UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7199395811

COMBINED SCIENCE **0653/03**

Paper 3 (Extended) **October/November 2008**

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 a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

For Examiner's Use	
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3	
4	
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7	
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Total	

This document consists of **18** printed pages and **2** blank pages.

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1 Fig. 1.1 shows a food web.

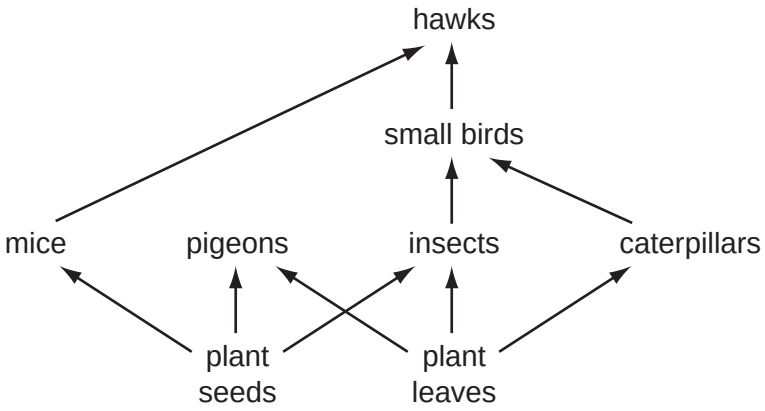

Fig. 1.1

(a) (i) State what the arrows in Fig. 1.1 represent.

.....

.....

..... [1]

(ii) The longest food chain in Fig. 1.1 has four organisms. Explain why it is rare for food chains to be longer than this.

.....

.....

.....

.....

..... [2]

(b) Describe how an atom of carbon in a glucose molecule in an insect could become part of a glucose molecule in a plant leaf.

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..... [4]

2 **(a)** Two inflated rubber rings, one black and one white, are left on a hot beach in the

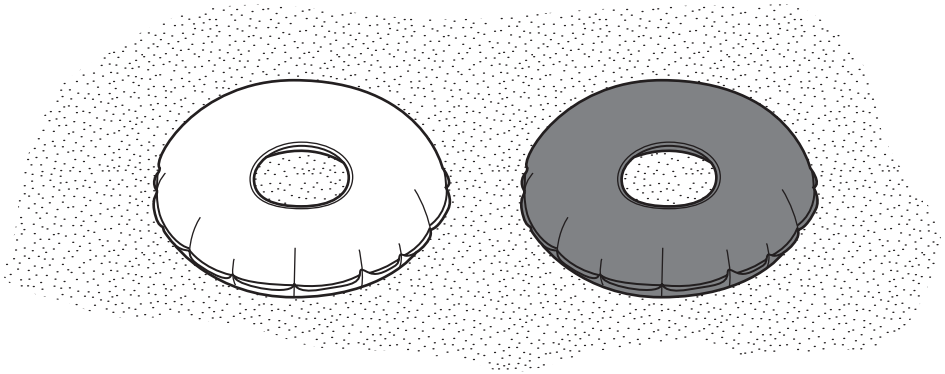

Fig. 2.1

Explain why the temperature of the air inside the black rubber ring rises more quickly than that in the white rubber ring.

.....

.....

..... [2]

(b) Someone has left a glass bottle on the beach. The curved glass acts like a lens focussing the sun's rays.

Complete the light rays on Fig. 2.2 to show what happens to rays of light after they have passed through a convex lens.

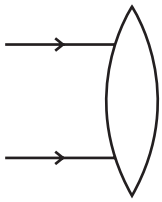

Fig. 2.2

[2]

(c) The power of the waves is used as a renewable source of energy.

Suggest how the motion of the waves can be converted to electrical energy.

.....

.....

..... [2]

(d) A girl collects two pebbles of the same size from the beach but one seems to be heavier than the other. How could she measure the densities of the two pebbles?

.....

.....

.....

