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| Centre Number | Candidate Number | Name |
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**COMBINED SCIENCE**

**0653/02**

Paper 2

May/June 2004

**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 in the spaces provided on the Question Paper.  
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.

Answer **all** questions.  
The number of marks is given in brackets [ ] at the end of each question or part question.  
A copy of the Periodic Table is printed on page 20.

| For Examiner's Use |  |
|--------------------|--|
| 1                  |  |
| 2                  |  |
| 3                  |  |
| 4                  |  |
| 5                  |  |
| 6                  |  |
| 7                  |  |
| 8                  |  |
| 9                  |  |

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

1 Fig. 1.1 shows three atoms, P, Q and R. These letters are **not** chemical symbols.

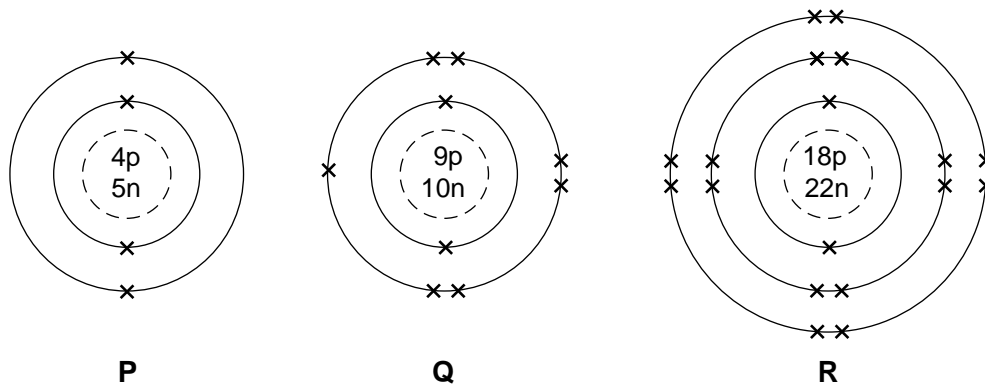
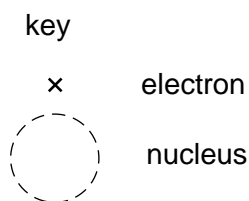


Fig. 1.1

(a) Which atom, P, Q or R,

has the full chemical symbol  ${}^{19}_9\text{F}$ , .....

is of an element in Group 2 of the Periodic Table, .....

gains one electron to form an ion? .....

[3]

(b) A mixture of hydrogen and oxygen in a test-tube explodes violently with a very loud bang if ignited.

A mixture of hydrogen and air in a test-tube explodes with a squeaky 'pop' if ignited.

(i) Suggest why the mixture of hydrogen and air explodes less violently.

.....  
.....  
..... [2]

(ii) Write a **word** equation for the reaction between hydrogen and oxygen.

..... [1]

3

2 (a) Fig. 2.1 shows an animal cell.

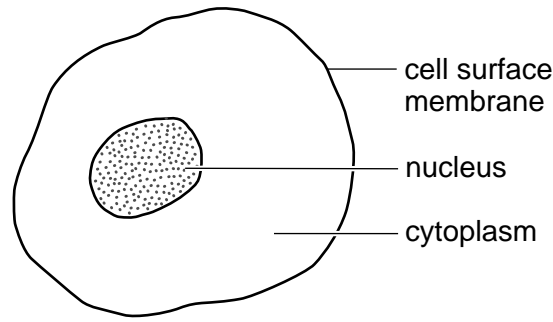


Fig. 2.1

Describe the function of the nucleus.

.....

.....

..... [2]

(b) Make a large, labelled diagram of a plant cell that could carry out photosynthesis.

[4]

(c) In photosynthesis, light energy is converted into chemical energy.

Using this information, and your own knowledge, explain why wood from trees is said to be a *renewable* fuel.

.....

.....

