Centre Number	Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Joint Examination for the School Certificate and General Certificate of Education Ordinary Level

ADDITIONAL COMBINED SCIENCE 5130/2

PAPER 2

OCTOBER/NOVEMBER SESSION 2002

2 hours 15 minutes

Additional materials:
Answer paper

TIME 2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on all separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer **one** part of each of the three questions.

Write your answers on the separate answer paper provided.

At the end of the examination, fasten all separate answer paper securely to the question paper.

INFORMATION FOR CANDIDATES

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 16.

FOR EXAMINER'S USE	
Section A	
10	
11	
12	
TOTAL	

This question paper consists of 16 printed pages.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

Section A

Answer **all** the questions.

1 The parts of the electromagnetic spectrum are listed below in alphabetical order.

gamma rays **infrared** **microwaves** **radio waves**

ultraviolet **visible light** **X-rays**

(a) In the table in Fig. 1.1, list the parts of the electromagnetic spectrum in order of wavelength, starting with the shortest wavelength.

shortest wavelength ↓	
longest wavelength	

Fig. 1.1 [4]

(b) Long exposure of the skin to ultraviolet light causes sunburn.

Long exposure to visible light causes no harm to the skin.

Explain this difference.

.....

.....

..... [2]

(c) Radiation is given out when isotopes such as cobalt-60 decay.

(i) What is meant by the term *isotopes*?

.....

.....

..... [2]

(ii) Gamma rays emitted by cobalt-60 are used to treat cancer.

State **one** safety precaution needed when this treatment is used.

..... [1]

2 The apparatus shown in Fig. 2.1 is used to obtain ethanol from fermented liquor.

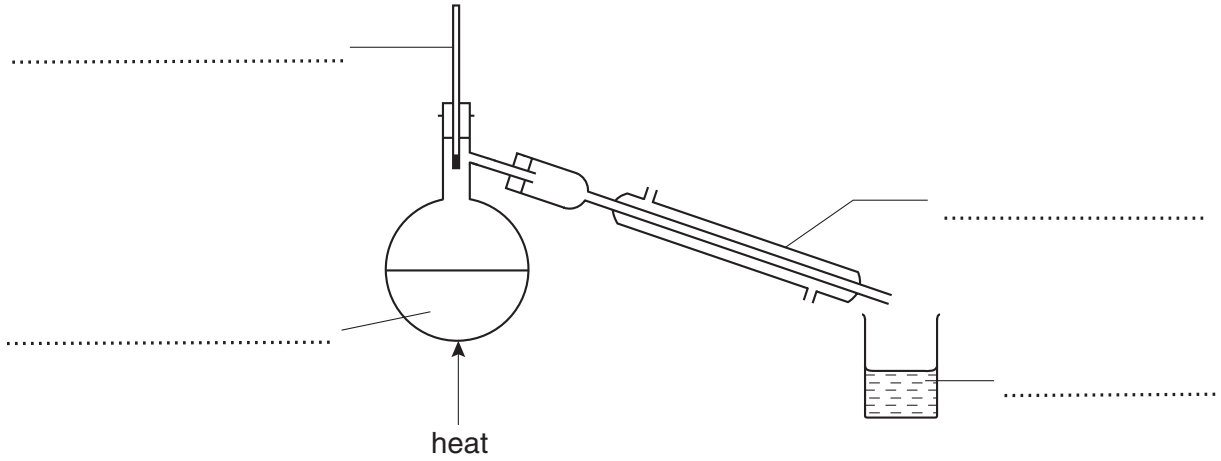

Fig. 2.1

(a) Choose from the list below to label the apparatus in Fig. 2.1.

condenser ethanol fermented liquor filter funnel stirring rod thermometer [4]

(b) The fermented liquor is made from a solution of sugar in water.

Explain how the sugar solution is fermented.

.....

.....

