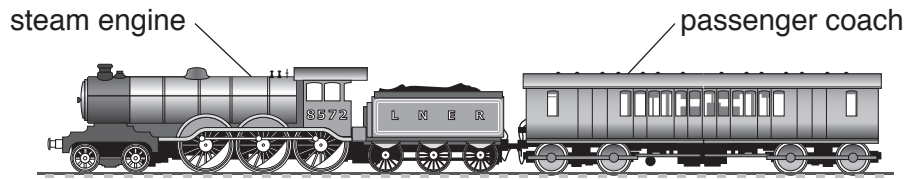


Fig. 3.1

- (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.

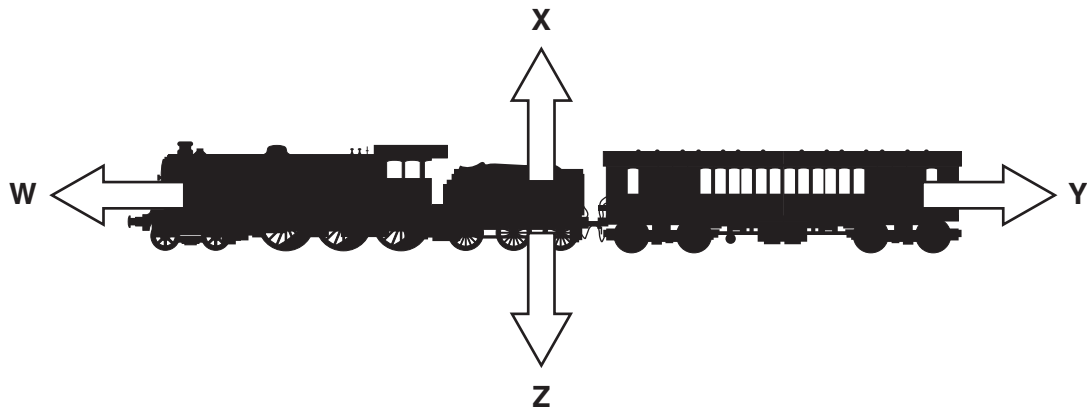


Fig. 3.2

- (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.

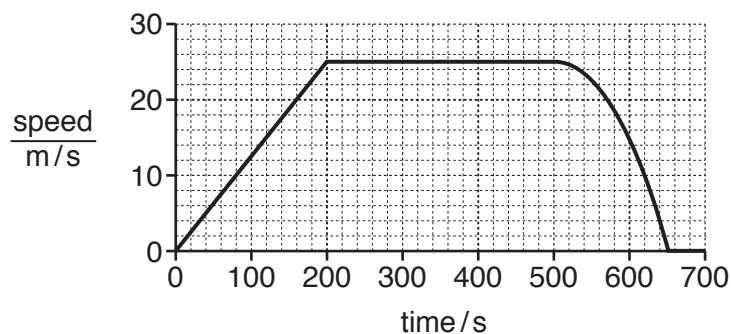


Fig. 3.3

- (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 500s on this journey, the train travels a further 2.8km 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.

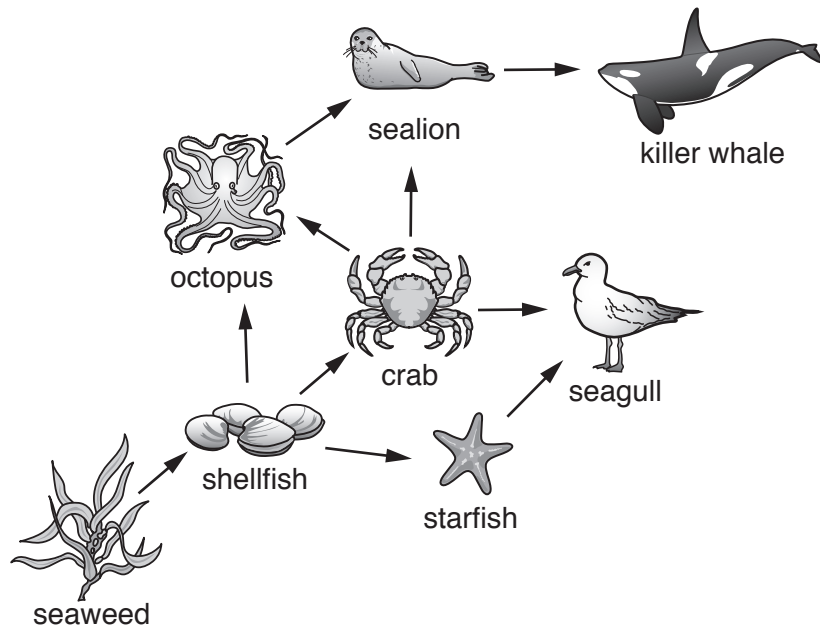


Fig. 4.1

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.

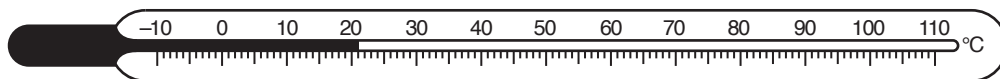


Fig. 6.1

- (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.

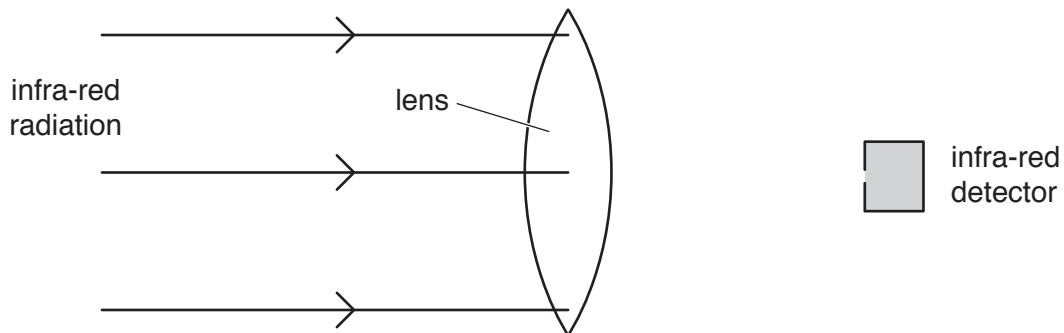


Fig. 6.2

[1]

7 A student is investigating photosynthesis in an aquatic plant.

(a) Complete the balanced symbol equation for photosynthesis.



