



--

--	--	--	--	--

--	--	--	--

0653/31

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 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 **22** printed pages and **2** blank pages.

- 1 (a) Fig. 1.1 shows diagrams of cells as they are seen under a light microscope. They are not drawn to scale.

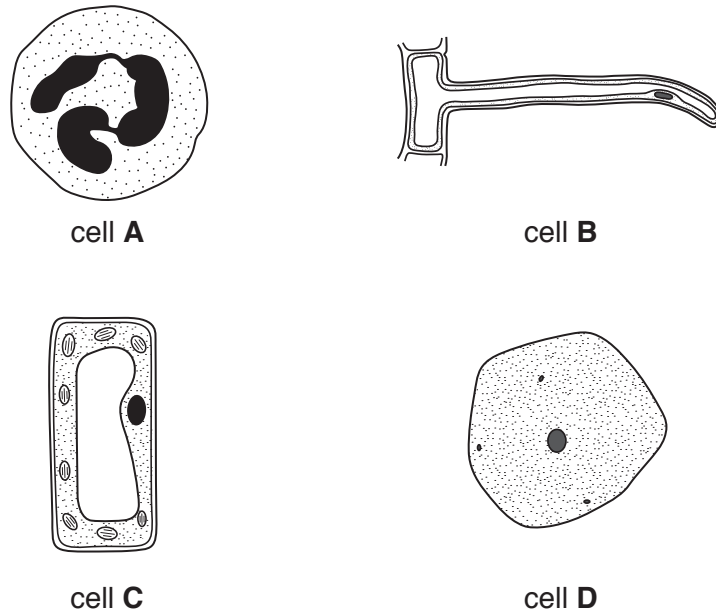


Fig. 1.1

- (i) State the letters of **two** plant cells shown in Fig. 1.1.

..... and [1]

- (ii) Give **two** reasons for your answer to (i).

1.

.....

2.

..... [2]

- (iii) Name cell **A** shown in Fig. 1.1 and state its function.

cell **A**

function of cell **A**

..... [2]

(b) Fig. 1.2 shows a simplified diagram of some body cells surrounded by capillaries.

Substances in the blood can reach the body cells by moving out of the capillaries.

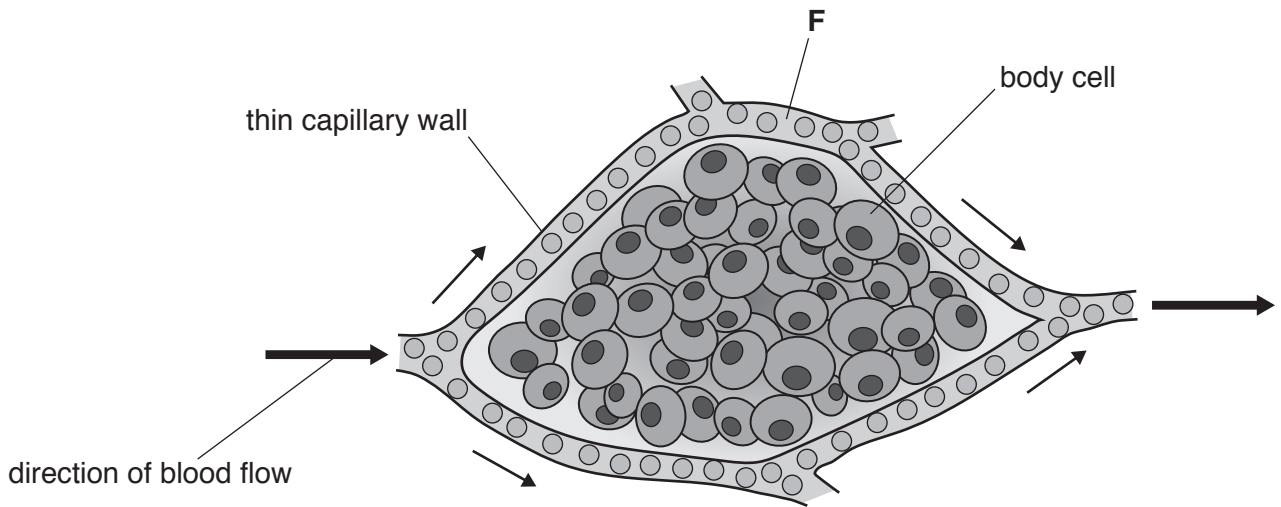


Fig. 1.2

(i) Name the part of the **blood** labelled **F**.

..... [1]

(ii) Small molecules move from the blood in the capillaries to the body cells.

Underline **two** substances that move from the blood in the capillaries to the body cells.

fat **glucose** **glycogen** **oxygen** **starch**

[2]

(iii) Complete the sentences.

Carbon dioxide is produced in body cells by the process of

.....

Carbon dioxide is removed from the blood in the

[2]

[Total: 10]

- 2 (a) Element **A** is in Group III in the Periodic Table.

Element **B** is in Group VII in the Periodic Table.

Elements **A** and **B** are in the same period in the Periodic Table.

- (i) Suggest which element, **A** or **B**, has more metallic character.

Explain your answer.

element

explanation

[1]

- (ii) Element **C** is below element **B** in Group VII.

Suggest which element, **B** or **C**, has:

a darker colour

a lower boiling point.

[1]

- (b) Element **D** is a monoatomic gas that is used to provide an inert atmosphere.

Element **E** has a high density and is often used as a catalyst.

State the group number or the name of the collection of elements for elements **D** and **E** in the Periodic Table.

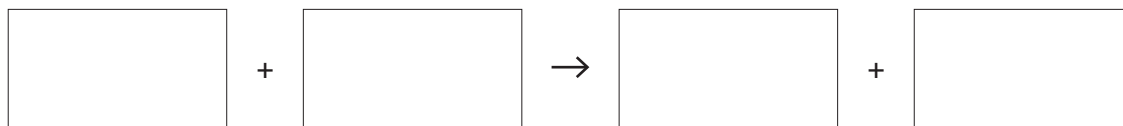
element **D**

element **E**

[2]

- (c) A student adds excess copper oxide powder to dilute sulfuric acid to make copper sulfate and one other product.

- (i) Complete the word equation for the reaction between copper oxide and dilute sulfuric acid.



[2]

- (ii) Explain why copper oxide is added in excess.

.....

..... [1]

- (iii) The type of chemical bond that forms between copper and oxygen is the same as the type of chemical bond that forms between sodium and chlorine.

State this type of chemical bond.

Use ideas about electrons to explain how these bonds form.

bond

explanation

.....

[2]

[Total: 9]

- 3 Fig. 3.1 shows how a small hydroelectric power station is used to supply electricity.

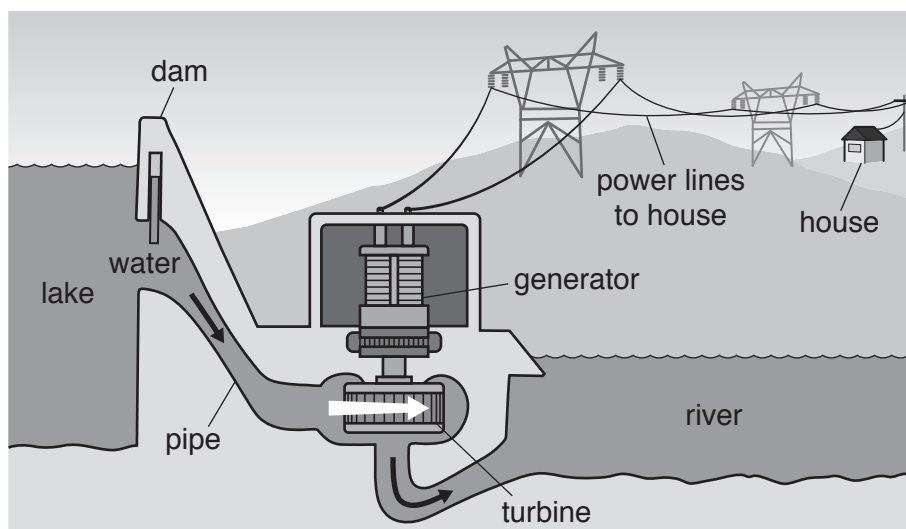


Fig. 3.1

- (a) The flowing water turns the turbine (a type of waterwheel), which then turns the generator.

Use words from the list to complete the sequence of energy changes that take place.

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

chemical elastic electrical gravitational
kinetic light sound thermal

..... potential energy of water in the lake

→ energy of flowing water in the pipe

→ energy of the turning turbine and generator

→ energy in the power lines.

[3]

- (b) In a house, the electricity is used to power a television set.

The aerial for the television set receives one type of electromagnetic wave.

The television set emits a different type of electromagnetic wave.

Fig. 3.2 shows the electromagnetic spectrum.

gamma radiation	X-rays	ultraviolet	visible light	infrared	microwaves	radio waves
-----------------	--------	-------------	---------------	----------	------------	-------------

Fig. 3.2

- (i) Name the type of electromagnetic wave received by the aerial.

..... [1]

- (ii) Name the type of electromagnetic wave emitted by the television set.

..... [1]

- (c) A man in the house is listening to music on the television.

Fig. 3.3 shows the sound waves coming from three different instruments, **A**, **B** and **C**, playing musical notes at the same time.

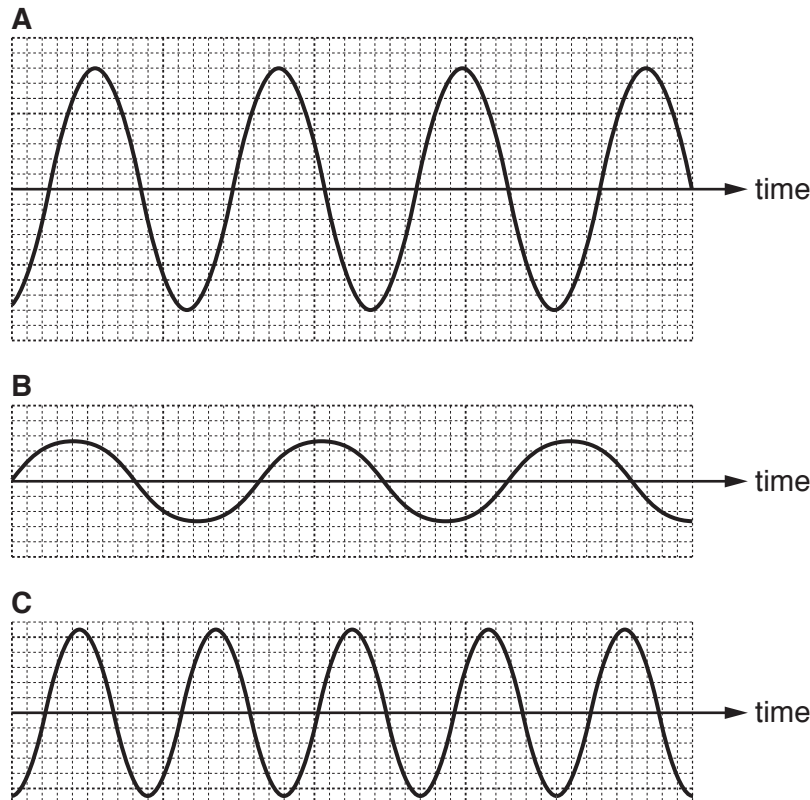


Fig. 3.3

- (i) State which instrument was playing the note with the highest pitch.