..... [3]

3 The chemical symbol of magnesium is shown below.

$$^{24}_{12}\mathrm{Mg}$$

(a) Draw a labelled diagram of an atom of magnesium.

Your diagram should show the numbers of nucleons and the electron configuration.

[2]

(b) Magnesium is produced industrially by the electrolysis of molten magnesium chloride. Fig. 3.1 shows a simplified diagram of this process.

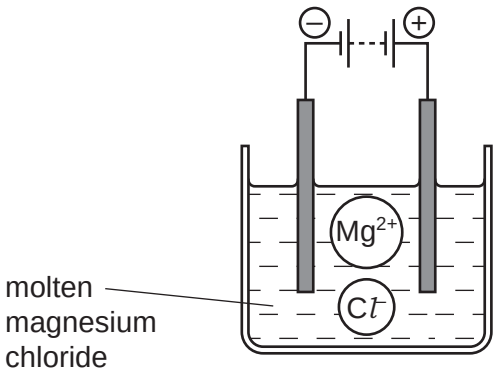

Fig. 3.1

(i) Describe, in terms of ions and electrons, what happens at the surface of the cathode.

.....

.....

..... [2]

(ii) Use the information in Fig. 3.1 to explain why the chemical formula of magnesium chloride is $MgCl_2$.

.....

..... [1]

(c) A student added magnesium to dilute hydrochloric acid as shown in Fig. 3.2.

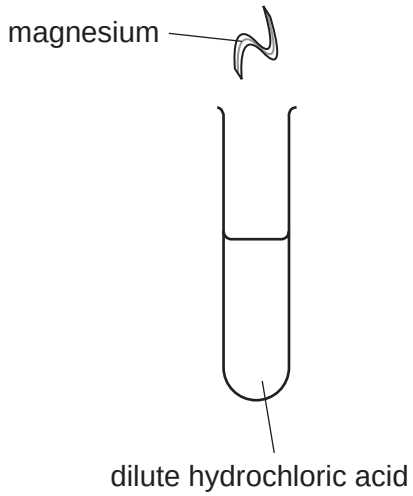

Fig. 3.2

(i) Explain, in terms of electrons, why the magnesium atoms in the reaction in Fig. 3.2 are said to be oxidised.

.....

.....

..... [2]

(ii) Explain, in terms of ions, why the pH of the mixture in Fig. 3.2 increases when magnesium is added to the acid.

.....

.....

..... [2]

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4 Fig. 4.1 shows part of the male reproductive system.

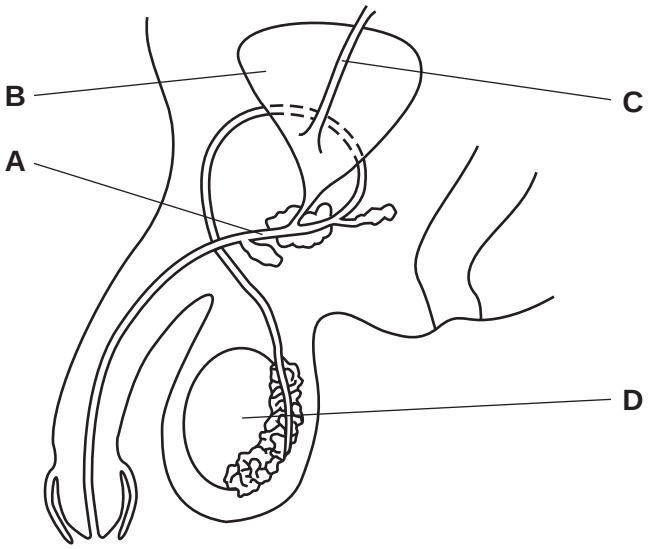

Fig. 4.1

(a) (i) Name the parts labelled **A** and **B**.

A .....

B ..... [2]

(ii) Describe the functions of parts **C** and **D**.

C .....

.....

D .....

..... [2]

(iii) On Fig. 4.1, write the letter **X** to show the part of the reproductive system which is cut or tied when a man has a sterilisation operation. [1]

(b) Humans reproduce using sexual reproduction. Sexual reproduction produces offspring that are genetically different from each other and from their parents.