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

after a few hours

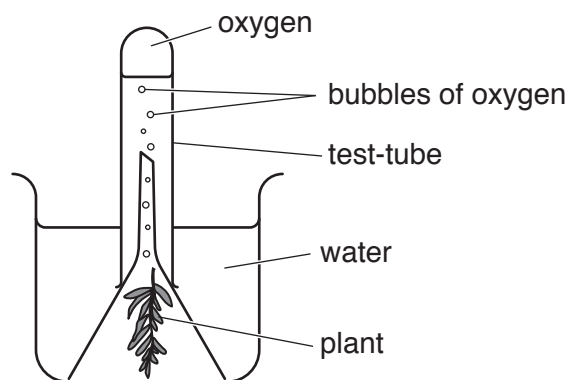


Fig. 7.1

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.

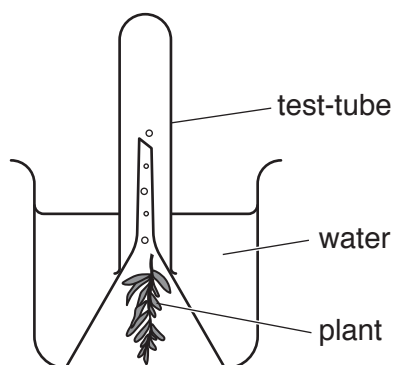


Fig. 7.2

(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.

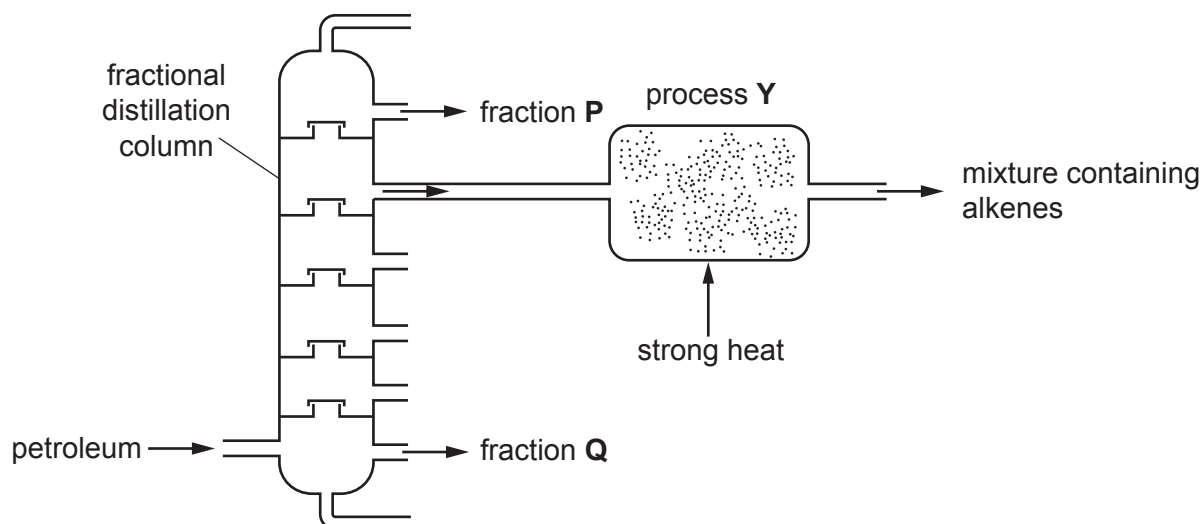


Fig. 8.1

- (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).

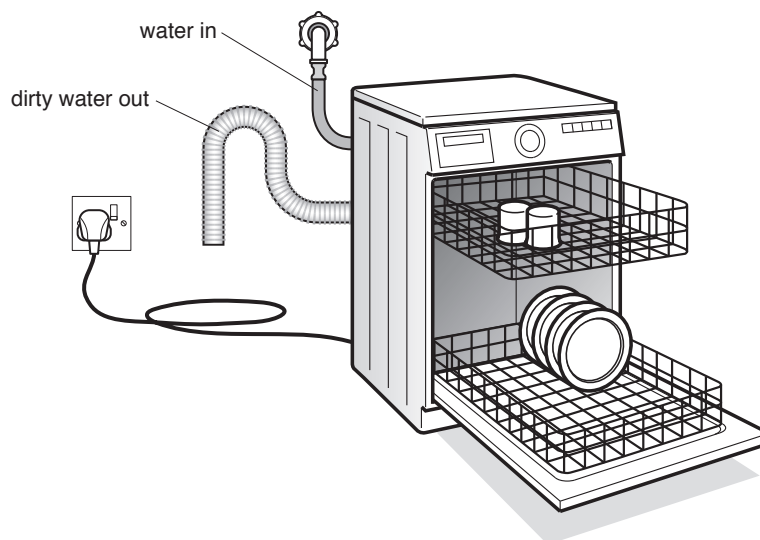


Fig. 9.1

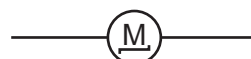
The dishwasher uses electrical energy to

- 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.

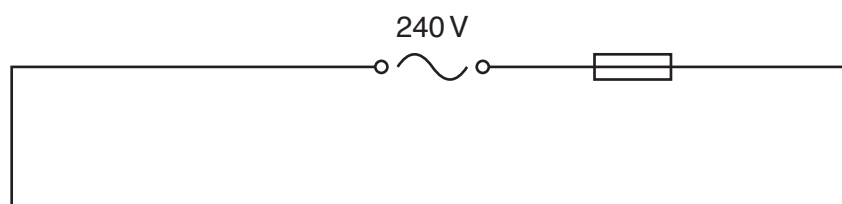


Fig. 9.2

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

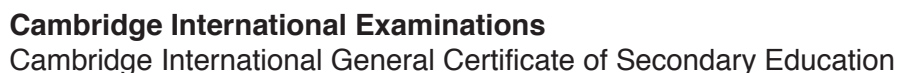
Group																		
I	II	Key										III	IV	V	VI	VII	VIII	
		1 H hydrogen 1																
		atomic number atomic symbol name relative atomic mass																
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	
11 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 —							

lanthanoids

actinoids

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
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 dm³ at room temperature and pressure (r.t.p.).



