Centre Number	Examination Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Science 5124/2

Paper 2

2021

Additional Materials:

Electronic calculator (non programmable)
Graph paper
Soft clean eraser
Soft pencil (type B or HB is recommended)

Time: 2 hour **Marks: 85**

Instructions to Candidates

1 Write the **centre number** and your **examination number** on every page of this question paper and on the separate Answer Booklet/Paper provided.

2 There are **three** sections in this paper.

(i) Section A

There are **twenty** questions in this section. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the best one and mark it with a cross (X) on the **answer grid provided** in this question paper.

(ii) Section B

Answer **all** questions. Write your answers in the **spaces provided** in this question paper.

(iii) Section C

Answer any **two** questions. Write your answers on a separate **Answer Booklet/Paper provided**.

Candidate's Use	Examiner's Use
Section A	
Section B	
Section C 1	
2	
3	
Total	

Information for candidates

1 Any rough working should be done in this question paper.

2 **At the end of the examination:**

(i) Fasten the separate Answer Booklet/Papers used securely to the question paper.

(ii) Circle the numbers of the section **C** questions you have answered in the grid below.

3 The Periodic Table is printed on **page 18**.

4 Cell phones are **not allowed** in the examination room.

This question paper consists of 18 printed pages

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SECTION A

Answer **all** the questions in this section. Choose the best answer from the letters **A**, **B**, **C** or **D** and then mark the letter with a cross **(X)**.

For example if the answer is **B**, it is shown as:

A	B	C	D

ANSWER GRID

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

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SECTION A [20 marks]

Answer **all** the questions on the answer grid provided in this question paper.

A1 Which of the following is **not** a laboratory rule?

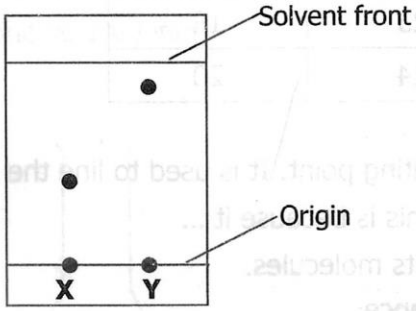
A Do not write on the board
B Do not eat while in the laboratory
C Always put on closed shoes
D Always close gas taps

A2 A learner accidentally mixed ammonium chloride and common salt. What method would you use to separate the mixture?

A Decantation
B Filtration
C Floatation
D Sublimation

A3 The results of a paper chromatography experiment are shown in the chromatogram below.

X is an aqueous solution of a salt of a Group I element
Y is an aqueous solution of a salt of a transition element



Which row is correct?

	Large R_f value	Requires a locating agent
A	Y	X
B	X	Y
C	X	X
D	Y	Y

[Turn over

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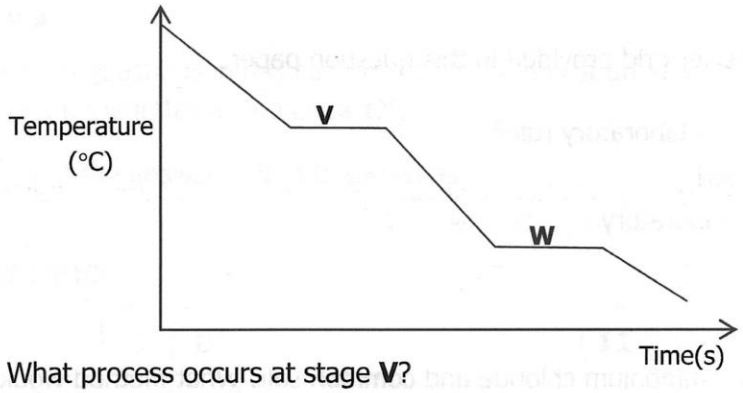
A4 The following diagram is a cooling curve for a gas.



What process occurs at stage **V**?

A Boiling
B Condensation
C Melting
D Sublimation

A5 From the table below, which one is an ion?

	Particles in the substance		
	Protons	**Neutrons**	**Electrons**
A	12	18	12
B	12	17	12
C	16	23	18
D	20	24	20

A6 Magnesium oxide has a high melting point. It is used to line the inside of furnaces that operate at high temperatures. This is because it ...

A has strong forces between its molecules.
B is a simple molecular substance.
C has metallic bonds.
D is an ionic compound.

A7 Naturally occurring element **Y** has four isotopes whose relative abundance is shown in the table below.

