

Centre Number				Examination Number									



EXAMINATIONS COUNCIL OF ZAMBIA



Examination for School Certificate Ordinary Level

Science

5124/2

Paper 2

Monday

14 NOVEMBER 2022

- Additional Materials:**
 Answer Booklet
 Electronic calculator (non-programmable)
 Graph paper
 Soft clean eraser
 Soft pencil (type B or HB is recommended)

Time: 2 hours

Marks: 85

Instructions to Candidates

- Write the centre number and your examination number on every page of this question paper and on the separate Answer Booklet/Paper provided.
- There are three sections in this paper; Section A, B and C.

(i) Section A

There are twenty questions in this section. Answer all. 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

There are nine questions in this section. Answer all questions. Write your answers in the spaces provided in this question paper.

(iii) Section C

There are three questions in this section. Answer any two questions. Write your answers on a separate Answer Booklet/Paper provided.

3. At the end of the examination:

- Enter the numbers of the questions you have answered from Section C in the grid provided.
- Fasten the separate Answer Booklet/Papers used securely to the question paper.

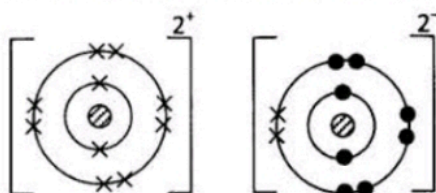
Information for candidates

- Any rough working should be done in this question paper.
- The Periodic Table is on page 17.
- Cell phones are not allowed in the examination room.

For Examiner's Use		
For Candidate's Use	Mark Obtained	Examiner's Initials
Section A		
Section B		
1		
2		
3		
4		
5		
6		
7		
8		
9		
Section C		
Total		

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- A1** Which of the following best describes why a factory manufacturing pesticides should be located far away from human settlement? Pesticides ...
- A** are poisonous.
 - B** contaminate the environment.
 - C** destroy buildings.
 - D** may kill animals.
- A2** Which of the following is **not** a basic unit of matter?
- A** Atom
 - B** Electron
 - C** Ion
 - D** Molecule
- A3** Which of the following shows the best order of obtaining salt from a mixture of sand and salt?
- A** Dissolving, filtering, evaporation.
 - B** Dissolving, filtering, decantation.
 - C** Dissolving, decantation, evaporation.
 - D** Dissolving, decantation, crystallisation.
- A4** The best method of separating iron filings from copper powder is ...
- A** filtration.
 - B** floatation.
 - C** hand picking.
 - D** magnetism.
- A5** In which of the following are the greatest intermolecular forces?
- A** Bromine
 - B** Chlorine
 - C** Fluorine
 - D** Iodine
- A6** The following dot and cross diagram represents a compound.

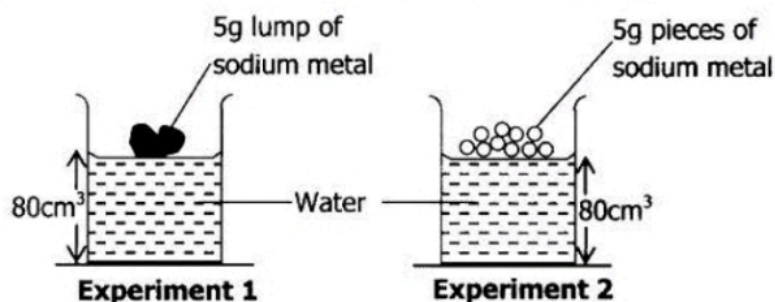


Identify the compound shown in the diagram. The compound is ...

- A** magnesium chloride.
- B** magnesium oxide.
- C** sodium chloride.
- D** sodium oxide.