--

--	--	--	--	--

--	--	--	--

0653/42

October/November 2018

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

A copy of the Periodic Table is printed on page 24.

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.

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

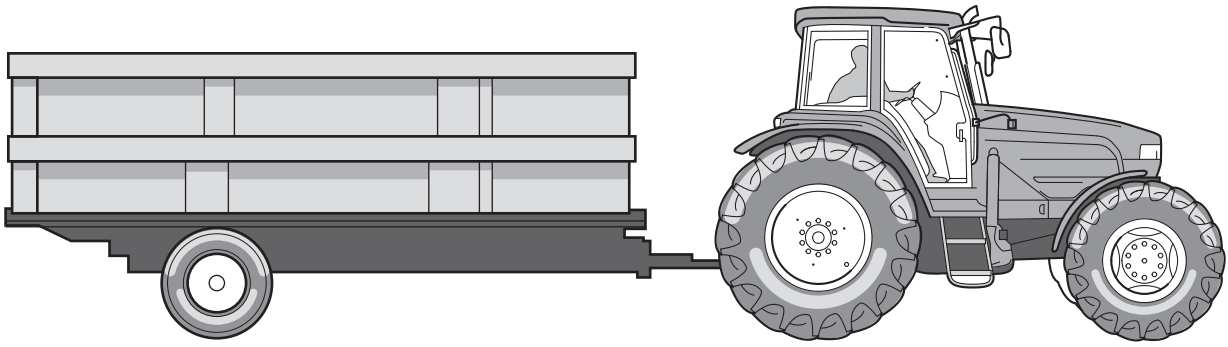


Fig. 1.1

- (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.

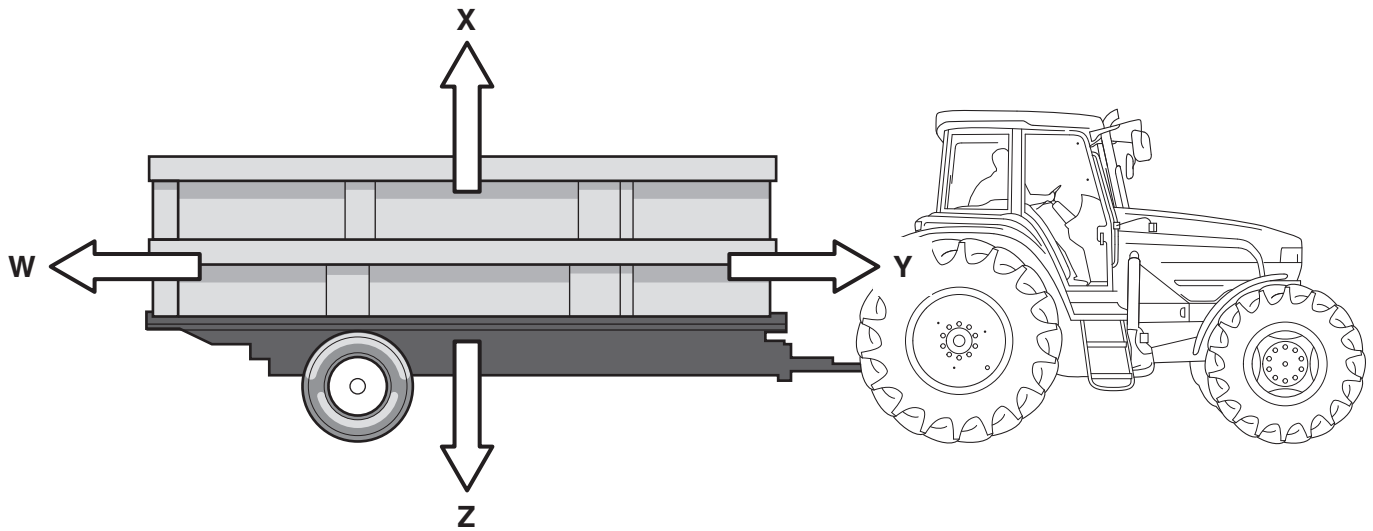


Fig. 1.2

- (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.

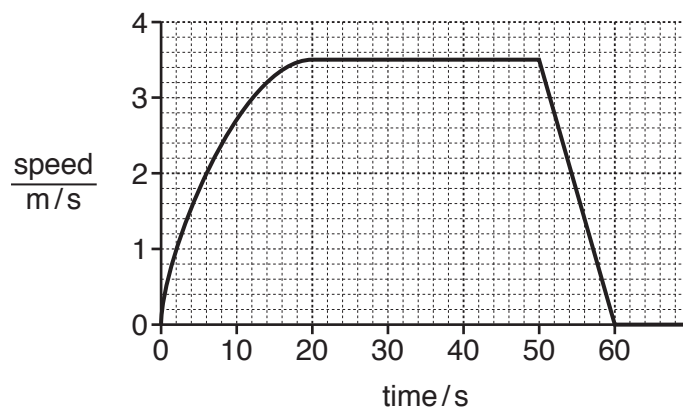


Fig. 1.3

- (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

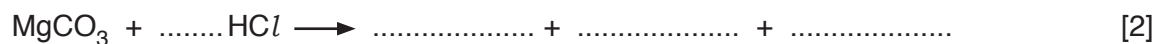
explanation

.....

[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.



(ii) Describe a test for aqueous chloride ions.

State the result that shows chloride ions are present.

test

result

.....

[2]

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.

