Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0921445172

COMBINED SCIENCE **0653/31**

Paper 3 (Core) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 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.

CAMBRIDGE International Examinations

1 **(a)** Substances in food can be identified using test solutions.

Use lines to join each substance with the correct test solution and the colour of its positive result.

One example is done for you.

substance	test solution	colour of positive result
fats	Benedict's solution	blue-black
protein	biuret solution	milky emulsion
reducing sugar	ethanol	purple
starch	iodine solution	red

[3]

(b) Fig. 1.1 shows three leaves, **P**, **Q** and **R**.

The leaves are of similar size. They are all taken from the same type of plant on a sunny day.

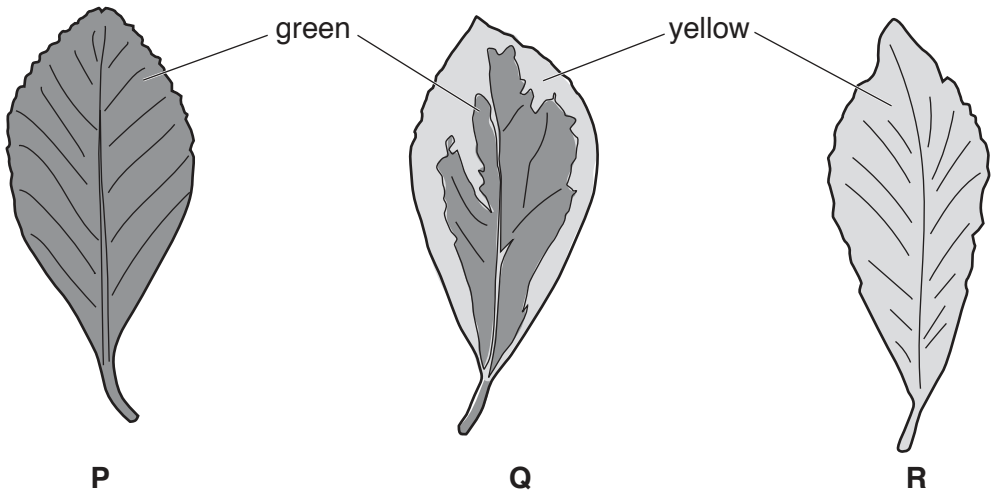

Fig. 1.1

(i) The leaves in Fig. 1.1 are all tested for the presence of starch. **P**, **Q** and **R** are found to contain different amounts of starch.

Use Fig. 1.1 to place the leaves **P**, **Q** and **R** in order of the amount of starch they contain.

..... highest amount of starch

.....

.....

lowest amount of starch [1]

(ii) Explain your answer to **(i)**.

.....

.....

.....[2]

(c) The word equation for photosynthesis is shown.

carbon dioxide + water ⟶ glucose + oxygen

Describe how carbon dioxide and water enter a plant.

carbon dioxide .....

.....

.....

water .....

.....

.....

[4]

(d) A student made the following statement.

'Plants carry out respiration in their cells **only** when it is dark.'

(i) State whether you agree with the student's statement **and** explain your decision.

.....

.....[1]

(ii) State **one** use of the energy released by respiration in plants.

.....[1]

2 **(a)** A student investigates the reactivity of four different metals.

She places pieces of calcium, copper, iron and zinc separately in dilute hydrochloric acid, as shown in Fig. 2.1.

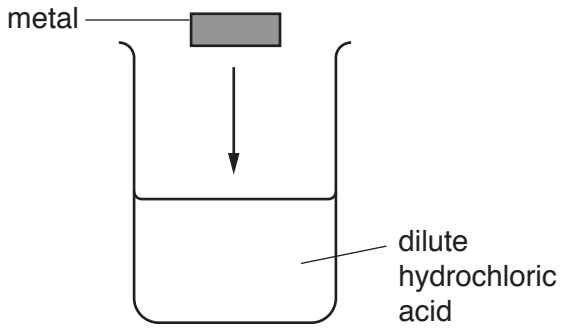

Fig. 2.1

(i) Place these four metals in order of reactivity, from most to least reactive.

..... most reactive

.....

.....