Explain your answer.

instrument

explanation

..... [1]

- (ii) State which instrument was playing the loudest note.

Explain your answer.

instrument

explanation

..... [1]

- (iii) The man says he could hear two of the notes, but not the one with the lowest frequency.

Suggest a value for the frequency that the man could **not** hear. State the unit of frequency in your answer.

frequency = ... unit [2]

- (iv) Give a reason for your answer to (iii).

.....
..... [1]

[Total: 10]

4 (a) Plants need water to survive.

(i) State **two** functions of water in plants.

1.

2.

[2]

(ii) Fig. 4.1 shows the pathway taken by water through a plant.

Use words from the list to complete the pathway.

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

cortex **cuticle** **mesophyll**
middle **phloem** **skin** **xylem**

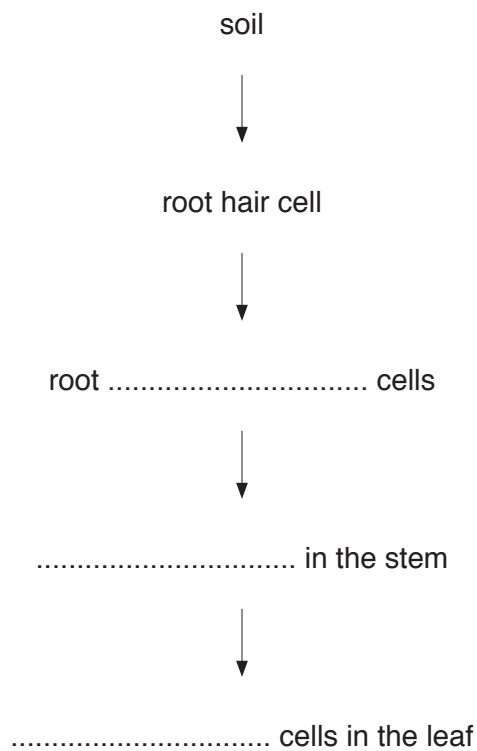


Fig. 4.1

[3]

(b) Plants show growth responses to different stimuli.

The plant shown in Fig. 4.2 is placed on its side in the dark. It is observed over the next few days.

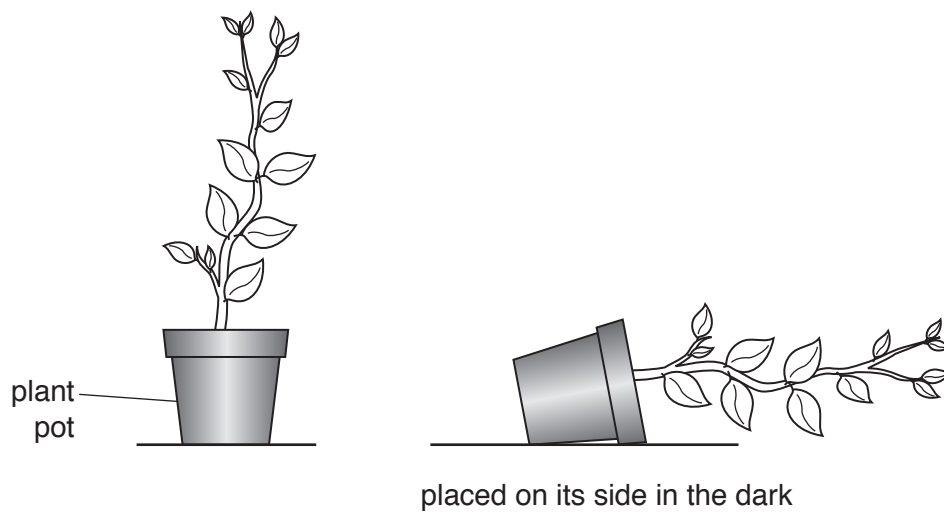


Fig. 4.2

Fig. 4.3 shows the appearance of the plant after a few days in the dark.

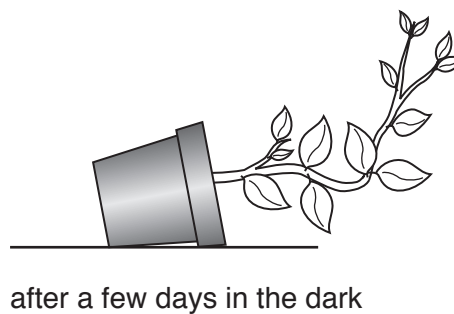


Fig. 4.3

Name the response shown by the plant in Fig. 4.3.

..... [1]

(c) One of the roots of the plant shown in Fig. 4.3 starts to grow out of a hole in the bottom of the plant pot.

(i) On Fig. 4.4 continue the diagram of the root to show the direction of growth. [1]

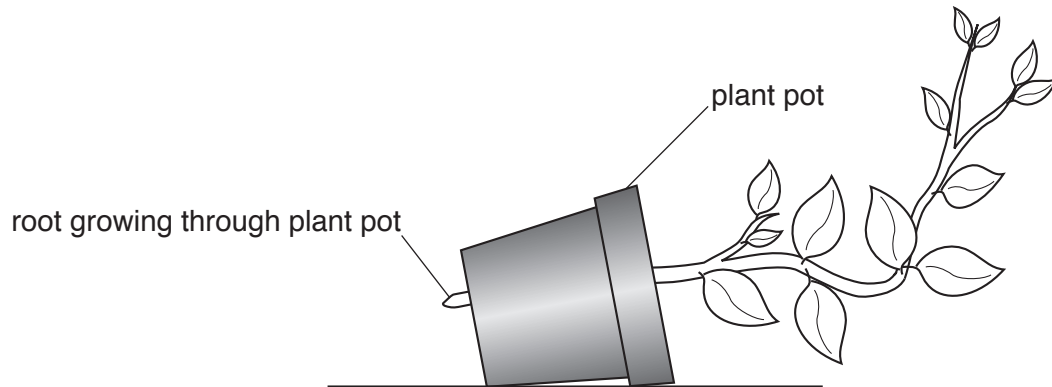


Fig. 4.4

(ii) Explain your answer in (i).

.....
 [1]

(d) Explain why a plant will eventually die if it is left in the dark.

.....
 [1]

[Total: 9]

- 5 (a) Some of the apparatus a student uses to investigate the rate of reaction between a piece of zinc and dilute hydrochloric acid is shown in Fig. 5.1.

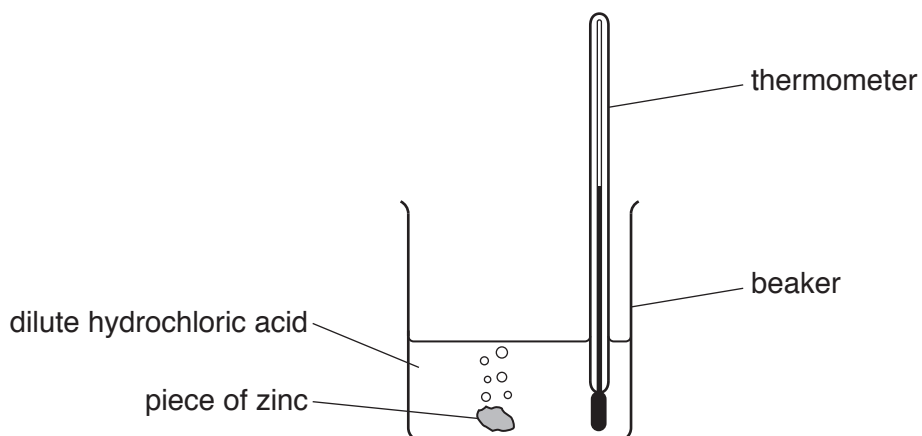


Fig. 5.1

- (i) Identify the gas formed in the reaction between zinc and dilute hydrochloric acid.

..... [1]

- (ii) Suggest the **change** in the pH of the mixture in the beaker during this reaction.

..... [1]

- (iii) Describe the effect of increasing the temperature on the rate of this reaction.

..... [1]

- (iv) The experiment is repeated using the same mass of zinc powder instead of the piece of zinc.

Describe how this change affects the rate of the reaction.

..... [1]

- (b) Zinc oxide is heated with carbon.

Reduction occurs during the reaction.

The reaction is endothermic.

- (i) State what is meant by *reduction*.

.....
 [1]

- (ii) State what is meant by *endothermic*.

.....
 [1]

(c) Complete Fig. 5.2 by drawing one straight line from each gas to the test for that gas.

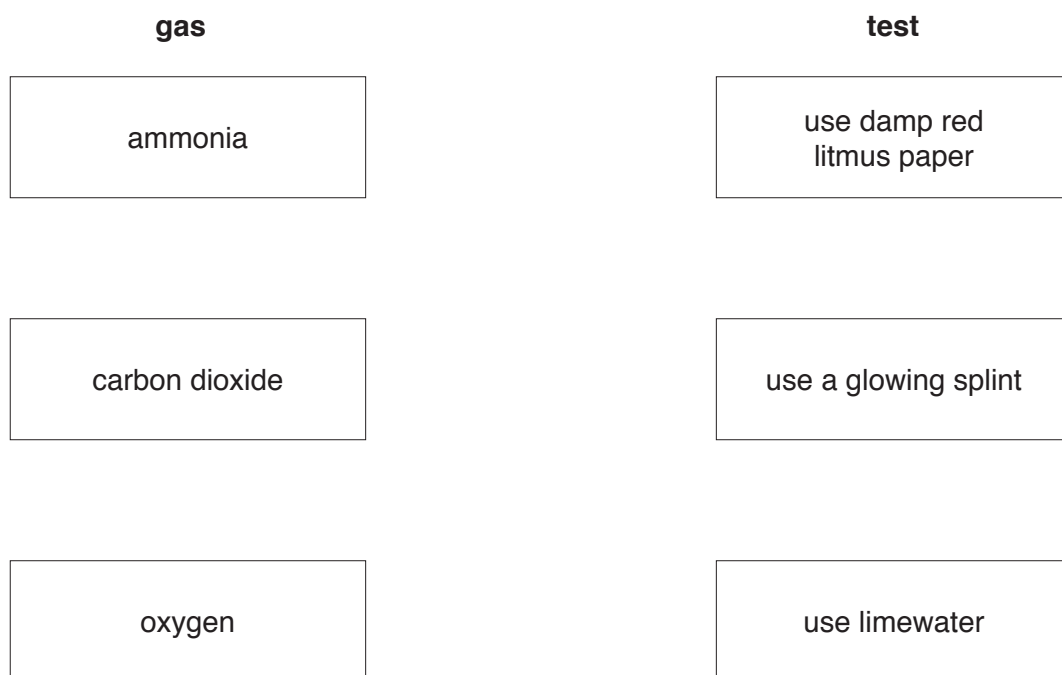


Fig. 5.2

[2]

[Total: 8]

- 6 Table 6.1 gives some data about the planets Earth, Mars and Venus.