Explain how this can be an advantage to a species of organism.

.....

.....

.....

..... [3]

5 **(a)** Fig. 5.1 shows two cars **A** and **B**.

Car **A** produces exhaust gases which appear black. The exhaust gases from car **B** cannot be seen. Both cars have engines which use diesel (gas oil) which is a hydrocarbon fuel.

car **A** car **B**

Fig. 5.1

(i) Describe briefly how hydrocarbon fuels like diesel are obtained.

.....

.....

..... [2]

(ii) The formula of a typical molecule in diesel is $C_{13}H_{28}$.

Calculate the relative molecular mass, M_r, of $C_{13}H_{28}$.

Show your working.

..... [2]

(b) The energy needed to move cars is provided by the combustion of the fuel. Air is supplied to the engine for this combustion to occur.

Fig. 5.2 shows a bar chart of the main gases in a sample of dry air.

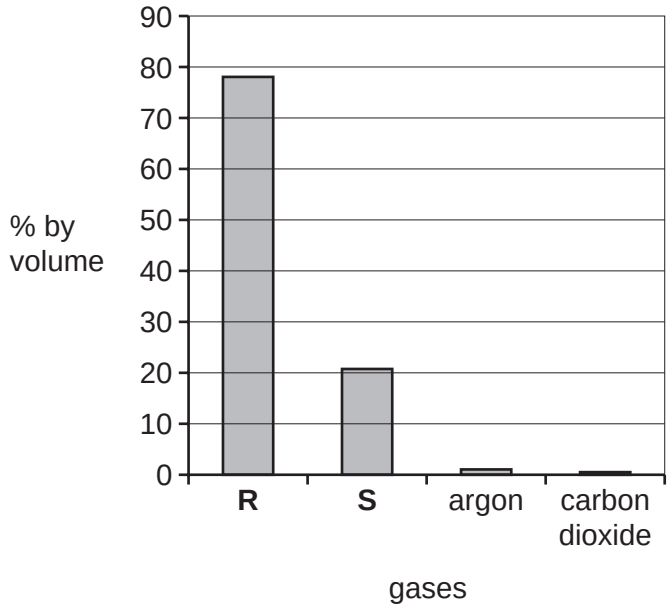

Fig. 5.2

(i) Explain which gas shown in Fig. 5.2 reacts with the diesel fuel in car engines.

.....

..... [1]

(ii) Suggest the name of the black substance in the exhaust gases of car **A** in Fig. 5.1, and explain briefly how it is formed.

.....

.....

..... [2]

(iii) Explain why car engines should never be left running for long periods of time in a garage or other enclosed space where there are people.

.....

.....

..... [2]

6 **(a)** The isotope radon–220 is radioactive. A sample was investigated to find its h
The activity of the isotope was measured every 30 seconds for 6 minutes. The re
are shown in Fig. 6.1.