- 3 (a) Fig. 3.1 is a graph to show how much electrical power is generated by a wind-powered generator, when the wind is blowing.

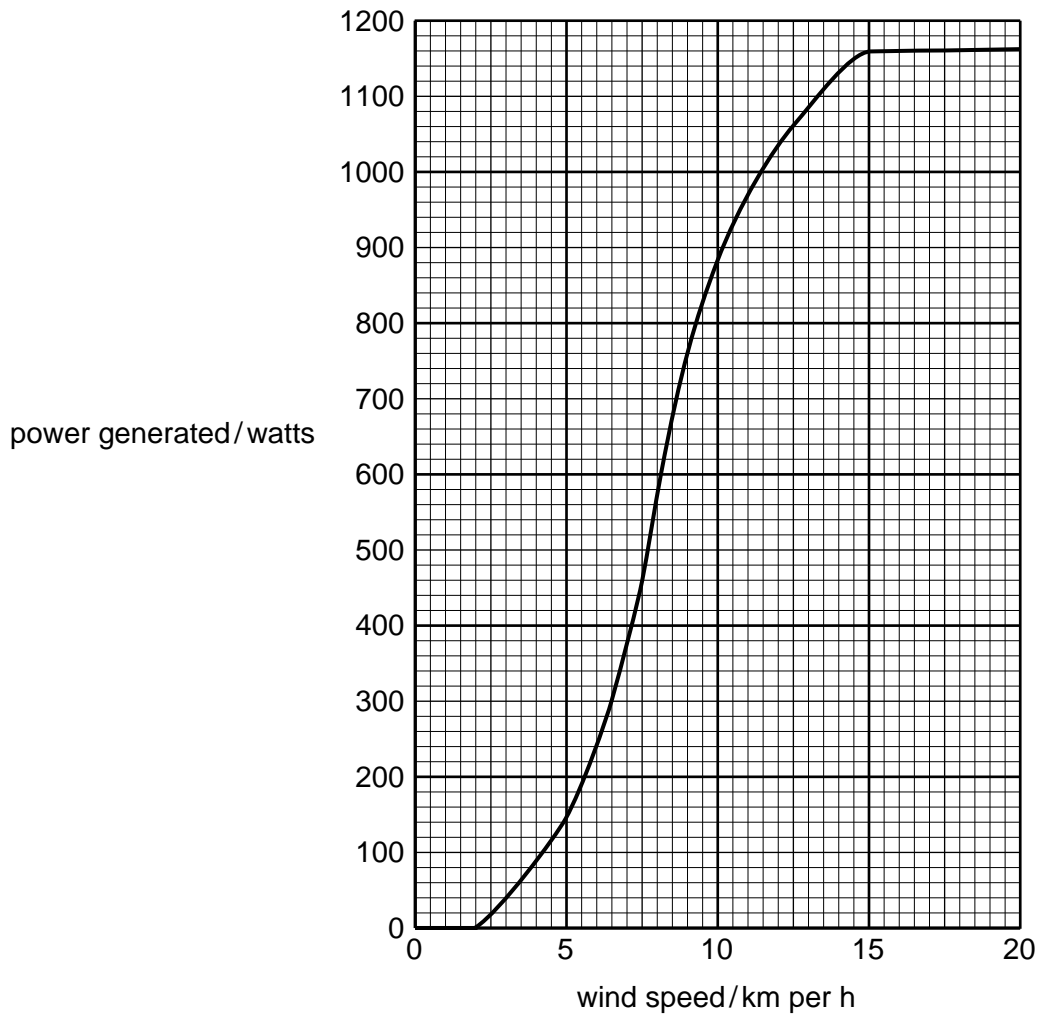


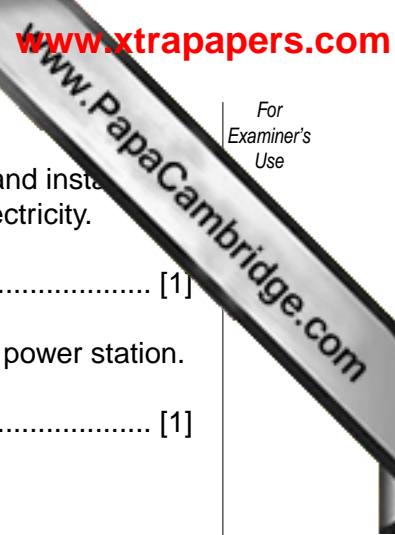
Fig. 3.1

(i) What is the lowest speed needed to generate any electrical power at all?  
 ..... km/h [1]

(ii) What is the lowest speed needed to generate the maximum power?  
 ..... km/h [1]

(b) Complete the sentence to show the energy transfer taking place in the wind-powered generator.

..... energy is transferred to ..... energy. [2]



(c) (i) One disadvantage of wind turbines is the high cost of manufacture and installation. State **one** other disadvantage of using wind turbines to generate electricity.

..... [1]

(ii) Name **one** other fossil fuel, apart from coal, that can be burned in a power station.

..... [1]

(iii) Name the chemical element present in **all** fossil fuels.

..... [1]

- 4 Some types of bottled water contain a dissolved gas. When the cap is removed, the gas bubbles out of the water.

Fig. 4.1 shows this gas being bubbled through solution Y.