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- A7** Which of the following liquids when added to a strongly acidic solution in the correct amounts could produce a solution with pH of 7?
- A** Distilled water
B Ethanoic acid
C Lime water
D Potassium hydroxide
- A8** What is the identity test of the gas produced when an acid reacts with a carbonate? It ...
- A** puts off the burning splint with a pop sound.
B relights the glowing splint.
C turns lime water colourless.
D turns lime water milky.
- A9** 25cm³ of 1.0 mol/dm³ NaOH solution are measured into a 100cm³ volumetric flask and water added to make the solution up to the 100cm³ mark. The concentration of NaOH in this solution is ...
- A** 0.25mol/dm³.
B 0.025mol.
C 0.0025mol/dm³.
D 0.00025mol/dm³.
- A10** What mass of sodium carbonate, Na₂CO₃, is required to make a 250cm³ solution whose concentration is 0.3M?
- A** 7.50g
B 7.95g
C 10.6g
D 15.9g
- A11** An experiment was carried out as shown in the following diagrams.



Where was the reaction faster?

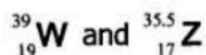
- A** In experiment 1
B In experiment 2
C In both experiment 1 and 2
D None of the two experiments

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A12 Which of the following best explains why hydrogen (**H**) is **not** placed in any group on the Periodic Table? It has ...

- A** no neutrons.
- B** one electron in its shell.
- C** properties of both Group I and Group VII elements.
- D** properties of most of the elements.

A13 The atomic symbols of elements **W** and **Z** are as follows;



The base units of the compound formed by **W** and **Z** are ...

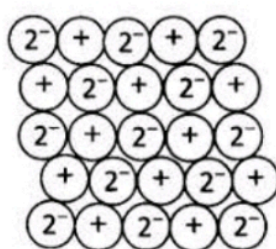
- A** atoms.
- B** ions.
- C** molecules.
- D** radicals.

A14 Element **X** is less dense than water and reacts fast with cold water liberating a gas. Which details are correct about element **X**?

	Name of element	Period	Type of solution	Gas produced
A	Beryllium	2	Acidic	Oxygen
B	Caesium	5	Neutral	Hydrogen
C	Calcium	4	Alkaline	Oxygen
D	Sodium	3	Alkaline	Hydrogen

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A15 The following diagram shows the ionic lattice of a substance.

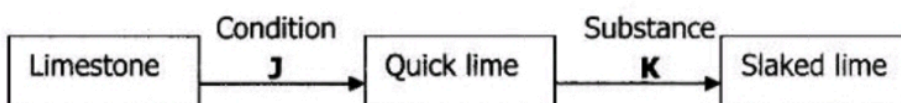


What is this substance likely to be?

- A** Magnesium chloride
- B** Magnesium oxide
- C** Sodium chloride
- D** Sodium oxide

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A16 The flowchart shows a commercial manufacture of slaked lime.



What is condition **J** and substance **K**?

- | | | |
|----------|----------|----------------|
| | J | K |
| A | Catalyst | Water |
| B | Heat | Oxygen |
| C | Heat | Water |
| D | Oxygen | Carbon dioxide |

A17 Which of the following shows the correct method of collection of a dry sample of each of the named gas in the table shown?

	Ammonia	Carbon dioxide	Hydrogen
A	Displacement of water	Upward delivery	Downward delivery
B	Downward delivery	Displacement of water	Upward delivery
C	Upward delivery	Displacement of water	Displacement of water
D	Upward delivery	Downward delivery	Upward delivery

A18 An unsaturated hydrocarbon with six carbon atoms contains only three C=C double bonds. This hydrocarbon is reacted with excess hydrogen at a high temperature.

What is the formula of the resulting hydrocarbon?

- A** C₆H₈
B C₆H₁₀
C C₆H₁₄
D C₆H₁₆

A19 The reactions listed all involve ethanol.

