UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

7514372702

COMBINED SCIENCE **0653/21**

Paper 2 (Core) **October/November 2011**

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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **20** printed pages.

1 The chemical reaction involved in the manufacture of ammonia requires an iron catal

Fig.1.1 shows a simplified diagram of the reaction vessel in which ammonia is made.

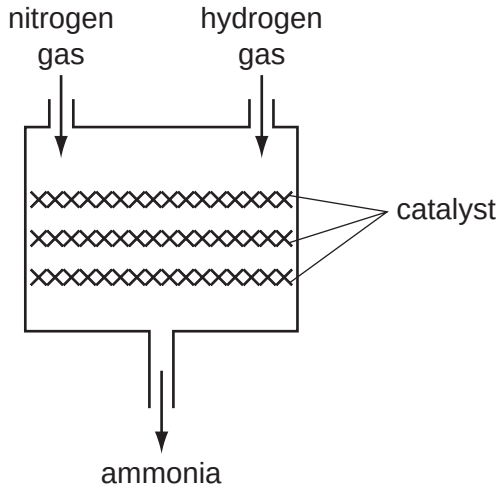


Fig. 1.1

(a) (i) Explain the meaning of the term *catalyst*.

.....

..... [2]

(ii) Iron is a member of the family of metals which lies between scandium and zinc in the Periodic Table.

Name this family of metals. ..... [1]

(iii) The iron catalyst is prepared by reacting iron oxide with hydrogen gas.

The balanced symbolic equation for this reaction is shown below.

$$Fe_3O_4 + 4H_2 \longrightarrow 3Fe + 4H_2O$$

State the total number of atoms shown on the **left hand side** of this equation.

..... [1]

(iv) State the number of hydrogen molecules shown in the equation in **(iii)**.

..... [1]

(v) Explain why the reaction in **(iii)** is an example of a *redox reaction*.

.....

.....

..... [2]

(b) (i) Complete the displayed (graphical) chemical formula of an ammonia molecule, NH_3, which has been started below.

H — N

[2]

(ii) A student states that an ammonia molecule contains **covalent** chemical bonds between its atoms.

Explain whether or not the student is correct.

.....

..... [1]

2 **(a)** The arrows in Fig. 2.1 show the horizontal forces acting on a car moving forwa... each case the length of the arrow indicates the size of the force.

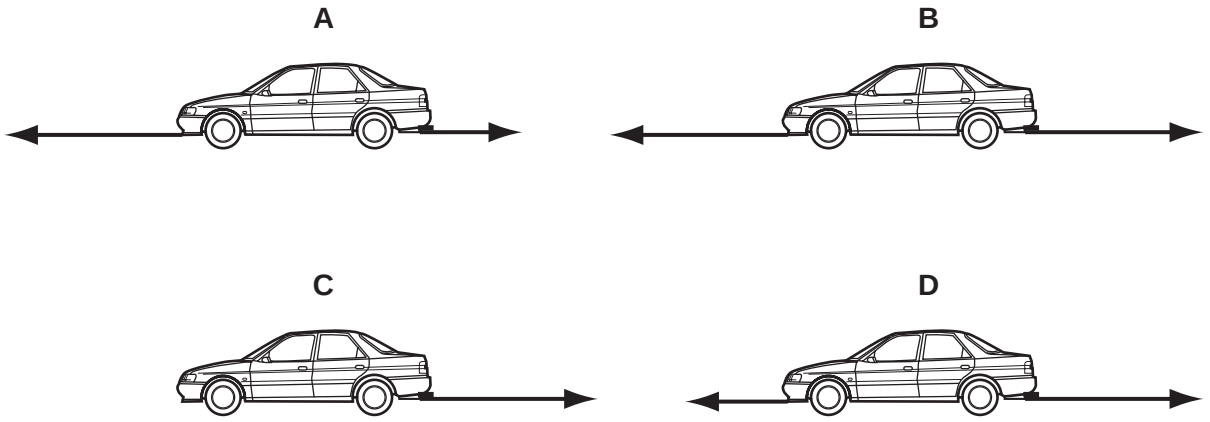


Fig. 2.1

(i) State which of the diagrams out of **A**, **B**, **C** and **D** show a car that is slowing down.