..... [2]

3 The diagram in Fig. 3.1 shows parts of the human digestive system.

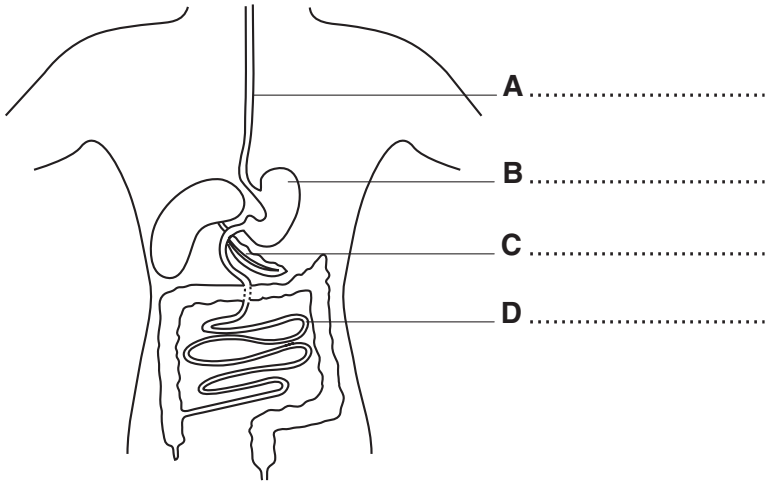

Fig. 3.1

(a) Label the parts **A**, **B**, **C** and **D** on the diagram. [4]

(b) Complete the table in Fig. 3.2 showing the function of some parts of the human digestive system. [3]

part of the digestive system	function
gall bladder	
pancreas	
rectum	

Fig. 3.2

(c) **(i)** What is the function of peristalsis?

..... [1]

(ii) How is peristalsis carried out?

.....

.....

..... [2]

4 The diagram in Fig. 4.1 shows a simple electric bell.

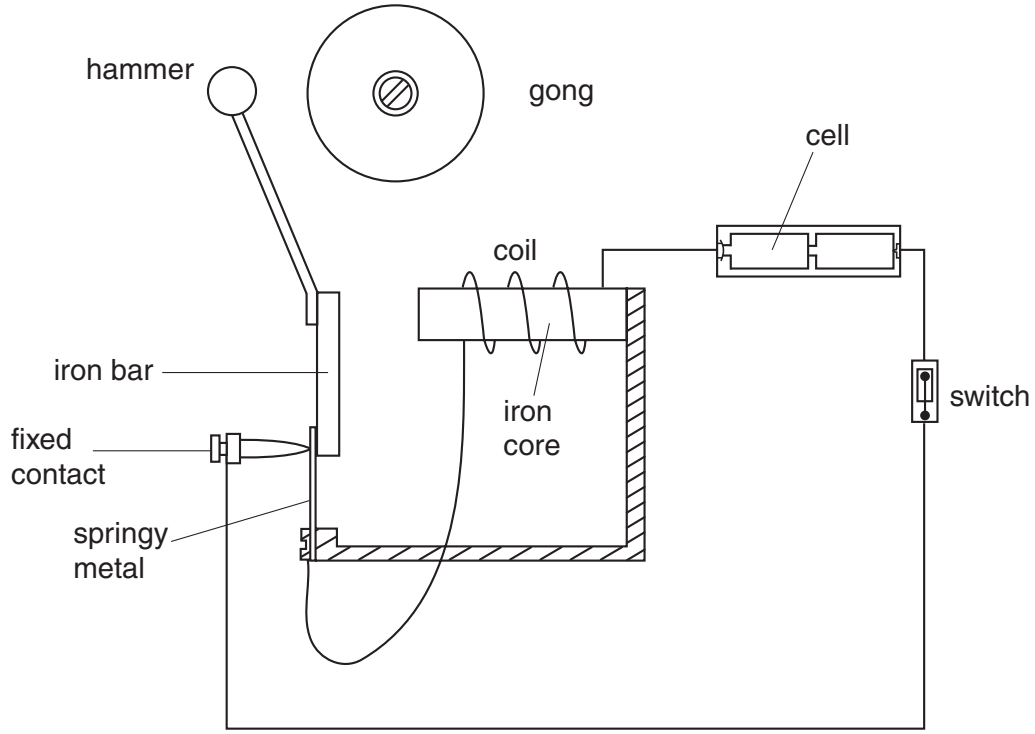

Fig. 4.1

The bell uses electromagnetism to make it work.

(a) **(i)** When the switch is closed, the hammer hits the gong.

Explain why.