..... least reactive

[2]

(ii) Suggest what happens to the pH number of the acid when it reacts with a piece of metal.

.....[1]

(b) Excess magnesium powder reacts with dilute hydrochloric acid.

During this reaction, a gas and aqueous magnesium chloride solution are produced.

(i) Name this gas.

.....[1]

(ii) State how the unreacted solid magnesium can be removed from the reaction mixture.

.....[1]

(iii) State how solid magnesium chloride can be obtained from magnesium chloride solution.

.....[1]

(c) An atom of an isotope of magnesium is represented by:

$$^{25}_{12}Mg$$

(i) State the atomic number and the mass number of this atom.

atomic number .....

mass number .....

[1]

(ii) State the number of neutrons in this atom.

..... [1]

(d) Aluminium is used in overhead power cables.

Aluminium alloys are used in aircraft bodies.

(i) State the physical property of aluminium that makes it suitable for use in power cables.

.....[1]

(ii) Explain why aluminium alloys, rather than pure aluminium, are used in aircraft bodies.

.....[1]

[Turn over

3 Fig. 3.1 shows an airship carrying a heavy load.

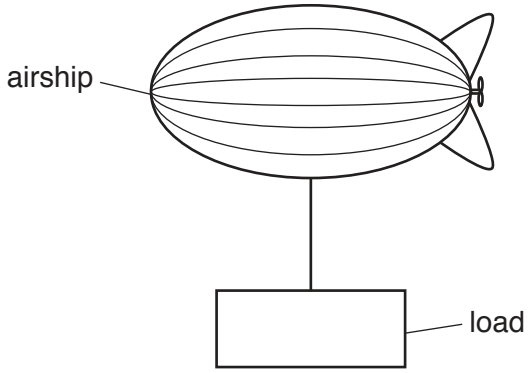

Fig. 3.1

(a) The airship and load are floating above the ground.

(i) On Fig. 3.1 draw **two** force arrows to show the vertical forces acting on the load. [2]

(ii) At one point in its journey, the airship is moving and all the forces acting on the airship are balanced.

Describe the motion of the airship at this time.

.....

.....[1]

(iii) Name the unit of force.

.....[1]

(b) Fig. 3.2 shows a speed-time graph for part of the journey of the airship.

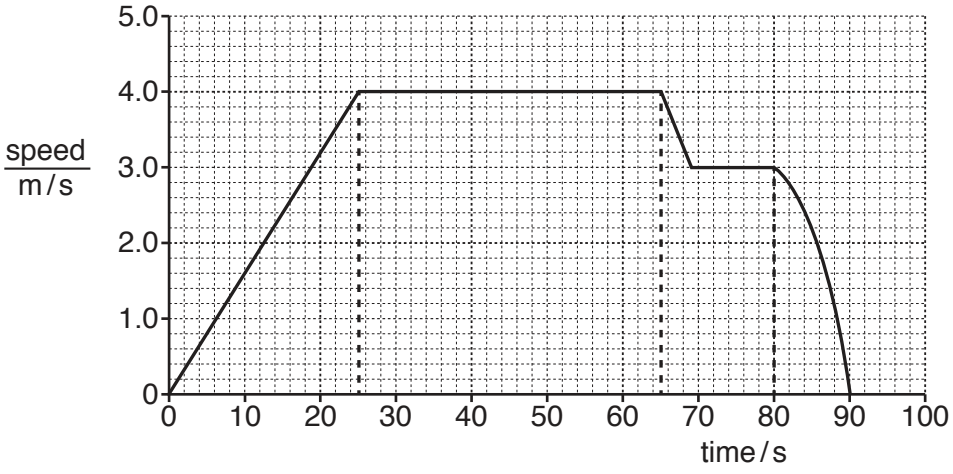

Fig. 3.2

(i) State the speed of the airship at 70 s.

..... m / s [1]

(ii) Use terms from this list to complete the statements below.

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

constant speed **decreasing speed** **increasing speed**

Between 0 s and 25 s the airship travels with ..... .

Between 25 s and 65 s the airship travels with ..... .

Between 80 s and 90 s the airship travels with ..... .