Table 6.1

	Earth	Mars	Venus
surface temperature	15 °C	−63 °C	462 °C
average distance from the Sun	$150 \times 10^6 \text{ km}$	$225 \times 10^6 \text{ km}$	$108 \times 10^6 \text{ km}$
time for one orbit around the Sun	365 days	687 days	225 days

- (a) (i) Use Table 6.1 to deduce which of these planets could have liquid water on the surface.
 [1]
- (ii) Use data from Table 6.1 to explain your answer to (i).

 [2]
- (b) (i) State the method of thermal energy transfer from the Sun to these planets.

 [1]
- (ii) Explain why other methods of energy transfer cannot transfer thermal energy from the Sun to these planets.

 [1]
- (c) The Earth travels a distance of 940 million kilometres in one orbit around the Sun.
 Use data from Table 6.1 to calculate the speed in kilometres/hour (km/h) at which the Earth travels around the Sun.
 Show your working.

speed = ... km/h [3]

(d) At the Earth's surface the Sun's energy is not usually sufficient to start a fire.

If the Sun's rays are focused by a lens, they can cause a fire.

On Fig. 6.1, complete the ray diagram to show how a lens can focus the Sun's rays and set fire to some dry grass.

You should draw **two** complete rays.

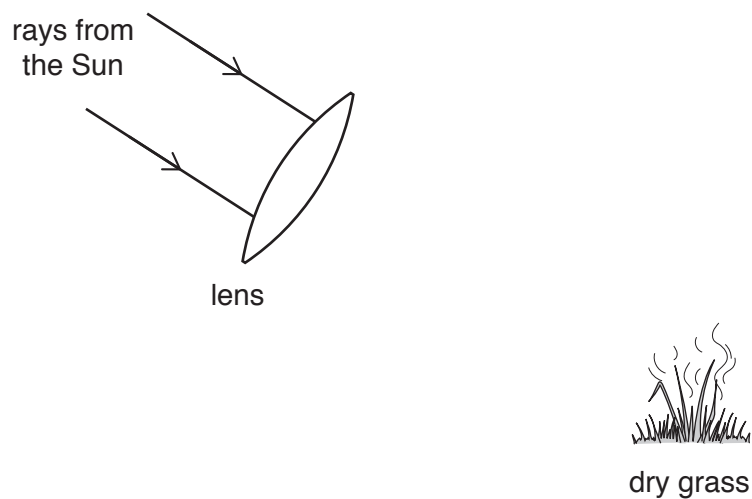
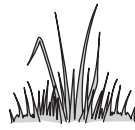


Fig. 6.1

[2]

[Total: 10]

- 7 (a) Fig. 7.1 shows information about the organisms in a food chain.



grass – producer



owl – tertiary consumer



cricket – primary consumer



frog – secondary consumer

Fig. 7.1

- (i) Write down the food chain using the information in Fig. 7.1.

..... [2]

- (ii) Define the term *producer*.

.....

 [2]

- (b) Explain why chemical digestion is needed in the alimentary canals of consumers.

.....

 [2]

- (c) (i) State why deforestation can disrupt the food chains in a forest.

.....
 [1]

- (ii) State **one** other harmful effect of deforestation.

..... [1]

[Total: 8]

- 8 (a) The hydrocarbons in petroleum are separated into useful products using the process shown in Fig. 8.1.

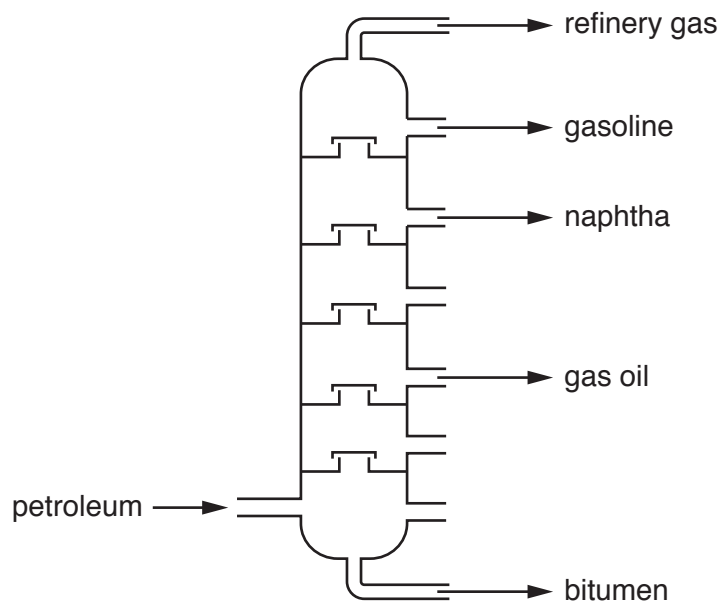


Fig. 8.1

- (i) Name this process.

..... [1]

- (ii) State what is meant by *hydrocarbon*.

.....
 [2]

- (iii) State **one** use for naphtha.

..... [1]

- (b) When hydrocarbons burn, they may produce carbon dioxide, carbon monoxide and water.

- (i) Describe **one** test to show the presence of water.

State the positive result.

test

result [2]

- (ii) Describe **one** adverse effect of carbon monoxide on humans.

.....
 [1]

- (iii) Suggest the percentage of carbon dioxide in clean air.

percentage = ... % [1]

- (iv) Using your knowledge of the amounts of other gases in clean air, explain your answer to (iii).

.....

..... [1]

[Total: 9]

- 9 (a) Fig. 9.1 shows a circuit diagram.

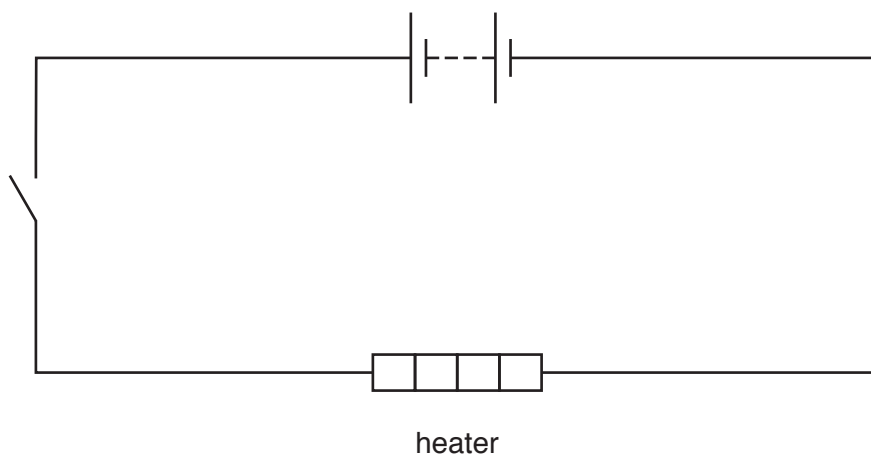


Fig. 9.1

On Fig. 9.1, add a suitable meter to measure the e.m.f. of the battery.

[2]

- (b) The current in a heater circuit is 10.0A.

Select from the list below the correct rating for a fuse to use in this circuit.

Put a circle around your choice.

3 A 5 A 10 A 13 A

[1]

(c) Fig. 9.2 shows a heater fixed to a wall in a room.

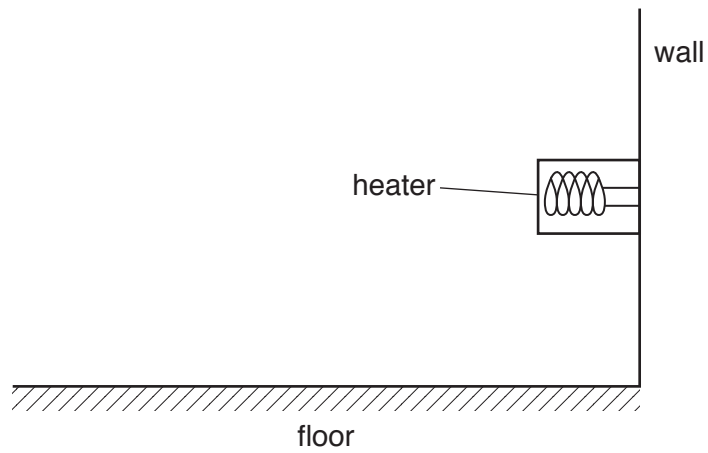


Fig. 9.2

On Fig. 9.2 draw arrows to show the direction in which air flows from the heater as the air is heated. [1]

(d) On Fig. 9.3, complete the circuit by adding:

- a lamp in parallel with the motor
- a variable resistor to change the current through the motor, but not through the lamp.

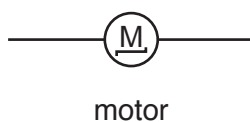
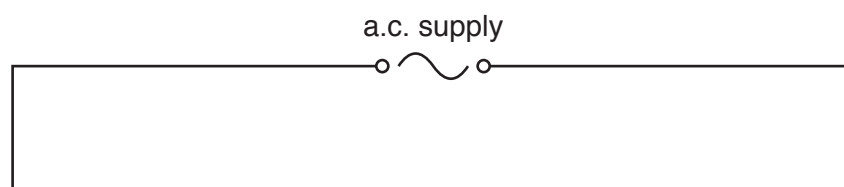


Fig. 9.3

[3]

[Total: 7]

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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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

The Periodic Table of Elements

Group																		
I	II	Key										III	IV	V	VI	VII	VIII	
		atomic number atomic symbol name relative atomic mass																
		1 H hydrogen 1																
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	2 He helium 4	
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		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 —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —		114 Fl flerovium —		116 Lv livermorium —			

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.).



--

--	--	--	--	--

--	--	--	--

0653/32

October/November 2019

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 **19** printed pages and **1** blank page.