..... [2]

(ii) Explain how you decided on your answer to **(i)**.

.....

..... [1]

(iii) There are other forces acting on the cars that are **not** horizontal.

Name **one** of these forces. ..... [1]

(b) The car has a radiator. This contains hot water that has been heated by passing it through the hot car engine.

The purpose of the radiator is to cool down the water. The radiator is painted black.

(i) State the method by which heat is transferred from the hot water to the radiator.

..... [1]

(ii) Explain why the radiator is painted black.

.....

..... [1]

(c) Fig. 2.2 shows a racing car.

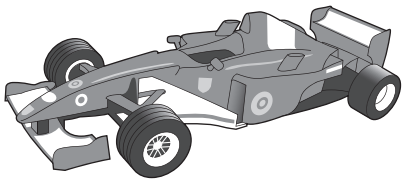


Fig. 2.2

The car took 1.5 hours to complete a race of 330 kilometres.

Calculate the average speed of the car in kilometres per hour.

State the formula that you use and show your working.

formula used

working

..... km / h [2]

(d) Fig. 2.3 shows the speed–time graph for the racing car over a short period of time.

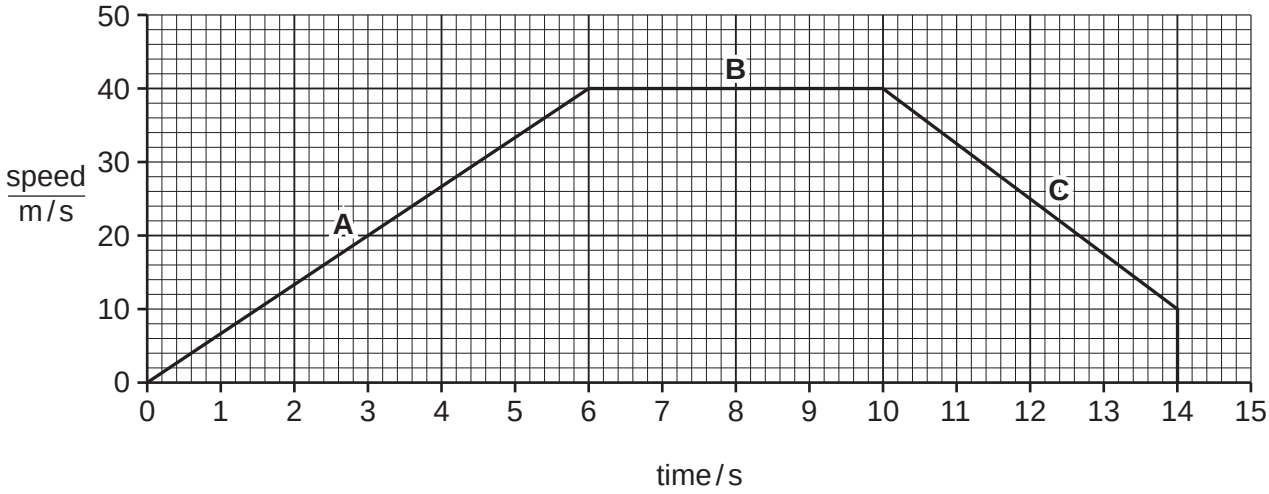


Fig. 2.3

Describe the motion of the racing car during

section **B**, ...

section **C**. ..... [2]

3 Rice and cassava are important parts of a person's diet in some parts of the world.

(a) Table 3.1 shows the main nutrients present in 100 g of white rice and 100 g of cassava.

Table 3.1

nutrient	white rice	cassava
protein / g	5.0	1.2
carbohydrate / g	58.6	34.7
fat / g	0.4	0.3

(i) Which of the nutrients listed in Table 3.1 can provide energy?

.....

[1]

(ii) A diet that consists mostly of rice is better for a young child than a diet that consists mostly of cassava.

Use the information in Table 3.1 to explain **one** reason why this is so.

.....

.....

.....

[2]

(iii) Carbohydrates include sugars and starch.

