Centre Number	Candidate Number	Name

MINISTRY OF EDUCATION, BOTSWANA

in collaboration with

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

Botswana General Certificate of Secondary Education

SCIENCE : DOUBLE AWARD

0569/02

Paper 2

October/November 2003

2 hours

Candidates answer on the Question Paper
No additional materials are required

Read the following carefully before you start.

Write your centre number, candidate number and name in the spaces provided at the top of this page.

Answer **all** questions.

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

Do not use staples, paper clips, highlighters, glue or correction fluid.

The number of marks is given in brackets [ ] at the end of each question or part question.

You may use a calculator.

A copy of the Periodic Table is printed on page 20.

For Examiner's Use	
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TOTAL	

This question paper consists of **19** printed pages and **1** blank page.

For Examiner's Use

1 Fig. 1.1 shows vernier callipers being used to measure the length of a wooden block.

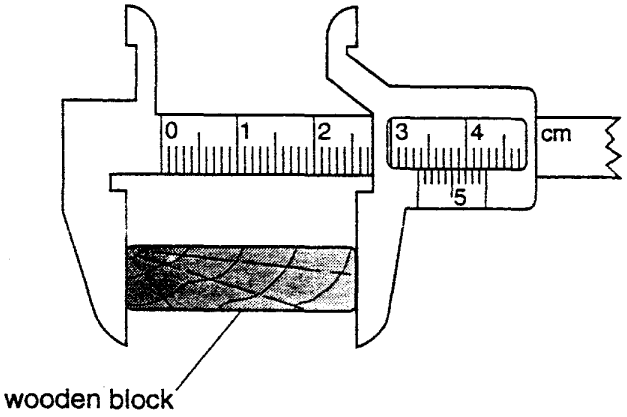


Fig. 1.1

What is the length of the wooden block?

length ..... cm [1]

For Examiner's Use

2 Fig. 2.1 shows a bus travelling closely behind a car. The speed of the car is 100 km/h. A child runs onto the road and both drivers slam on the brakes at the same time.

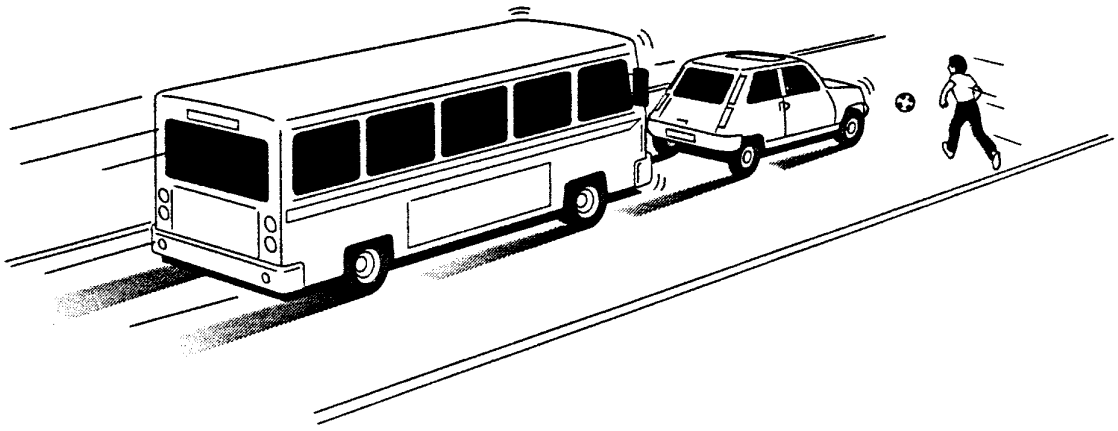


Fig. 2.1

(a) Which vehicle is likely to stop first?

.....

Explain your answer.

.....

.....

..... [3]

(b) Why is it necessary for the passengers of the car to wear seat belts?

.....

..... [1]

3 **(a)** A 20 kg object is released from an aeroplane at a high altitude. The object accelerates at the beginning of its fall then starts to fall with a uniform speed. (1 kg has a weight of 10 N).