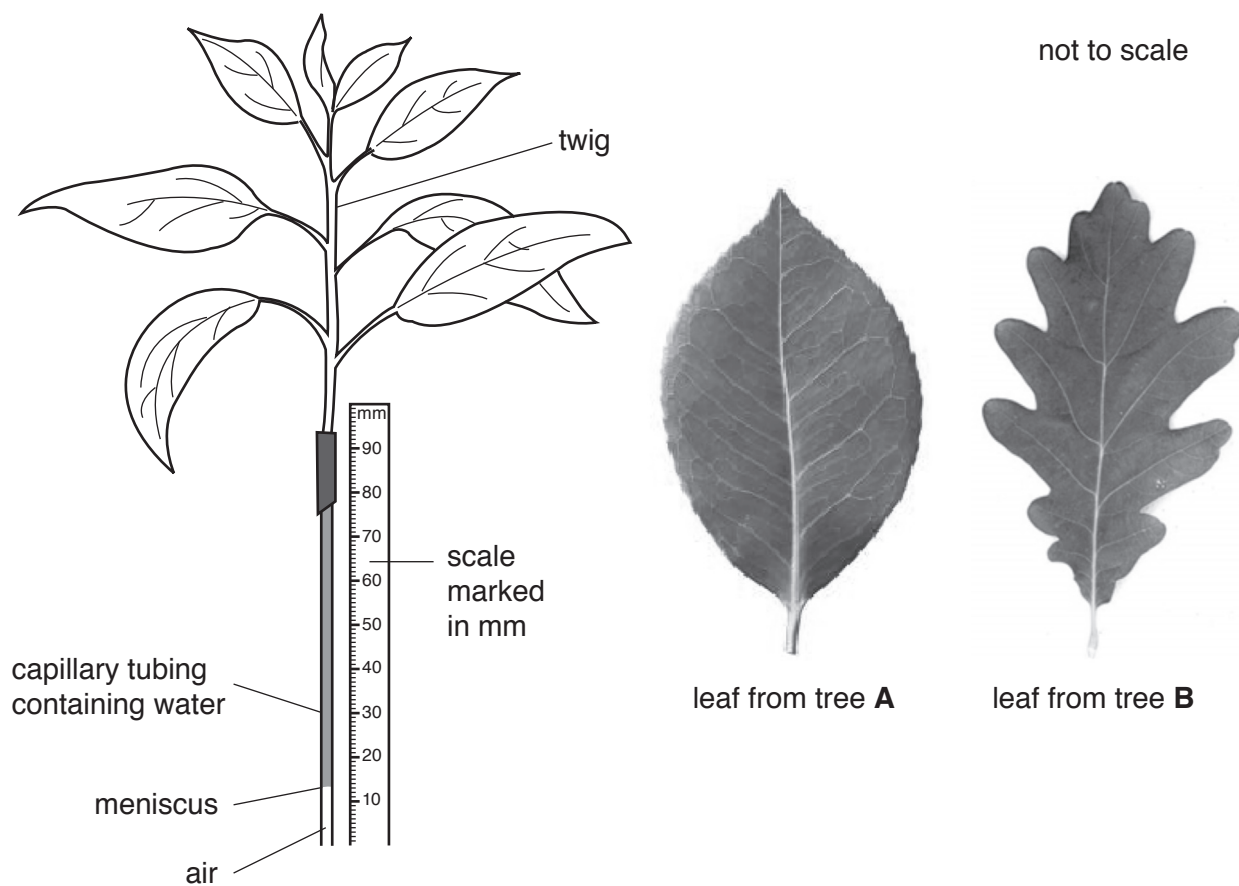


Fig. 3.1

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**.

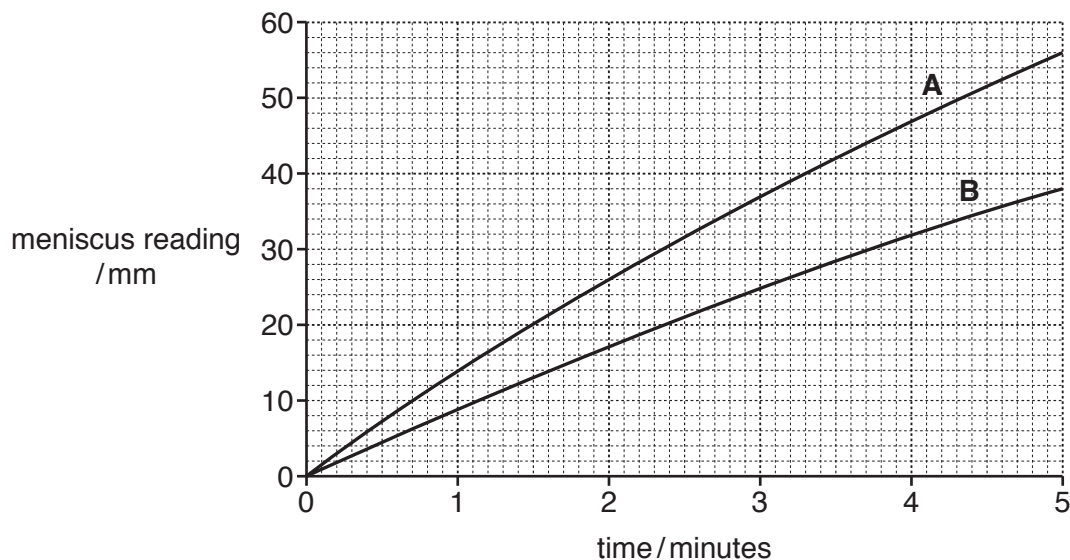


Fig. 3.2

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.

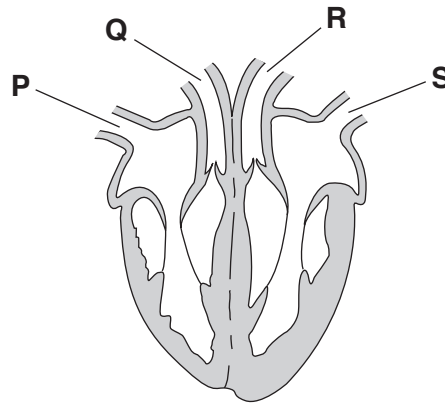


Fig. 4.1

(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.

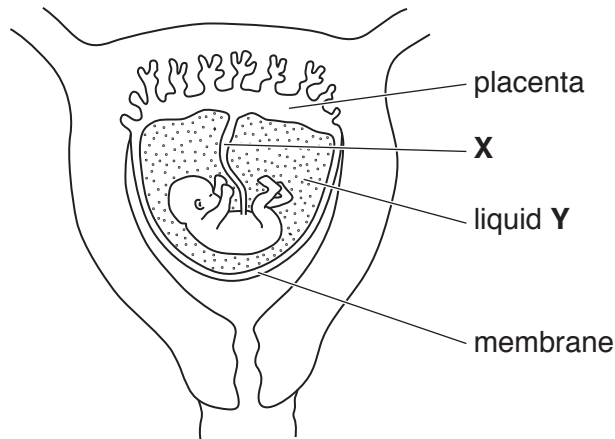


Fig. 4.2

(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.



