Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

* 9 7 3 5 6 4 9 8 4 6 *

COMBINED SCIENCE **0653/21**

Paper 2 (Core) **May/June 2014**

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 **24** printed pages.

1 **(a)** Fig. 1.1 shows an experiment to compare how three metals react with dilute hydrochloric acid.

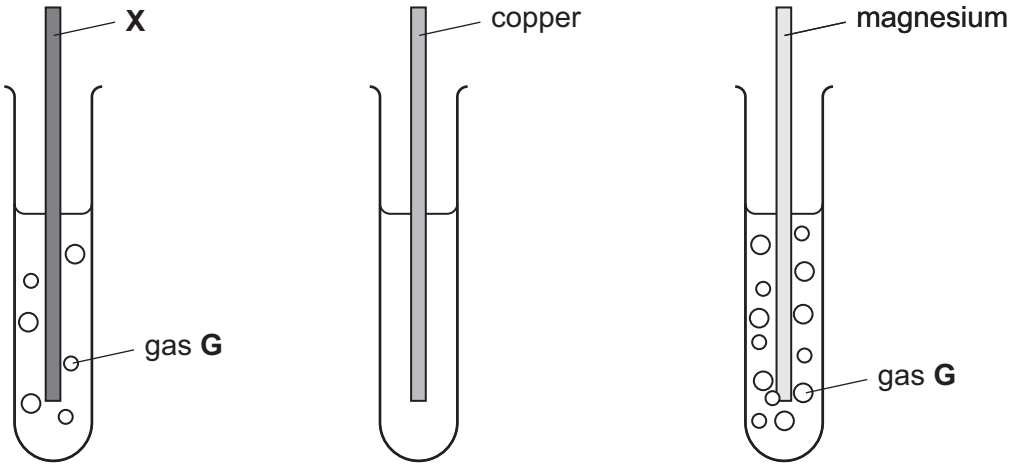

Fig. 1.1

In two of the test-tubes, bubbles of a gas **G** are produced. Gas **G** is an element.

(i) State the name of gas **G**. ..... [1]

(ii) Describe a test for gas **G**.

test .....

result .....

..... [2]

(iii) List the four elements **X**, copper, magnesium and **G** in order of reactivity.

most reactive .....

.....

.....

least reactive ..... [2]

(iv) Suggest the identity of metal **X**. ..... [1]

(b) Fig. 1.2 shows how a teacher could use a Bunsen burner to heat a mixture of carbon and copper oxide until it starts to glow.

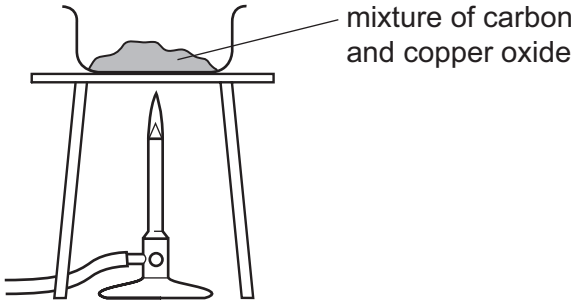

Fig. 1.2

The mixture glows even more brightly for some time after the burner is removed.

Carbon has reduced copper oxide to copper.

(i) State what is meant by the term *reduced.*

.....

..... [1]

(ii) Name the other product that is formed in this reaction.

..... [1]

(c) Lead can be produced from molten lead bromide using electrolysis, as shown in Fig. 1.3.

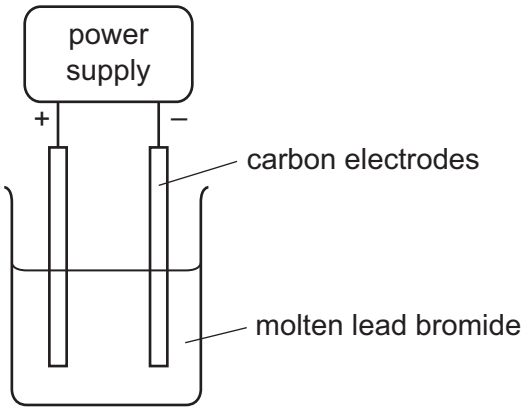

Fig. 1.3

(i) Mark, with the letter **P** and a label line, the position on the diagram where lead first appears after the circuit is connected. [1]

(ii) Name the other element that is formed during the electrolysis.