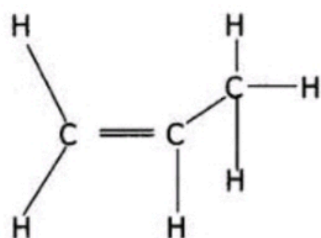
- 1** CH₃CH₂OH + O₂ → CH₃COOH + H₂O
2 CH₃CH₂OH + CH₃COOH → CH₃COOCH₂CH₃ + H₂O
3 C₆H₁₂O₆ → 2CH₃CH₂OH + 2CO₂

Which row correctly describes each reaction?

	1	2	3
A	Combustion	Acidification	Fermentation
B	Combustion	Esterification	Addition
C	Oxidation	Acidification	Addition
D	Oxidation	Esterification	Fermentation

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A20 Study the following organic compound.



Why is the compound shown able to decolourise the bromine solution? It ...

- A** can dissolve in bromine solution.
- B** has a double C=C bond.
- C** has a single C—C bond.
- D** has both single C—C and C—H bonds.

SECTION B: [45 MARKS]

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

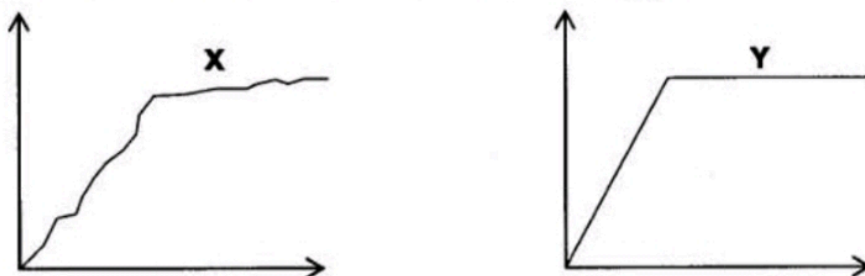
B1 (a) (i) Give **one** reason why laboratory rules are very important. www.eczpastpapers.com

.....
 [1]

(ii) State **one** importance of chemistry in our day to day life?

.....
 [1]

(b) The following graphs show heating curves that were drawn after pure ice and candle wax were heated over time to their melting points.



(i) Identify the heating curve for the candle wax and give a reason for your answer.

Candle wax: Curve: [1]

Reason:

..... [1]

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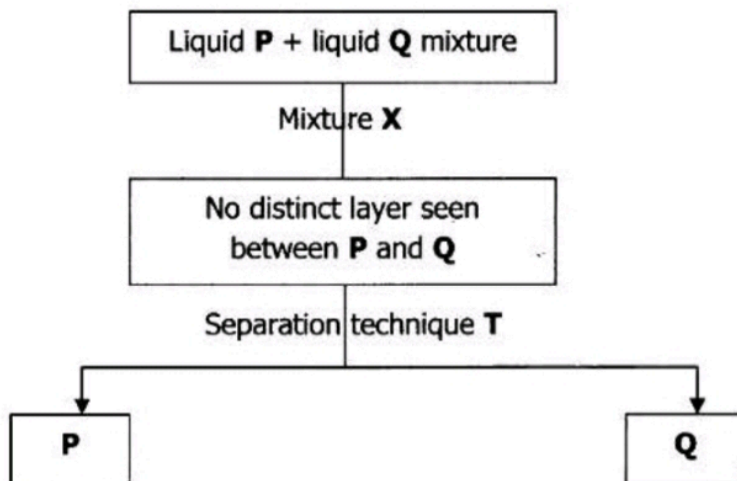
(ii) Give **one** effect of impurities on the melting and boiling points of a pure substance.

.....

..... [1]

[Total: 5 marks]

B2 Study the following flowchart and answer the questions that follow.



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(a) What are liquids **P** and **Q** in mixture **X** called?

..... [1]

(b) What is the separation technique **T**? Give the criterion used to separate the mixtures.

Separation technique **T**: [1]

Criterion:

..... [1]

(c) Deduce the names of liquids **P** and **Q**.

P: [1]

Q: [1]

[Total: 5 marks]

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B3 The following symbol shows a nuclide of element **A**.



