EXAMINATIONS COUNCIL OF SWAZILAND
Swaziland General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

PHYSICAL SCIENCE **6888/03**

Paper 3 Extended **October/November 2013**

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.

You may use a calculator.

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	
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This document consists of **18** printed pages and **2** blank pages.

1 The Athletics Association uses chromatography to test for the presence of caffeine and paracetamol in urine samples from athletes.

Fig. 1.1 shows a chromatogram of caffeine **(1)** and paracetamol **(2)** alongside urine samples from four different athletes, **A**, **B, C** and **D**.

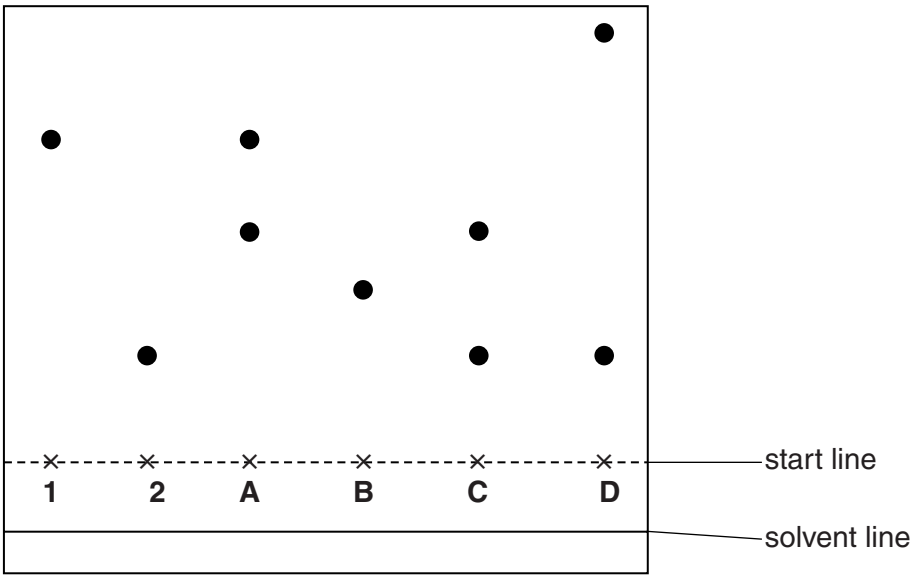

Fig. 1.1

(a) Explain why the start line must be above the solvent.

.....[1]

(b) Suggest conclusions that the Athletics Association could make about the presence or absence of caffeine or paracetamol in athletes **A**, **B**, **C** and **D**.

A .....

B .....

C .....

D .....[2]

2 A ball of mass 400 g is thrown vertically upwards.

It reaches a maximum height of 3 m.

[g = 10 N / kg]

(a) Calculate the value of the gravitational force on the ball at its highest point.

.....[2]

(b) After the ball has fallen 1 m from its highest point, the acceleration falls from 10 m / s^2 to 8 m / s^2.

Explain why the acceleration decreases.

.....

.....

.....

.....[2]

(c) On Fig. 2.1, sketch the speed-time graph for the ball as it moves upwards.

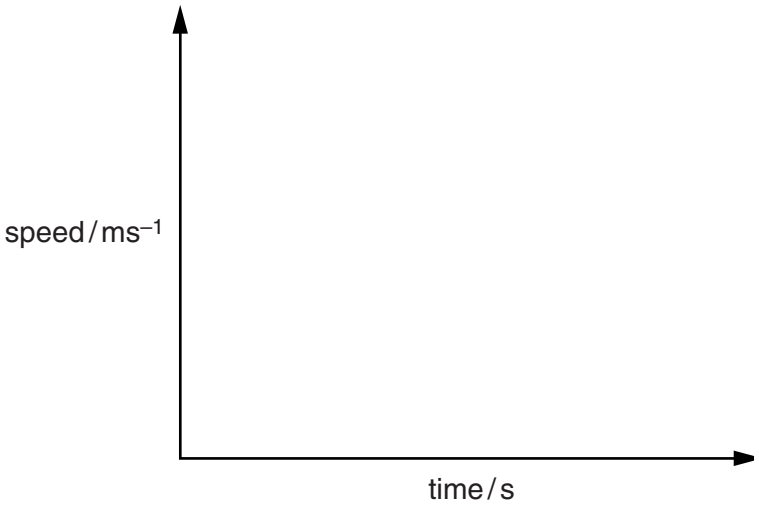

Fig. 2.1 [2]

3 A substance melts at –7 °C and boils at 59 °C.

Fig. 3.1 shows the arrangement of particles in the substance at –10 °C.