[2]

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

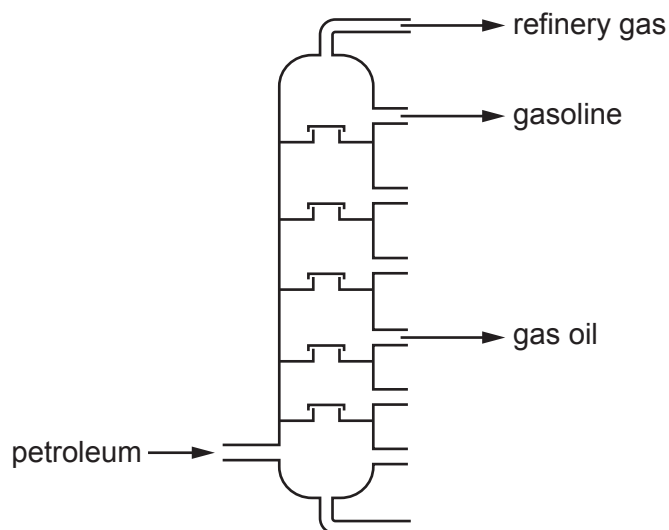


Fig. 5.1

(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.

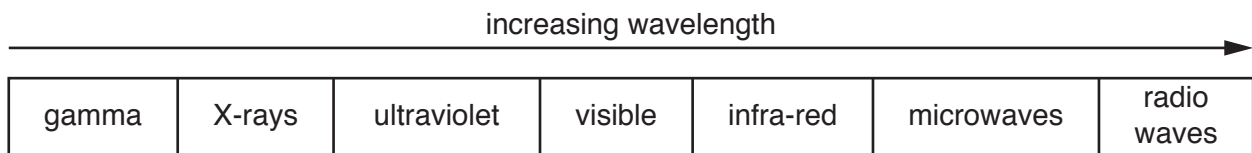


Fig. 6.2

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.

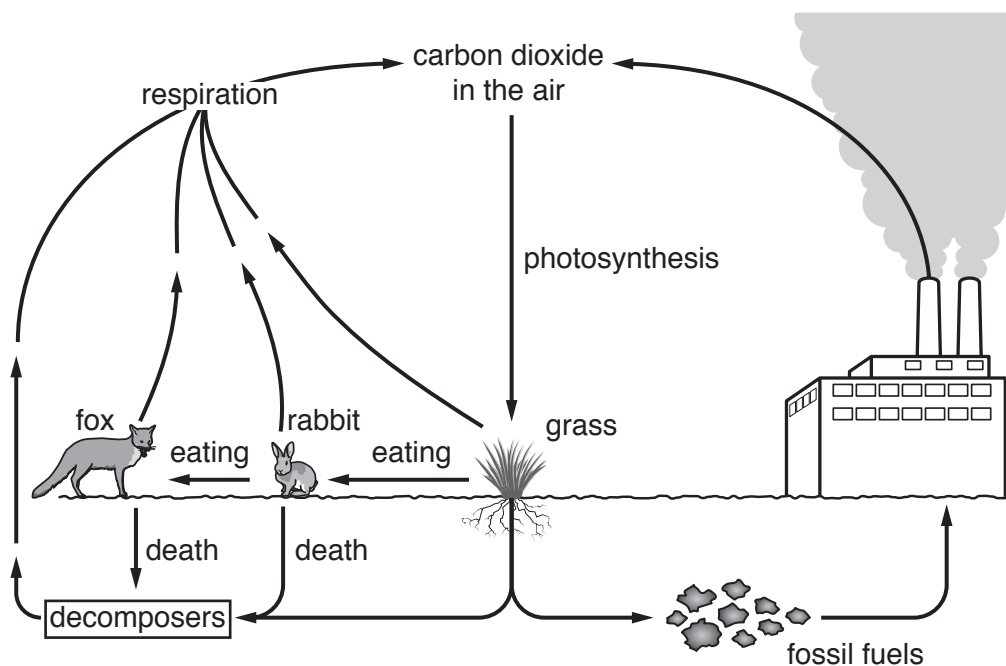


Fig. 7.1

- (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.

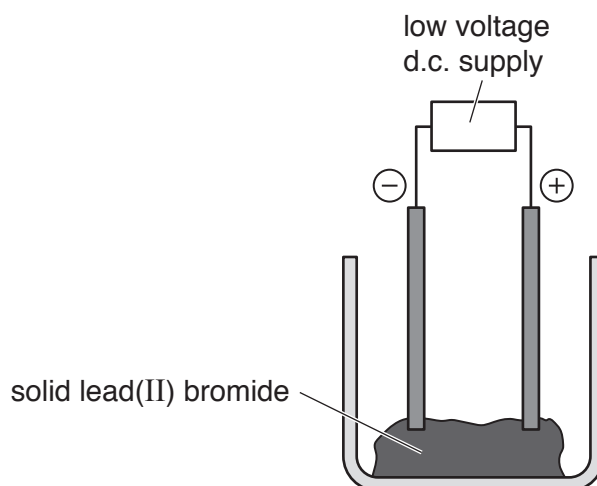


Fig. 8.1

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.

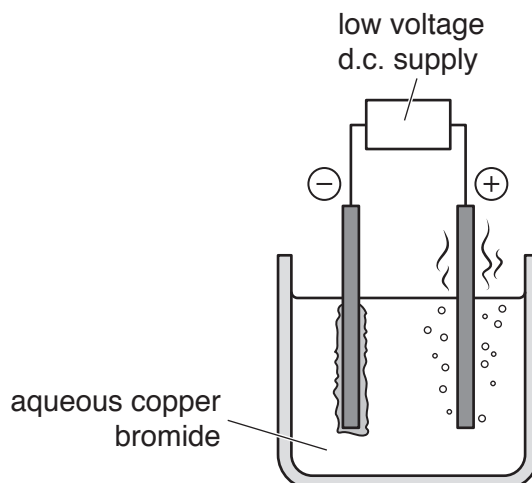


Fig. 8.2

- (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]

- 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.