.....

.....

..... [2]

(ii) The hammer then moves back to its original position.

Explain why.

.....

.....

..... [2]

(b) Why is a **permanent** magnet of no use in this bell?

.....

.....

..... [2]

(c) The electric bell rings louder if the hammer hits the gong harder.

In what ways can this electric bell be modified to make it ring louder?

.....

.....

.....

..... [3]

5 In an experiment a spatula full of a metal powder is added to an aqueous solution of a metal salt. Any change to the appearance of the solid is noted. The experiment is repeated with different metals and metal salts.

Results for these experiments are shown in the table in Fig. 5.1.

	solution of metal salt		
metal	copper(II) sulphate	iron(II) sulphate	magnesium sulphate
copper	no change	no change	no change
iron	light grey solid turns to red-brown solid	no change	no change
magnesium	light grey solid turns to red-brown solid	light grey solid turns to dark grey solid	no change

Fig. 5.1

(a) **(i)** Name the red-brown solid formed when iron is added to aqueous copper(II) sulphate solution.

..... [1]

(ii) Explain why this solid is formed.

.....

.....

..... [2]

(iii) Write an equation for the reaction taking place when this solid is formed.

..... [2]

(b) Aqueous copper(II) sulphate solution is blue.

(i) Describe the change to the colour of this solution when magnesium powder is added.

..... [1]

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

.....

.....

..... [2]

(c) Use the information in the table to place the three metals, copper, iron and magnesium, in order of reactivity. Begin with the most reactive.

..... [2]

6 A survey was made to investigate some effects of smoking on health.

Results of this survey are shown in the bar chart in Fig. 6.1.

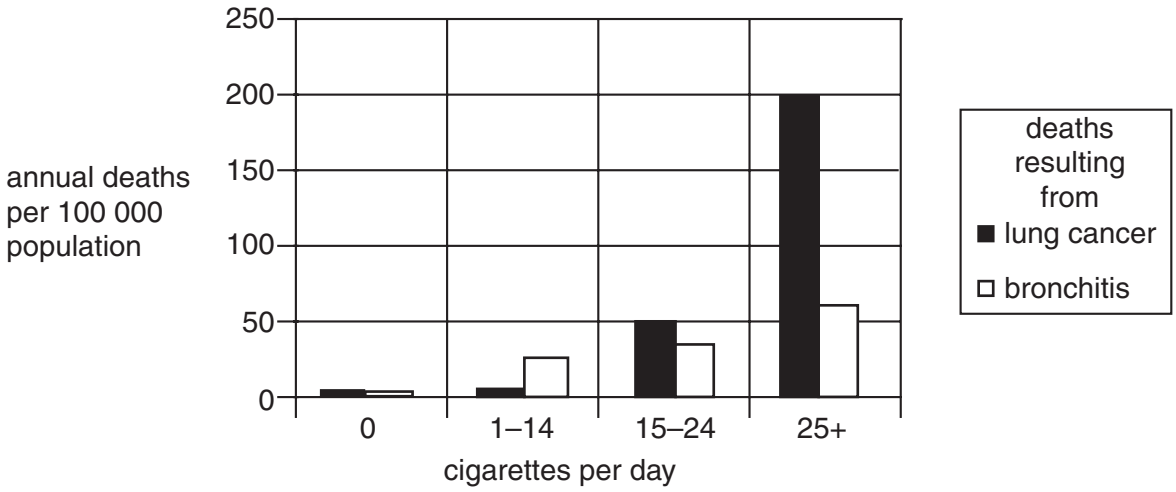

Fig. 6.1

(a) **(i)** What is the effect of increasing the number of cigarettes smoked per day on the chance of a person dying from bronchitis?

.....

..... [1]

(ii) What is the effect of increasing the number of cigarettes smoked per day on the chance of a person dying from lung cancer?

.....

..... [1]

(iii) How do the effects you have noted in **(a)(i)** and **(a)(ii)** differ?

.....

..... [2]

(b) Smokers are also more likely to suffer from emphysema than non-smokers.

Emphysema decreases the number of alveoli functioning in the lungs.

(i) What is the function of alveoli?

.....

.....