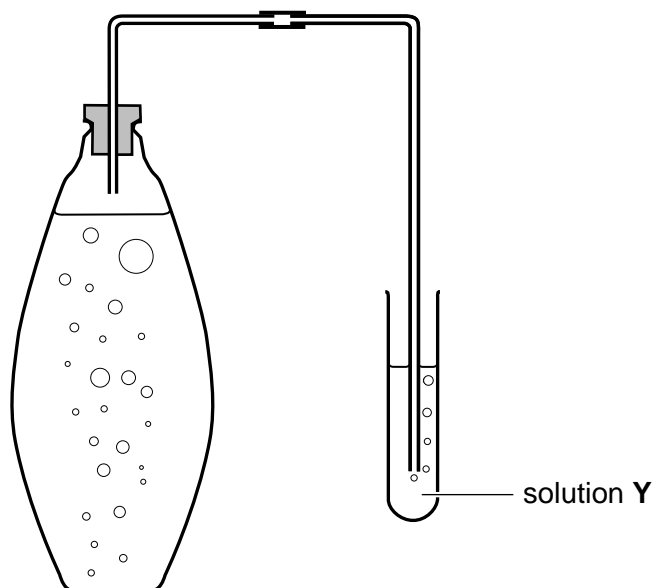


Fig. 4.1

The solution turns cloudy when it reacts with the gas.

- (a) Suggest the name of the gas and of solution Y.

gas .....

solution Y .....

[2]

- (b) Fig. 4.2 shows some of the particles in the gas.

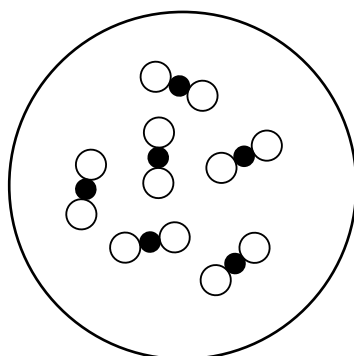


Fig. 4.2

Explain why the gas is a compound and not an element.

.....

.....

(c) A student spills some dilute sulphuric acid onto the floor. He sprinkles sodium carbonate crystals onto the acid in order to neutralise it.

(i) State the chemical formula of sulphuric acid ..... [1]

(ii) Complete the **word** equation for the reaction between sodium carbonate and dilute sulphuric acid.



[3]

(iii) Suggest an observation, other than using an indicator, which would show the student that he had added enough sodium carbonate to neutralise all of the acid.

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

(iv) Sodium metal reacts with dilute sulphuric acid. Explain why the student should **not** attempt to use sodium to neutralise the spilled acid.

