Centre Number	Candidate Number

Candidate Name _____

MINISTRY OF EDUCATION, BOTSWANA
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
Botswana General Certificate of Secondary Education

SCIENCE : DOUBLE AWARD 0569/2

PAPER 2

OCTOBER/NOVEMBER SESSION 2001 2 hours

Candidates answer on the question paper.
No additional materials are required.

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

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

Answer **all** questions.

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

INFORMATION FOR CANDIDATES

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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
TOTAL	

This question paper consists of 18 printed pages and 2 blank pages.

MML 451 8/00 S10746

[Turn over

1 Fig. 1.1 shows a 20 kg box resting on a smooth, horizontal surface and a force, **F**, of 15 N is applied to it. The box moves horizontally.

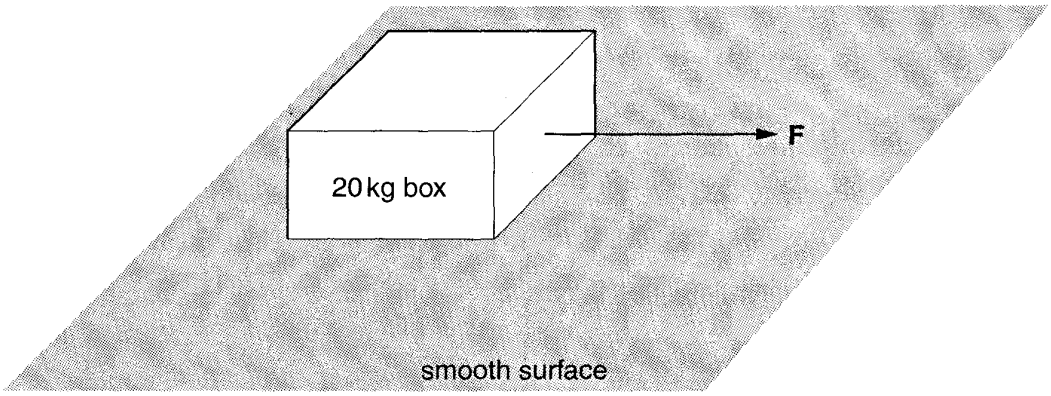


Fig. 1.1

(a) Calculate the acceleration of the box. Show your working.

acceleration of box = ... m/s^2 [2]

(b) What is the advantage of moving the box along a smooth surface?

.....

..... [1]

2 Fig. 2.1 shows the cooling system of a refrigerator.

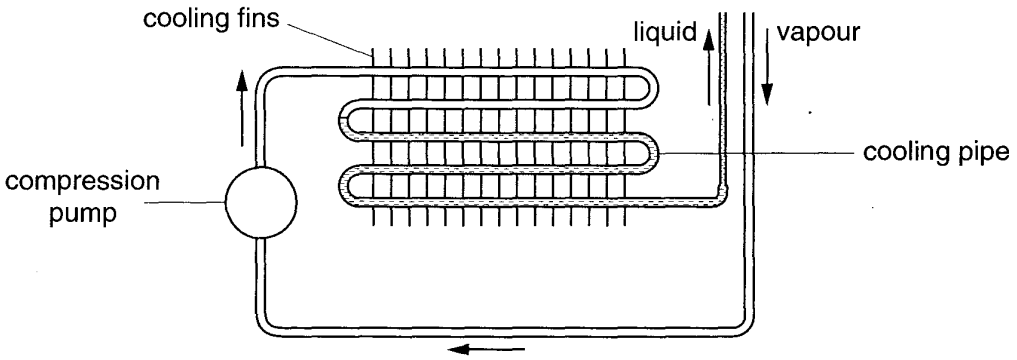


Fig. 2.1

(a) The pipe and fins at the back of the refrigerator are painted black.

Explain why

(i) the pipes and the cooling fins are painted black,

.....

..... [1]

(ii) there are many fins fitted along the pipe.

.....

.....

..... [2]

(b) Explain why the body of the refrigerator is painted white.

.....

.....

..... [1]

3 Fig. 3.1 shows a ray of light entering a rectangular glass block.

The refractive index of the glass is 1.5.