- (a) Distinguish between the numbers 16 and 32 shown in the nuclide for element **A** given.

.....

 [2]

- (b) (i) To which group of the Periodic Table does element **A** belong?

..... [1]

- (ii) Use the Periodic Table to identify element **A**.

..... [1]

- (c) (i) Draw a dot and cross diagram to show the bonding formed in a compound between element **A** and hydrogen.

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- (ii) Compare the bonding in the compound formed in **c(i)** with that in calcium oxide.

..... [1]

 [1]

[Total: 6 marks]

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B4 Salts are important substances that have many uses.

(a) Describe how a fairly dry sample of lead (II) sulphate can be prepared from aqueous sodium sulphate and a soluble compound of lead in the laboratory.

.....

[4]

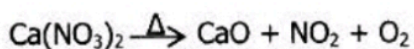
(b) Suggest the name of another salt that can be prepared in the same way as lead (II) sulphate.

.....

[1]

[Total: 5 marks]

B5 Calcium nitrate decomposes on heating according to the equation:



(a) Copy the equation given and balance it.

.....

[1]

(b) Calculate the relative formula mass of calcium nitrate.

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[1]

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(c) 16.4g of calcium nitrate is decomposed, calculate the volume of oxygen gas liberated at room temperature and pressure (r.t.p).

[2]

[Total: 4 marks]

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B6 The following elements with their electronic configurations are in a certain group of the Periodic Table.

W:2 **X:**2.8 **Y:**2, 8, 8 **Z:**2, 8, 18, 8

(a) Name the group in which these elements belong. [1]

.....

(b) What accounts for the chemical unreactivity of this group of elements? [1]

.....

.....

.....

(c) **W** is used in weather balloons. Explain why **W** is the most suitable for this use. [1]

.....

.....

.....

(d) Describe the change in density as you go down the group. [1]

.....

.....

[Total: 4 marks]

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B7 Many carbonates decompose to form the metal oxide and carbon dioxide. **Table 7.1** shows the mass of the carbonate before and after heating.

	Carbonate	Mass before heating/g	Mass after heating/g
1	Zinc carbonate	2.00	1.30
2	Copper carbonate	2.00	1.29
3	Calcium carbonate	2.00	1.12
4	Iron (II) carbonate	2.00	1.24
5	Potassium carbonate	2.00	2.00
6	Magnesium carbonate	2.00	0.95

Table 7.1

- (a) Write a balanced chemical equation for the decomposition of zinc carbonate.
 [1]
- (b) Which carbonate is the most thermally stable? Give a reason for your answer.

 [2]
- (c) Calcium oxide is produced on a large scale by heating calcium carbonate in a kiln. What environmental problem is associated with large scale production of calcium oxide?

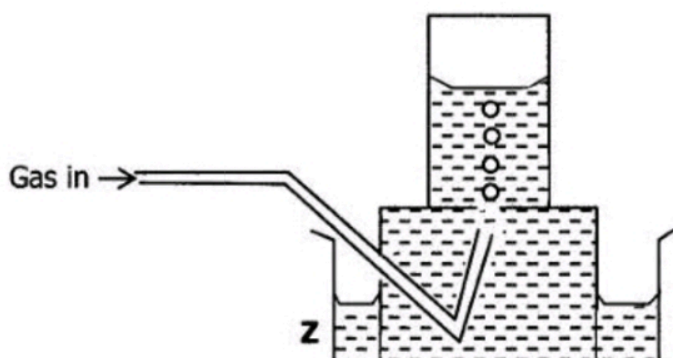
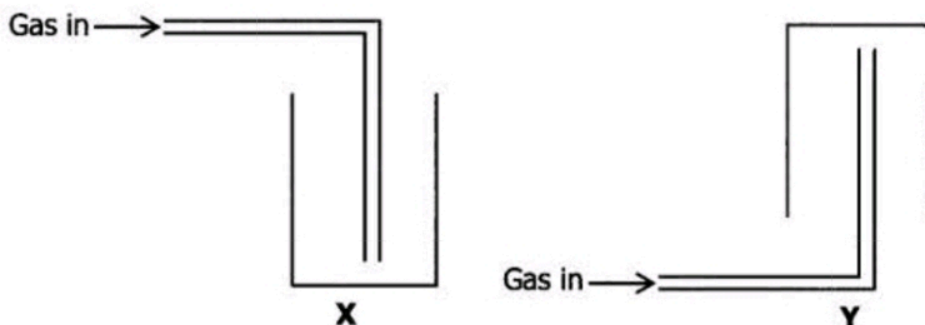
 [1]
- (d) Select the carbonate which on heating produces a compound which is used as a refractory material.
 [1]