..... [2]

(ii) How would a person suffering from emphysema be affected by having fewer functioning alveoli in the lungs?

..... [1]

7 The diagram in Fig. 7.1 shows a crane working on a building site.

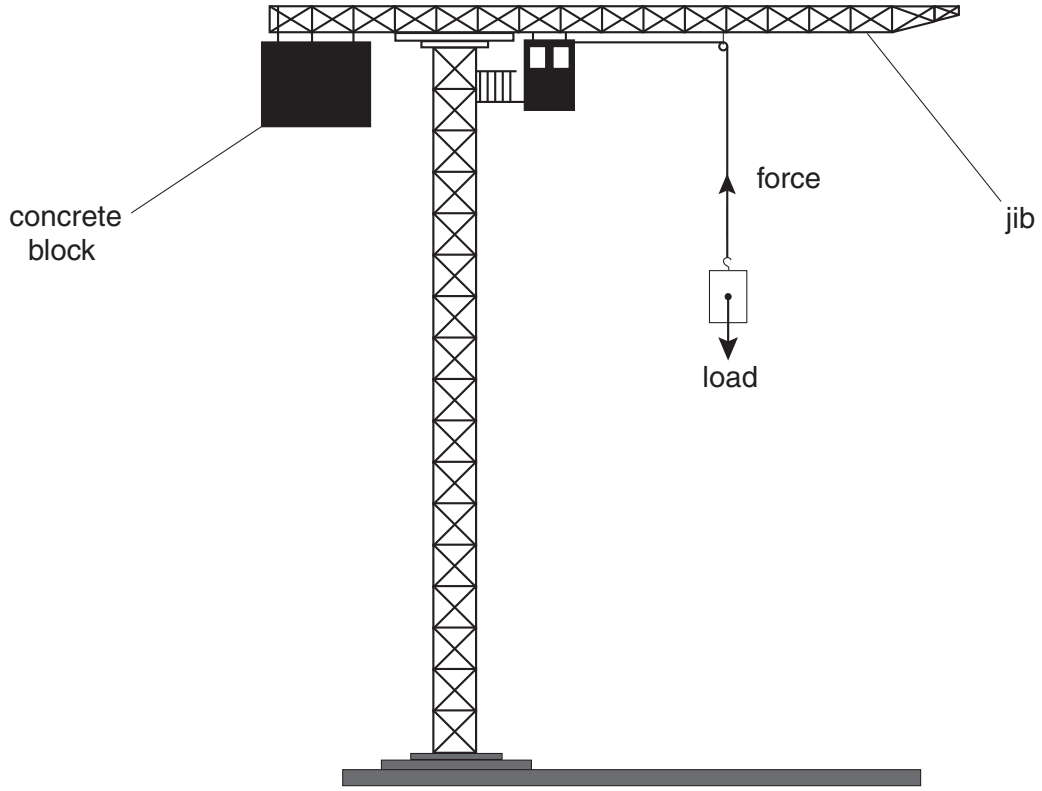

Fig. 7.1

(a) **(i)** What is the effect of removing the concrete block from the crane?

..... [1]

(ii) Explain how the concrete block prevents this effect.

.....

.....

..... [2]

(b) The crane lifts a piece of steel of mass 800 kg from the ground to a height of 30 m.

Calculate the work done by the crane.

work = ... [3]

8 Magnesium burns in chlorine gas to produce the ionic solid magnesium chloride.

The table in Fig. 8.1 gives information about the atoms and ions of magnesium and chlorine.

	formula	number of electrons	arrangement of electrons
magnesium atom	Mg	12	2,8,2
chlorine atom	Cl	17	2,8,7
magnesium ion	Mg^{2+}	10	
chloride ion	Cl^{-}	18	

Fig. 8.1

(a) Fill in the two gaps in the table. [2]

(b) Hydrogen also reacts with chlorine forming hydrogen chloride. The compound hydrogen chloride is a gas.

(i) What sort of bonding is present in hydrogen chloride?

..... [1]

(ii) In terms of electrons, how is the bonding in hydrogen chloride different from that in magnesium chloride?

.....

.....

..... [2]

(iii) Magnesium chloride is a solid. Hydrogen chloride is a gas.