..... [1]

2 Fig. 2.1 shows a food web of the organisms in a woodland containing oak trees.

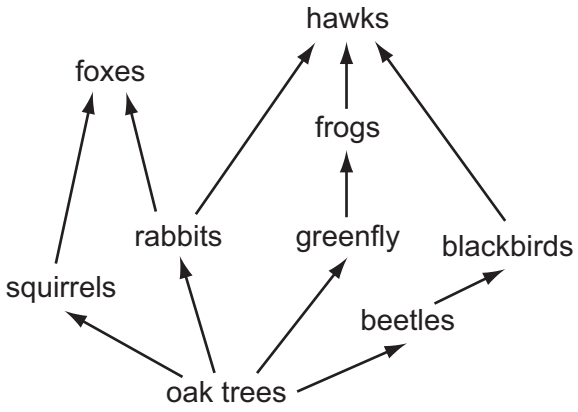

Fig. 2.1

(a) State the source of energy for this food web.

.....

[1]

(b) From the food web, name

(i) **one** producer,

.....

[1]

(ii) **one** herbivore.

.....

[1]

(c) The food web is a network of interconnected food chains.

One food chain in Fig. 2.1 with three stages is shown.

oak tree → rabbit → hawk

Write down a food chain from Fig. 2.1 which has four stages.

[2]

(d) The oak trees are cut down.

Suggest **two** possible effects this could have on the organisms in the food web.

1 .....

.....

2 .....

..... [2]

(e) Describe how the concentration of carbon dioxide in the atmosphere may change as the result of the oak trees being cleared from the woodland.

Explain why this happens.

.....

.....

..... [2]

3 Fig. 3.1 shows a small torch (flashlight). The torch contains cells (batteries), a lamp and a switch.

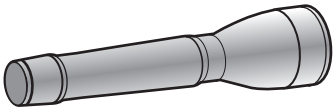

Fig. 3.1

(a) Draw a circuit diagram for the torch using standard circuit symbols.

[2]

(b) Fig. 3.2 shows a cell and lamp taken from the torch.

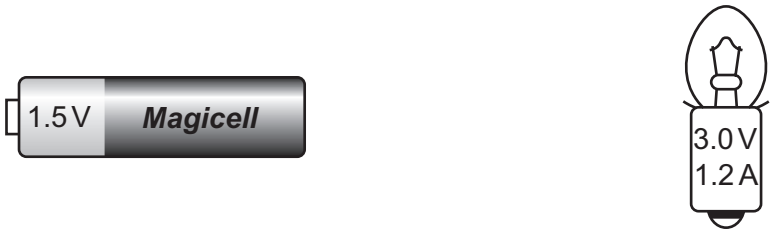

Fig. 3.2

(i) State how many cells are needed to light up this lamp. Give a reason for your answer.

number of cells needed .....

reason .....

..... [1]

(ii) State what is meant by the quantity *1.2 A* on the lamp.

.....

..... [1]

(c) After a long time in use with the same cells, the torch lamp becomes less bright.

A student says that this is because the cell is running out of energy.

Draw a circuit, including an ammeter and a voltmeter, that could be used to test this.

[2]

4 **(a)** Petroleum (crude oil) is a fossil fuel consisting of a mixture of different hydrocarbons.

Fig. 4.1 shows the industrial apparatus used to separate useful products from petroleum.