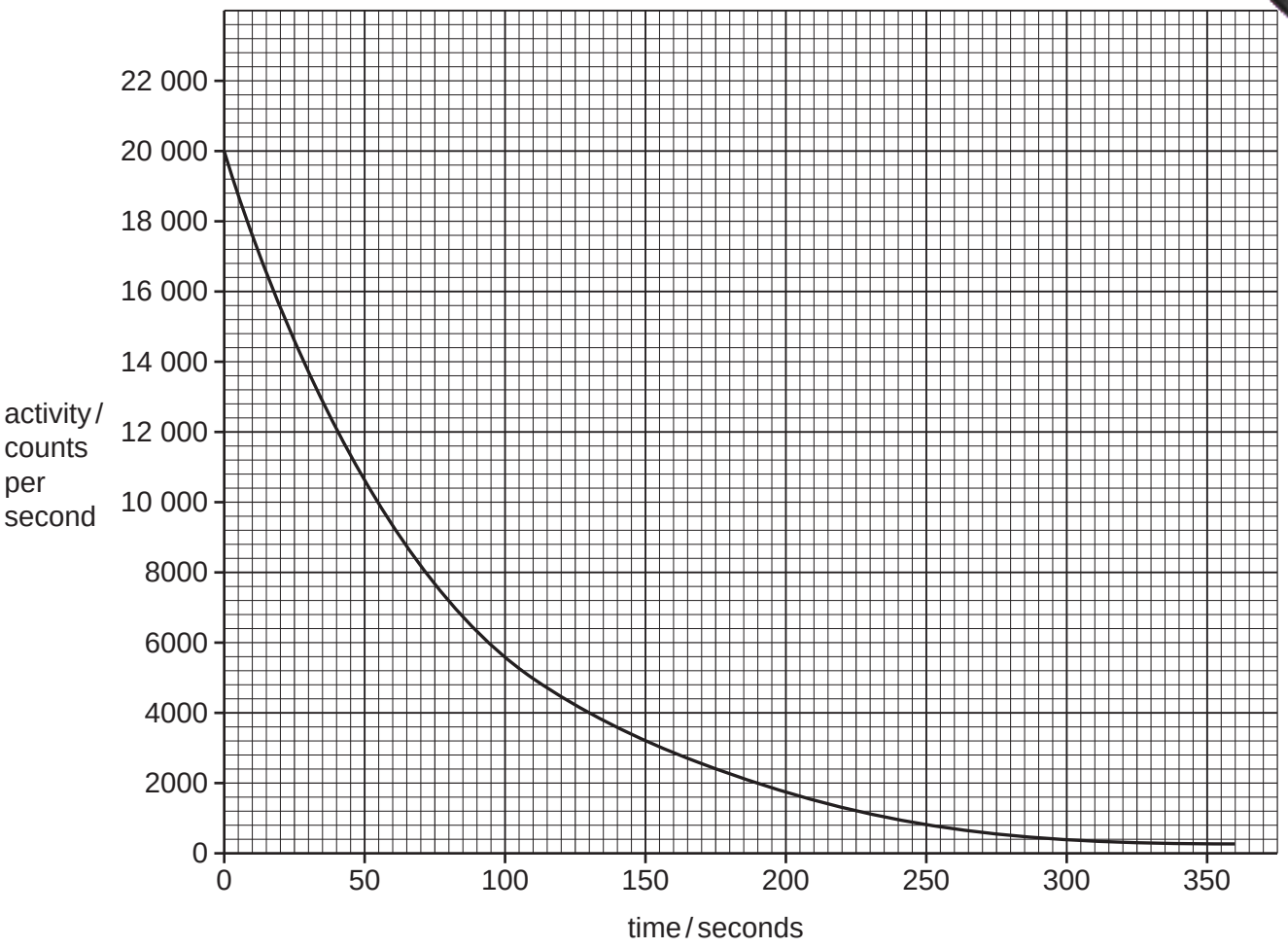

Fig. 6.1

Use the graph to calculate the half-life of the isotope. Show your working on the graph.

..... [2]

(b) There are several isotopes of radon.

State the meaning of the word *isotope*.

.....

..... [1]

(c) Radon-220 emits alpha radiation.

Explain why alpha radiation is dangerous to human beings.

.....

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.....

.....

.....

..... [4]

7 This article appeared in a newspaper in Pakistan in 2006.

> Many more people in Pakistan and India are developing diabetes. This is an illness where the regulation of blood glucose does not work properly. It is dangerous because rising levels of glucose in the blood can damage cells in many parts of the body, including the blood system and the eyes.
>
> Doctors think that the increase in diabetes is happening because people are eating more fast food. Where they used to eat a lot of rice and lentils, they are now eating more fried foods and greasy take-aways. As well as increasing the risk of diabetes, it is causing an increase in obesity. This also increases the risk of heart disease.

(a) The regulation of blood glucose is part of homeostasis.

Explain the meaning of the term *homeostasis*.