Describe how a student could test a sample of cooked rice to find out if it contains reducing sugar.

.....

.....

.....

.....

[3]

(b) Fig. 3.1 shows a cassava plant.

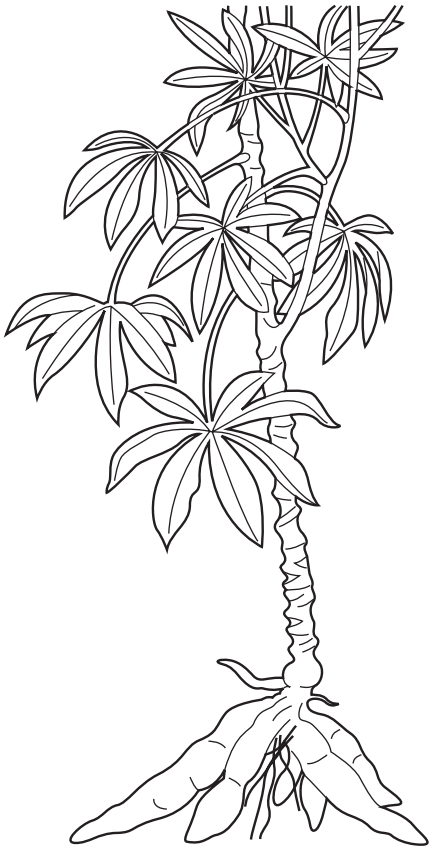


Fig. 3.1

The cassava plant makes food in its leaves.

(i) Describe how food is made by photosynthesis in a plant's leaves.

.....

.....

..... [2]

(ii) Suggest and explain **one** way, visible in Fig. 3.1, in which the structure of a cassava plant's leaves helps them to carry out photosynthesis.

.....

.....

..... [2]

4 **(a)** Fig. 4.1 shows an incomplete diagram of the electromagnetic spectrum.

radio waves		**infra-red**	**visible light**		**X–rays**	

Fig. 4.1

(i) Complete the diagram using terms from the list:

gamma radiation **microwaves** **ultraviolet**

[2]

(ii) State **one** use for

infra–red radiation,

.....

microwaves.

..... [2]

(b) Gamma radiation and X-rays are two examples of ionising radiation.

(i) Explain the meaning of the term *ionising radiation*.

.....

..... [2]

(ii) Explain why ionising radiation can be harmful to living things.

.....

.....

..... [2]

(c) Some types of food are treated with gamma radiation. The radiation kills the mi
that make food decay

(i) Explain why gamma radiation can be used for this, even when the fruit is packed in
boxes.

.....

..... [1]

(ii) Fig. 4.2 shows how a conveyor belt can be used to move the boxes of fresh fruit past the radioactive source.