Isotope	% abundance
204	1.48
206	23.60
207	22.60
208	52.32

Find the relative atomic mass of the element.

A 208.26
B 207.24
C 206.25
D 204.22

A8 The chemical formula for ammonia gas is NH_3. Calculate the number of atoms contained in 85g of ammonia gas.

A 3.0×10^{25} atoms
B 1.2×10^{25} atoms
C 3.0×10^{24} atoms
D 2.4×10^{24} atoms

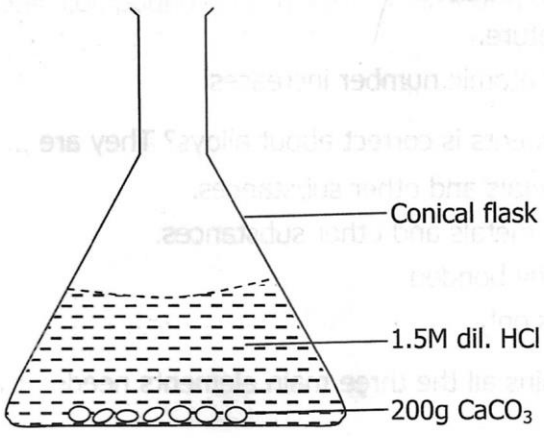
A9 Sodium hydroxide was used to neutralise sulphuric acid as shown in the equation below.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

How much sodium hydroxide would be used to neutralise 490 tons of sulphuric acid.

A 600 tons
B 450 tons
C 200 tons
D 150 tons

A10 A learner placed 200g of calcium carbonate into a conical flask and added $500cm^3$ of a 1.5 molar dilute hydrochloric acid solution.



What would remain in the flask at the end of the chemical reaction?

A Calcium chloride and water only.
B Aqueous calcium hydroxide only.
C Calcium carbonate, aqueous calcium hydroxide and water.
D Calcium carbonate, aqueous calcium chloride and water.

[Turn over

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A11 Solution **Q** reacted with aqueous sodium hydroxide producing a gas which changed the colour of red litmus paper.
Which of the following could have been solution **Q**?

A Ammonium sulphate
B Calcium sulphate
C Potassium sulphate
D Sodium sulphate

A12 Salts can be classified as acidic, basic or neutral. Which of the following is a pair of basic salts only?

A KCl and Na_2CO_3
B NH_4Cl and $CuSO_4$
C Na_3PO_4 and $Ca(CH_3COO)_2$
D $ZnCl_2$ and $BaSO_4$

A13 A bee sting is acidic. Which household substance will neutralise a bee sting?

A Damp bicarbonate of soda
B Damp common salt
C Lemon juice
D Vinegar

A14 Choose a statement that is most likely to be true about the elements in Group VIII of the Periodic Table? They ...

A are equally reactive chemically.
B form oxides of similar formulae.
C occur uncombined in nature.
D become less metallic as atomic number increases.

A15 Which of the following statements is correct about alloys? They are ...

A mixtures made up of metals and other substances.
B compounds made up of metals and other substances.
C metals that are covalently bonded.
D formed by heavy metals only.

A16 Choose a fertilizer that contains all the three main elements needed by plants for normal growth.

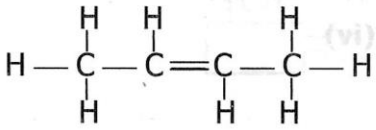
A NH_4NO_3
B KNO_3
C $NH_4K_2PO_4$
D $(CO)(NH_2)_2$

A17 A gas escaping from a pipe in a chemical plant is tested and found to be alkaline. What is this gas?

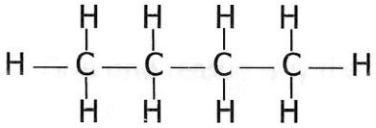
A Ammonia
B Carbon dioxide
C Hydrogen
D Oxygen

A18 Some organic compounds are generally non-reactive due to lack of a specific site for chemical attack. Which of the following is such a compound?

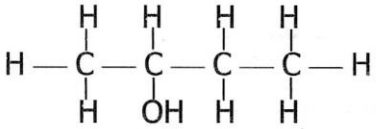
A



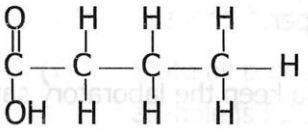
B



C



D



A19 Choose one organic compound that makes up 98% of natural gas.

