Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8636320979

COMBINED SCIENCE **0653/33**

Paper 3 Theory (Core) **May/June 2024**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **24** pages. Any blank pages are indicated.

[Turn over

1 **(a)** Fig. 1.1 is a diagram of the human heart.

Complete the labels on Fig. 1.1.

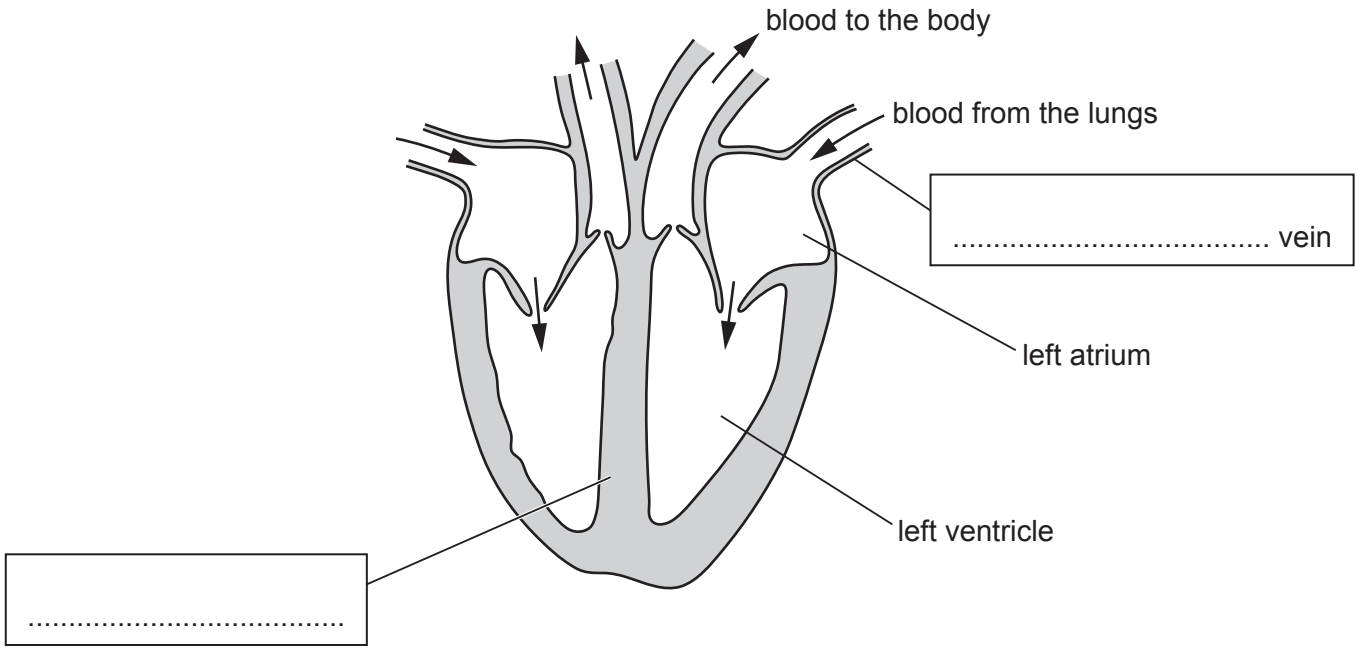


Fig. 1.1

[2]

(b) The boxes on the left show different components of blood.

The boxes on the right show different functions of the components.

Draw **one** straight line from each component to its function.

component	function
plasma	transport oxygen
platelets	transport ions
red blood cells	blood clotting

[2]

(c) Hormones are transported in the blood.

(i) Circle the words in **bold** that make this definition of hormones correct.

Hormones are **chemical / electrical** substances produced by a **gland / vacuole**.

They are carried in the blood and alter the activity of a specific **excretion / target** organ.

[2]

(ii) A patient is given an injection of the hormone adrenaline.

The doctor measures the patient's pulse rate before and after the injection.

Table 1.1 shows the results.

Table 1.1

pulse rate before injection / beats per minute	pulse rate after injection / beats per minute
70	91

Calculate the percentage increase in pulse rate using the results from Table 1.1.

percentage increase = ...% [2]

(iii) State **one** other effect of adrenaline on the body.