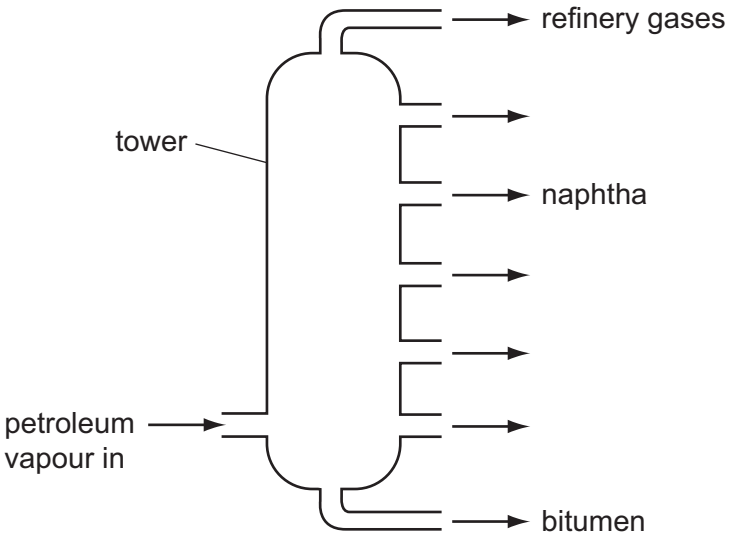

Fig. 4.1

Petroleum is vaporised and passed up a tower. Useful products from petroleum condense at different positions in the tower.

(i) State the name of the process shown in Fig. 4.1.

.....

[1]

(ii) Different products from this process have different boiling point ranges.

State how the boiling point of a product affects the position in the tower where a product will condense.

.....

.....

[1]

(iii) Three of the useful products obtained from petroleum are shown in Fig. 4.1.

State the name of **another** useful product that is separated from petroleum.

State **one** use of this product.

name of product .....

use .....

.....

[2]

(b) Table 4.1 contains some information about gases in the Earth's atmosphere.

Table 4.1

gases in the Earth's atmosphere	percentage
carbon dioxide	very small
nitrogen	
oxygen	
other gases	about 1%
water vapour	variable

Complete Table 4.1 to show the percentages of nitrogen and oxygen in the atmosphere. [2]

(c) Natural gas is a fossil fuel consisting mostly of methane. It is used as a fuel to heat a greenhouse for growing vegetables.

(i) Describe the changes to the atmosphere in a greenhouse that will occur.

.....

.....

..... [2]

(ii) Burning methane is an exothermic chemical change.

State the meaning of

exothermic,

.....

.....

chemical change.

.....

.....

[2]

5 **(a)** A boy looks at himself in a mirror and waves his hand. Fig. 5.1 shows what he sees in the mirror.

Fig. 5.1

Which hand is he waving?

Explain your answer.

.....

..... [1]

(b) The boy uses headphones to listen to the radio.

(i) State the useful energy transformation that occurs in his headphones.

from ..... energy to ..... energy [1]

(ii) The radio emits sounds with frequencies between 100 Hz and 10 000 Hz.

Explain why the boy is able to hear all the sounds emitted through the headphones. The boy has normal hearing.

.....

..... [1]

(c) The boy swims in an outdoor swimming pool. He swims one length of the 25 metre long pool in 40 seconds.

(i) Calculate his speed.

State the formula you use, show your working and state the units of your answer.

formula

working

speed = ... units ..... [3]

(ii) Fig. 5.2 shows two forces, the driving force and the frictional force, acting on the boy as he swims.

Fig. 5.2

The boy exerts a driving force of 100 N and swims at a constant speed.

Deduce the value of the frictional force and explain your reasoning.

The frictional force is ..... N

because .....

..... [1]

Fig. 5.3 shows waves created by a wind blowing at constant speed across the water in the pool.

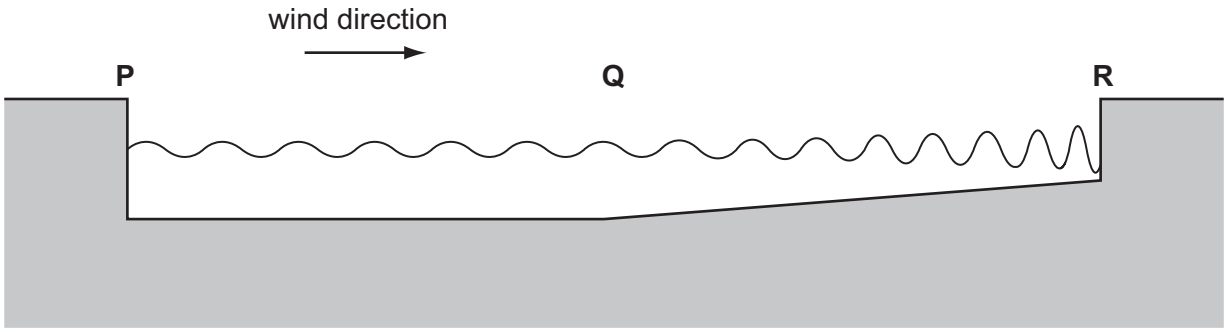

Fig. 5.3

(iii) On Fig. 5.3, mark clearly and label **one** complete wavelength of the wave motion between **P** and **Q**. [1]