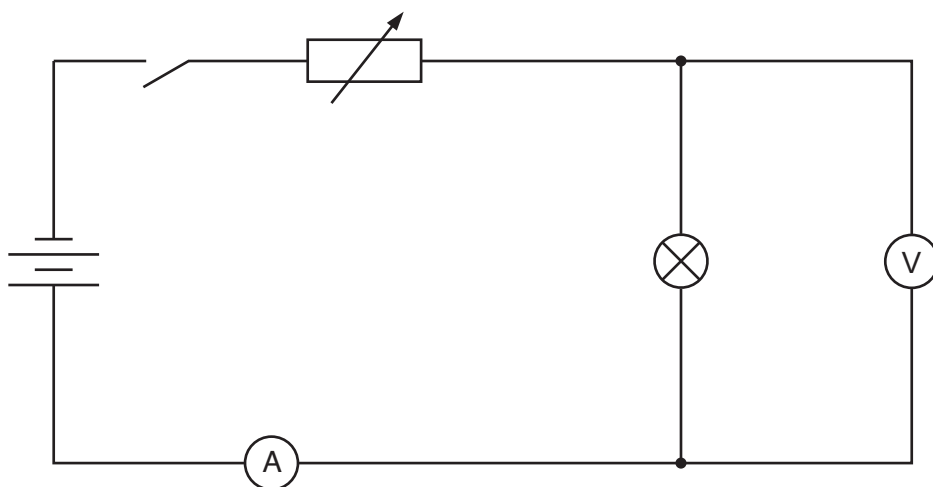


Fig. 9.1

- (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]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

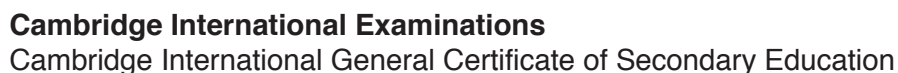
To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

[illegible]

actinoids

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	euporium	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
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	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	—



--	--	--	--	--

--	--	--	--

0653/43

October/November 2018

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

A copy of the Periodic Table is printed on page 24.

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.

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

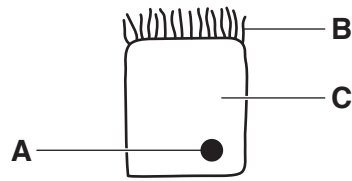


Fig. 1.1

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.

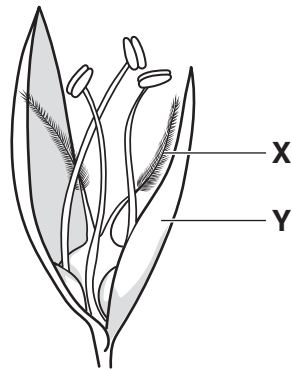


Fig. 1.2

- (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.



[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.

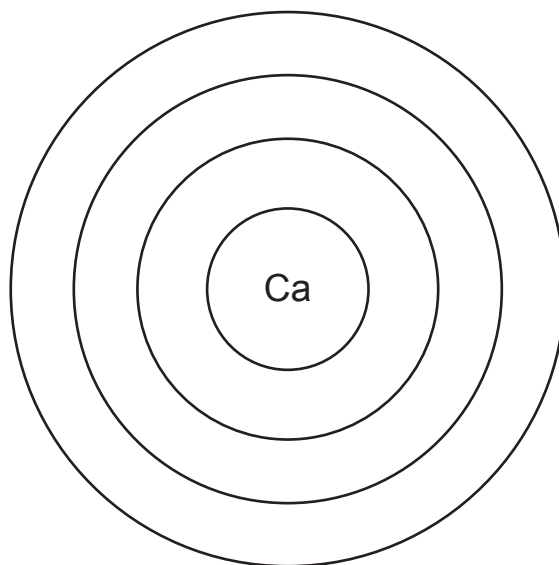


Fig. 2.1

[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.

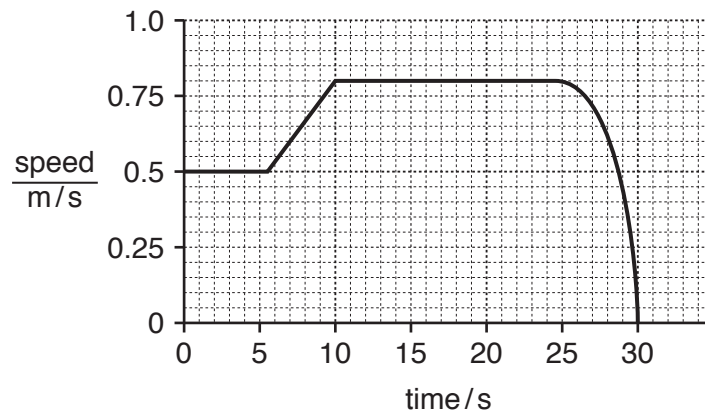


Fig. 3.2

(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.

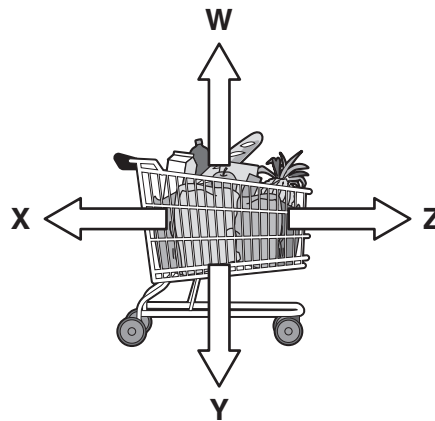


Fig. 3.3

(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 20s and 30s.

.....

.....[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]

BLANK PAGE

- 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.