..... [1]

[Total: 9]

2 A student investigates the reactions of iron using iron nails.

(a) The student places an iron nail into water, as shown in Fig. 2.1.

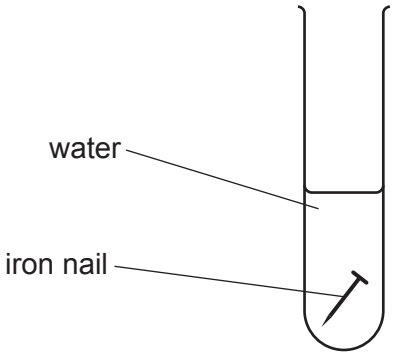


Fig. 2.1

(i) Water is needed for iron to rust.

State **one other** substance needed for iron to rust.

..... [1]

(ii) Suggest **one** method used to stop iron nails rusting.

..... [1]

(b) In another experiment, the student compares the rates of reaction of iron and three other metals with dilute hydrochloric acid.

The student places equal-sized pieces of the four metals in dilute hydrochloric acid of the same concentration at the same temperature. Then the student collects the gas produced for 2 minutes, as shown in Fig. 2.2.

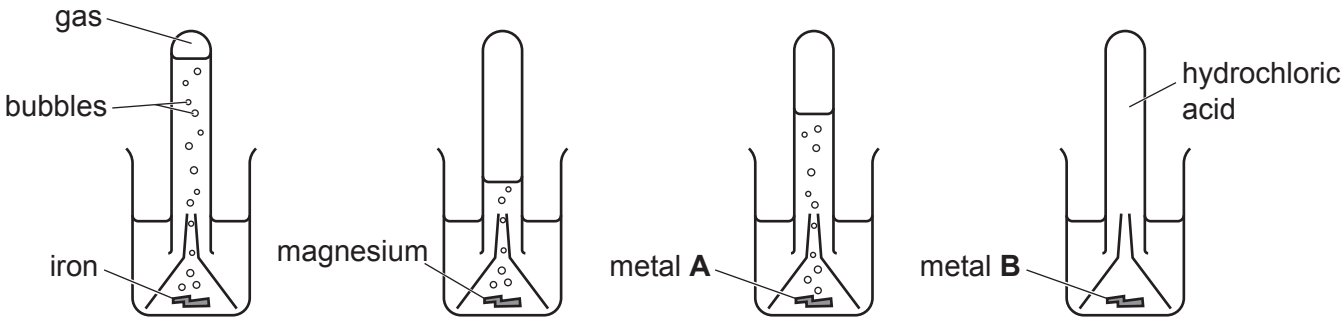


Fig. 2.2

(i) Identify the gas produced in the reactions shown in Fig. 2.2.

..... [1]

(ii) Suggest the identity of metal **A** and the identity of metal **B**.

Explain your answer.

metal **A** .....

metal **B** .....

explanation .....

.....

.....

.....

[3]

(iii) Suggest **one** change to increase the rate of the reaction of iron with dilute hydrochloric acid.

..... [1]

(c) An atom of iron is represented as shown.

$$^{56}_{26}Fe$$

Deduce the number of protons, neutrons and electrons in this atom.

number of protons = ...

number of neutrons = ...

number of electrons = ...

[2]

[Total: 9]

3 Fig. 3.1 shows three forces, **Q**, **R** and **S**, acting on a bus moving along a level road at constant speed.

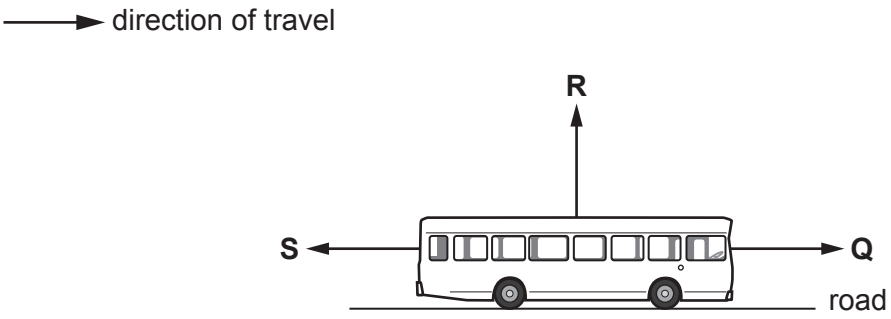


Fig. 3.1

(a) The gravitational force acting on the bus is **not** shown on Fig. 3.1.