(iv) As the water in the pool gets shallower between **Q** and **R**, the wavelength becomes shorter.

Use Fig. 5.3 to state **one** property of the wave motion that **increases** between **Q** and **R**.

..... [1]

(d) The boy switches on a television set using a remote control.

Fig. 5.4 shows some of the parts of the electromagnetic spectrum.

In the correct blank box on Fig. 5.4, write the name of the part of the spectrum used by the remote control.

	X-rays		visible light		microwaves	

Fig. 5.4

[2]

Please turn over for Question 6.

6 Fig. 6.1 shows part of the human life cycle. The cells are not drawn to scale.

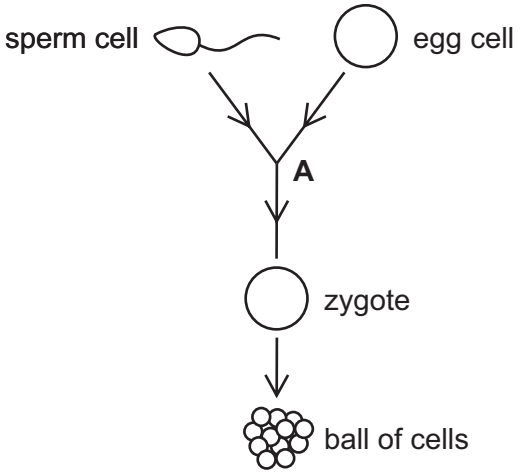

Fig. 6.1

(a) From Fig. 6.1

(i) name a diploid cell, ... [1]

(ii) State the term to describe what happens at **A**.

..... [1]

(b) Cell division of the zygote produces a ball of cells.

Describe in detail where in the female reproductive system this ball of cells is positioned for the next stage of development.

.....

..... [2]

(c) Table 6.1 summarises some of the nutrients contained in 100 g of milk.

Table 6.1

nutrient	mass in milk sample
protein	1.2 g
fat	3.8 g
carbohydrate	7.6 g
vitamin C	3.9 mg
calcium	33.0 mg

Name **one** vitamin, present in milk but not included in Table 6.1, which is essential for healthy growth of the baby and describe the function of this vitamin in the body.

vitamin .....

.....

function ..... [2]

(d) Energy is released from milk by respiration.

1 g of fat releases 37 kJ of energy.

Use the information about milk in Table 6.1 to calculate how much energy can be released from the fat in the 100 g sample of milk.

Show your working.

energy = ... kJ [2]

7 **(a)** Table 7.1 shows some of the properties of the halogens in Group VII of the Periodic Table.

Table 7.1

period	halogen	colour	physical state at room temperature
3	chlorine	pale yellow-green	gas
4	bromine	dark red-brown	liquid
5	iodine	blue-black	solid

Describe **one** trend in the physical properties of chlorine, bromine and iodine.

.....

..... [1]

(b) **(i)** A dilute solution of chlorine is added to a colourless solution of potassium bromide.

Describe what is seen.

..... [1]

(ii) Write a **word** equation for this reaction.

[ ] + [ ] → [ ] + [ ]

[2]

(c) Fig. 7.1 shows the arrangement of the outer electrons of the atoms in a chlorine molecule, Cl_2.

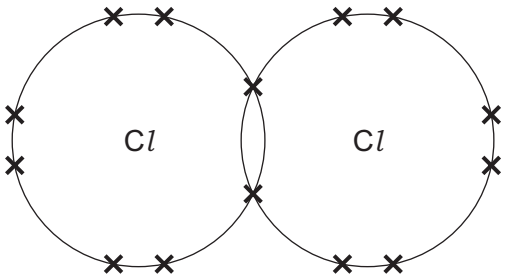

Fig. 7.1

State the name of this type of bonding. ..... [1]

(d) Chlorine is used in the purification of the public water supply.