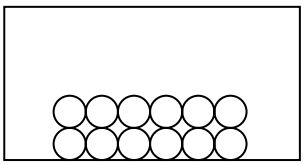

Fig. 3.1

(a) Draw the arrangement of particles in the substance at 40 °C, in Fig. 3.2.

Fig. 3.2 [2]

(b) The temperature of the sample is raised to 65 °C. In terms of the kinetic particle theory, compare the structure of the sample at this temperature with the sample at –10 °C.

movement .....

arrangement .....[2]

4 Fig. 4.1 shows an object, **O**, and its image, **I**, formed by a convex lens.

Fig. 4.1

(a) Draw a suitable ray on Fig. 4.1 to find the position of the lens.

Draw in the lens and label it **L**. [2]

(b) Draw another ray to find the position of the principal focus.

Mark the position of the principal focus and label it **F**. [2]

5 Table 5.1 shows data about three organic compounds.

Table 5.1

name	formula	boiling point / °C
methanol	CH_3OH	65
ethanol	C_2H_5OH	78
propanol	C_3H_7OH	97

(a) Draw a dot and cross diagram to show bonding in methanol, CH_3OH. (Show outer electrons only.)

[2]

(b) These compounds are members of the same homologous series.

(i) State the name of this homologous series.

.....[1]

(ii) State two characteristics, other than the trend in boiling point, of the members of the homologous series in Table 5.1.

1 .....

2 .....[2]

(c) Ethanol reacts with ethanoic acid to form an ester.

(i) Name the ester that is formed.

.....[1]

(ii) Draw the structure of the ester formed in **(c)(i)**.

[2]

6 Fig. 6.1 shows a lighting circuit.

It contains two bulbs and three switches which are correctly wired.

Each bulb has a resistance of 960 Ω.

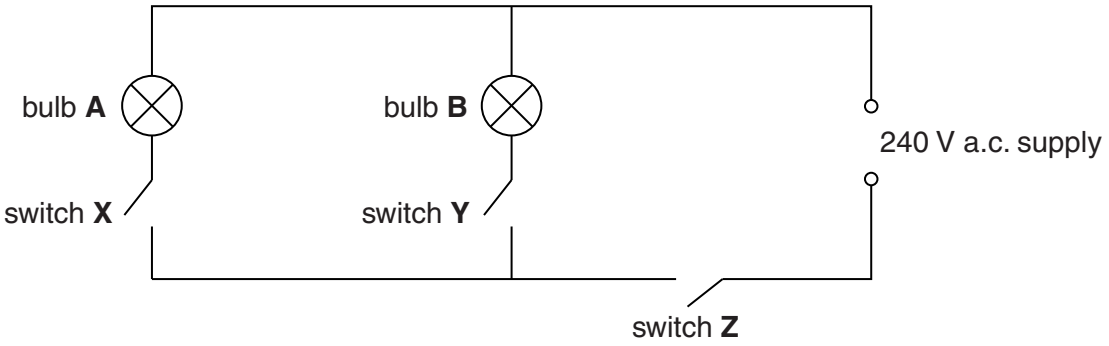

Fig. 6.1

(a) Which switches must be closed to light bulb **B** only?

.....[1]

(b) The circuit is to be protected by a fuse.

Draw, on Fig. 6.1, the fuse in its correct position. [1]

(c) Explain how the fuse protects the circuit.

.....

.....

.....[3]

(d) Calculate the total current in the circuit when all the switches are closed.

Show your working.

.....[3]

(e) State the energy changes in the bulbs.

.....[1]

7 Strontium and calcium are elements found in Group II of the Periodic Table.

(a) Calcium reacts with water in a similar way to Group I elements.

(i) Suggest two observations that can be made during the reaction.

1 .....

2 .....[2]

(ii) Write a balanced chemical equation for the reaction of calcium with water.

.....

.....[2]

(b) Suggest an element in Group II of the Periodic Table that is more reactive than strontium.

.....[1]

8 Fig. 8.1 shows a method of measuring the speed of sound.

An observer watches his assistant fire a gun.

On seeing the smoke he starts a stop watch and on hearing the sound of the gun he presses the stop button.