(i) On Fig. 3.1, draw an arrow to represent the gravitational force acting on the bus and label it **P**. [1]

(ii) State the name of the gravitational force **P**.

..... [1]

(b) The driving force **Q** of the bus is 2500 N as it moves.

(i) Explain why force **S** must also be 2500 N as the bus moves along a level road at constant speed.

.....

..... [1]

(ii) Force **Q** is increased to 3000 N. Force **S** does not change.

Find the resultant of the forces **Q** and **S** acting on the bus.

resultant = ... N [1]

(iii) Describe the effect on the motion of the bus of the resultant force in **(b)(ii)**.

..... [1]

(c) Fig. 3.2 shows a speed–time graph of the motion of a bus between two bus stops.

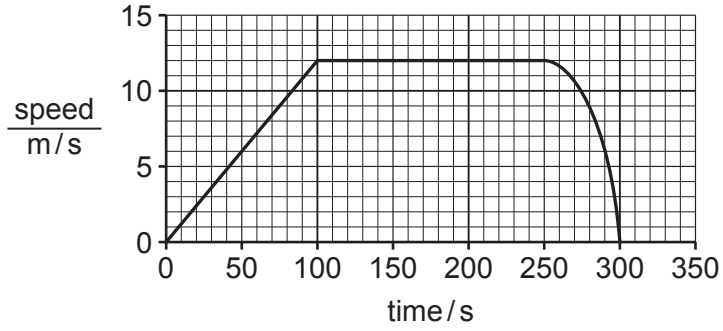


Fig. 3.2

(i) Determine the speed of the bus when it is travelling at constant speed.

speed = ... m / s [1]

(ii) Determine the time when the bus begins to decelerate and the time when it ends decelerating.

begins at time = ... s

ends at time = ... s
[1]

(d) The bus uses batteries to supply energy to the electric motors that drive the wheels of the bus.

Complete the sentence by identifying the energy transfers that happen when the bus is moving. One has been done for you.

Energy is transferred from ..... potential energy in the batteries

to .....electrical..... energy in the motors and then to .....

energy of the motors and the moving bus.

[2]

[Total: 9]

4 **(a)** Fig. 4.1 shows some of the parts of an insect-pollinated flower.

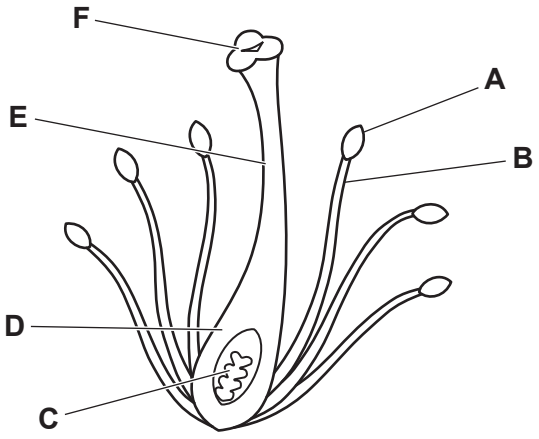


Fig. 4.1

(i) State the letter on Fig. 4.1 that identifies:

an ovule .....

where pollination occurs. .....
[2]

(ii) Fig. 4.1 does **not** show the sepals and petals of the flower.

State the function of:

sepals .....

petals. .....
[2]

(b) An animal gets its energy by eating **only** plants.

State the term that describes this type of animal.

..... [1]

(c) Plants use carbon dioxide for photosynthesis.

(i) Complete the word equation for photosynthesis.

carbon dioxide	+		→		+	oxygen

[2]

(ii) Fig. 4.2 is a graph showing the effect of carbon dioxide concentration on the rate of photosynthesis.