(i) Calculate the resultant force on the object just as it starts to fall.

resultant ..... N [2]

(ii) Explain why the object finally falls with a uniform speed.

.....

..... [1]

(b) Fig. 3.1 shows an irregular shape plane lamina suspended from a nail and held to one side.

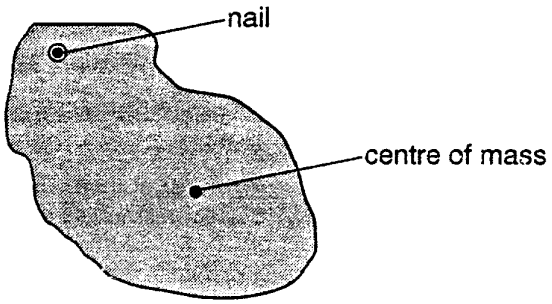


Fig. 3.1

Explain why the lamina swings clockwise when released.

.....

.....

..... [2]

4 A household uses solar electricity from solar panels.

(a) State two advantages of using solar energy.

1 .....

2 ..... [2]

(b) State the main energy change in the solar panel.

..... [1]

For Examiner's Use

5 Fig. 5.1 shows a temperature-time graph of a substance being cooled.

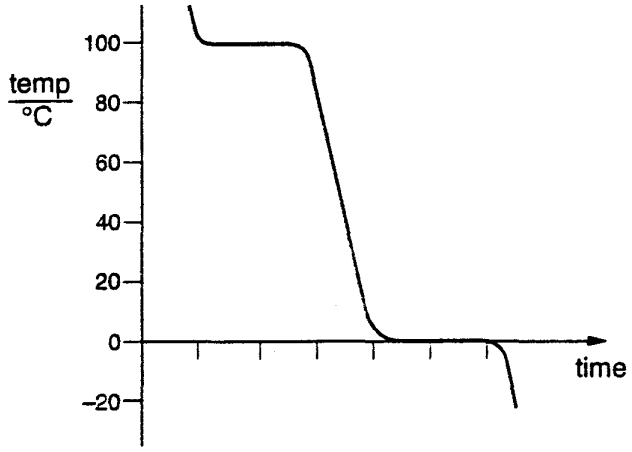


Fig. 5.1

(a) At what temperature is the substance condensing?

.....°C [1]

(b) **(i)** What is meant by the term melting point?

.....

..... [1]

(iii) If the substance is heated in its solid state, at what temperature would it melt?

..... °C [1]

6 RB 2 radio station broadcasts at a frequency of 107 MHz around Mahalapye. The speed of electromagnetic waves is 3×10^8 m/s.

Calculate the wavelength of the transmitted waves.

wavelength = ... m [2]

7 **(a)** Fig. 7.1 shows an electric iron.

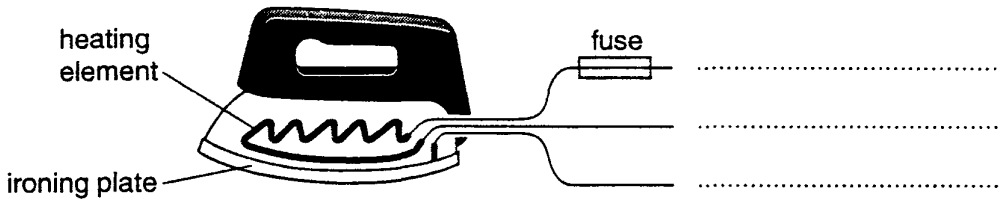


Fig. 7.1

(i) On the diagram name each of the wires in the electrical cord connected to the electric iron. [3]

(ii) Explain the function of the wire connected to the ironing plate.

.....

..... [1]

(iii) Explain the function of the fuse.

.....

..... [2]

(b) Fig 7.2 shows a magnet suspended in a coil by a string.