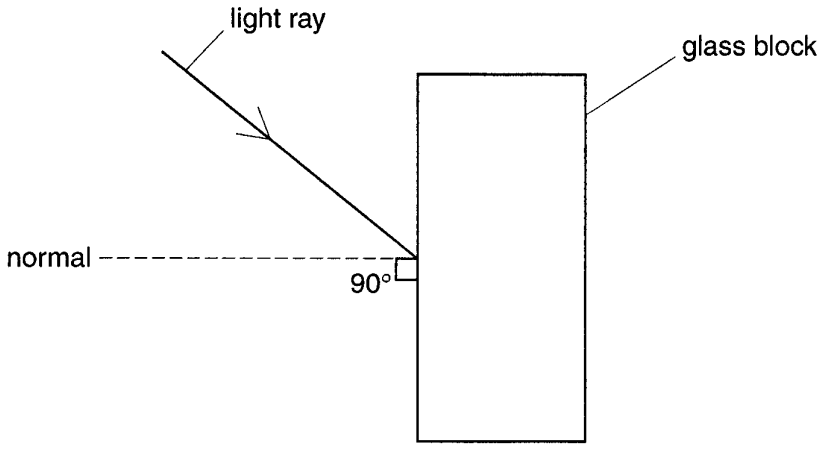


Fig. 3.1

(a) Draw the approximate path of the ray through the block and out the other side. [2]

(b) **(i)** What is meant by *refractive index*?

.....

..... [1]

(ii) The angle of incidence is 39°.

Calculate the angle of refraction. Show your working.

angle of refraction = ... [2]

4 Fig. 4.1 shows a person addressing a crowd using a public address system.

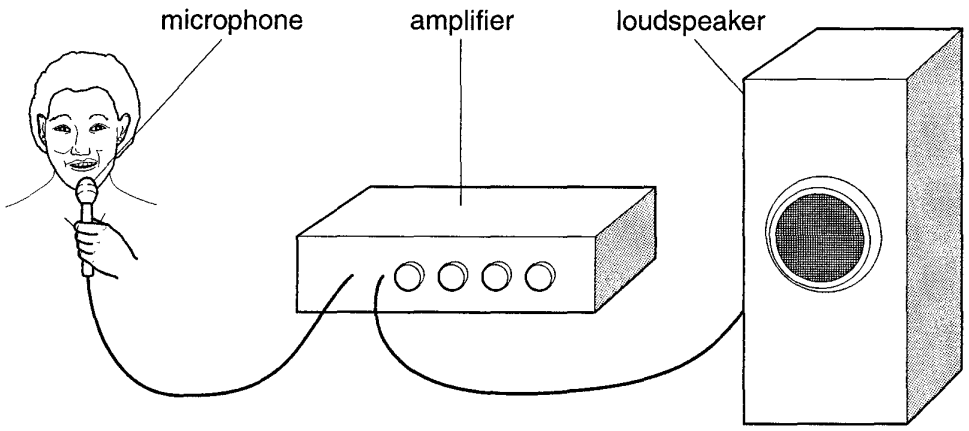


Fig. 4.1

State the main energy changes involved.

.....

.....

..... [3]

5 Fig. 5.1 shows a negatively charged, plastic strip suspended by a thin thread and a charged strip **R** made of a different plastic material.

The diagram shows what happens when **R** is brought near end **Y**.

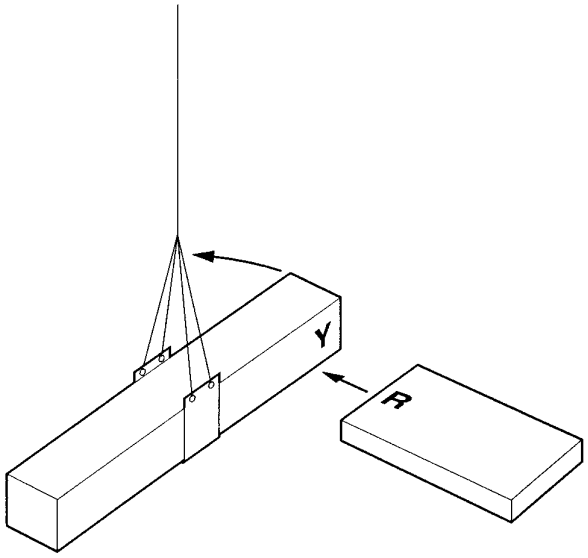


Fig. 5.1

(a) Name the effect of bringing **R** near to **Y**.

..... [1]

(b) Explain how the strip **R** was charged.

..... [1]

(c) How can the negatively charged strip be discharged?