[1]

(c) The load is a solid metal cube of density 7000 kg / m^3. Each side of the cube measures 0.50 m.

(i) Calculate the volume of the metal cube.

Show your working.

volume = ... m^3 [1]

(ii) Calculate the mass of the metal cube.

State the formula you use and show your working.

formula

working

mass = ... kg [2]

4 **(a)** Fig. 4.1 shows apparatus which is used to compare the carbon dioxide content of inspired air with expired air.

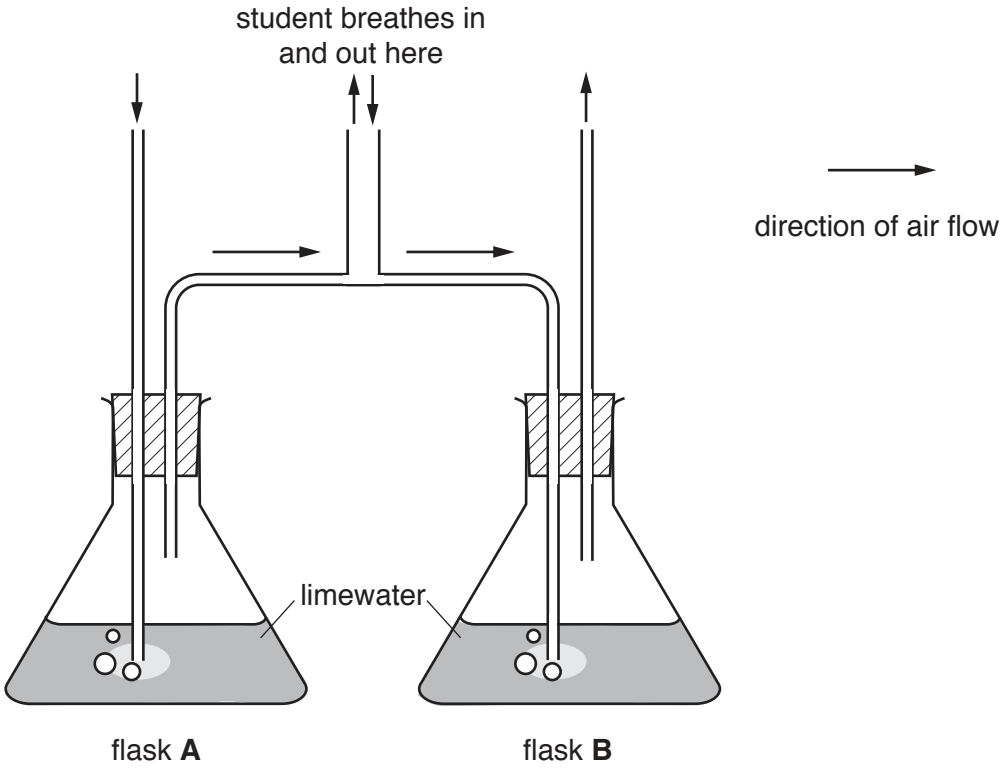

Fig. 4.1

The apparatus is designed so that **only** inspired air goes through flask **A** and **only** expired air goes through flask **B**.

A student breathes in and out of the apparatus until the limewater turns milky in one of the flasks.

Complete the sentences.

The limewater turns milky in flask ..... because .....

..... .

There is no change in the other flask because .....

..... .

[2]

(b) Complete Table 4.1 with **more**, **less** or **the same** to show how the composition of expired air differs from the composition of inspired air.

Table 4.1

component of air	change
oxygen	
nitrogen	
water vapour	

[3]

(c) An athlete is preparing to run a race. The concentration of adrenaline in his blood increases.

(i) Complete the following sentence about adrenaline.

Adrenaline is a ..... which is produced by the adrenal glands and carried by the blood. [1]

(ii) Describe **two** effects of the increase in adrenaline concentration in the athlete's blood.

1. .....

2. .....

[2]

(iii) The concentration of adrenaline in the athlete's blood falls after the race.

Describe how this happens.

.....

.....[1]

5 **(a)** The process used to produce refinery gas, gasoline and gas oil from petroleum is shown in Fig. 5.1.