A Butane
B Ethane
C Methane
D Propane

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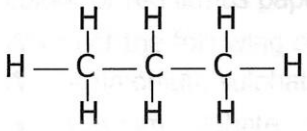
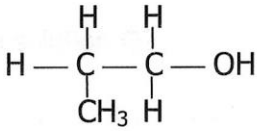
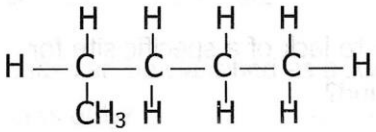
A20 Which of the following structures belong to the same homologous series of compounds?



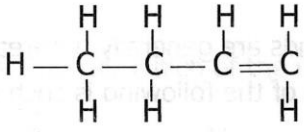
(i)



(ii)



(iii)



(iv)

A (i), (iii) and (iv)
B (i), (ii) and (iii)
C (ii) and (iii)
D (i) and (iii)

Section B [45 marks]

Answer **all** questions in this section.

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

B1 Laboratory safety rules and regulations are important to keep the laboratory safe.

(a) State the immediate action that a learner should take if the following happened while carrying out an experiment:

(i) Chemicals got into contact with his or her clothes or skin or mouth.

.....

..... [1]

(ii) She or he burnt or cut herself or himself.

.....

..... [1]

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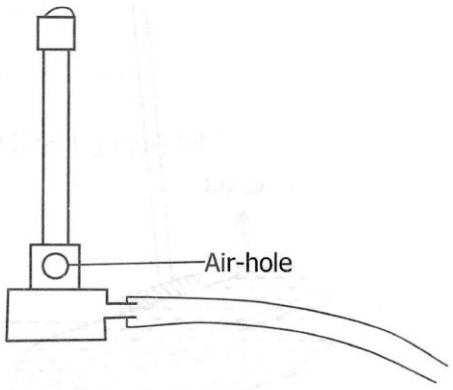
(b) The following diagram shows a Bunsen burner, the most commonly used heating apparatus in the chemistry laboratory.



Give **one** reason why the air hole should be fully open when the Bunsen burner is in use.

.....

..... [1]

(c) One of the gases used in a Bunsen burner is methane.

(i) State all products of combustion of this gas in the Bunsen burner when the air-hole is fully open.

..... [1]

(ii) One of the products of complete combustion of methane is a pollutant. Name the product and state its effect on the environment.

Name..... [1]

Effect..... [1]

[Total: 6 marks]

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B2 **Figure B2.1** shows a separation technique used to separate miscible liquids.