..... [1]

6 Fig. 6.1 shows an electromagnet.

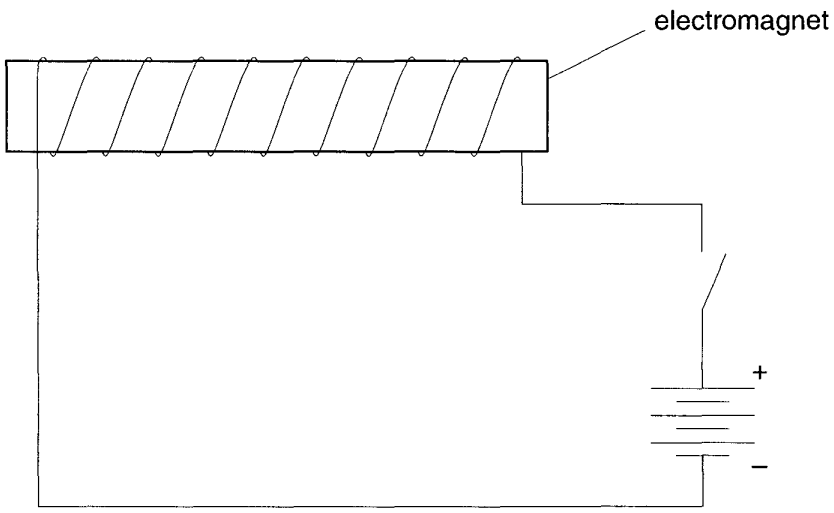


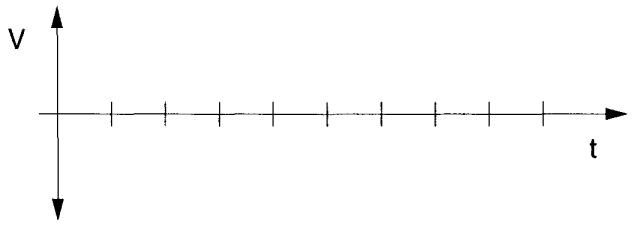
Fig. 6.1

(a) State two ways by which the strength of the electromagnet can be increased.

1. .....

2. ..... [2]

(b) Sketch the voltage–time graph for two complete rotations of an a.c. generator on the axes below.



[3]

(c) State three ways of increasing the size of the induced electromotive force in an a.c. generator.

1. .....

2. .....

3. ..... [3]

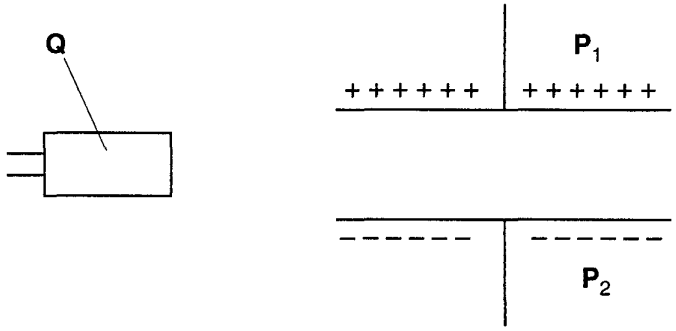
7 **(a)** Complete Table 1 to show the nature of each emission and state whether the ionising effect of each emission is small, medium or large.

Table 1

particle or radiation	nature	ionising effect
alpha emission		
beta emission		
gamma emission		

[4]

(b) A radioactive source **Q**, emits alpha, beta and gamma radiation. The radiation travels between charged plates $\mathbf{P_1}$ and $\mathbf{P_2}$. Draw in the paths followed by each radiation and label each path accordingly.



[3]

8 Table 2 shows the electronic structure of six elements, U, V, W, X, Y and Z.

Table 2

element	electronic structure
U	2,1
V	2,2
W	2,4
X	2,8,7
Y	2,8,8
Z	2,8,8,1

(a) Give the letters of

(i) **two** elements in the same period of the Periodic Table,

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

(ii) a noble gas, ... [1]

(iii) a Group I metal. ..... [1]

(b) **(i)** What is the formula of a molecule of a compound formed between hydrogen atoms and one atom of **W**?

..... [1]

(ii) Draw a dot and cross diagram to show the bonding between these hydrogen atoms and one atom of **W**. (Show the outer orbitals only.)

[2]

(c) An element T has a melting point of 30 °C and a boiling point of 2440 °C. It conducts electricity at room temperature. It burns in oxygen to form an oxide with formula T_2O_3 which can react with both acids and bases. T also forms a compound with fluorine, which has a high melting point and conducts electricity in molten form. The approximate relative atomic mass of T is 70.