[Total: 5 marks]

B8 Three gases **A**, **B** and **C** have properties shown in the table.

Gas	Density	Solubility in water	Appearance
A	More dense than air	Soluble	Colourless
B	Less dense than air	Soluble	Colourless
C	More dense than air	Insoluble	Colourless

Some apparatus used to collect gases are shown in the following diagrams.



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(a) Which apparatus **X**, **Y** or **Z** is most suitable to collect gas

(i) **A**; [1]

(ii) **B**? [1]

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- (b) Give the names for
- (i) solution P;
..... [1]
- (ii) process Q;
..... [1]
- (iii) gas R.
..... [1]
- (c) Write a balanced chemical equation for the complete combustion of ethanol.
.....
..... [2]

[Total: 6 marks]

SECTION C: [20 MARKS]

Answer any **two (2)** questions from this section in the separate Answer Booklet provided.

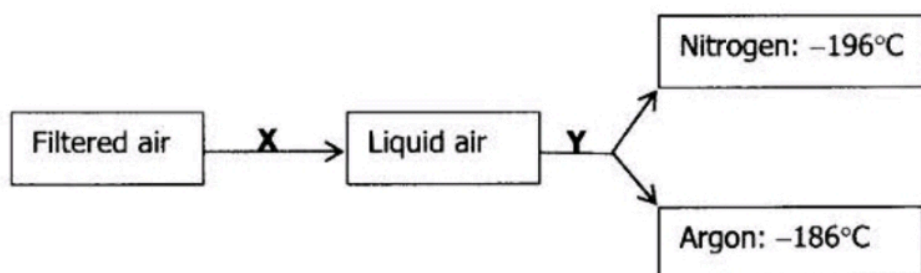
- C1** In an experiment to find the concentration of a solution of sodium hydroxide, 0.1M of hydrochloric acid was run from a burette into a conical flask containing 25cm³ of aqueous sodium hydroxide until neutralisation took place. 20cm³ of the acid was required.
- (a) (i) Name a suitable indicator to use in this experiment. [1]
- (ii) Describe the colour change that would be observed when neutralisation occurred for the indicator you named in (a) (i). [1]
- (b) Write down the chemical equation for the reaction that takes place in the conical flask. [1]
- (c) (i) How many moles of hydrochloric acid were used in the experiment? [1]
- (ii) Using the equation in (b), calculate the number of moles of sodium hydroxide used. [1]
- (iii) Calculate the concentration of the sodium hydroxide in mol/dm³. [2]
- (d) (i) Give a reason why the burette was used to determine the volume of the acid and not a measuring cylinder? [1]
- (ii) How was exactly 25cm³ of sodium hydroxide transferred into the conical flask? [2]

[Total: 10 marks]

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C2 Nitrogen and argon are both elements found in air.

- (a) Draw the electronic structures of nitrogen and argon. [2]
- (b) With reference to the electronic structures in (a), explain why nitrogen and argon are found in Period 2 and 3 respectively. [2]
- (c) The flowchart shows the separation of nitrogen and argon from air by fractional distillation.