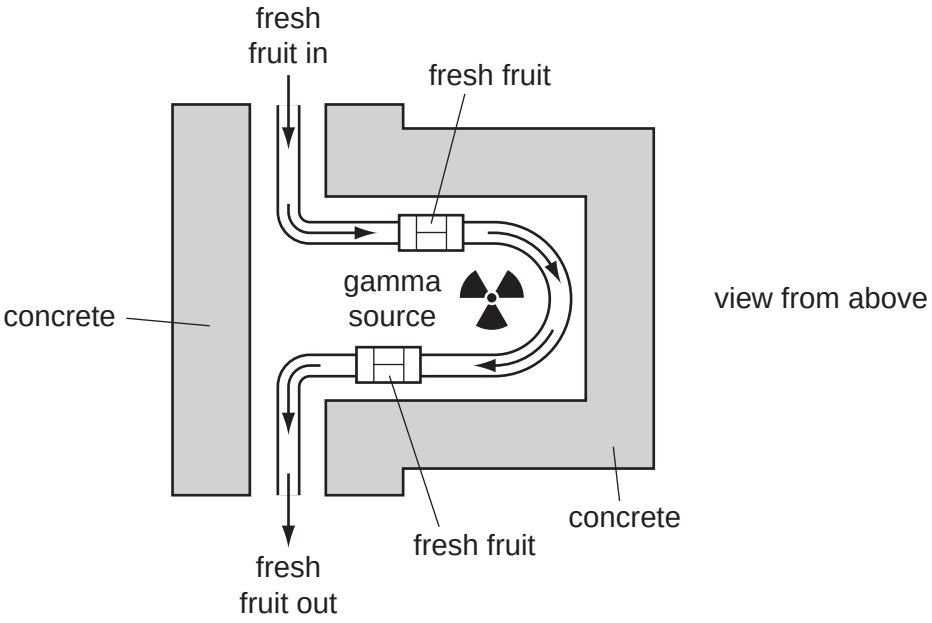


Fig. 4.2

Suggest why concrete is used to surround the radioactive source.

.....

..... [1]

5 Fig. 5.1 shows a piece of magnesium ribbon which a student has just dropped container of dilute sulfuric acid.

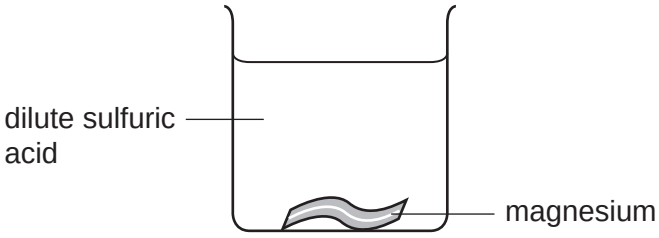


Fig. 5.1

(a) (i) Describe **two** observations about this reaction which the student could make.

1 .....

.....

2 .....

..... [2]

(ii) Complete the **word** chemical equation for the reaction in **(i)**.

sulfuric acid	+	magnesium	→		+	

[2]

(iii) State the **name** of the element which is present in both hydrochloric acid and sulfuric acid.

..... [1]

(b) Containers for dilute sulfuric acid are often made of poly(ethene). Poly(ethene) is a polymer which is formed from hydrocarbon monomers.

(i) Suggest **one** property of poly(ethene) which makes it suitable for making sulfuric acid containers.

.....

[1]

(ii) One method of dealing with waste poly(ethene) is to burn it.

Predict **two** compounds which will be produced when poly(ethene) is burnt.

1 .....

2 .....

[2]

(iii) Suggest **one** advantage of burning as a means of dealing with waste poly(ethene).

.....

.....

[1]

6 Fig. 6.1 shows part of the human nervous system.

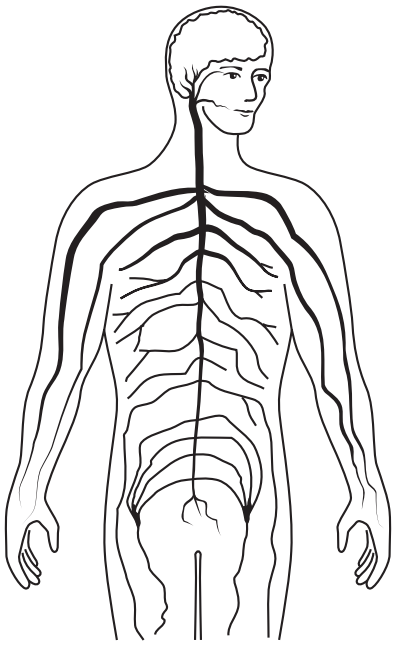


Fig. 6.1

(a) On Fig. 6.1, use label lines to indicate and name the **two** parts of the central nervous system. [2]

(b) If a person touches a hot pan with his finger, signals pass from his hand, through the central nervous system, to a muscle in his arm. The muscle contracts and moves the arm away.

State the correct biological term for each of the following descriptions.

(i) the cells in the finger that detect the hot pan and send signals to the central nervous system

..... [1]

(ii) an organ such as a muscle that responds to the signals

..... [1]

(c) A nerve cell has a nucleus and a cell surface membrane.

(i) Name **one** type of cell in the human body that does **not** contain a nucleus.

.....

[1]

(ii) The nucleus contains DNA. State the function of DNA.

.....

.....

[1]

(iii) Outline **one** function of the cell surface membrane.

.....

.....