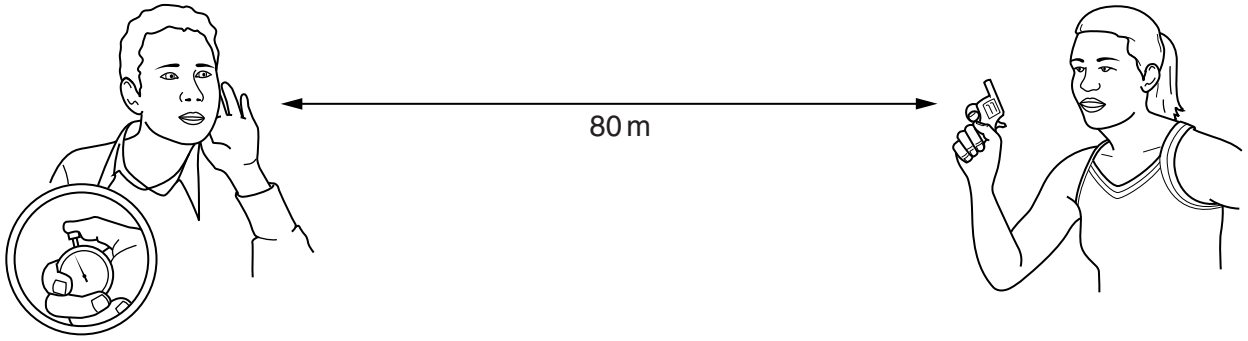

Fig. 8.1

(a) (i) Suggest why there is a large uncertainty in the value obtained in this experiment.

.....

.....[1]

(ii) Explain how this uncertainty could be reduced.

.....

.....[1]

(b) A sound wave has a frequency of 220 Hz and a speed of 330 m / s.

Calculate its wavelength.

.....[2]

(c) The amplitude of the sound wave is increased.

State the effect this has on the sound heard.

.....[1]

9 Fig. 9.1 shows the apparatus used to prepare lime from limestone.

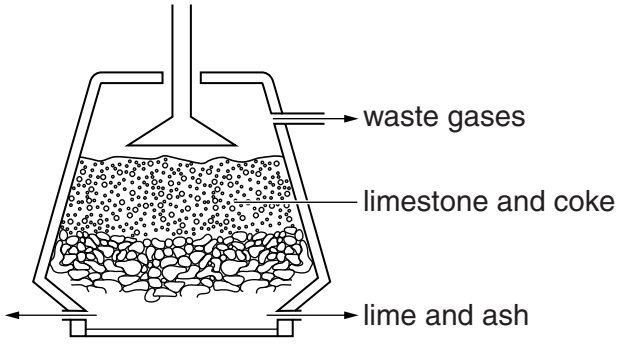

Fig. 9.1

(a) Name the apparatus shown in Fig. 9.1.

.....[1]

(b) State the name of a waste gas produced in this process.

.....[1]

(c) The coke acts as a fuel in this process, providing the high temperature needed for the reaction to occur.

(i) Name the type of reaction that occurs when the limestone is converted to lime.

.....[1]

(ii) Write a balanced equation (using symbols) for the reaction.

.....[1]

(d) Describe the manufacture of cement using limestone.

.....[1]

10 Fig. 10.1 shows an experiment where water is heated to boiling point at the top while ice remains at the bottom of a glass test-tube.

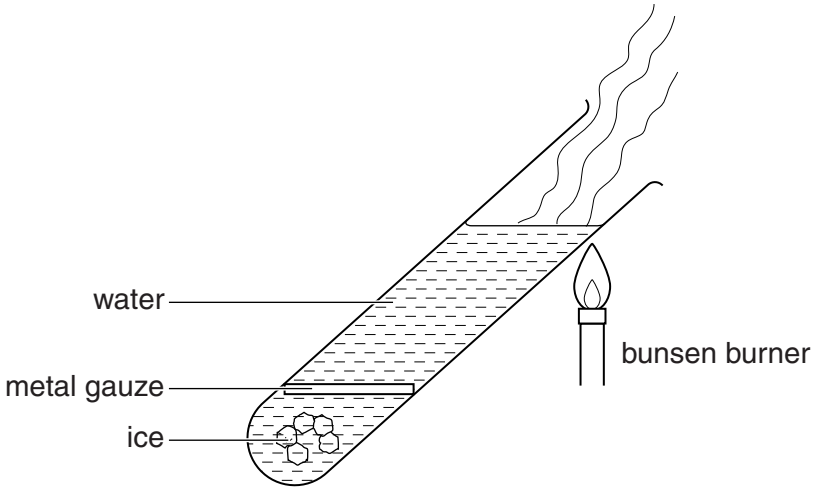

Fig. 10.1

The experiment is repeated using a copper test-tube and the ice is found to rapidly melt.