Explain this difference in terms of the forces holding particles together.

.....

.....

.....

..... [2]

9 The graph in Fig. 9.1 shows how the rate of photosynthesis in a green plant changes with light intensity at two different concentrations of carbon dioxide.

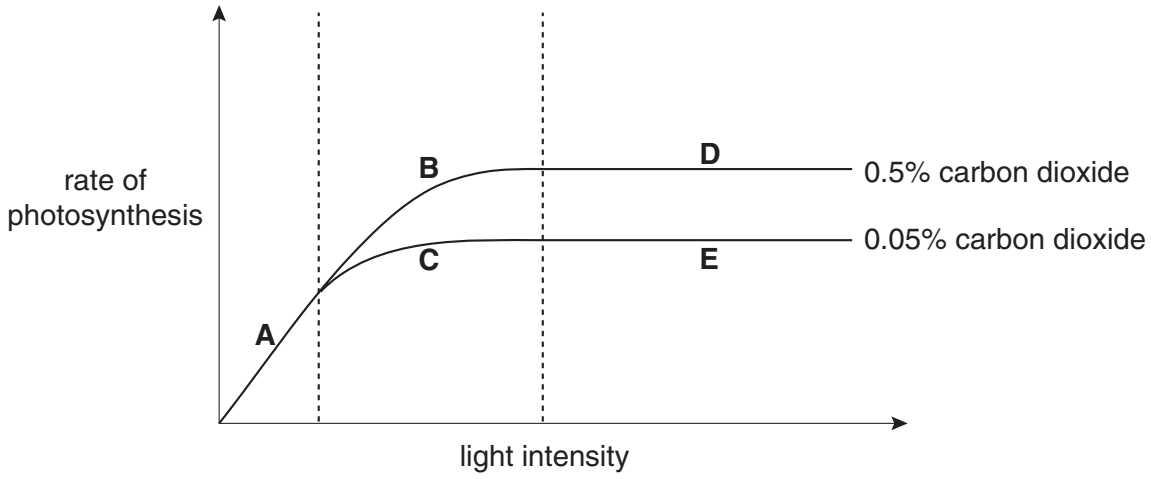

Fig. 9.1

(a) Describe the effect of light intensity on the rate of photosynthesis in the parts of the graph indicated below.

(i) part **A**

..... [1]

(ii) part **B**

..... [1]

(iii) part **C**

..... [1]

(b) Why does the graph **ACE** show a lower maximum rate of photosynthesis than the graph **ABD**?

.....

.....

..... [3]

Section B

Answer **one** part, either **(a)** or **(b)**, of each question in this section.

10 Either (a) (i) A television set operates at a voltage of 240 V and uses a current of 5 A.
The television is switched on to watch a programme lasting 50 minutes. Calculate the number of coulombs of charge flowing through the television set and the number of joules of electrical energy used, during this programme.
Show the formulae you are using for your calculations. [6]

(ii) The television set has a *plastic case*. Its mains cable has an *earth wire* and a plug fitted with a *fuse*.
Explain how each of the items printed in italics helps to make the television set safer to use. [4]

Or (b) (i) Draw a diagram showing a ray of light entering a rectangular glass block to help you explain the term *refractive index*.
Describe an experiment that you could carry out to find the refractive index of the glass. [6]

(ii) Explain, with the help of a diagram, how refraction makes a swimming pool appear less deep than it really is. [4]

11 Either **(a)** An experiment was carried out to investigate the rate of reaction between calcium carbonate and hydrochloric acid contained in a flask. The flask was weighed every two minutes until all of the calcium carbonate had reacted. Results of this experiment are shown in the table in Fig. 11.1.

time in minutes	mass of flask and contents in grams
0	159.8
2	157.8
4	156.7
6	156.1
8	155.9
10	155.8
12	155.8

Fig. 11.1

(i) Use graph paper to plot the results of this experiment.
Plot time on the horizontal axis and mass on the vertical axis.
Draw a curve through the points. Label this curve **X**.
Describe and explain the change in the rate of reaction during this experiment. [6]

(ii) On the same axes sketch the graph you would expect if the experiment is repeated using hydrochloric acid of twice the concentration.
Label this curve **Y**. Explain the shape of curve **Y**. [4]