Explain why chlorine is added to water supplied to homes.

.....

.....

..... [2]

8 Fig. 8.1 shows a simple type of air conditioner called a 'swamp cooler' that is used in buildings in dry desert places.

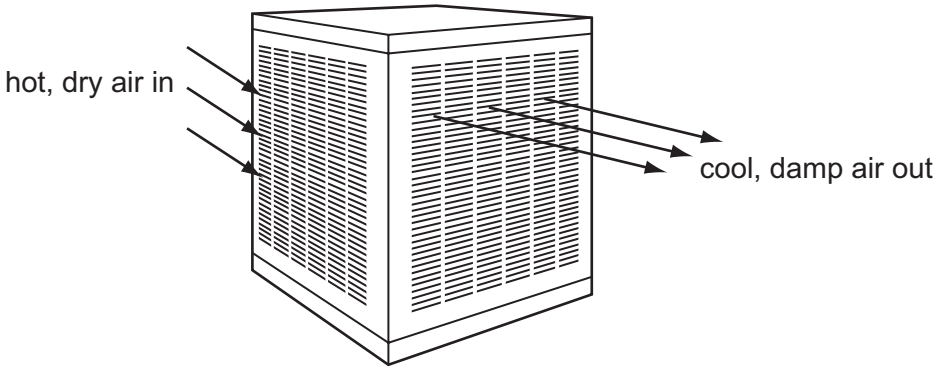

Fig. 8.1

Hot dry air is blown by a fan over the surface of water in a metal container. The hot dry air evaporates some of the water. The air coming out of the swamp cooler is cool and damp.

(a) The boxes in Fig. 8.2 show different ways in which atoms and molecules may be arranged in different situations.

Three materials found in the swamp cooler are air, metal and water.

Draw lines from the materials in the left column to the correct arrangement of atoms or molecules for each material in the right column. One has been done for you.

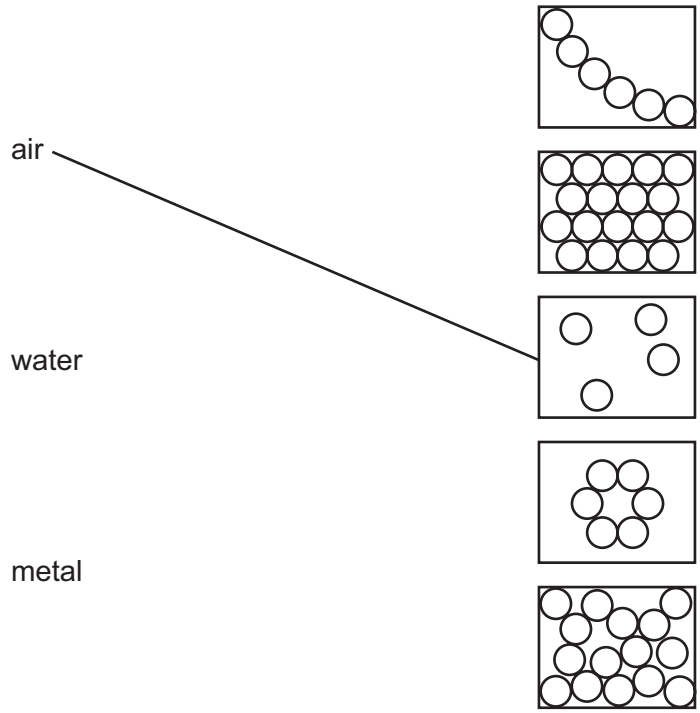

Fig. 8.2

[2]

(b) (i) Explain, referring to molecules of water, why evaporation of water cools the remaining water.

.....

.....

..... [2]

(ii) Describe how the water cools the hot air.

.....

..... [1]

(c) In buildings in hot desert countries, where days are hot and nights can be very cold, windows with steel frames are often used.

Fig. 8.3 shows how a space is left between the steel frame and the mudbricks of the surrounding wall.