Explain why the results of the experiments are different.

.....

.....

.....

.....

.....

.....[3]

11 Green plants make glucose by the process of photosynthesis.

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

(a) State the source of energy for this process.

.....[1]

(b) A plant uses 12 g of water to make glucose.

Calculate

(i) the mass of glucose made,

mass of glucose ..... g [3]

(ii) the volume, at room temperature and pressure, of carbon dioxide used.

(The volume of 1 mole of any gas is 24 dm^3 at room temperature and pressure.)

volume .....[3]

12 Phosphorus-32 is used in agriculture to study the uptake of fertilisers in plants.

It has a half-life of 14 days and decays by beta emission.

(a) Complete the equation showing the decay of phosphorus.

$^{32}_{15}P \rightarrow$ ..... + ... [2]

(b) Explain why phosphorus-32 is suitable to be used in this study.

.....

.....

.....

.....[2]

13 Fig. 13.1 represents the structures of brass, zinc and graphite.

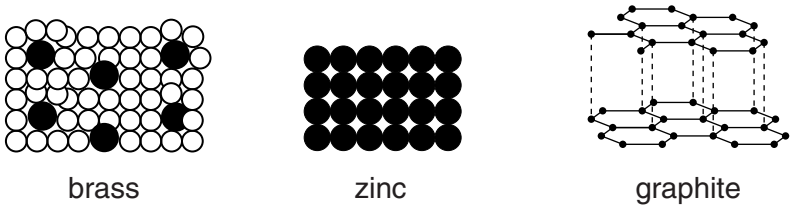

Fig. 13.1

Use ideas about structure and bonding to explain the following

(a) brass is stronger than zinc,

.....

.....

.....

.....[2]

(b) graphite is soft and slippery.

.....

.....[1]

14 Fig. 14.1 shows two buses. Bus **A** has a luggage carrier on top and bus **B** has a luggage compartment below the passenger seats.

Both buses are carrying the same mass of luggage and passengers.

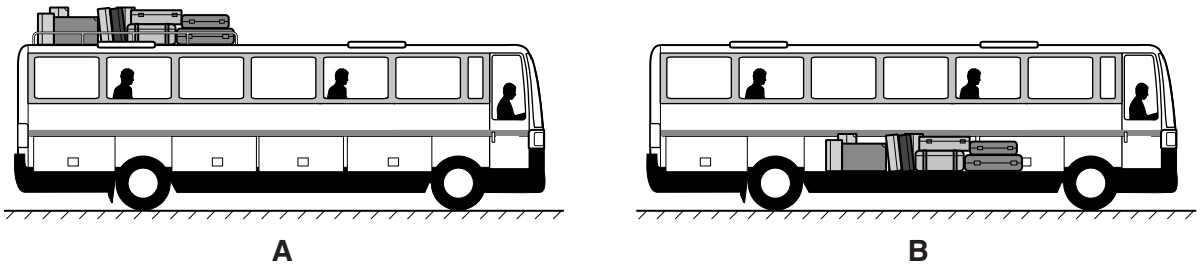

Fig. 14.1

Explain why bus **B** is more stable than bus **A**.

.....

.....

.....

.....

.....

.....

.....[3]

15 The apparatus in Fig. 15.1 shows a gas reacting with an oxide.

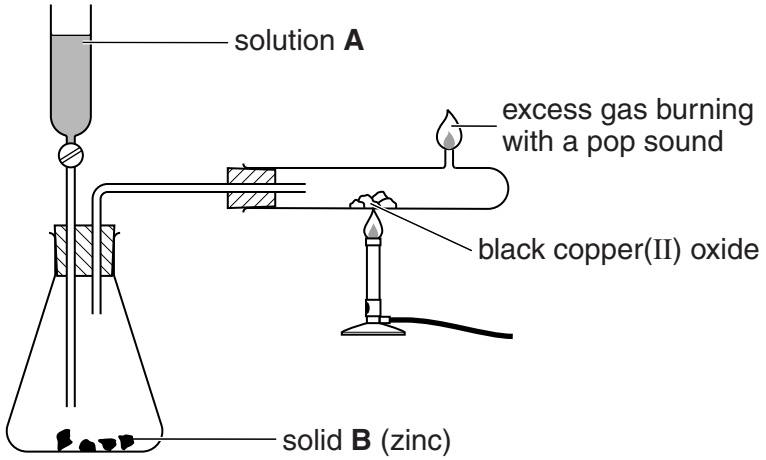

Fig. 15.1

(a) Suggest the identity of solution **A**.

solution **A** .....[1]

(b) The copper(II) oxide changes into a red-brown solid as the reaction proceeds.