Or **(b)** The table in Fig. 11.2 shows properties of four elements from Group VII of the Periodic Table (the halogens) listed in order of relative atomic mass.

halogen	relative atomic mass	colour at r.t.p.	melting point in °C	boiling point in °C
fluorine	19	yellow	–220	–188
chlorine	35.5	green	–101	–35
bromine	80	red/brown	–7	58
iodine	127	dark grey	114	183

Fig. 11.2

(i) Describe trends in colour and state of the halogens at room temperature.
The next member of Group VII is called astatine.
Predict, with reasons for your choices, the colour of astatine and its state at room temperature. [4]

(ii) Describe how one halogen element may displace another from a solution of its ions.
Write an equation for a reaction of this type.
Use examples of these reactions to show how the reactivity of the halogen elements changes as the Group is descended. [6]

12 Either (a) (i) Describe and explain the differences between a typical cell from an animal and one from a plant. You may use diagrams to help your answer. [3]

(ii) Describe how root hair cells, xylem vessels and red blood cells differ from typical plant and animal cells.
Explain how these differences help the modified cells to carry out their functions. [7]

Or (b) The diagram in Fig. 12.1 shows a food web in a field of maize.

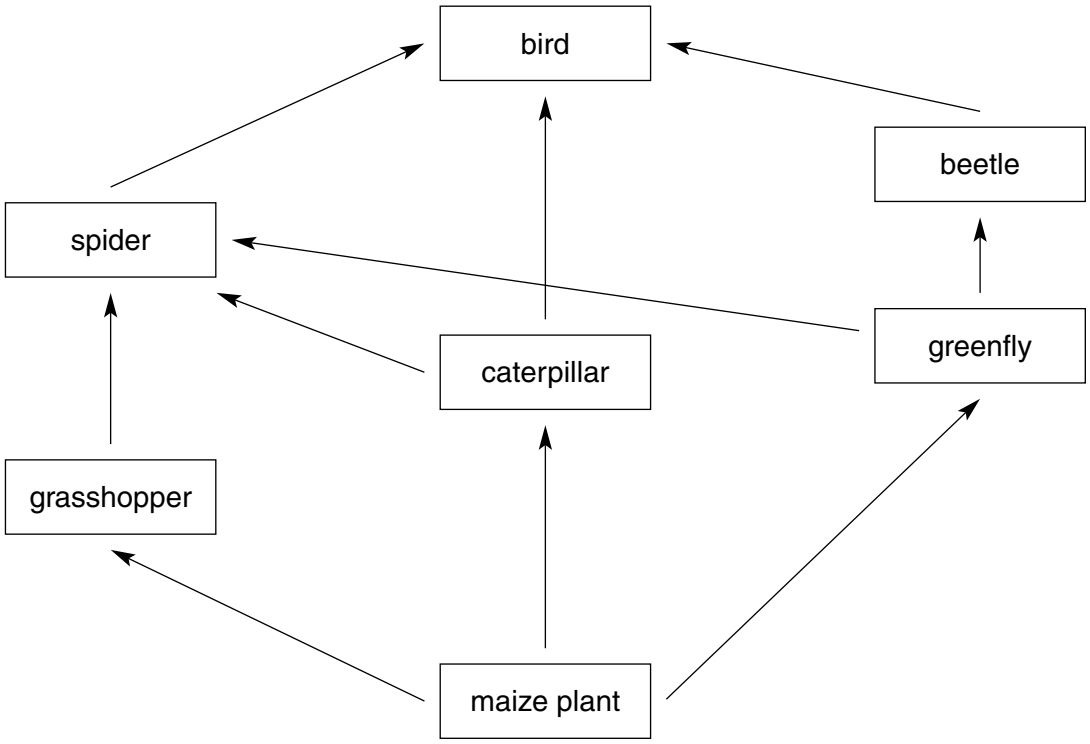

Fig. 12.1

(i) Draw one food chain from this food web.
Describe and explain the energy losses from your food chain. [6]

(ii) The field is sprayed with an insecticide that kills the grasshoppers and greenflies.
Describe and explain the effects that this has on the food web. [4]

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 †															

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

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

Key: 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.).