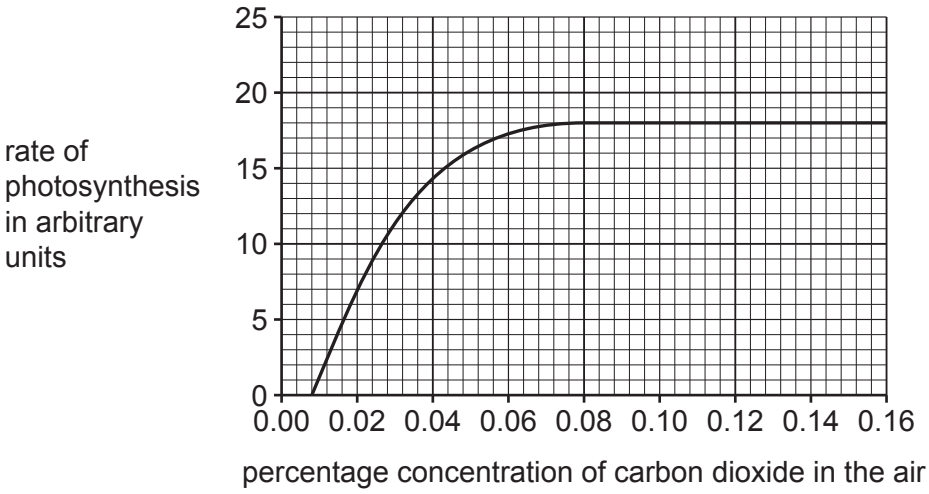


Fig. 4.2

Describe the effect of increasing carbon dioxide concentration on the rate of photosynthesis shown in Fig. 4.2.

Include data in your answer.

.....

.....

.....

..... [2]

(d) Deforestation causes an increase in carbon dioxide concentration in the atmosphere.

State **two other** undesirable effects of deforestation.

1 .....

2 .....

[2]

[Total: 11]

5 Part of the Periodic Table is shown in Fig. 5.1.

Group																	
I	II											III	IV	V	VI	VII	VIII
							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

Fig. 5.1

(a) (i) Draw **one** straight line to show the trend in metallic character across a period.

metallic character	decreases across a period from left to right
	increases across a period from left to right
	stays the same across a period from left to right

[1]

(ii) State the name of the collection of metals that includes iron, Fe, and copper, Cu.

..... [1]

(b) Lithium, Li, sodium, Na, and potassium, K, are in Group I of the Periodic Table.

State the trend in the melting point and the trend in the reaction with water of these elements going down Group I.

melting point .....

.....

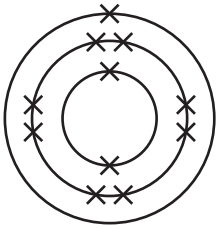
reaction with water .....

.....

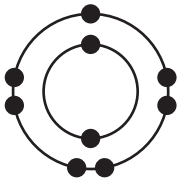
[2]

(c) Sodium, Na, reacts with fluorine, F, to form sodium fluoride.

Fig. 5.2 shows the electronic structure of a sodium atom and of a fluorine atom.



sodium atom

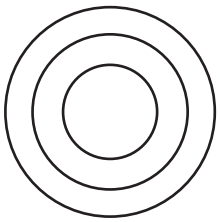


fluorine atom

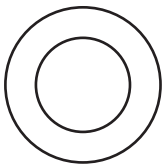
Fig. 5.2

When sodium atoms react with fluorine atoms, sodium ions and fluoride ions form.

Complete the dot-and-cross diagrams in Fig. 5.3 to show all of the electrons in a sodium ion and in a fluoride ion.



sodium ion

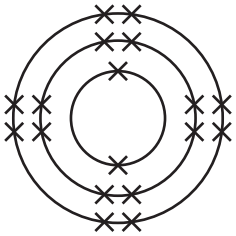


fluoride ion

Fig. 5.3

[2]

(d) The electronic structure of an atom of element **Z** is shown in Fig. 5.4.



element **Z**

Fig. 5.4

(i) Use the Periodic Table to identify element **Z**.

..... [1]

(ii) Sodium and element **Z** do **not** easily form a compound together.

Use the electronic structure shown in Fig. 5.4 to explain this observation.

.....

.....

..... [2]

[Total: 9]

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6 The list shows some types of wave.

infrared waves	**microwaves**	**radio waves**
sound waves	**visible light waves**	**water waves**

(a) Choose types of wave from the list to answer these questions.