[1]

7 Fig. 7.1 shows some data about the percentage by mass of elements in the Earth's cr

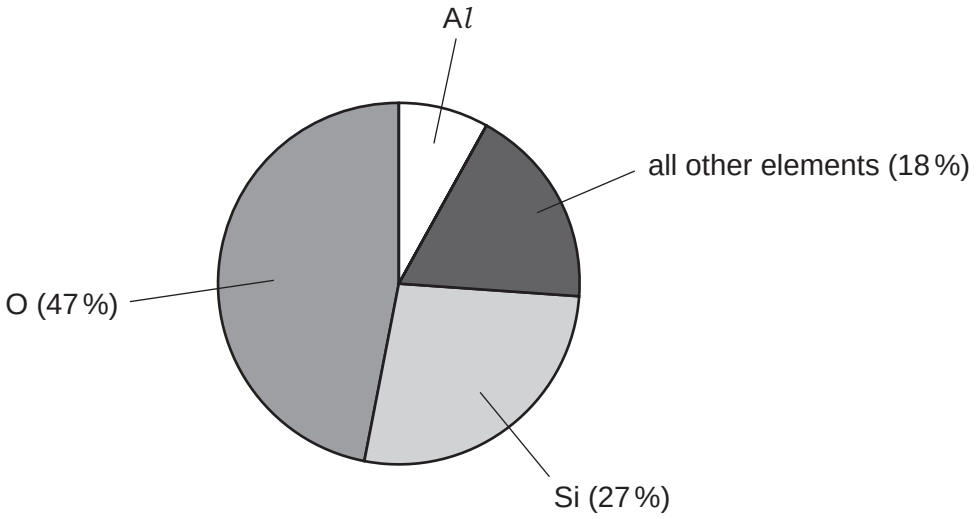


Fig. 7.1

(a) State the percentage by mass of aluminium in the Earth's crust.

..... [1]

(b) Fig. 7.2 shows a diagram of an ion of element **E**.

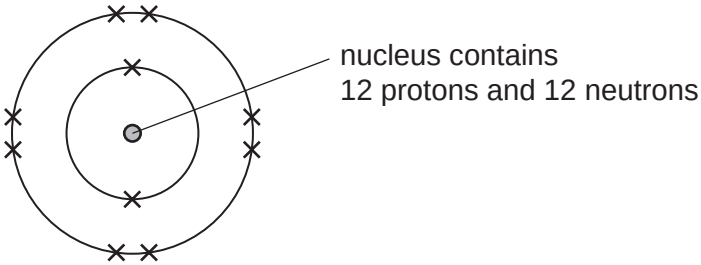


Fig. 7.2

(i) Name element **E** and explain how the diagram shows that the ion has a positive electrical charge.

name of element **E** .....

.....

.....

..... [3]

(ii) Name the noble gas whose **atoms** have the same number of electrons as shown in Fig. 7.2

.....[1]

(iii) Explain, in terms of electron configuration, why the atoms of all the noble gases are unreactive.

.....

.....[1]

(c) Fig. 7.3 shows a simplified diagram of a process which could be used to produce the reactive metal, sodium.

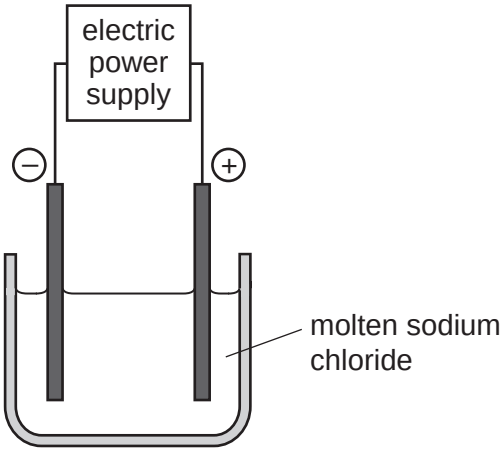


Fig. 7.3

(i) Name the process shown in Fig. 7.3.

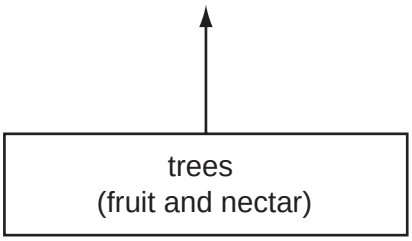
.....[1]

(ii) Name the element which forms at the anode.