.....

..... [2]

(b) **(i)** Name the hormone that is produced when the blood glucose level rises, and which helps to bring it back down to normal.

..... [1]

(ii) Describe how the hormone reduces the amount of glucose in the blood.

.....

.....

..... [2]

(c) When a person with diabetes eats food containing sugar, the concentration of g
in their blood increases.

Using what you know about osmosis, explain how this might cause damage to body cells.

.....

.....

..... [2]

(d) **(i)** Suggest why eating foods containing a lot of fat, rather than eating lentils and rice, can lead to obesity.

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.....

..... [2]

(ii) Explain how a poor diet can increase the risk of a heart attack.

.....

.....

.....

..... [2]

8 **(a)** Fig. 8.1 shows part of the Periodic Table. The letters are **not** the chemical sym… elements.

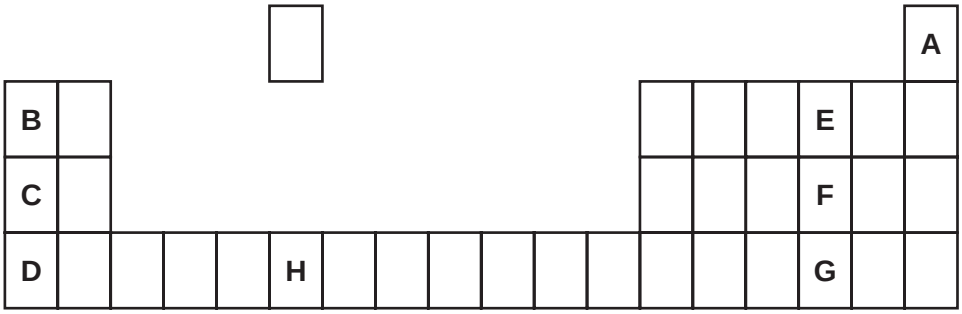


Fig. 8.1

Choose **one** of the letters from **A** to **H**, which shows

a metal which reacts vigorously with cold water .....

an element whose atoms have only one electron shell ..... [2]

(b) Calcium carbonate, $CaCO_3$, is an important compound used in many industries.

A student used the apparatus in Fig. 8.2 to investigate the thermal decomposition of calcium carbonate.

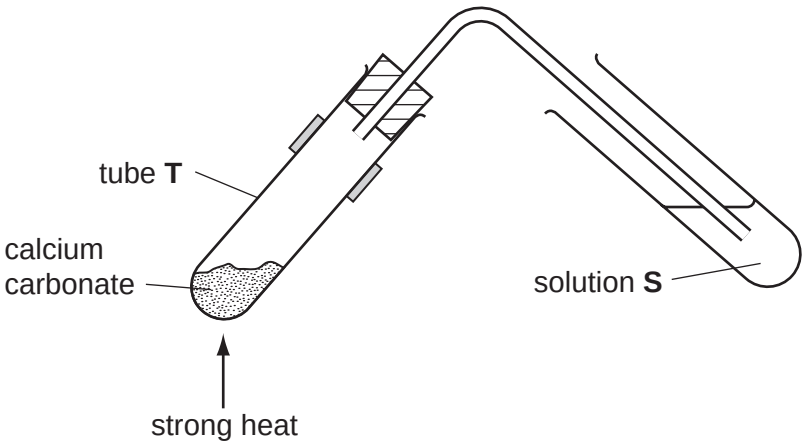


Fig. 8.2

(i) Write a word equation and a balanced symbolic equation for the reaction which occurs when calcium carbonate is heated strongly.

word equation

.....

symbolic equation

..... [3]

(ii) Name solution **S** in Fig. 8.2, and predict what would be observed during the reaction.

.....

..... [1]

(iii) Describe how the student could test the solid which remains in tube **T** to find out if all the calcium carbonate had reacted.

.....

.....

.....

..... [2]

(iv) Why are large amounts of calcium carbonate sometimes spread on soil which is going to be used for growing crops?