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

5 Babies that are well below the average weight when they are born are said to have low birthweight. Babies with a low birthweight are more likely than other babies to have health problems when they are older.

Fig. 5.1 shows the relationship between having a baby with low birthweight and smoking during pregnancy.

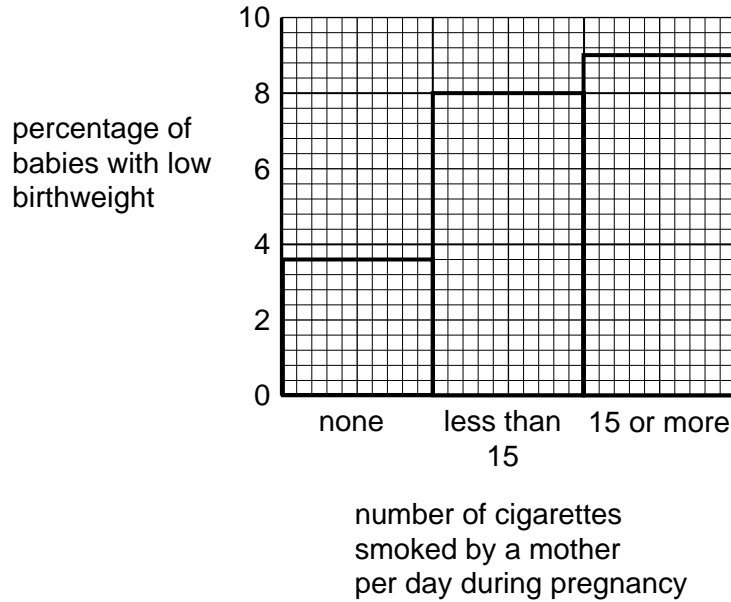


Fig. 5.1

(a) (i) What conclusions can you draw from the trend shown in the graph?

.....

.....

..... [2]

(ii) Do the results shown in the graph prove that smoking causes an increase in the chance of having a baby with low birthweight? Explain your answer.

.....

.....

..... [2]



(b) It is thought that one reason for the harmful effects of smoking on a developing fetus is that carbon monoxide from the cigarette smoke passes into the blood of the fetus.

Describe where and how the carbon monoxide passes from the mother to the fetus.

.....  
.....  
.....  
..... [3]

(c) Explain how smoking could lead to the development of bronchitis in the mother.

.....  
.....  
.....  
..... [2]

6 (a) Below is a list of electromagnetic waves.

- |                     |                      |                   |                   |
|---------------------|----------------------|-------------------|-------------------|
| <b>gamma rays</b>   | <b>infra-red</b>     | <b>microwaves</b> | <b>radiowaves</b> |
| <b>ultra-violet</b> | <b>visible light</b> | <b>X-rays</b>     |                   |

Name **one** type of electromagnetic wave that

- (i) causes ionisation, ..... [1]
- (ii) is used to sterilise food and medical equipment, ..... [1]
- (iii) is used to photograph bone structure, ..... [1]
- (iv) is used to transmit information. .... [1]

(b) Microwaves are used for detecting aircraft. This is called radar.

The speed of all electromagnetic radiation is 300 000 000 m/s.

The time between sending out a microwave signal and receiving the signal back from an aircraft is 0.00004 s.

(i) Calculate how far away the aircraft is.

Show your working and state the formula that you use.

formula

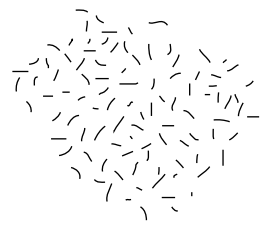
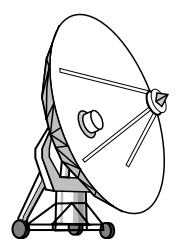
working

..... m [3]

(ii) The signal received back from the aircraft is much weaker than the signal sent out. Suggest why this is so.