.....[1]

8 The golden lion tamarin is a species of monkey that lives in forests in Brazil. It includes fruits and nectar from trees. Its predators include snakes, bamboo rats and owl

(a) (i) In the space below, complete the food web, using the information above.



[3]

(ii) On your food web, draw a circle around the producer. [1]

(b) The nectar that the monkeys eat is made by flowers that grow on some of the t… the forests. The fruits that the monkeys eat develop from the flowers.

Fig. 8.1 shows a section through a flower.

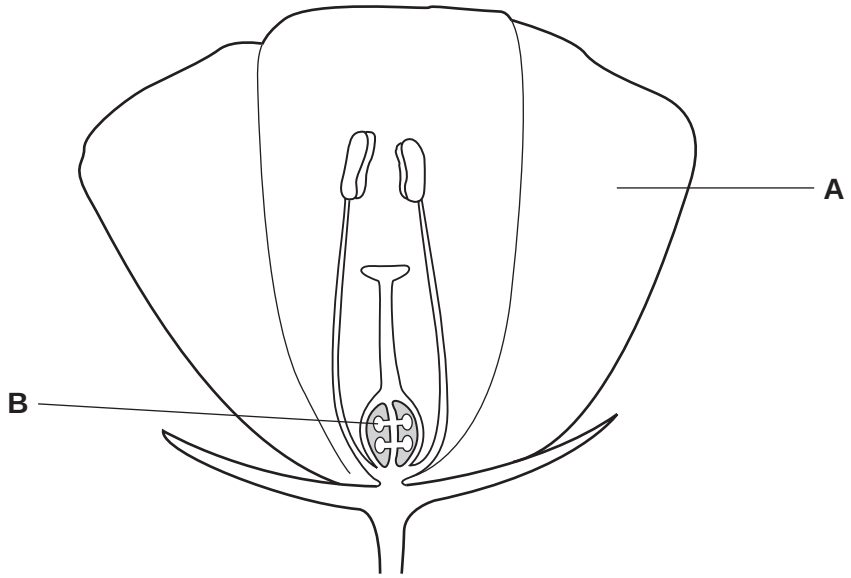


Fig. 8.1

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

A .....

B ..... [2]

(ii) On Fig. 8.1, label the part that produces pollen, using a label line and the letter **P**. [1]

(iii) On Fig. 8.1, label the part that will develop into a fruit, using a label line and the letter **F**. [1]

(iv) Explain why the flower produces nectar.

.....

.....

..... [2]

9 **(a)** Fig. 9.1 shows the circuit diagram of a circuit which a student set up. He measu
current passing through the 2 Ω resistor. The ammeter reading was 6 A.

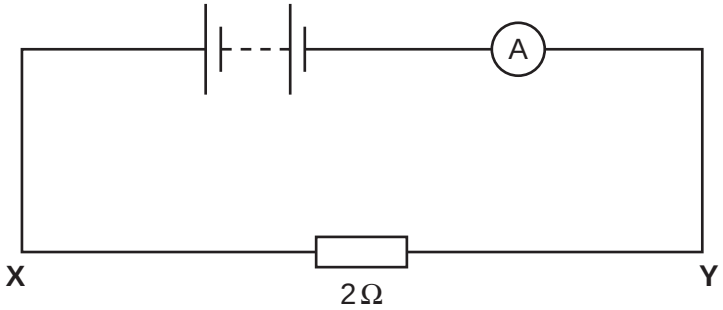


Fig. 9.1

(i) Show that the voltage across the resistor was 12 V.

State the formula that you use and show your working.

formula used

working

[2]

(ii) A 4 Ω resistor is placed in series with the 2 Ω resistor between **X** and **Y**.

Calculate the total resistance between **X** and **Y**.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

(b) Many countries are seeking alternatives to fossil fuels as energy sources for gen
electricity.

Explain why is it necessary to find alternative energy sources for generating electricity.

.....

.....

.....

..... [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 (above) X (centre) b (below)

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.).