(i) What type of oxide is T_2O_3?

..... [1]

(ii) Give two properties that indicate that T is probably a metal.

1. .....

2. ..... [2]

(iii) Predict the formula for the fluoride of T.

..... [1]

(iv) What are the products of the electrolysis of the molten fluoride of T, using inert electrodes?

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

(v) In which group and period of the Periodic Table will T be placed?

group .....

period ..... [2]

(vi) Write the symbol of the element in the Periodic Table which most closely resembles T.

..... [1]

For Examiner's Use

9 **(a)** **A** and **B** are white powders. **A** is insoluble in water but **B** is soluble in water and its solution has a pH value of 3.

A mixture of **A** and **B** bubbles or fizzes in water. A gas is given off and a clear solution forms.

(i) Which powder is acidic?

..... [1]

(ii) The other powder is a carbonate.

What gas is given off in the reaction?

..... [1]

(b) Anyhdrous copper(II) sulphate is a white powder.

(i) Write its formula. ..... [1]

(ii) What happens when water is added to anhydrous copper(II) sulphate?

..... [1]

(c) Describe **two** tests to show that a given liquid is water.

1. .....

.....

2. .....

..... [2]

[Turn over

For Examiner's Use

10 Limestone, $CaCO_3$, decomposes on heating according to the following equation.

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

(a) Calculate the relative molecular mass of limestone.

relative molecular mass = ... [2]

(b) 20 g of limestone was decomposed.

(i) Calculate the number of moles of limestone used.

number of moles = ... [2]

(ii) Calculate the mass of calcium oxide, CaO, formed.

mass = ... g [2]

(c) At the end of heating, the calcium oxide formed was weighed and only 10 g was collected.

(i) Calculate the percentage yield of the product.

% yield = ... % [2]

(ii) Name a substance that would react with calcium oxide to form calcium chloride.

..... [1]

(iii) Write a balanced reaction equation for the reaction. Include state symbols.

..... [3]

11 Fig. 11.1A shows an animal cell and Fig. 11.1B a plant cell.

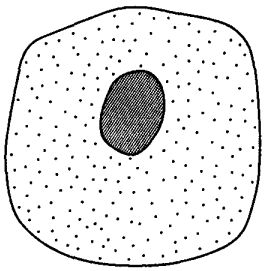


Fig. 11.1A

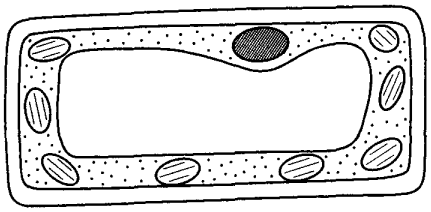


Fig. 11.1B

(a) State one visible similarity and one visible difference between the two cells.

(i) similarity .....

..... [1]

(ii) difference .....

..... [1]

(b) Fig. 11.2 shows how the cell in Fig. 11.1A would appear if it was left in a concentrated solution for an hour.

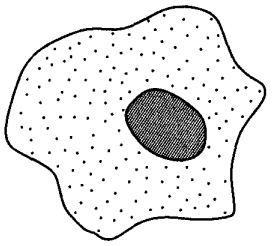


Fig. 11.2

Explain the changes that have taken place in the cell while it was in the concentrated solution.

.....

.....

.....

.....

..... [4]

12 Fig. 12.1 shows the apparatus used to investigate a process taking place in yeast cells.

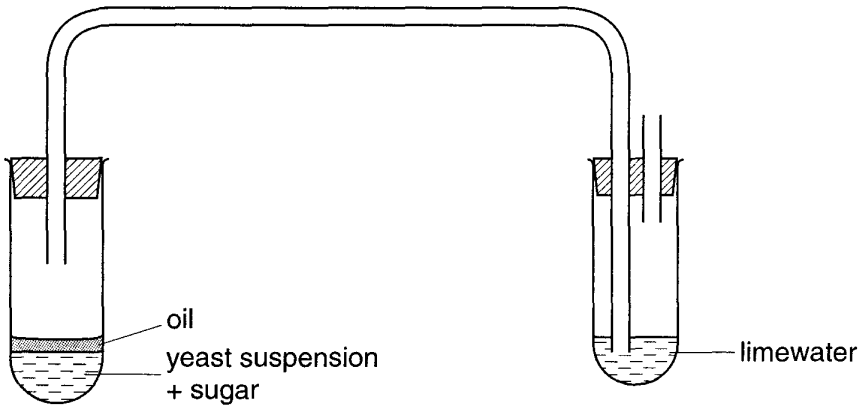


Fig. 12.1

(a) Name the process under investigation.