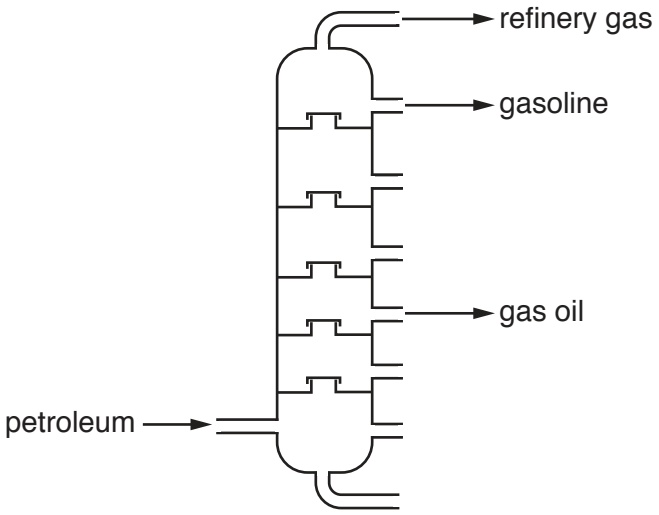

Fig. 5.1

(i) Name this process.

.....[1]

(ii) The petroleum is changed in this process. No new chemicals are made.

Name this type of change.

.....[1]

(iii) Petroleum is a mixture of different compounds.

State what is meant by the terms *mixture* and *compound*.

mixture .....

.....

.....

compound .....

.....

.....
[2]

(b) Refinery gas contains ethane, C_2H_6, a hydrocarbon.

(i) A molecule of ethane contains covalent bonds.

Explain how covalent bonds form between non-metallic elements.

Use ideas about electrons in your answer.

.....

.....[1]

(ii) When ethane burns, water is formed.

Describe a chemical test and the positive result for water.

test .....

result .....
[2]

(iii) When ethane burns, there is a temperature increase.

Identify the type of chemical reaction that produces a temperature increase.

.....[1]

6 Fig. 6.1 shows a man watching television. He changes the channel with a remote control. The channel he now watches shows a hot-air balloon high in the sky.

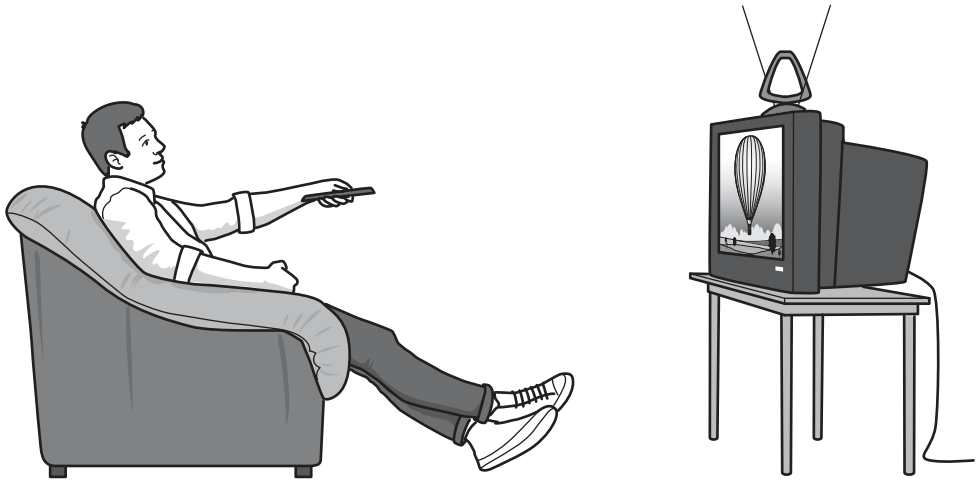

Fig. 6.1

(a) Fig. 6.2 shows an incomplete electromagnetic spectrum.

On Fig. 6.2 write in their correct boxes the names of the parts of the electromagnetic spectrum used for

- television transmission,
- changing the channel,
- watching the television.