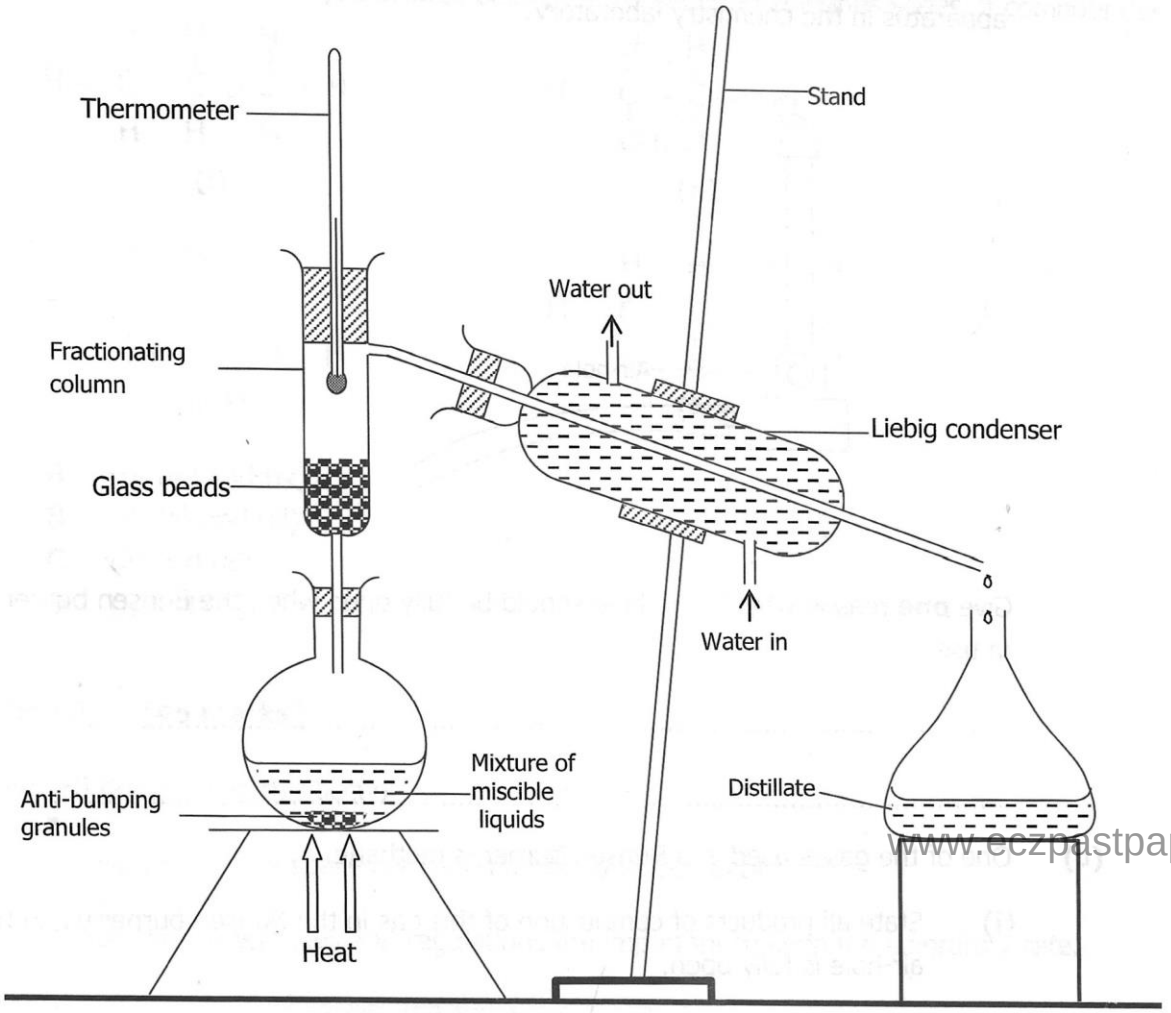

Figure B2.1

(a) What is the name of this separation technique?

..... [1]

(b) What is the purpose of the glass beads in the fractionating column.

.....

..... [1]

(c) Why is the Liebig condenser kept in the slanting position as shown in **Figure B2.1?**

..... [1]

(d) Apart from the mixture of miscible liquids, name **two** other mixtures which can be separated using this separation technique.

..... [2]

[Total: 5 marks]

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B3 2.0g of pure magnesium ribbon reacted with exactly 100cm^3 of 2.0 mol/dm^3 hydrochloric acid.

(a) Construct a balanced chemical equation for the reaction. Include state symbols.

..... [3]

(b) Determine the limiting reagent for the reaction.

[2]

(c) Calculate the volume of the gas that was evolved at r.t.p.

Volume ..... [2]

[Total: 7 marks]

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B4 **(a)** **Table B4** contains atomic mass units (a.m.u) and percentage (%) abundances for element **Q**.

Element	a.m.u	% abundance
Q	107	52
	109	48

Table B4

Determine the relative atomic mass of element **Q**.

Relative atomic mass ..... [2]

(b) Describe a radioisotope.

..... [1]

(c) State **one** use of

(i) Carbon–14 isotope,

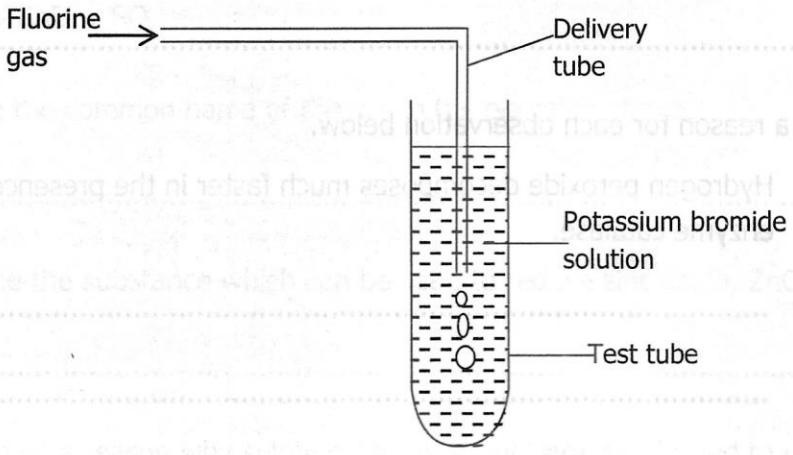
..... [1]

(ii) Iodine–131 isotope.