.....

..... [1]

9 **(a)** A student has six resistors as shown in Fig. 9.1.

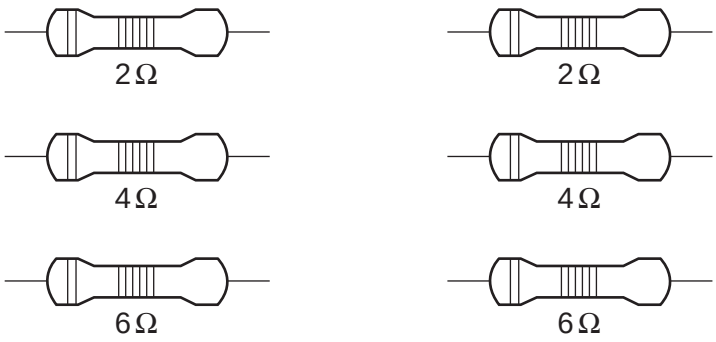


Fig. 9.1

(i) Describe how he can combine **two** of these resistors to get a total resistance of 10 ohms.

.....

..... [1]

(ii) Explain how he can combine **two** of these resistors to get a total resistance of three ohms.

.....

..... [3]

(b) Electricity can be generated by turning a coil of copper wire in a magnetic field.

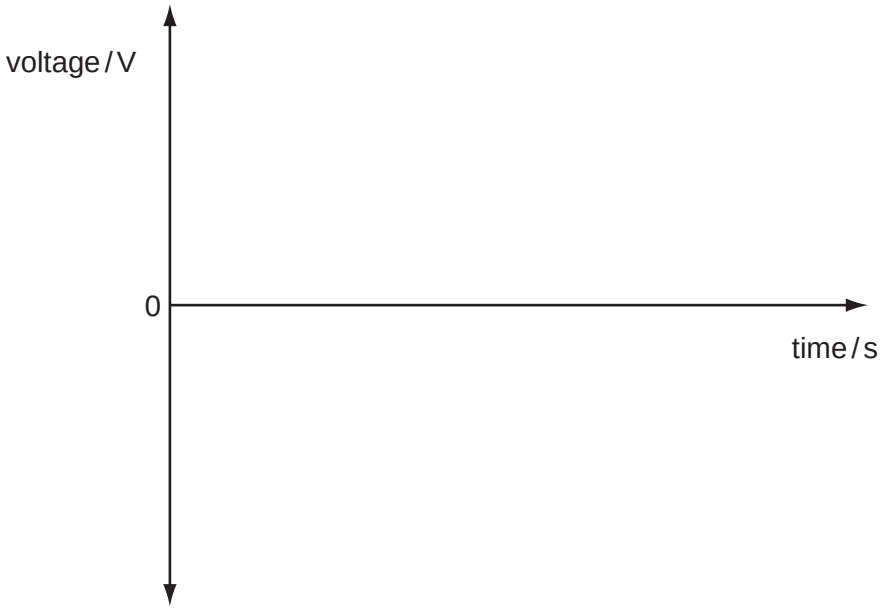
(i) Describe **two** ways to increase the voltage produced by this generator.

1 .....

2 ..... [2]

(ii) Generators can supply an alternating current which has a frequency of 50 Hz

On the grid below, sketch a graph to show the current produced by this alternating current generator during a period of 0.1 seconds.



[3]

(c) Electricity is often transmitted through overhead power cables hung from pylons. If these cables are put up on a hot summer day, they are hung loosely from the pylons as shown in Fig. 9.2.

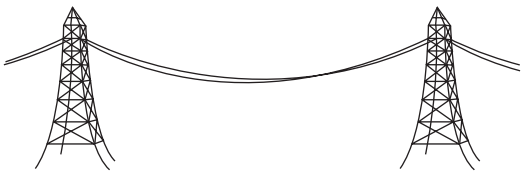


Fig. 9.2

Suggest why they are hung loosely.

.....

.....

..... [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** Sulphur 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.).