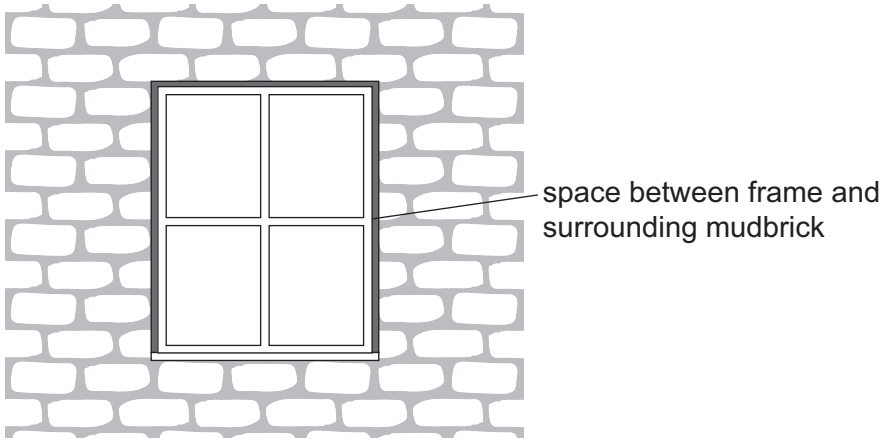

Fig. 8.3

Explain why it is necessary to leave this space between the window frame and the mudbricks.

.....

..... [1]

(d) A mudbrick is 30 cm long, 15 cm wide and 10 cm thick, and has a mass of 7 500 g.

(i) Calculate the volume of the mudbrick in cubic centimetres.

..... cm^3 [1]

(ii) Calculate the density of the mudbrick in g / cm^3.

State the formula that you use and show your working.

formula:

working

density = ... g / cm^3 [2]

Please turn over for Question 9.

9 **(a)** Table 9.1 shows diagrams of two blood cells.

Complete Table 9.1 to show the names and functions of these cells. [4]

Table 9.1

diagram	name of cell	function of cell
		
		

(b) Fig. 9.1 is a flowchart to show the circulation of blood in the body.

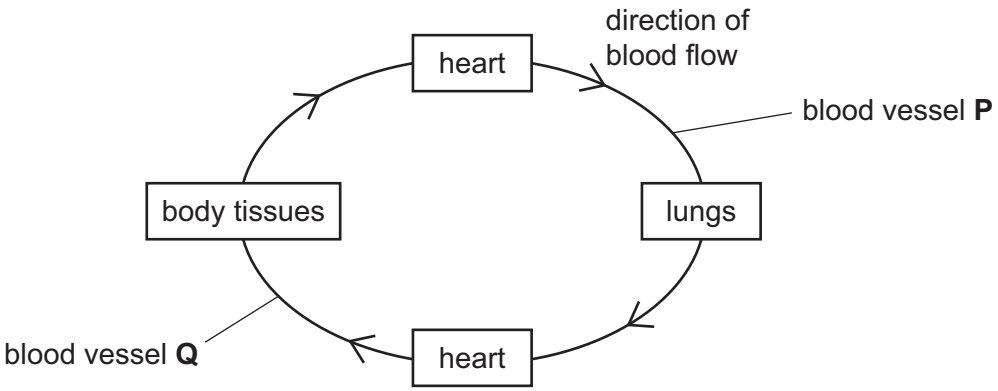

Fig. 9.1

Complete the paragraph using words or phrases from the list.

You may use each word or phrase once, more than once, or not at all.

aorta **body** **left** **lungs**
pulmonary artery **pulmonary vein** **right** **valves**

Blood leaves the ..... ventricle of the heart to go through blood vessel **P**, which is the ..... . It then goes to the lungs. There are ..... in the heart to make sure there is a one-way flow of blood. [3]

(c) The composition of blood changes as it flows through the tissues of the small intestine.

State

(i) **one** substance that **leaves** the blood as it flows through the tissues of the small intestine,

.....

[1]

(ii) **two** substances that **enter** the blood as it flows through the tissues of the small intestine.

.....

.....

[2]

DATA SHEET
The Periodic Table of the Elements

Group I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a X b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

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