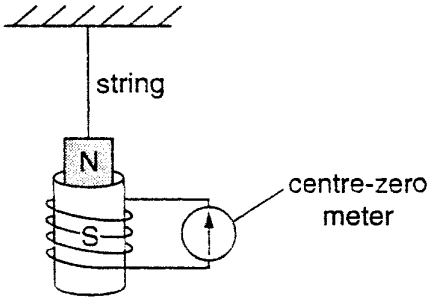


Fig. 7.2

The thread is cut and the magnet falls through the coil.

(i) Describe what would happen to the pointer of the electrical meter.

.....

.....

..... [2]

(ii) What causes the pointer to behave as in **(b)(i)**?

.....

.....

.....

..... [3]

8 Fig. 8.1 shows emissions from a radioactive source directed to pass near a positively charged plate.

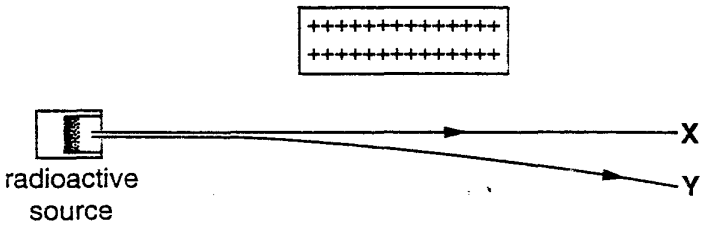


Fig. 8.1

(a) Identify the emissions **X** and **Y**.

X .....

Y ..... [2]

(b) Arrange the three radioactive emissions according to their ability to penetrate matter.

....

most penetrating least penetrating [2]

[Turn over

For Examiner's Use

9 Fig. 9.1 shows the structure of an atom of an element.

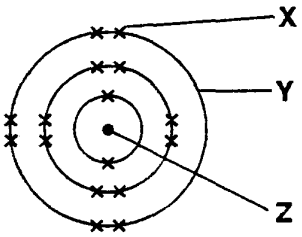


Fig. 9.1

(a) **(i)** Name the particle labelled **X**.

X .....

(ii) What does the circle labelled **Y** represent?

..... [2]

(b) State **two** components of the part labelled **Z**.

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

(c) Write the name of the element with the structure shown.

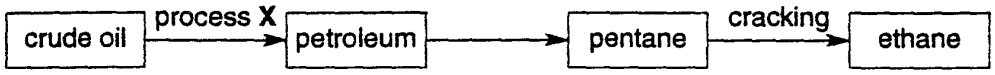
..... [1]

(d) State the group in which the element is found.

..... [1]

For Examiner's Use

10 The flow chart shows some of the stages involved in the production of ethane from crude oil.



(a) **(i)** What is process **X**?

..... [1]

(ii) Why is it possible to obtain petroleum by process **X**?

..... [1]

(iii) Name **one** other product from crude oil treated by process **X**.

..... [1]

(iv) What is cracking?

.....

..... [2]

(v) Write an equation to show the production of ethane from pentane.

..... [2]

(b) The equation shows the energy changes for the complete combustion of ethane.

$$C_2H_6 + O_2 \longrightarrow CO_2 + H_2O \quad \Delta H = -91 \text{ kJ/mol}$$

(i) Balance the equation.

(ii) Draw the structural formula for ethane.

(iii) Name a product, other than water, of the **incomplete** combustion of ethane.

.....

(iv) Name the type of chemical reactions with the energy change shown in the equation.

.....

(v) What observation is made on the reaction vessel of chemical reactions with the energy change shown in **(b)**?

.....