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

(i) State the type of wave used in intruder alarms.

..... [1]

(ii) State **two** types of wave that are **not** part of the electromagnetic spectrum.

1 .....

2 .....
[2]

(iii) State the type of wave which is the electromagnetic wave with the lowest frequency.

..... [1]

(b) The air temperature is 15 °C.

A sound wave in the air takes 2.6 s to travel from the source to a person hearing the sound.

The speed of sound in air at 15 °C is 340 m / s.

(i) Show that the distance of the person from the source is 884 m.

[1]

(ii) The speed of sound in air increases as the temperature of the air increases.

At 35 °C the speed of sound in air is 352 m / s.

Estimate the speed of sound at 25 °C.

speed = ... m / s [1]

(c) **(i)** State the equation used to calculate the density of a substance from known values of mass and volume.

..... [1]

(ii) Explain why the density of air decreases when the temperature of air increases.

.....

.....

..... [2]

[Total: 9]

7 **(a)** Table 7.1 shows information about some fruits.

Table 7.1

fruit	mass of nutrient per 100 g of fruit / g			
	carbohydrate	protein	fat	fibre
apple	13.8	0.3	0.2	2.4
avocado	8.5	2.0	15.0	6.7
blueberry	14.5	0.7	0.3	2.4
orange	13.0	0.9	0.1	2.2
strawberry	7.7	0.7	0.3	2.0

(i) Identify **two** fruits with identical fat content per 100 g of fruit.

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

(ii) Eating fruit helps the movement of food through the alimentary canal.

Explain why avocados are the best fruit in Table 7.1 to eat for this process.

..... [1]

(iii) A student mixes 20 g of crushed avocado into a biuret solution.
After 5 minutes the biuret solution changes colour.

Use Table 7.1 to explain this observation.

.....

.....

..... [2]

(b) Complete these sentences about the digestion of food in the alimentary canal.

Choose words from the list.

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

absorption **egestion** **ingestion**

insoluble **osmosis** **soluble**

Food is taken into the mouth by the process of ..... .

Digestion breaks down large ..... food molecules into

small water ..... food molecules.

The small molecules then move through the wall of the intestine by the process of

..... .

[3]

[Total: 7]

8 **(a)** The fossil fuel petroleum is a liquid mixture of hydrocarbons.

(i) Complete the sentence about hydrocarbons.

Hydrocarbons are molecules that contain ..... and ..... only. [1]

(ii) Describe the arrangement and motion of particles in a liquid.

arrangement .....

.....

motion .....

.....
[2]

(iii) Explain why the change in state from a liquid to a gas is described as a physical change.

.....

..... [1]

(b) A diagram of the equipment used to separate petroleum is shown in Fig. 8.1.

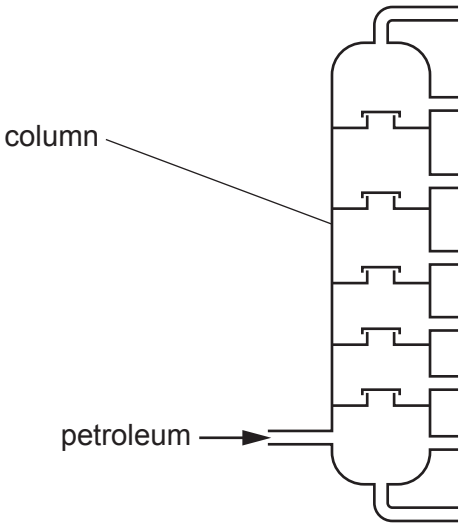

Fig. 8.1

State the name of the separation process that uses this equipment.

..... [1]

(c) Ethene is an unsaturated hydrocarbon.

(i) Describe what is meant by unsaturated.

..... [1]

(ii) Naphtha is obtained from petroleum.

Naphtha undergoes a process to produce ethene.

State the name of the process that produces ethene from naphtha.

..... [1]

(iii) State the name of the type of chemical reaction that changes ethene into poly(ethene).