1 (a) Fig. 1.1 shows two cells.

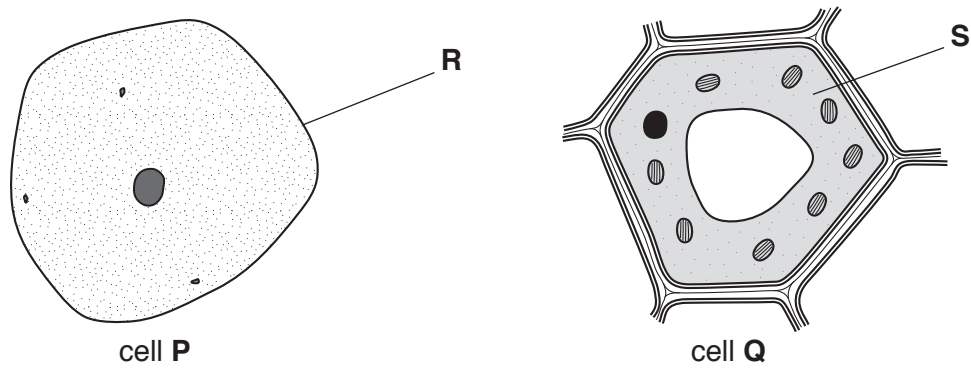


Fig. 1.1 (not to scale)

(i) Identify structures **R** and **S**, as shown on Fig. 1.1.

R

S

[2]

(ii) Cell **Q** is a plant cell.

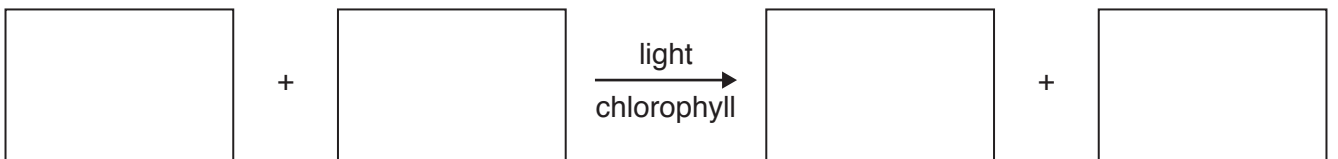
State **two** pieces of evidence from Fig. 1.1 that support this statement.

1.

2.

[2]

(b) Complete the word equation for photosynthesis.



[2]

(c) One of the food chains in a garden is shown in Fig. 1.2.

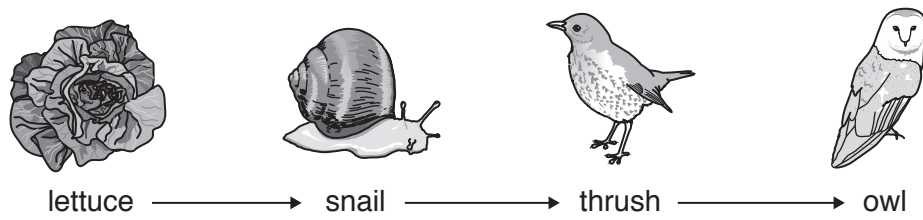


Fig. 1.2

(i) Name **one** organism in the food chain shown in Fig. 1.2 which is a herbivore.

..... [1]

(ii) Name **one** organism in the food chain shown in Fig. 1.2 which is a secondary consumer.

..... [1]

(iii) A gardener removes the lettuces.

Suggest what happens to the number of snails.

Explain your answer.

the number of snails will

explanation

..... [1]

[Total: 9]

- 2 Petroleum is a mixture of compounds which are separated in a fractional distillation column.

Process **X** changes molecules in one fraction, as shown in Fig. 2.1.

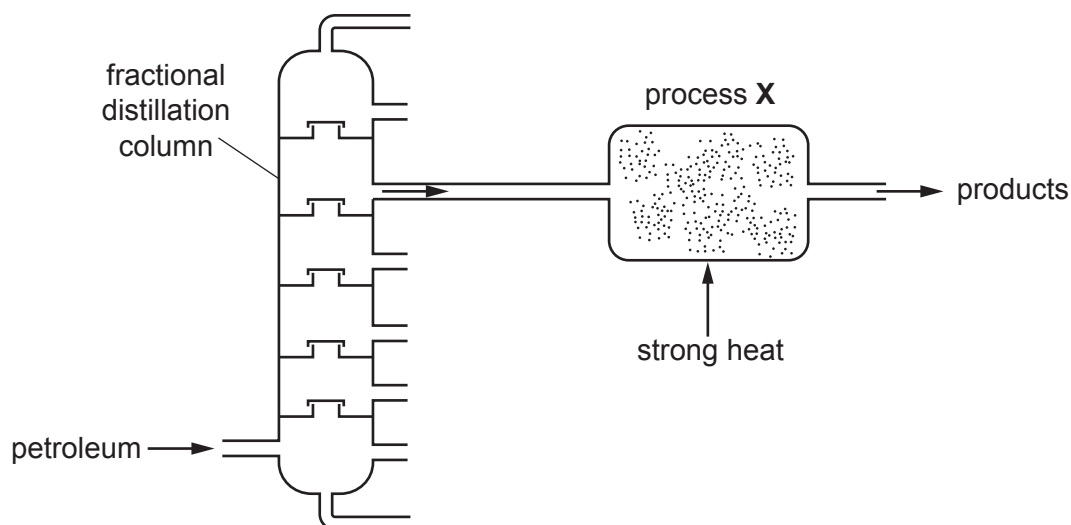


Fig. 2.1

- (a) The products of process **X** include alkenes.

(i) Identify process **X**.

..... [1]

(ii) Describe the colour change that is seen when aqueous bromine is mixed with an alkene.

from to [2]

(iii) Name the substance that is formed by the addition polymerisation of ethene.

..... [1]

(b) Most of the compounds in petroleum are alkanes.

Alkanes and alkenes contain carbon and hydrogen atoms only.

(i) Name the type of compound that contains carbon and hydrogen atoms only.

..... [1]

(ii) State the type of chemical bond that forms between carbon and hydrogen atoms.

..... [1]

(iii) Identify the **two** products of the complete combustion of alkanes.

..... and [2]

(iv) The formula of methane is CH₄.

Complete the dot-and-cross diagram to show the shared electron pairs in a molecule of methane.

H

C

[2]

[Total: 10]

3 Fig. 3.1 shows a game played on a sloping board.

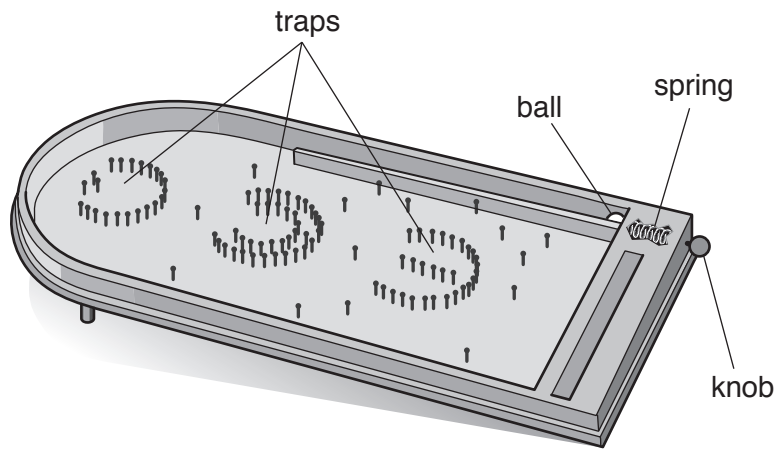


Fig. 3.1

A ball is launched by a spring up the slope and around the top of the board. The ball then rolls down the slope to fall into one of the traps.

(a) Fig. 3.2 shows the compressed spring when the knob is pulled back.

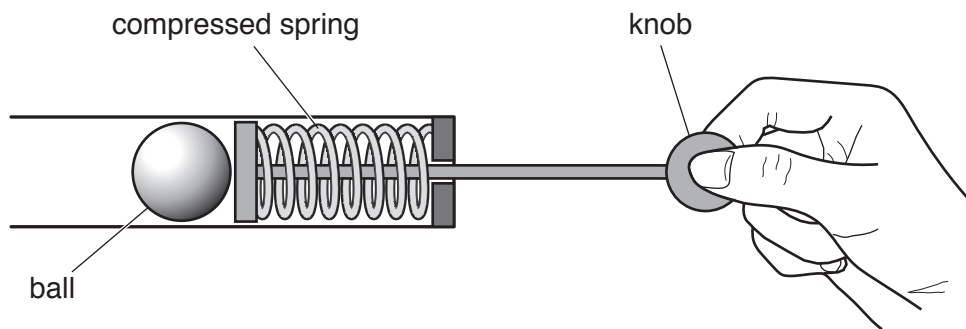


Fig. 3.2

Fig. 3.3 shows the spring before it is compressed.

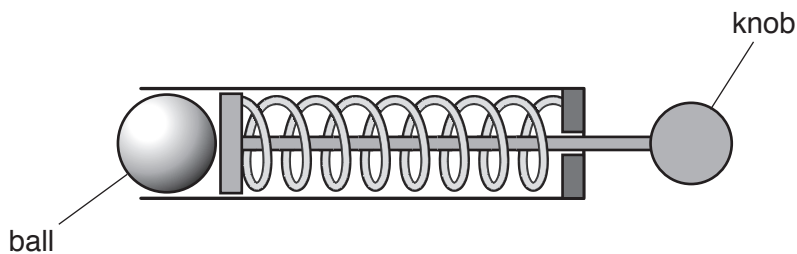


Fig. 3.3

- (i) On Fig. 3.3 draw a force arrow to show the direction of the force used to compress the spring. [1]

(ii) State **two** effects that a force can have on an object.

1.

2.

[2]

(iii) As the spring is pulled back, work is done.

State the **two** quantities that are needed to calculate the work done.

1.

2.

[2]

(b) When the ball is launched up the slope, energy is transferred from the compressed spring to the ball. The energy of the ball changes as it moves up the slope to other types of energy.

Complete the sequence of energy changes. One has been done for you.

from *elastic* potential energy in the spring

to energy of the ball as it begins to move up the slope

to potential energy as the ball slows down going up the slope

and *thermal* energy lost to the environment

[2]

(c) The ball is made from steel.

The mass of the ball is 6.0g.

The volume of the ball is 0.75 cm³.

Calculate the density of the steel ball. Show your working.

density = ...g/cm³ [2]

[Total: 9]

- 4 (a) Fig. 4.1 is a diagram of an insect-pollinated flower.