..... [1]

[Total: 5 marks]

B5 Fluorine gas is bubbled through a solution of potassium bromide as shown in the diagram below.



(a) **(i)** Describe what would be observed in the test tube.

..... [1]

(ii) Write a balanced chemical equation for the reaction that occurs in the test tube.

..... [2]

(b) What would be observed in the test tube if iodine gas was bubbled through the potassium bromide solution? Give a reason for your answer.

Observation .....

..... [1]

Reason .....

..... [1]

[Total: 5 marks]

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B6 **(a)** Describe the rate of a chemical reaction.

.....

..... [1]

(b) State a reason for each observation below.

(i) Hydrogen peroxide decomposes much faster in the presence of the enzyme catalase.

.....

..... [2]

(ii) The reaction between manganese carbonate and dilute hydrochloric acid speeds up when some concentrated hydrochloric acid is added.

.....

.....

..... [2]

(iii) Powdered magnesium is used in fireworks rather than magnesium ribbon.

.....

.....

..... [2]

[Total: 7 marks]

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B7 During the extraction of zinc, the ore is first roasted in air as illustrated by the equation below.

$ZnS + O_2 \rightarrow ZnO + SO_2$

(a) Give the common name of the ore in the equation above.

..... [1]

(b) Name the substance which can be used to reduce zinc oxide, ZnO.

..... [1]

(c) Suggest a reason why sulphur dioxide should **not** be allowed to escape into the atmosphere.

.....

..... [2]

(d) State **one** use of zinc.

..... [1]

[Total: 5 marks]

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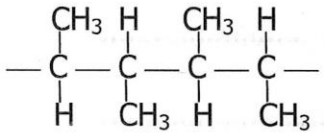
B8 The structure displayed below is a polymer that was formed from monomer **Y**.



(a) Name the polymer.

..... [1]

(b) **(i)** Name the monomer **Y**.

..... [1]

(ii) Construct the displayed structure of monomer **Y**.

[1]

(c) Monomer **Y** was reacted with steam under suitable conditions and an organic compound **Z** was produced.

(i) To which homologous series does compound **Z** belong?

..... [1]

(ii) Write the general formula of the homologous series stated in **(c)(i)**.

[1]

[Total: 5 marks]

SECTION C [20 marks]

Answer any **two** questions from this section in the separate Answer Booklet provided.

C1 Lime is an important compound in industry.

(a) **(i)** State the chemical name of lime. [1]

(ii) Describe how lime is obtained from limestone on a large scale. Include an equation in your answer. [2]

(b) **(i)** Give **two** uses of lime. [2]

(ii) What environmental problem is likely to arise or be caused by large scale production of lime? Suggest a possible solution to the problem. [5]

[Total: 10 Marks]

C2 Indicators are pigments that can be extracted from flowers, fruits or roots and are used in acid-base titrations.

(a) Describe how you can extract dyes or pigments from flowers. [4]

(b) **(i)** Name **one** salt that can be prepared by titration in the laboratory and give a reason why titration is suitable for preparing the salt. [2]

(ii) Describe an experiment you would carry out using the indicator solution extracted as described in **(a)** to show that it is an effective indicator. [4]

[Total: 10 Marks]

C3 A hydrocarbon **V** which contains only 3 carbon atoms was bubbled through bromine solution and there was a rapid decolourisation of the solution.

(a) **(i)** Identify the hydrocarbon **V** [1]

(ii) Draw the structure of the hydrocarbon **V** [1]

(iii) To which homologous series does the hydrocarbon **V** belong? [1]

(iv) Write the general formula of the homologous series where the hydrocarbon **V** belong. [1]

(b) **(i)** Explain the danger of burning the hydrocarbon **V** in limited oxygen. [3]

(ii) Write the balanced chemical equation for the reaction in **(b)(i)** above. [2]

(c) Under suitable conditions, the hydrocarbon **V** was polymerised and the polymer **W** was produced. Display the structure of polymer **W**. [1]

[Total: 10 Marks]

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 Tchnetium 43	104 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 Mecury 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 Yitterbium 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 = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

NA = 6.0 × 10^{23}/mol; 1F = 96 500C.