[5]

11 A 100 g sample of epoxyether contains 38.8 g carbon, 51.6 g oxygen and the rest is hydrogen.

(a) Calculate the mass of hydrogen in the sample.

hydrogen = ... g [1]

(b) What is the empirical formula of the epoxyether? Show your working.

empirical formula = ... [3]

(c) The relative molecular mass of the epoxyether is 62. What is its actual molecular formula? Show your working.

molecular formula = ... [2]

12 Fig 12.1 shows the structure of an allotrope of carbon.

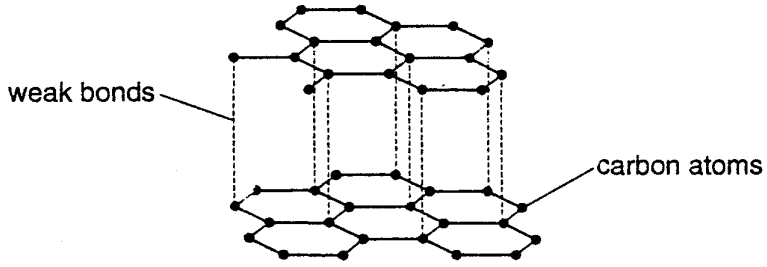


Fig 12.1

(a) (i) What is meant by *allotrope*?

.....

(ii) Name the allotrope shown.

.....

(iii) Name the other common allotrope of carbon.

.....

(iv) State **one** physical difference between the allotropes named in **(ii)** and **(iii)** above.

..... [4]

(b) (i) Give **one** use of the allotrope whose structure is shown above.

.....

(ii) State the property of the allotrope linked to the use given in **(b) (i)** above.

..... [2]

13 Fig. 13.1 shows a schematic diagram of a breathalyser used by police officers to measure the amount of alcohol taken by drivers. The breathalyser is filled with potassium dichromate, which changes colour when alcohol is blown through it.

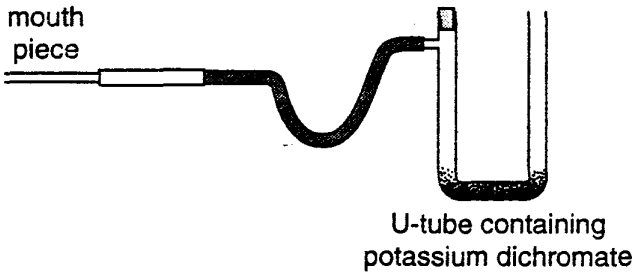


Fig. 13.1

(a) Is potassium dichromate an oxidising or reducing agent?

.....

Explain your answer.

.....

.....

(b) State the colour change when alcohol is blown through potassium dichromate.

.....

(c) Name the organic compound formed when alcohol is blown through potassium dichromate.

..... [4]