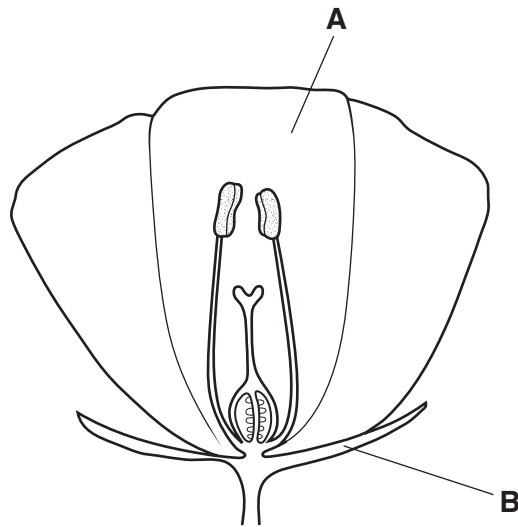


Fig. 4.1

- (i) Name parts **A** and **B** shown in Fig. 4.1.

A

B

[2]

- (ii) Describe what happens during fertilisation in the flower.

.....

.....

..... [2]

- (b) Some plants produce two different types of flowers on the same plant.

These flowers have either the male or female reproductive parts, as shown in Fig. 4.2.

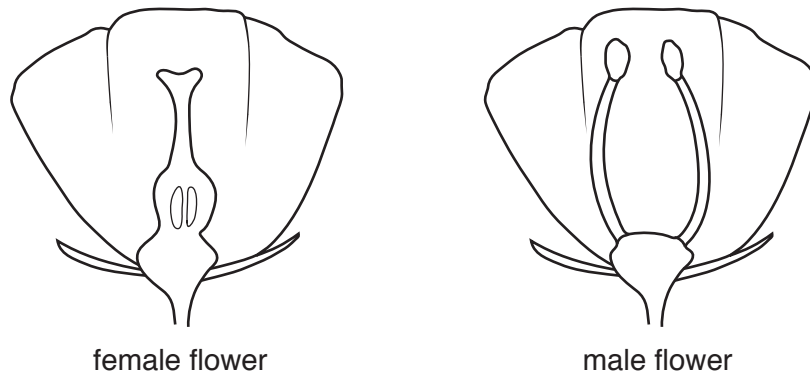


Fig. 4.2

- (i) Name **one** reproductive part of the **female** flower.
 [1]
- (ii) Name **one** reproductive part of the **male** flower.
 [1]
- (c) Fertilisation takes place in the reproductive system of the human female.
- (i) State where fertilisation takes place in the human female reproductive system.
 [1]
- (ii) State the name of the fertilised egg which develops into the embryo.
 [1]
- (iii) Describe where the embryo continues its development.

 [2]

[Total: 10]

- 5 (a) The electrolysis of concentrated aqueous sodium chloride is shown in Fig. 5.1.

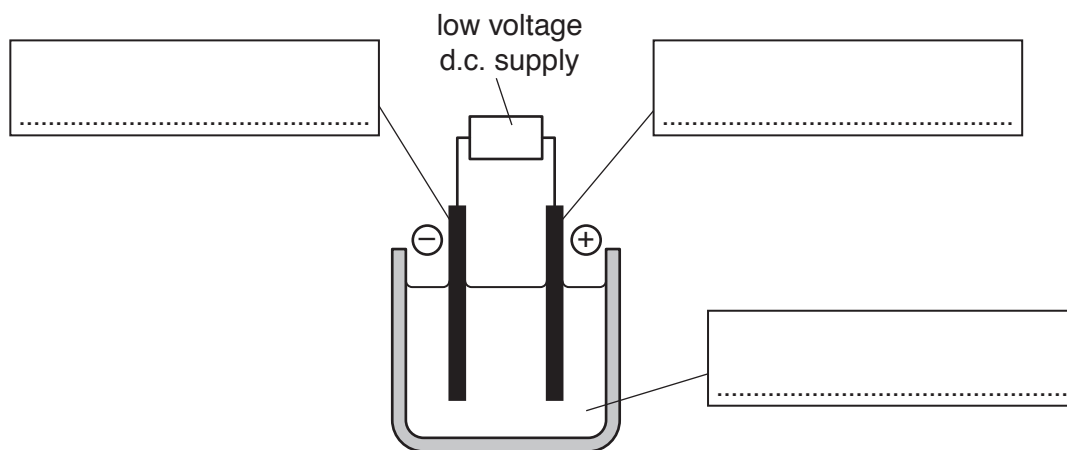


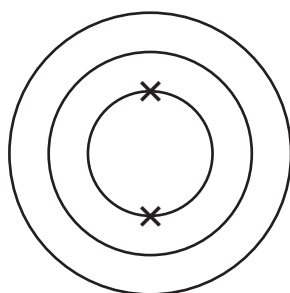
Fig. 5.1

- (i) Complete Fig. 5.1 by adding the labels *anode*, *cathode* and *electrolyte*. [2]
- (ii) One of the products of this electrolysis is chlorine gas.
Identify the **two** other products.
1.
2. [2]
- (iii) Describe a chemical test for chlorine gas and state the positive result.
- test
-
- result [2]
- (b) An atom of sodium has atomic number 11 and nucleon number 23.
- State the number of protons and the number of neutrons in this atom of sodium.
- protons
- neutrons [2]

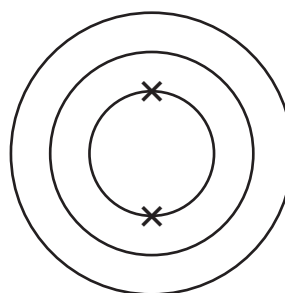
(c) A chlorine atom has 17 electrons.

A chloride ion has the symbol Cl^- .

Complete Fig. 5.2 to show the electron arrangements in a chlorine atom and in a chloride ion.



chlorine atom



chloride ion

Fig. 5.2

[2]

[Total: 10]

6 Fig. 6.1 shows an electric hair dryer.



Fig. 6.1

The hair dryer contains:

- an electrical heater to heat the air used to dry the hair
- a fan driven by the electric motor in the circuit to blow the air over the wet hair.

When the heater is switched off, the fan blows cool air over the hair.

When the heater is switched on, hot air is blown over the hair.

(a) Fig. 6.2 shows an incomplete circuit diagram for the hair dryer.

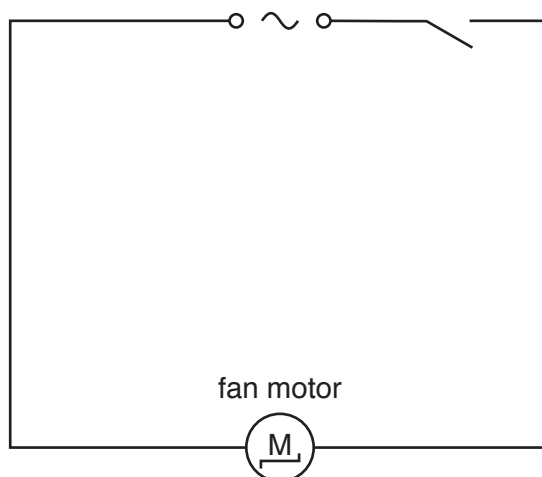


Fig. 6.2

The circuit symbol for a heater is 

On Fig. 6.2 complete the circuit diagram to show:

- how the heater is connected
- how the heater can be switched off so the fan only blows cool air.

[2]

(b) The hair dryer operates from a 240 V supply. The current through the hair dryer is 3.0 A.

(i) Calculate the total resistance of the circuit.

Show your working and state the unit of your answer.

resistance = ... unit [3]

(ii) Circle the correct fuse value to use in the hair dryer.

1 A 3 A 5 A 10 A 13 A [1]

(c) Wet hair will dry without the use of a hair dryer.

(i) Name the process by which hair dries.

..... [1]

(ii) Describe in terms of water molecules how this process causes wet hair to dry.

.....
 [1]

(iii) When hair is dried without using a dryer, the head feels colder as the hair dries.

Explain why the head feels colder.

.....

 [2]

[Total: 10]

7 (a) Chemical digestion occurs in the alimentary canal.

Use words from the list to complete the sentence about chemical digestion.

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

absorbed **atoms** **egested** **excreted**
ions **molecules**

Chemical digestion in the alimentary canal produces small, soluble

..... that can be

[2]

(b) Amylase is an enzyme that breaks down starch into simpler reducing sugars.

Starch solution is placed in each of two test-tubes.

Amylase solution is added to test-tube 1 and water is added to test-tube 2.

The apparatus is shown in Fig. 7.1.

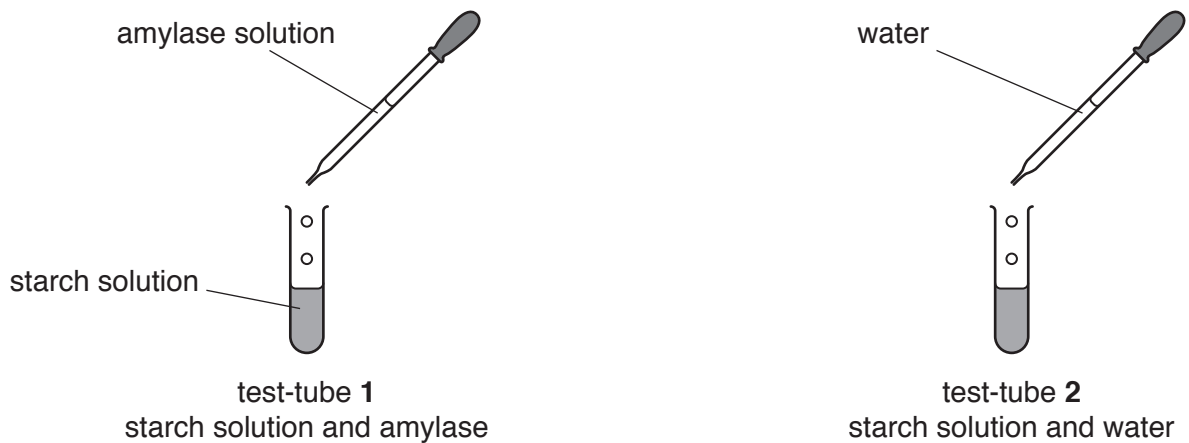


Fig. 7.1

After 10 minutes the contents of each test-tube are tested with Benedict's solution.

The results of the investigation are shown in Table 7.1.

Table 7.1

test-tube	amylase present	reducing sugar present	colour of result of Benedict's test
1	yes	yes	
2	no	no	

(i) Complete Table 7.1 with the colours of the Benedict's test results.

[2]

- (ii) The experiment is repeated with boiled enzyme in test-tube 1. This time there is **no** reducing sugar present in test-tube 1 after 10 minutes.