The equation for the reaction taking place is:

$$CuO + H_2 \rightarrow Cu + H_2O$$

(i) Explain, in terms of electron transfer, why this is a reduction reaction.

.....

.....

.....[2]

(ii) Explain, using the kinetic particle theory, why heating the copper(II) oxide makes the reaction go faster.

.....

.....

.....[2]

16 Fig. 16.1 shows a transformer which has an input of 240V and an output of 12V across the load resistor, R.

The current in the primary circuit is 0.1A. (Assume the transformer is 100% efficient.)

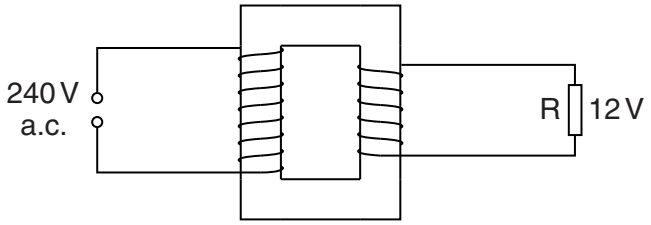

Fig. 16.1

(a) Calculate the current in the secondary circuit.

.....[2]

(b) Fig. 16.2 shows a second circuit.

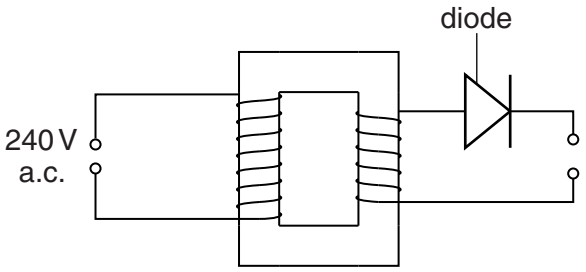

Fig. 16.2

A cathode ray oscilloscope (CRO) is connected across the output.

In Fig. 16.3, sketch the output voltage viewed on the screen of the CRO.

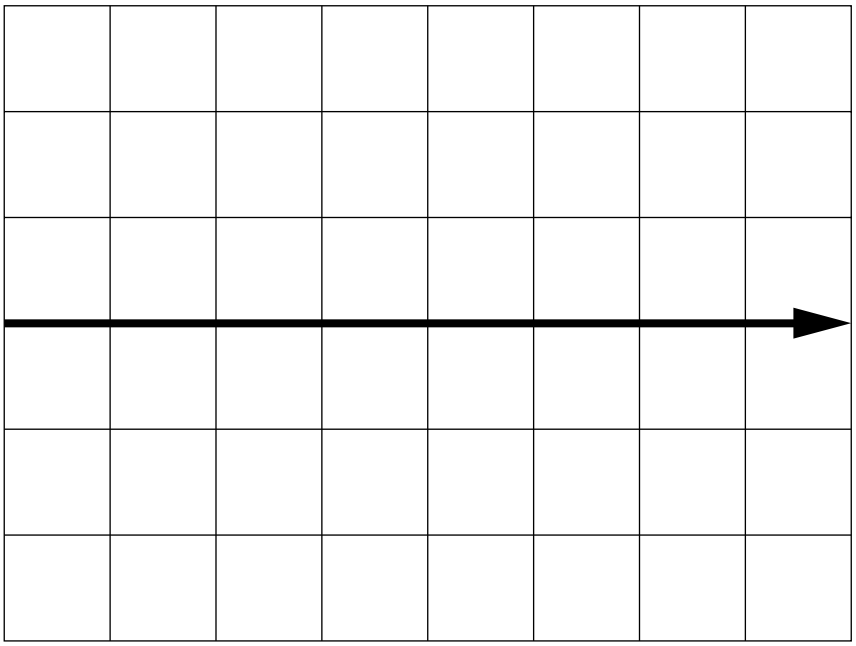

Fig. 16.3 [2]

(c) The 240 V a.c. supply is disconnected and replaced with a 240 V d.c. supply.

Explain why the transformer will not work.

.....

.....

.....[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 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	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

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

Key: a X b — a = relative atomic mass; X = atomic symbol; b = atomic (proton) number

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