.....  
..... [2]

(iii) Aircraft flying in war zones sometimes drop strips of aluminium foil to confuse enemy radar.



Explain how this works.

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

(c) A wave is shown in Fig. 6.1.

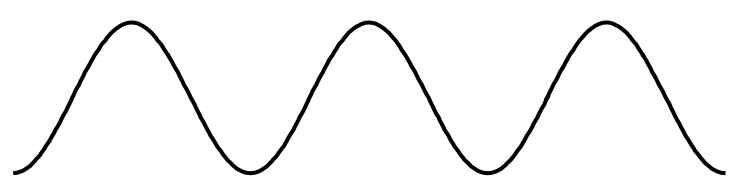


Fig. 6.1

- (i) Show clearly on the diagram the wavelength of the wave. Label it **W**. [1]
- (ii) Show clearly on the diagram the amplitude of the wave. Label it **A**. [1]
- (iii) This wave has a *frequency* of 10 Hz.

Explain what this means.

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

7 The two main types of element in the Periodic Table are metals and non-metals.

(a) State two physical properties of most metals that are different from those of most non-metals.

- 1 .....
- .....
- 2 .....
- ..... [2]

(b) Fig. 7.1 shows an apparatus being used to investigate the reaction between magnesium and steam.

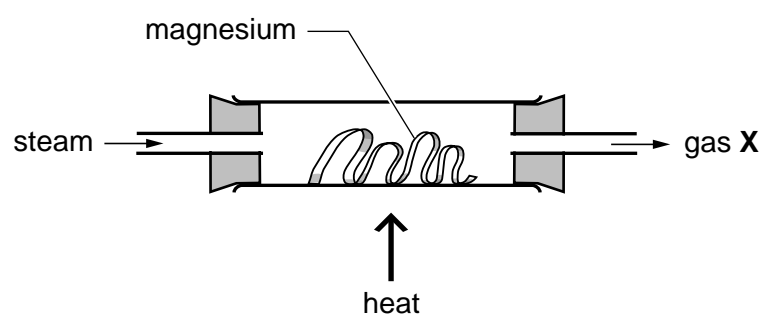


Fig. 7.1

There is an exothermic reaction between the magnesium and the steam and a white solid is produced in the reaction tube.

(i) State the meaning of the word *exothermic*.  
..... [1]

(ii) Name gas X and the white solid.

gas X .....

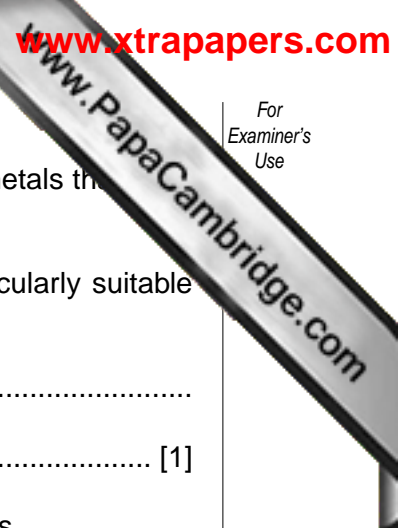
white solid ..... [2]

(c) The white solid from the reaction in Fig. 7.1 contains a metallic element joined to a non-metallic element. Steam contains two non-metallic elements joined together.

Name the type of chemical bonding present in the white solid and in steam.

type of bonding in the white solid .....

type of bonding in steam ..... [2]



(d) Aluminium is a widely used metal and the noble (inert) gases are non-metals that have many important uses.

(i) State and explain **one** property of aluminium that makes it a particularly suitable metal for the manufacture of food containers.

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

(ii) Name a noble gas and describe briefly **one** important use of this gas.

name .....

use .....