Explain why there is no reducing sugar in test-tube 1.

.....

.....

..... [1]

- (c) Table 7.2 shows four main processes that occur in the alimentary canal.

Complete each row of Table 7.2 with **one** region of the alimentary canal where each process takes place.

One is done for you.

Table 7.2

process	one region of the alimentary canal
absorption	small intestine
digestion	
egestion	
ingestion	

[3]

[Total: 8]

- 8 (a) Duralumin is a mixture of aluminium and copper.

Aluminium is in Group III in the Periodic Table, and copper is a transition element.

- (i) State the general name of mixtures of metals.

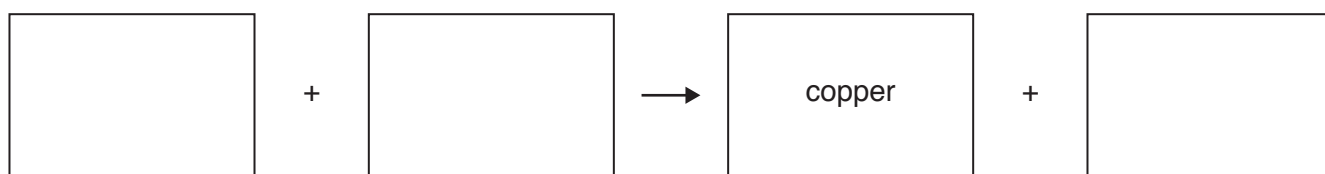
..... [1]

- (ii) Suggest **one** physical property of copper that is also a physical property of aluminium.

..... [1]

- (b) Carbon is used in the extraction of copper from copper oxide.

- (i) Complete the word equation for the reaction between carbon and copper oxide.



[2]

- (ii) State the type of chemical change that happens when oxygen is removed from a substance.

..... [1]

- (iii) The reaction between carbon and copper oxide is exothermic.

State what is meant by *exothermic*.

..... [1]

[Total: 6]

- 9 Fig. 9.1 shows a lightning flash, which is a form of electrostatic discharge.

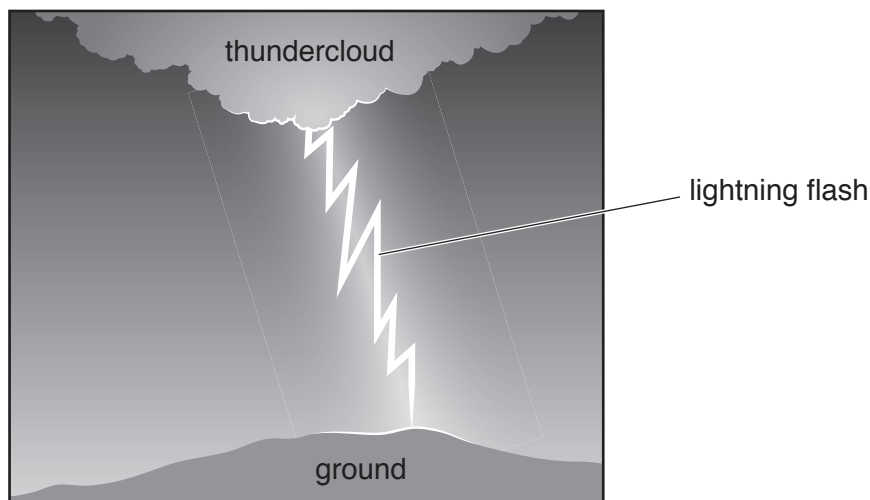


Fig. 9.1

- (a) Name the **two** opposite types of electric charge.

..... and [1]

- (b) Lightning occurs when clouds become highly charged. A very high potential difference of more than 1 000 000 V exists between the thundercloud and the ground.

Name the unit which has the symbol V.

..... [1]

- (c) The thundercloud consists mainly of water droplets. The droplets in the cloud become electrically charged.

Suggest what happens to the water molecules to cause them to become electrically charged.

.....
 [1]

- (d) A lightning flash emits a range of wavelengths between 390 nm and 590 nm.
(1 nm = 0.000 000 001 m).

Table 9.1 shows the range of wavelengths of different parts of the electromagnetic spectrum.

Table 9.1

type of electromagnetic wave	range of wavelengths
gamma rays	less than 0.001 nm
X-rays	0.001–10 nm
ultraviolet	10–400 nm
visible light	400–750 nm
infrared	750 nm–1 mm
microwaves	1 mm–100 cm
radio waves	more than 100 cm

Identify the **two** parts of the electromagnetic spectrum emitted by lightning.

..... and [2]

- (e) Thunder is the sound energy produced by the lightning flash.

- (i) A woman hears the sound of thunder 5.0 seconds after she sees the lightning flash hit the ground on top of a distant hill.

The speed of sound in air is 330 m/s.

Calculate the distance of the woman from the top of the hill.

Show your working.

distance = ... m [2]

- (ii) Explain why the thunder from a distant lightning flash is heard some time after the flash is seen.

.....
..... [1]

[Total: 8]

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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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

The Periodic Table of Elements

Group																		
I	II	Key										III	IV	V	VI	VII	VIII	
		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		2 He helium 4
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 —			

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



--

--	--	--	--	--

--	--	--	--

0653/33

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 **19** printed pages and **1** blank page.

1 (a) Fig. 1.1 shows two cells.

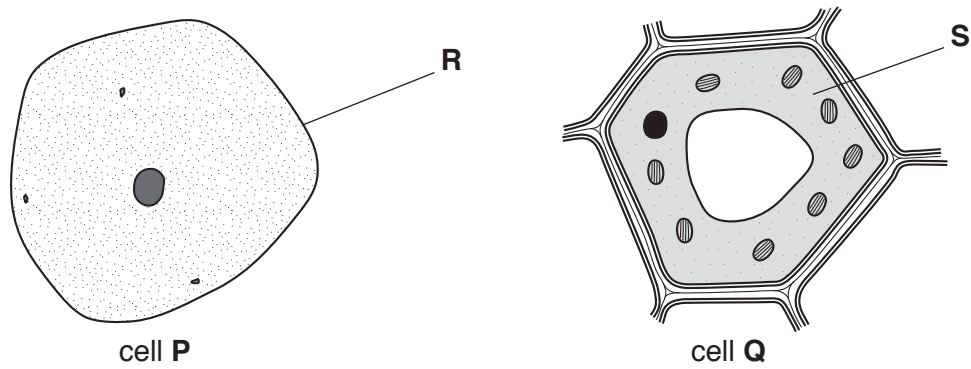


Fig. 1.1 (not to scale)

(i) Identify structures **R** and **S**, as shown on Fig. 1.1.

R

S

[2]

(ii) Cell **Q** is a plant cell.

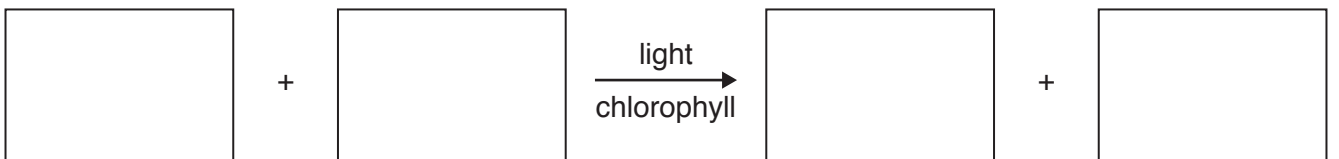
State **two** pieces of evidence from Fig. 1.1 that support this statement.

1.

2.

[2]

(b) Complete the word equation for photosynthesis.



[2]

(c) One of the food chains in a garden is shown in Fig. 1.2.

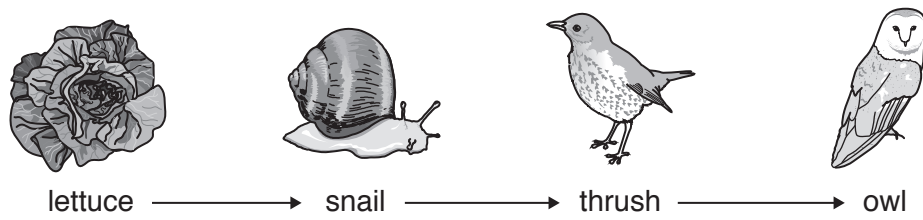


Fig. 1.2

(i) Name **one** organism in the food chain shown in Fig. 1.2 which is a herbivore.

..... [1]

(ii) Name **one** organism in the food chain shown in Fig. 1.2 which is a secondary consumer.

..... [1]

(iii) A gardener removes the lettuces.

Suggest what happens to the number of snails.

Explain your answer.

the number of snails will

explanation

..... [1]

[Total: 9]

- 2 Petroleum is a mixture of compounds which are separated in a fractional distillation column.

Process **X** changes molecules in one fraction, as shown in Fig. 2.1.

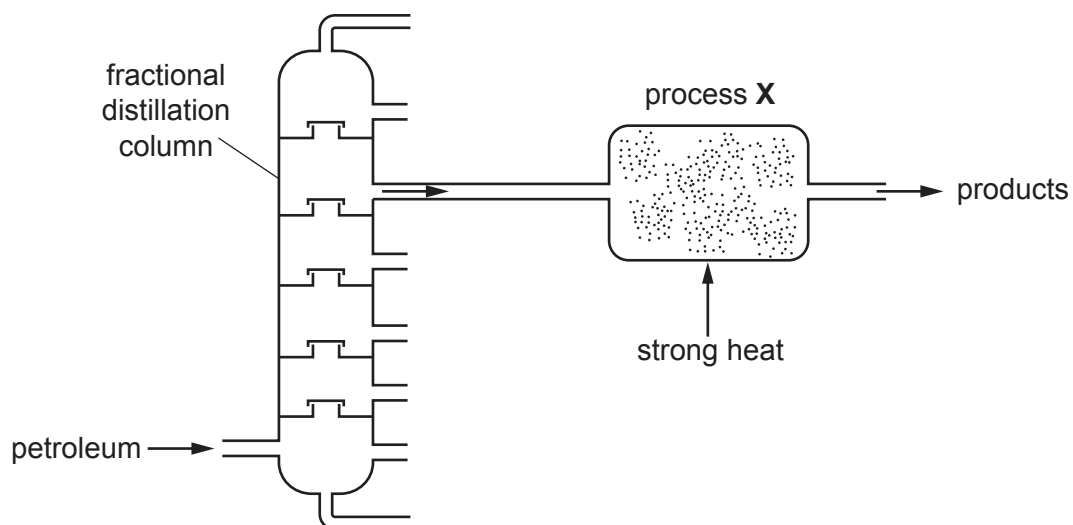


Fig. 2.1

- (a) The products of process **X** include alkenes.