For Examiner's Use

14 Fig. 14.1 represents the passage of a meal through the human digestive system.

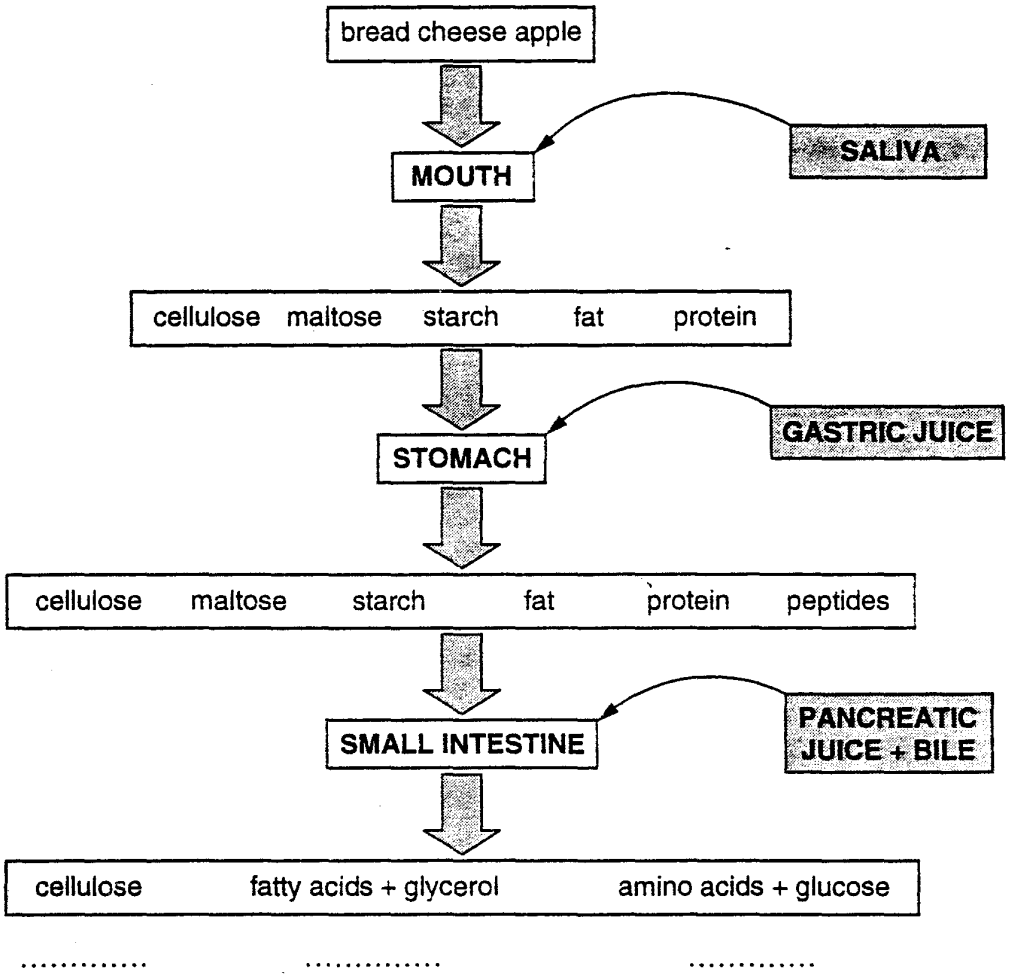


Fig. 14.1

(a) (i) Describe what happens to the food in the mouth.

.....

.....

(ii) From the small intestine, some of the substances pass into the blood, some into the lymph and some into the rectum.

On Fig. 14.1, write the letters **B** for blood, **L** for lymph and **R** for rectum, on the lines beneath the substances in the last box, to show which of these it will pass into. [5]

(b) Gastric juice has pH 2.

Describe how one would test whether the extracted enzyme from gastric juice would work at pH 8.5.

.....

.....

.....

..... [3]

15 Fig. 15.1 and 15. 2 show typical plant and animal cells respectively. (The cells are not drawn to scale)

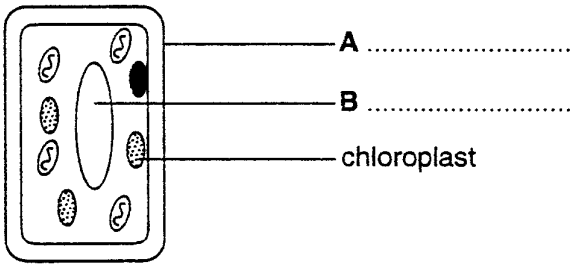


Fig. 15.1

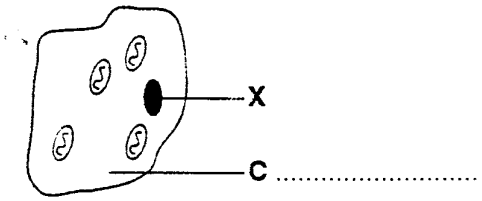


Fig. 15.2

(a) (i) Label structures **A**, **B** and **C**.

(ii) What is the main constituent of **A**?

.....

(iii) State the function of **X**.

.....

[5]

(b) (i) In which plant organ is the cell in Fig. 15.1 found?

.....

(ii) Give one reason to support your answer to **(i)** above.