..... [1]

[Total: 8]

9 Fig. 9.1 shows a circuit containing two identical lamps.

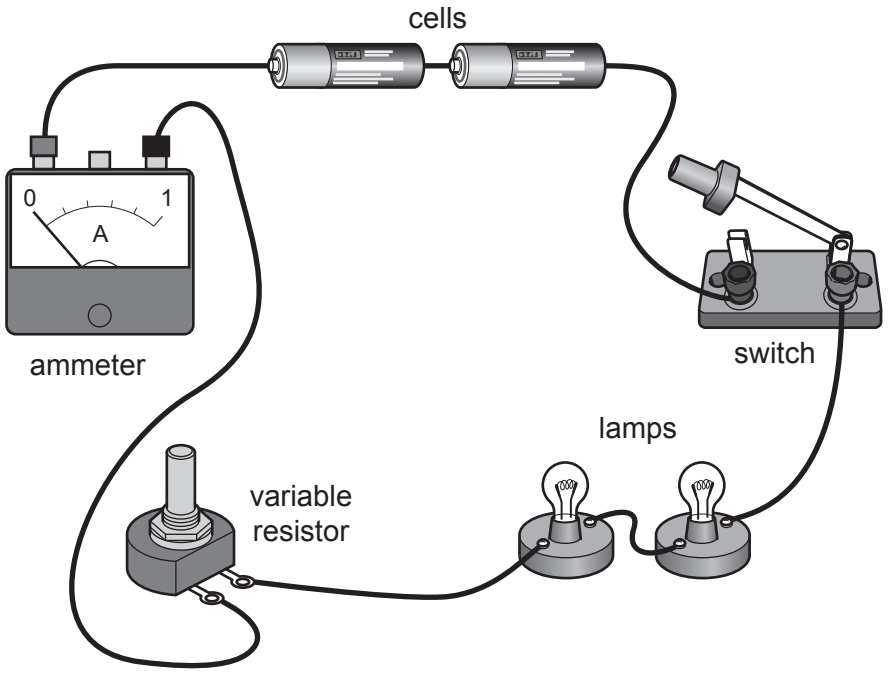

Fig. 9.1

(a) The variable resistor is at its minimum resistance and the voltage across the battery is 3.1 V.

When the switch is closed, both lamps are brightly lit.

(i) The ammeter reads 0.55 A.

Calculate the total resistance of the circuit.

Give the unit of your answer.

resistance = ... unit ..... [3]

(ii) When the variable resistor is at minimum resistance, its resistance is zero.

Use your answer to **(a)(i)** to calculate the value of the resistance of each lamp.

resistance = ... [1]

(b) The circuit remains switched on for a long time. The lamps become less bright.

(i) Predict what happens to the reading on the ammeter during this time.

..... [1]

(ii) The lamps become less bright because the cells are 'running down' and need replacing.

Suggest what measurement is made to check that the cells are 'running down'.

..... [1]

(c) On Fig. 9.2, complete the circuit diagram for the circuit shown in Fig. 9.1.

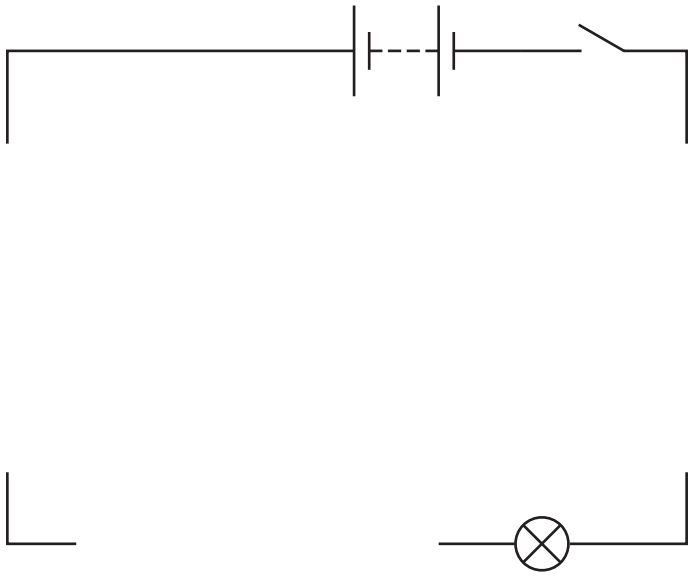

Fig. 9.2

[3]

[Total: 9]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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