(i) Identify process **X**.

..... [1]

(ii) Describe the colour change that is seen when aqueous bromine is mixed with an alkene.

from to [2]

(iii) Name the substance that is formed by the addition polymerisation of ethene.

..... [1]

(b) Most of the compounds in petroleum are alkanes.

Alkanes and alkenes contain carbon and hydrogen atoms only.

(i) Name the type of compound that contains carbon and hydrogen atoms only.

..... [1]

(ii) State the type of chemical bond that forms between carbon and hydrogen atoms.

..... [1]

(iii) Identify the **two** products of the complete combustion of alkanes.

..... and [2]

(iv) The formula of methane is CH_4 .

Complete the dot-and-cross diagram to show the shared electron pairs in a molecule of methane.

H

C

[2]

[Total: 10]

3 Fig. 3.1 shows a game played on a sloping board.

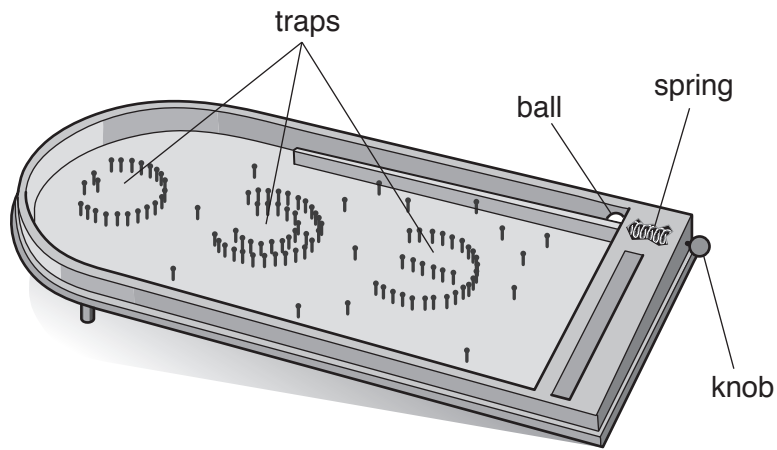


Fig. 3.1

A ball is launched by a spring up the slope and around the top of the board. The ball then rolls down the slope to fall into one of the traps.

(a) Fig. 3.2 shows the compressed spring when the knob is pulled back.

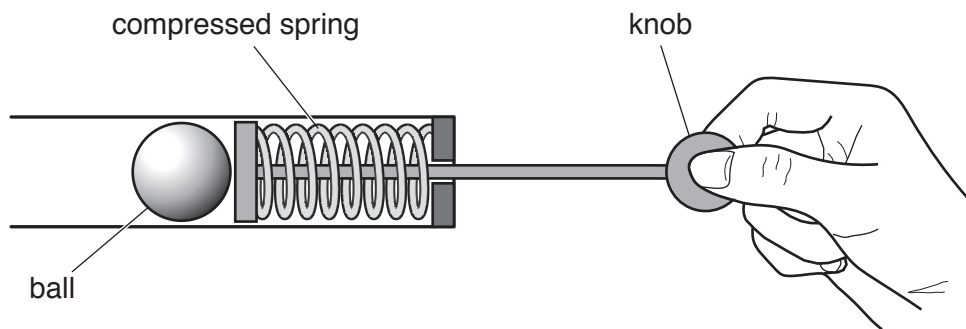


Fig. 3.2

Fig. 3.3 shows the spring before it is compressed.

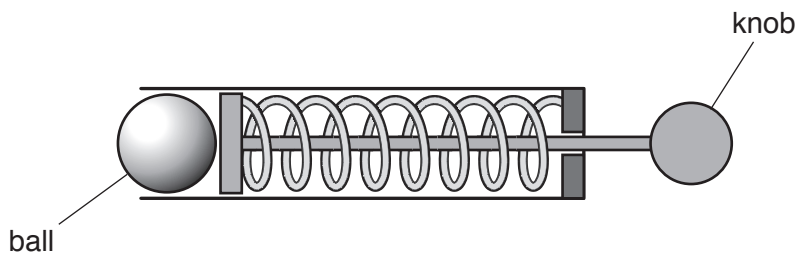


Fig. 3.3

- (i) On Fig. 3.3 draw a force arrow to show the direction of the force used to compress the spring. [1]

(ii) State **two** effects that a force can have on an object.

1.

2.

[2]

(iii) As the spring is pulled back, work is done.

State the **two** quantities that are needed to calculate the work done.

1.

2.

[2]

(b) When the ball is launched up the slope, energy is transferred from the compressed spring to the ball. The energy of the ball changes as it moves up the slope to other types of energy.

Complete the sequence of energy changes. One has been done for you.

from *elastic* potential energy in the spring

to energy of the ball as it begins to move up the slope

to potential energy as the ball slows down going up the slope

and *thermal* energy lost to the environment

[2]

(c) The ball is made from steel.

The mass of the ball is 6.0g.

The volume of the ball is 0.75 cm³.

Calculate the density of the steel ball. Show your working.

density = ...g/cm³ [2]

[Total: 9]

- 4 (a) Fig. 4.1 is a diagram of an insect-pollinated flower.

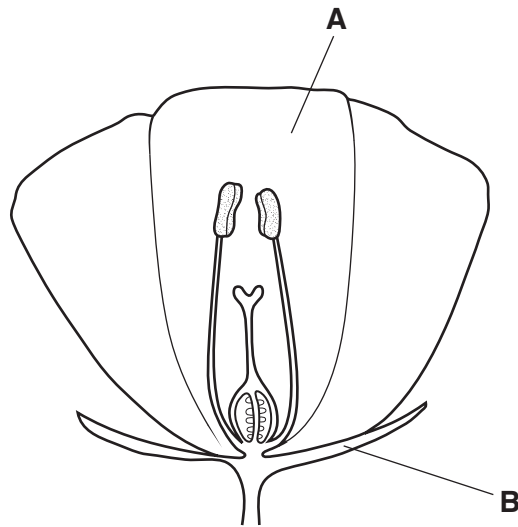


Fig. 4.1

- (i) Name parts **A** and **B** shown in Fig. 4.1.

A

B

[2]

- (ii) Describe what happens during fertilisation in the flower.

.....

.....

..... [2]

- (b) Some plants produce two different types of flowers on the same plant.

These flowers have either the male or female reproductive parts, as shown in Fig. 4.2.

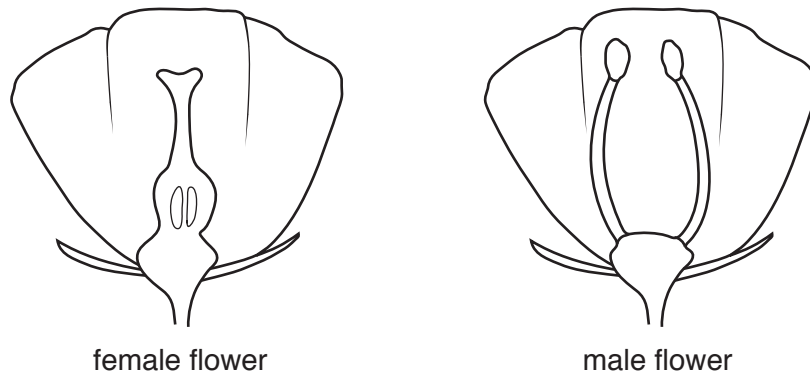


Fig. 4.2

- (i) Name **one** reproductive part of the **female** flower.
 [1]
- (ii) Name **one** reproductive part of the **male** flower.
 [1]
- (c) Fertilisation takes place in the reproductive system of the human female.
- (i) State where fertilisation takes place in the human female reproductive system.
 [1]
- (ii) State the name of the fertilised egg which develops into the embryo.
 [1]
- (iii) Describe where the embryo continues its development.

 [2]

[Total: 10]

- 5 (a) The electrolysis of concentrated aqueous sodium chloride is shown in Fig. 5.1.

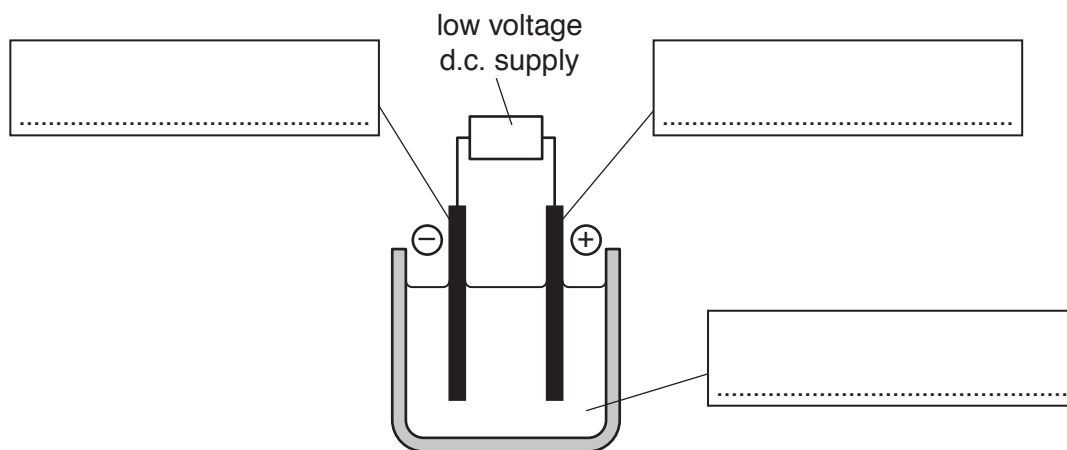


Fig. 5.1

- (i) Complete Fig. 5.1 by adding the labels *anode*, *cathode* and *electrolyte*. [2]
- (ii) One of the products of this electrolysis is chlorine gas.
Identify the **two** other products.
1.
2. [2]
- (iii) Describe a chemical test for chlorine gas and state the positive result.
- test
-
- result [2]

- (b) An atom of sodium has atomic number 11 and nucleon number 23.

State the number of protons and the number of neutrons in this atom of sodium.

protons

neutrons

[2]

(c) A chlorine atom has 17 electrons.

A chloride ion has the symbol Cl^- .

Complete Fig. 5.2 to show the electron arrangements in a chlorine atom and in a chloride ion.