Draw a line to link each use to the correct part of the spectrum you have named. One line has been completed for you.

gamma rays	X-rays	ultraviolet			microwaves	

changing television channel

watching the television

television transmission

Fig. 6.2 [3]

(b) Fig. 6.3 shows a hot-air balloon being prepared for flight. A fuel burner produces hot gases. The balloon fills with the hot gases and the balloon rises up into the air.

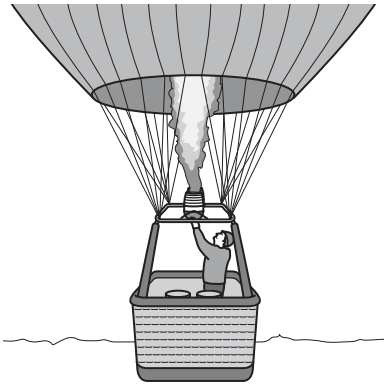

Fig. 6.3

(i) State the name of the method of thermal energy transfer from the fuel burner upwards into the balloon.

.....[1]

(ii) When the balloon has been filled with hot gases, it rises up into the air.

Explain why the fuel burner has to be used again at intervals to keep the balloon fully inflated with hot gases.

.....

.....

.....[2]

(iii) Complete the following sentences about the energy changes that occur.

As the fuel burns, the stored ..... energy

in the fuel changes into thermal energy in the gases produced.

As the balloon rises, it gains ..... energy.

[2]

(iv) Explain why people in the basket underneath the balloon can feel the heat from the fuel burner as the fuel burns.

.....

.....[1]

7 **(a)** Fig. 7.1 shows a food web in a garden.

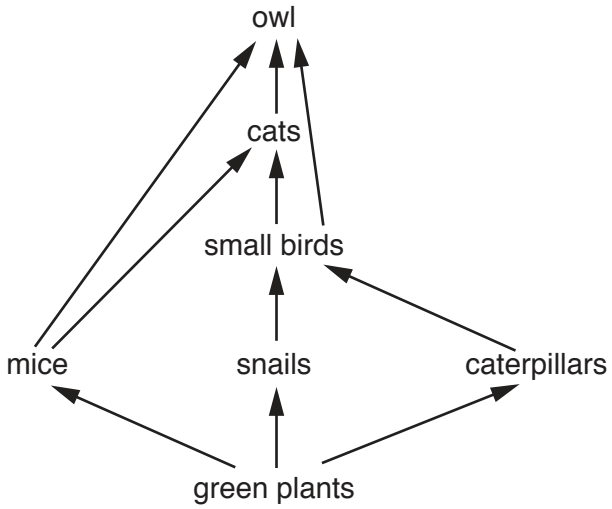

Fig. 7.1

(i) Use Fig. 7.1 to name

the producer,

.....

the herbivores.

.....

[2]

(ii) Using information in Fig. 7.1 draw a complete food chain consisting of **only three** organisms.

[2]

(b) The caterpillars in the food web in Fig. 7.1 are only present in the garden for three months of the year.

Suggest **and** explain the effect of the disappearance of caterpillars on the number of snails.

.....

.....

[1]

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8 **(a)** The electrolysis of aqueous copper chloride is shown in Fig. 8.1.

Copper forms on electrode **P**.

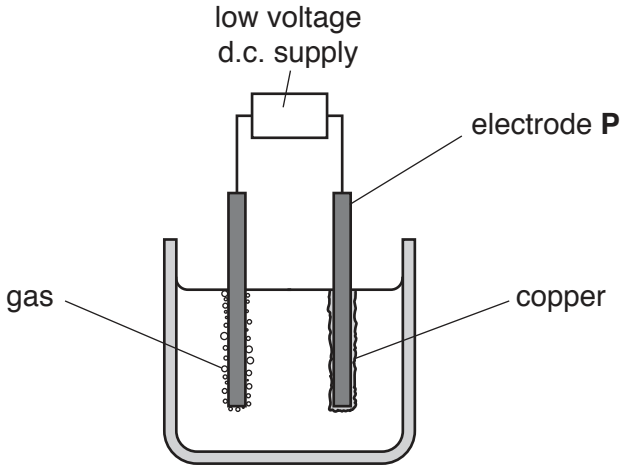


Fig. 8.1

(i) Predict the type of bonding between the particles in solid copper chloride.