..... [2]

8 A baby girl was born with a missing heart valve. Fig. 8.1 shows the structure of her heart.

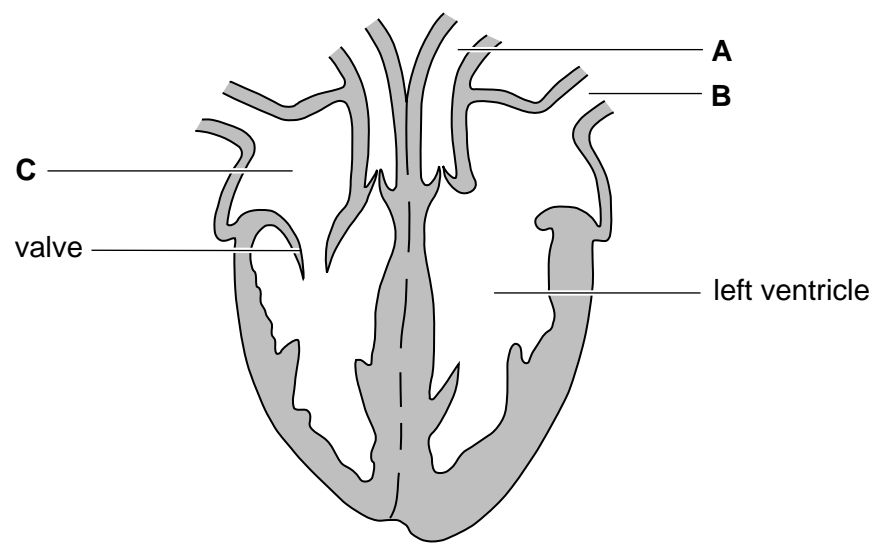


Fig. 8.1

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

- A .....
- B .....
- C .....

[3]

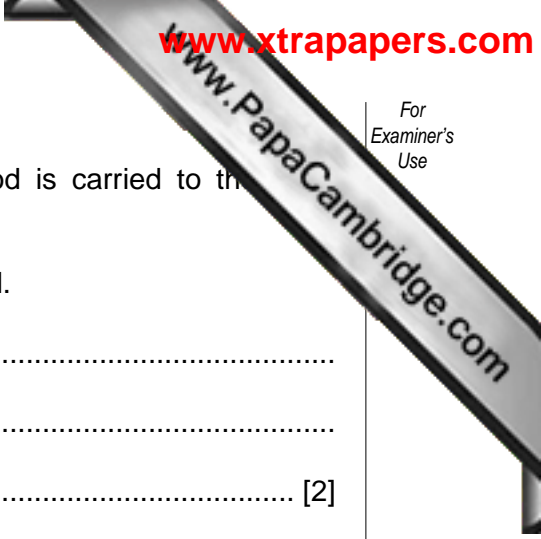
(b) When the ventricles of the heart contract, they push on the blood so that it flows into the arteries.

Explain why this will not happen properly in the left hand side of the baby's heart.

.....

.....

..... [2]



(c) The missing heart valve means that less oxygenated blood is carried to the tissues.

(i) Describe where and how the blood becomes oxygenated.

.....  
.....  
..... [2]

(ii) Explain why a lack of oxygen in the blood makes it difficult to do vigorous exercise.

.....  
.....  
..... [2]

9 Explain each of the following statements.

(a) Weight is not the same as mass.

.....  
.....  
..... [2]

(b) Electricity is transmitted through power lines at high voltages, rather than at low voltages.

.....  
.....  
..... [2]

(c) Sound waves can travel through water but not through a vacuum.

.....  
.....  
..... [2]

(d) Beta radiation can be used to measure the thickness of sheets of metal.