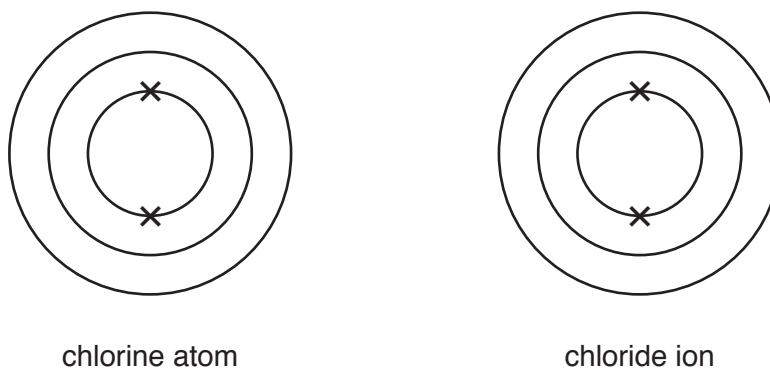


Fig. 5.2

[2]

[Total: 10]

6 Fig. 6.1 shows an electric hair dryer.



Fig. 6.1

The hair dryer contains:

- an electrical heater to heat the air used to dry the hair
- a fan driven by the electric motor in the circuit to blow the air over the wet hair.

When the heater is switched off, the fan blows cool air over the hair.

When the heater is switched on, hot air is blown over the hair.

(a) Fig. 6.2 shows an incomplete circuit diagram for the hair dryer.

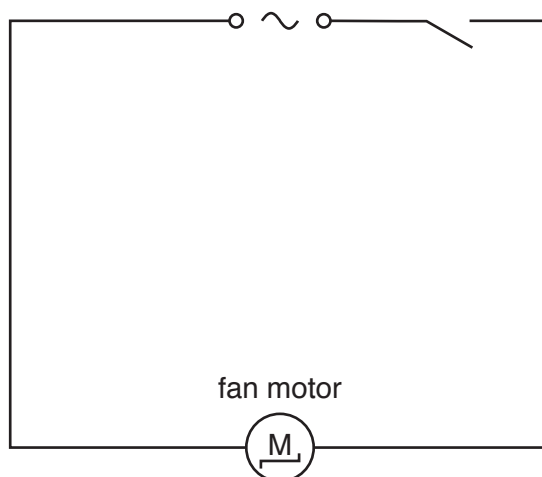


Fig. 6.2

The circuit symbol for a heater is 

On Fig. 6.2 complete the circuit diagram to show:

- how the heater is connected
- how the heater can be switched off so the fan only blows cool air.

[2]

(b) The hair dryer operates from a 240 V supply. The current through the hair dryer is 3.0 A.

(i) Calculate the total resistance of the circuit.

Show your working and state the unit of your answer.

resistance = ... unit [3]

(ii) Circle the correct fuse value to use in the hair dryer.

1 A 3 A 5 A 10 A 13 A [1]

(c) Wet hair will dry without the use of a hair dryer.

(i) Name the process by which hair dries.

..... [1]

(ii) Describe in terms of water molecules how this process causes wet hair to dry.

.....
 [1]

(iii) When hair is dried without using a dryer, the head feels colder as the hair dries.

Explain why the head feels colder.

.....

 [2]

[Total: 10]

- 7 (a) Chemical digestion occurs in the alimentary canal.

Use words from the list to complete the sentence about chemical digestion.

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

absorbed **atoms** **egested** **excreted**
ions **molecules**

Chemical digestion in the alimentary canal produces small, soluble

..... that can be

[2]

- (b) Amylase is an enzyme that breaks down starch into simpler reducing sugars.

Starch solution is placed in each of two test-tubes.

Amylase solution is added to test-tube 1 and water is added to test-tube 2.

The apparatus is shown in Fig. 7.1.

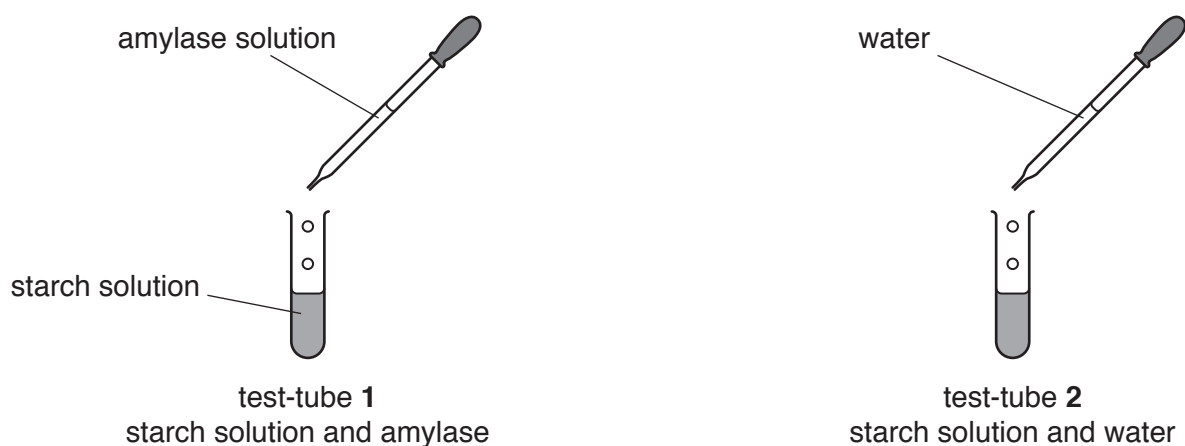


Fig. 7.1

After 10 minutes the contents of each test-tube are tested with Benedict's solution.

The results of the investigation are shown in Table 7.1.

Table 7.1

test-tube	amylase present	reducing sugar present	colour of result of Benedict's test
1	yes	yes	
2	no	no	

- (i) Complete Table 7.1 with the colours of the Benedict's test results.

[2]

- (ii) The experiment is repeated with boiled enzyme in test-tube 1. This time there is **no** reducing sugar present in test-tube 1 after 10 minutes.

Explain why there is no reducing sugar in test-tube 1.

.....

.....

..... [1]

- (c) Table 7.2 shows four main processes that occur in the alimentary canal.

Complete each row of Table 7.2 with **one** region of the alimentary canal where each process takes place.

One is done for you.

Table 7.2

process	one region of the alimentary canal
absorption	small intestine
digestion	
egestion	
ingestion	

[3]

[Total: 8]

- 8 (a) Duralumin is a mixture of aluminium and copper.

Aluminium is in Group III in the Periodic Table, and copper is a transition element.

- (i) State the general name of mixtures of metals.

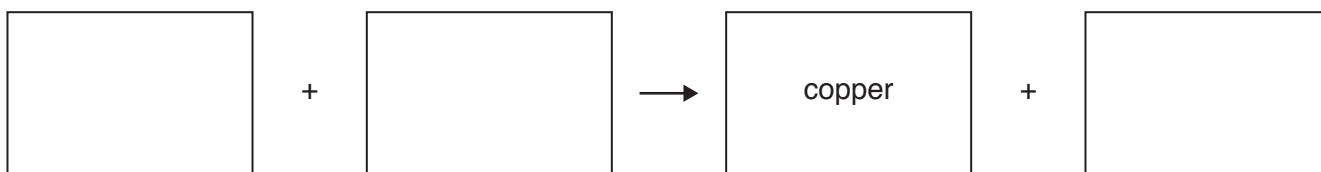
..... [1]

- (ii) Suggest **one** physical property of copper that is also a physical property of aluminium.

..... [1]

- (b) Carbon is used in the extraction of copper from copper oxide.

- (i) Complete the word equation for the reaction between carbon and copper oxide.



[2]

- (ii) State the type of chemical change that happens when oxygen is removed from a substance.

..... [1]

- (iii) The reaction between carbon and copper oxide is exothermic.

State what is meant by *exothermic*.

..... [1]

[Total: 6]

- 9 Fig. 9.1 shows a lightning flash, which is a form of electrostatic discharge.

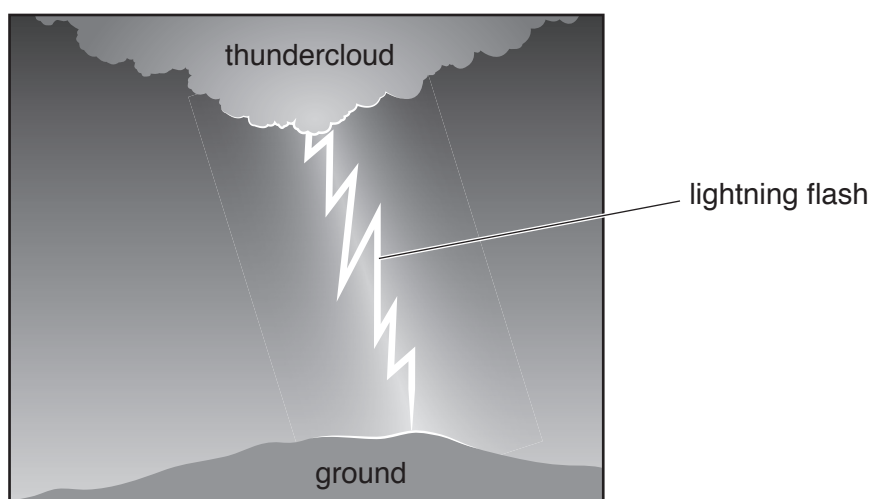


Fig. 9.1

- (a) Name the **two** opposite types of electric charge.

..... and [1]

- (b) Lightning occurs when clouds become highly charged. A very high potential difference of more than 1 000 000 V exists between the thundercloud and the ground.

Name the unit which has the symbol V.

..... [1]

- (c) The thundercloud consists mainly of water droplets. The droplets in the cloud become electrically charged.

Suggest what happens to the water molecules to cause them to become electrically charged.

.....
 [1]

- (d) A lightning flash emits a range of wavelengths between 390 nm and 590 nm.
(1 nm = 0.000 000 001 m).

Table 9.1 shows the range of wavelengths of different parts of the electromagnetic spectrum.

Table 9.1

type of electromagnetic wave	range of wavelengths
gamma rays	less than 0.001 nm
X-rays	0.001–10 nm
ultraviolet	10–400 nm
visible light	400–750 nm
infrared	750 nm–1 mm
microwaves	1 mm–100 cm
radio waves	more than 100 cm

Identify the **two** parts of the electromagnetic spectrum emitted by lightning.

..... and [2]

- (e) Thunder is the sound energy produced by the lightning flash.

- (i) A woman hears the sound of thunder 5.0 seconds after she sees the lightning flash hit the ground on top of a distant hill.

The speed of sound in air is 330 m/s.

Calculate the distance of the woman from the top of the hill.

Show your working.

distance = ... m [2]

- (ii) Explain why the thunder from a distant lightning flash is heard some time after the flash is seen.

.....
..... [1]

[Total: 8]

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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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

The Periodic Table of Elements

Group													
I	II						III	IV	V	VI	VII	VIII	
							1 H hydrogen 1						

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