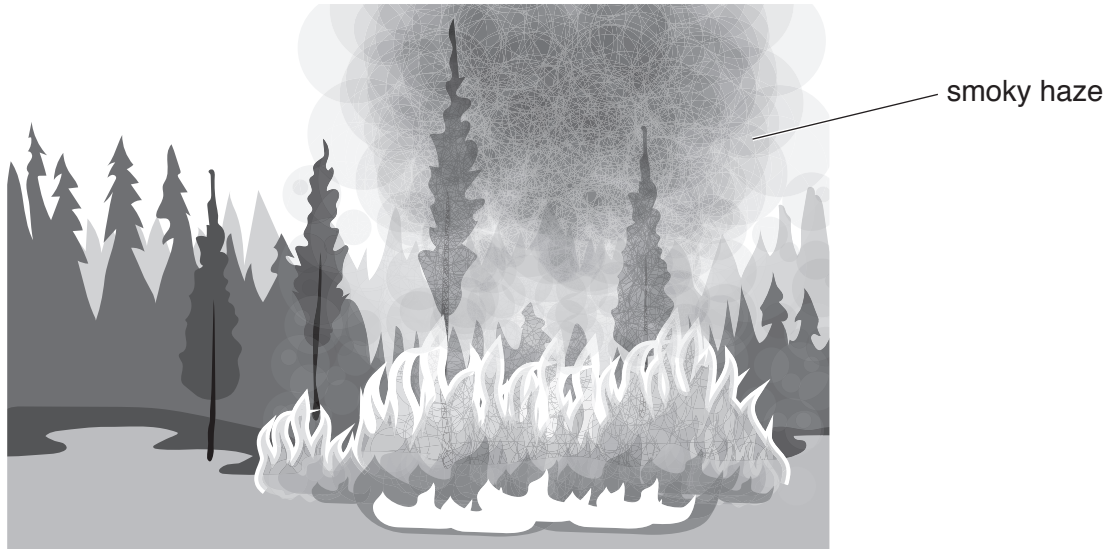


Fig. 4.1

- (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 cm³ of the gas.

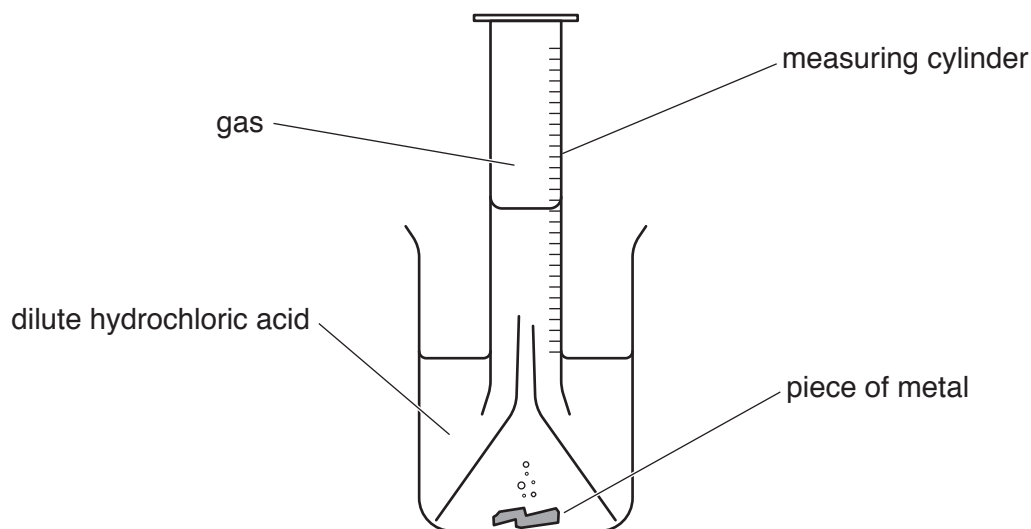


Fig. 5.1

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.

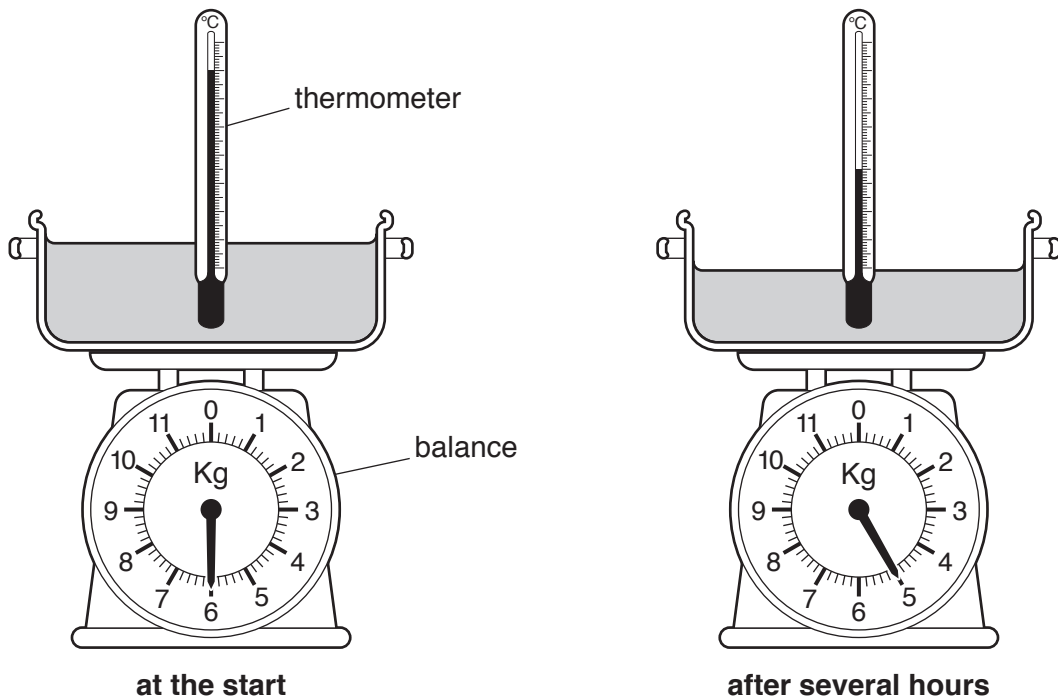


Fig. 6.1

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.

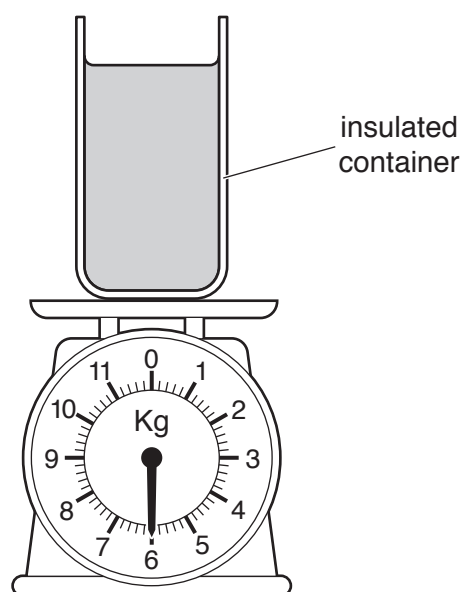


Fig. 6.2

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.