.....  
.....  
..... [2]









**DATA SHEET**  
**The Periodic Table of the Elements**

|                                |                                  | Group                          |                              |                               |                                 |                               |                                 |                               |                                 |                                    |                                    |                                  |                                    |                                 |                                     |                                |                                   |                                  |                                   |                                   |                                  |                                   |                                    |                               |                                 |                                 |                                 |                               |                                  |                                    |                                  |                                   |                                  |                                  |                                   |                                    |                                 |                                    |                                  |                                     |                                     |                                   |                                     |                                  |                                   |                                  |                               |                                    |                                 |                                 |                                   |                                  |                                     |                                   |                                    |                                   |                                  |                                   |                                    |                                |                                   |                                    |                                |                                   |                                    |                                    |                                    |                                  |                                    |                                   |  |                                  |                                     |                                     |                                     |                                  |                                     |                                       |                                       |                                    |  |                                     |                                       |                                  |  |                                     |                                    |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |
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| I                              | II                               | III                            | IV                           | V                             | VI                              | VII                           | 0                               |                               |                                 |                                    |                                    |                                  |                                    |                                 |                                     |                                |                                   |                                  |                                   |                                   |                                  |                                   |                                    |                               |                                 |                                 |                                 |                               |                                  |                                    |                                  |                                   |                                  |                                  |                                   |                                    |                                 |                                    |                                  |                                     |                                     |                                   |                                     |                                  |                                   |                                  |                               |                                    |                                 |                                 |                                   |                                  |                                     |                                   |                                    |                                   |                                  |                                   |                                    |                                |                                   |                                    |                                |                                   |                                    |                                    |                                    |                                  |                                    |                                   |  |                                  |                                     |                                     |                                     |                                  |                                     |                                       |                                       |                                    |  |                                     |                                       |                                  |  |                                     |                                    |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |
| 7<br><b>Li</b><br>Lithium<br>3 | 9<br><b>Be</b><br>Beryllium<br>4 | 1<br><b>H</b><br>Hydrogen<br>1 | 11<br><b>B</b><br>Boron<br>5 | 12<br><b>C</b><br>Carbon<br>6 | 14<br><b>N</b><br>Nitrogen<br>7 | 16<br><b>O</b><br>Oxygen<br>8 | 19<br><b>F</b><br>Fluorine<br>9 | 20<br><b>Ne</b><br>Neon<br>10 | 23<br><b>Na</b><br>Sodium<br>11 | 24<br><b>Mg</b><br>Magnesium<br>12 | 27<br><b>Al</b><br>Aluminium<br>13 | 28<br><b>Si</b><br>Silicon<br>14 | 31<br><b>P</b><br>Phosphorus<br>15 | 32<br><b>S</b><br>Sulphur<br>16 | 35.5<br><b>Cl</b><br>Chlorine<br>17 | 40<br><b>Ar</b><br>Argon<br>18 | 39<br><b>K</b><br>Potassium<br>19 | 40<br><b>Ca</b><br>Calcium<br>20 | 45<br><b>Sc</b><br>Scandium<br>21 | 48<br><b>Ti</b><br>Titanium<br>22 | 51<br><b>V</b><br>Vanadium<br>23 | 52<br><b>Cr</b><br>Chromium<br>24 | 55<br><b>Mn</b><br>Manganese<br>25 | 56<br><b>Fe</b><br>Iron<br>26 | 59<br><b>Co</b><br>Cobalt<br>27 | 59<br><b>Ni</b><br>Nickel<br>28 | 64<br><b>Cu</b><br>Copper<br>29 | 65<br><b>Zn</b><br>Zinc<br>30 | 70<br><b>Ga</b><br>Gallium<br>31 | 73<br><b>Ge</b><br>Germanium<br>32 | 75<br><b>As</b><br>Arsenic<br>33 | 79<br><b>Se</b><br>Selenium<br>34 | 80<br><b>Br</b><br>Bromine<br>35 | 84<br><b>Kr</b><br>Krypton<br>36 | 85<br><b>Rb</b><br>Rubidium<br>37 | 88<br><b>Sr</b><br>Strontium<br>38 | 89<br><b>Y</b><br>Yttrium<br>39 | 91<br><b>Zr</b><br>Zirconium<br>40 | 93<br><b>Nb</b><br>Niobium<br>41 | 96<br><b>Mo</b><br>Molybdenum<br>42 | 101<br><b>Ru</b><br>Ruthenium<br>44 | 103<br><b>Rh</b><br>Rhodium<br>45 | 106<br><b>Pd</b><br>Palladium<br>46 | 108<br><b>Ag</b><br>Silver<br>47 | 112<br><b>Cd</b><br>Cadmium<br>48 | 115<br><b>In</b><br>Indium<br>49 | 119<br><b>Sn</b><br>Tin<br>50 | 122<br><b>Sb</b><br>Antimony<br>51 | 127<br><b>I</b><br>Iodine<br>53 | 131<br><b>Xe</b><br>Xenon<br>54 | 133<br><b>Cs</b><br>Caesium<br>55 | 137<br><b>Ba</b><br>Barium<br>56 | 139<br><b>La</b><br>Lanthanum<br>57 | 178<br><b>Hf</b><br>Hafnium<br>72 | 181<br><b>Ta</b><br>Tantalum<br>73 | 184<br><b>W</b><br>Tungsten<br>74 | 190<br><b>Os</b><br>Osmium<br>76 | 192<br><b>Ir</b><br>Iridium<br>77 | 195<br><b>Pt</b><br>Platinum<br>78 | 197<br><b>Au</b><br>Gold<br>79 | 201<br><b>Hg</b><br>Mercury<br>80 | 204<br><b>Tl</b><br>Thallium<br>81 | 207<br><b>Pb</b><br>Lead<br>82 | 209<br><b>Bi</b><br>Bismuth<br>83 | 210<br><b>Po</b><br>Polonium<br>84 | 210<br><b>At</b><br>Astatine<br>85 | 226<br><b>Fr</b><br>Francium<br>87 | 226<br><b>Ra</b><br>Radium<br>88 | 227<br><b>Ac</b><br>Actinium<br>89 | 232<br><b>Th</b><br>Thorium<br>90 | 232<br><b>Pa</b><br>Protactinium<br>91 | 238<br><b>U</b><br>Uranium<br>92 | 238<br><b>Np</b><br>Neptunium<br>93 | 238<br><b>Pu</b><br>Plutonium<br>94 | 238<br><b>Am</b><br>Americium<br>95 | 238<br><b>Cm</b><br>Curium<br>96 | 238<br><b>Bk</b><br>Berkelium<br>97 | 238<br><b>Cf</b><br>Californium<br>98 | 238<br><b>Es</b><br>Einsteinium<br>99 | 238<br><b>Fm</b><br>Fermium<br>100 | 238<br><b>Md</b><br>Mendelevium<br>101 | 238<br><b>No</b><br>Nobelium<br>102 | 238<br><b>Lr</b><br>Lawrencium<br>103 | 140<br><b>Ce</b><br>Cerium<br>58 | 141<br><b>Pr</b><br>Praseodymium<br>59 | 144<br><b>Nd</b><br>Neodymium<br>60 | 150<br><b>Sm</b><br>Samarium<br>62 | 152<br><b>Eu</b><br>Europium<br>63 | 157<br><b>Gd</b><br>Gadolinium<br>64 | 159<br><b>Tb</b><br>Terbium<br>65 | 162<br><b>Dy</b><br>Dysprosium<br>66 | 165<br><b>Ho</b><br>Holmium<br>67 | 167<br><b>Er</b><br>Erbium<br>68 | 169<br><b>Tm</b><br>Thulium<br>69 | 173<br><b>Yb</b><br>Ytterbium<br>70 | 175<br><b>Lu</b><br>Lutetium<br>71 |

58-71 Lanthanoid series  
-90-103 Actinoid series

**key**

|   |          |                            |
|---|----------|----------------------------|
| a | <b>X</b> | a = relative atomic mass   |
|   | <b>X</b> | X = atomic symbol          |
| b |          | b = proton (atomic) number |

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