..... [2]

16 Fig. 16.1 shows a cross section of a plant root.

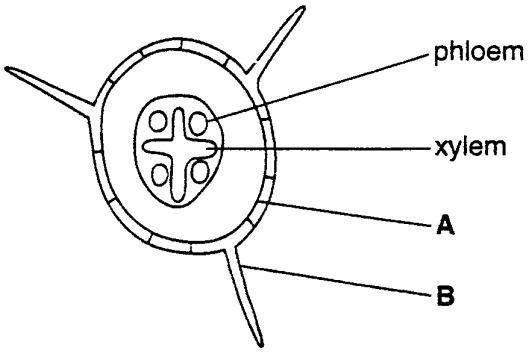


Fig. 16.1

Cells A and B are epidermal cells.

(a) (i) Draw a detailed diagram of cell B in the space below as it would appear under a microscope.

[3]

(ii) Which of the two epidermal cells would absorb more water from the soil?

.....

Explain your answer.

.....

..... [2]

(b) Suggest two ways in which the absorbed water may be used by a green plant.

..... [2]

[Turn over

For Examiner's Use

17 Selibe Phikwe is a mining town experiencing an air pollution problem from sulphur dioxide.

(a) **(i)** Name the harmful substance that sulphur dioxide forms when it dissolves in rain water.

.....

(ii) Describe the effect of this substance on plants.

.....

..... [2]

(b) The table shows the mass of sulphur dioxide produced in Selibe Phikwe and released into the atmosphere over a period of twenty years.

year	*mass of SO_2 (arbitrary units)*
1975	2.8
1980	3.1
1985	3.5
1990	3.9
1995	3.3

Give **two** possible reasons why there was an increase in the mass of sulphur dioxide up to 1990.

.....

.....

..... [2]

For Examiner's Use

18 Fig. 18.1 shows the position of some endocrine glands in the human body.

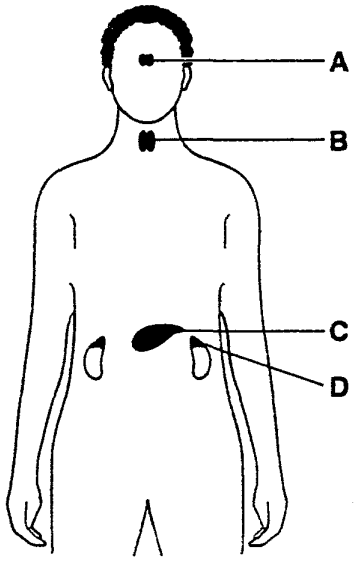


Fig. 18.1

(a) Complete the table below to identify the gland and the hormones they secrete.

	gland	*hormone*
A		
B		
D		

[3]

(b) Describe the effect of a named hormone from gland **C** on blood sugar level.

..... [1]

For Examiner's Use

19 Fig. 19.1 shows a cross-section of a Devil's thorn flower.

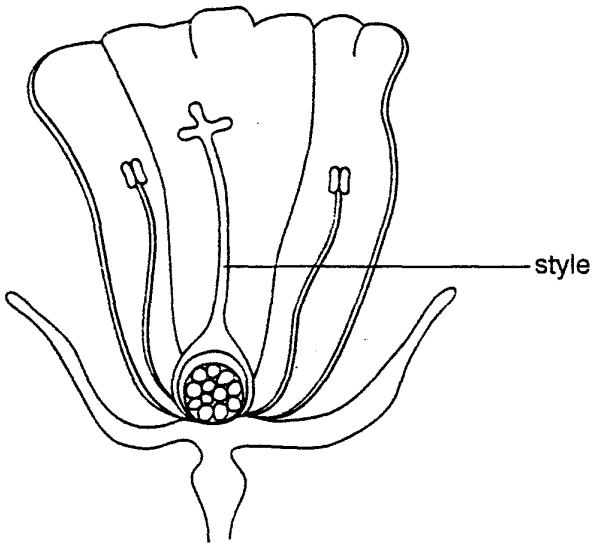


Fig. 19.1

(a) Using a label line and the letter **Y** show the part of the flower where fertilisation occurs. [1]

(b) Suggest how this flower is pollinated.

.....

Explain your answer.

.....

..... [2]

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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.).