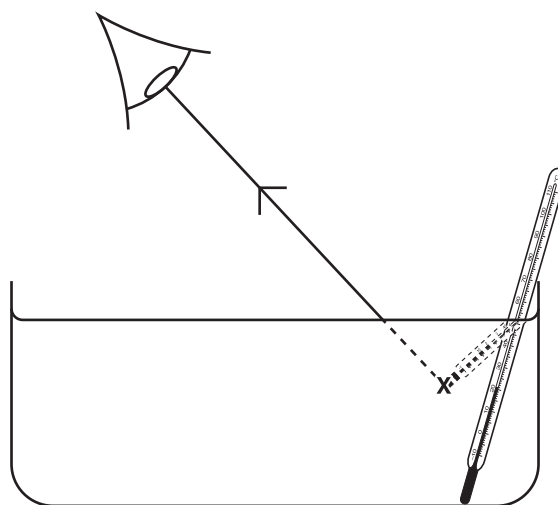


Fig. 6.3

- (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.

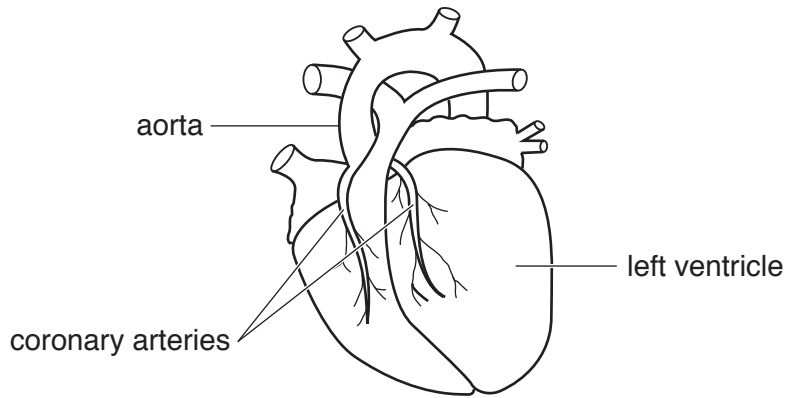


Fig. 7.1

- (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.

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

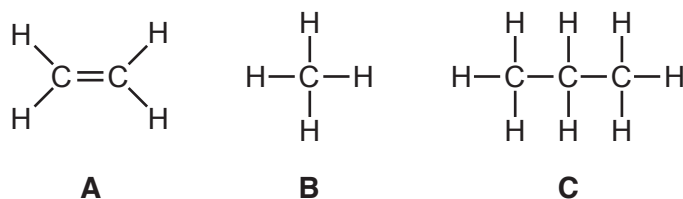


Fig. 8.1

(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**.

..... + ... $\longrightarrow$ + ... [2]

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

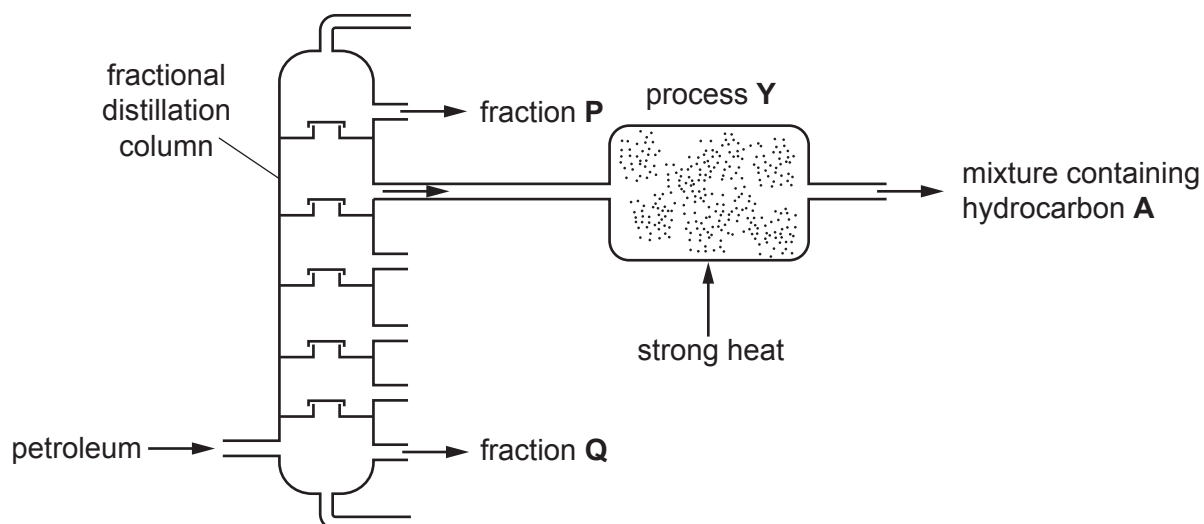


Fig. 8.2

(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.

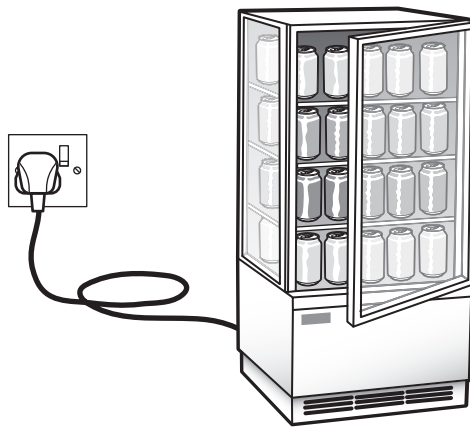


Fig. 9.1

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.

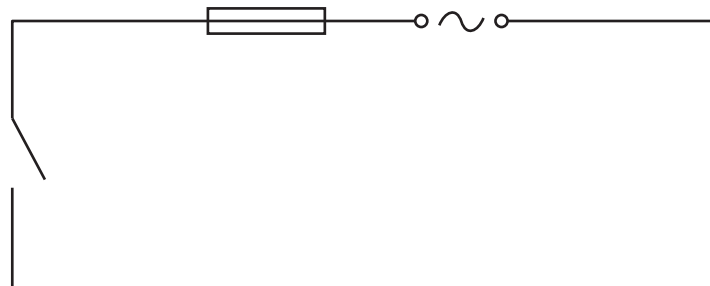


Fig. 9.2

- (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]

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of Elements

Group																		
I	II											III	IV	V	VI	VII	VIII	
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										1 H hydrogen 1	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 —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganesson —	

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
	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 dm³ at room temperature and pressure (r.t.p.).