..... [1]

(b) State the **word** equation for this process.

..... [1]

(c) Explain why a layer of oil was put on the yeast–sugar mixture.

.....

..... [1]

(d) **(i)** State what would be observed in the test-tube with limewater if a different test-tube containing a boiled yeast–sugar mixture is used in the set-up.

.....

..... [1]

(ii) Explain your answer in **(i)** above.

.....

..... [1]

For Examiner's Use

13 Fig. 13.1 shows the human blood circulation.

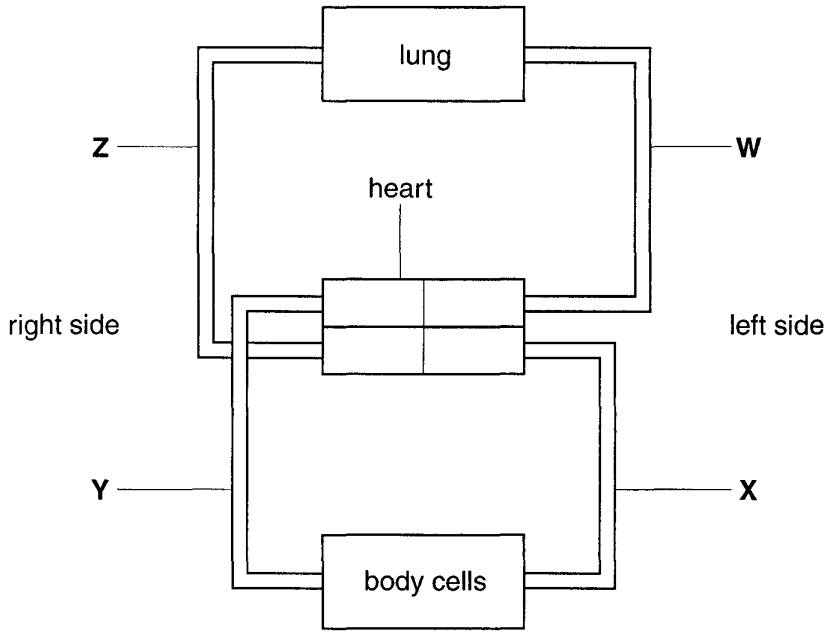


Fig. 13.1

(a) Identify the blood vessels labelled **W**, **X**, **Y** and **Z**.

W .....

X .....

Y .....

Z ..... [4]

(b) Draw arrows in the blood vessels to show the direction of blood flow. [1]

(c) State two differences in structure between blood vessel **X** and blood vessel **Y**.

1. .....

.....

2. .....

..... [2]

(d) State the function of the heart in blood circulation.

..... [1]

[Turn over

For Examiner's Use

14 Fig. 14.1 shows half of a flower.

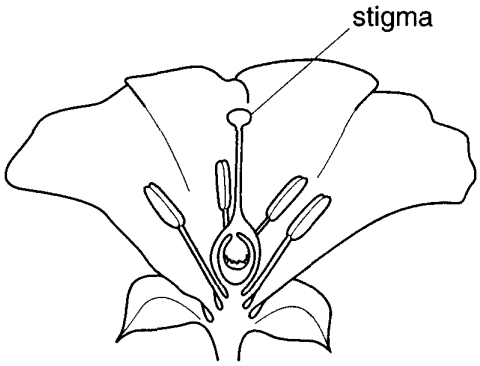


Fig. 14.1

(a) Describe how this flower is pollinated.

.....

.....

.....

..... [3]

(b) Give two features of a flower that is pollinated in this way.

1. .....

.....

2. .....

..... [2]

(c) Pollination can lead to fertilisation and the development of fruits and seeds.

Describe the functions of the following parts of a seed.

(i) cotyledon .....

..... [1]

(ii) testa .....

..... [1]

(d) Explain how the dispersal of fruits like tomatoes by animals is possible even though there are digestive juices in the gut.

.....

.....

.....

..... [3]

For Examiner's Use

15 Conservation of **both** plant and animal species is of great importance to mankind.

(a) Give **two** reasons why conservation of some species is of importance to Botswana.

.....

.....

..... [2]

(b) Describe how recycling of paper contributes to conservation.

.....

.....

..... [2]

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DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 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.).

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