- (i) Describe the processes that take place at X and Y. [3]
- (ii) Give **one** use of nitrogen gas. [1]
- (d) Argon is a liquid at -188°C .
- (i) In what state will argon be at 5°C ? [1]
- (ii) Draw a diagram to show how the atoms of argon are arranged at 5°C . [1]

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[Total: 10 marks]

C3 Ethanol is a product of many fermentation reactions. The molecular formula of ethanol is $\text{C}_2\text{H}_5\text{OH}$.

- (a) Draw the displayed molecular structure of ethanol. [1]
- (b) When ethanol is heated with potassium dichromate (VI) it is converted to ethanoic acid.
- (i) What type of reaction is this? [1]
- (ii) Give **one** safety rule to be observed when handling ethanoic acid in the laboratory. [1]
- (c) Ethanoic acid reacts with ethanol in the presence of a catalyst to produce a new substance. Give the name and deduce the formula of the new substance. [2]
- (d) Ethanoic acid is a weak acid. It can react with a metal such as sodium and magnesium to liberate hydrogen gas.
- (i) Compare the rates of reaction of ethanoic acid with sodium and with magnesium. [2]
- (ii) What would be observed when aluminium is added to ethanoic acid? Give a reason for this observation. [2]
- (iii) Give **one** use of aluminium based on the observation made in d (ii). [1]

[Total: 10 marks]

DATA SHEET
The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0										
		1 H Hydrogen 1																	
7 Li Lithium 3	9 Be Beryllium 4																		
23 Na Sodium 11	24 Mg Magnesium 12																		
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	64 Cu Copper 29										
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	104 Ru Ruthenium 44	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48										
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	192 Ir Iridium 77	197 Au Gold 79	201 Hg Mercury 80										
87 Fr Francium	226 Ra Radium 88	227 Ac Actinium 89																	
*58-71 Lanthanoid series +90-103 Actinoid series																			
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 10%;">a</td> <td style="width: 10%;">X</td> <td style="width: 10%;">b</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> </table> <p>Key a = relative atomic mass X = atomic symbol b = proton (atomic) number</p>										a	X	b							
a	X	b																	
11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18	19 F Fluorine 9	20 Ne Neon 10										
70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	76 Se Selenium 34	79 Br Bromine 35	80 Kr Krypton 36	84 Xe Xenon 54	85 At Astatine 85	86 Rn Radon 86											
115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54														
204 Tl Thallium 81	207 Pb lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 Po Polonium 84	210 Po Polonium 84														
162 Dy Dysprosium 66	163 Ho Holmium 67	164 Er Erbium 68	165 Tm Thulium 69	166 Yb Ytterbium 70	167 Lu Lutetium 71														
159 Tb Terbium 65	160 Dy Dysprosium 66	161 Ho Holmium 67	162 Er Erbium 68	163 Tm Thulium 69	164 Yb Ytterbium 70	165 Lu Lutetium 71													
150 Sm Samarium 62	151 Eu Europium 63	152 Gd Gadolinium 64	153 Tb Terbium 65	154 Dy Dysprosium 66	155 Ho Holmium 67	156 Er Erbium 68	157 Tm Thulium 69	158 Yb Ytterbium 70	159 Lu Lutetium 71										
140 Ce Cerium 58	141 Pr Praseodymium 59	142 Nd Neodymium 60	143 Pm Promethium 61	144 Sm Samarium 62	145 Eu Europium 63	146 Gd Gadolinium 64	147 Tb Terbium 65	148 Dy Dysprosium 66	149 Ho Holmium 67										
232 Th Thorium 90	233 Pa Protactinium 91	234 U Uranium 92	235 Np Neptunium 93	236 Pu Plutonium 94	237 Am Americium 95	238 Cm Curium 96	239 Bk Berkelium 97	240 Cf Californium 98	241 Es Einsteinium 99										

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

NA = 6.0 × 10²³/mol; 1F = 96 500C.

2 0 2 2