.....[1]

(ii) Copper chloride is produced when one atom of copper reacts with two atoms of chlorine.

Predict the formula of this compound.

..... [1]

(iii) Name electrode **P**.

.....[1]

(iv) Name the gas that forms at the other electrode.

.....[1]

(b) Copper compounds are used as catalysts.

(i) Describe what is meant by a *catalyst*.

.....

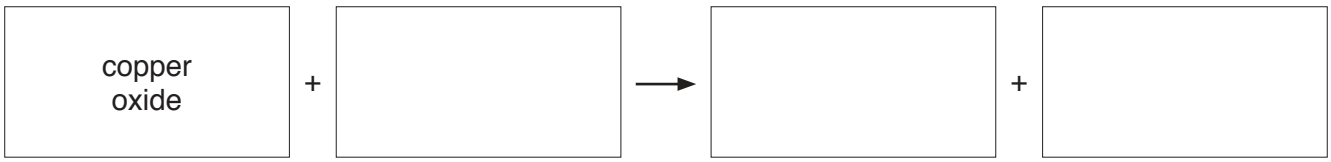
.....[1]

(ii) State the name of the collection of metals in the Periodic Table that includes copper.

.....[1]

(c) Copper is extracted from copper oxide by heating it with carbon.

(i) Complete the word equation for this reaction.



[2]

(ii) Explain why this reaction is described as a *redox* reaction.

.....

.....[1]

9 Fig. 9.1 shows a small electric cooker with two hot plates.

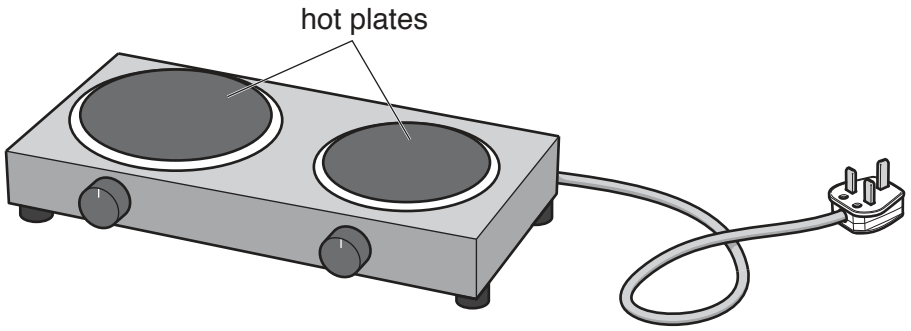


Fig. 9.1

The cooker is connected to a 240 V supply.

Each hot plate is controlled by a switch and a variable resistor.

Each hot plate can be turned on and off and controlled without affecting the other hot plate.

(a) (i) In Table 9.1 draw the circuit symbols for each component used in the cooker circuit.

Table 9.1

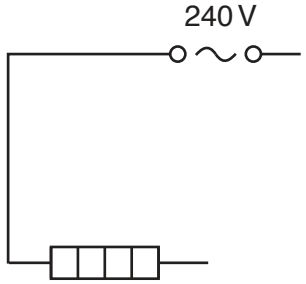
component	fuse	switch	variable resistor
symbol			

[2]

(ii) The two hot plates are connected in parallel, so that each can be controlled separately by a switch and a variable resistor. The whole cooker circuit is protected by a fuse.

The circuit symbol for a heater in the hot plate is: 

Complete the circuit diagram for the cooker, which has been started for you.



[4]

(b) For this question you may assume that the resistance of each variable resistor in the circuit is zero and can be ignored.

(i) The large hot plate has a resistance of 40 Ω, and the small hot plate has a resistance of 60 Ω.

Draw a circle around the correct value for the combined resistance of the two hot plates.

24 Ω 50 Ω 72 Ω 100 Ω

[1]

(ii) Use your chosen answer in **(i)** to calculate the current from the supply when both hot plates are switched on.

State the formula you use and show your working.

formula

working

current = ...A [2]

The Periodic Table of Elements

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

Key

atomic number
atomic symbol
name
relative atomic mass

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

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