



EXAMINATIONS COUNCIL OF ESWATINI  
Junior Certificate Examination

CANDIDATE  
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CENTRE  
NUMBER

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**SCIENCE**

**414/02**

Paper 2

**October/November 2022**

**1 hour 45 Minutes**

Candidates answer on the Question Paper.

Additional Materials required: Electronic Calculators may be used.

**READ THESE INSTRUCTIONS FIRST**

Write your name, centre number and candidate number in the spaces provided.

Write in dark blue or black ink pen in the spaces provided on the Question Paper.

You may use an HB pencil for any diagrams, graphs, tables, or rough working.

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

This paper consists of two sections (Section **A** and **B**).

Answer **all** questions in both sections **A** and **B**.

A copy of the Periodic Table is printed on page 14.

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

The total of the marks for this paper is 80.

| Question         | Examiner's use |
|------------------|----------------|
| <b>Section A</b> |                |
| <b>1</b>         |                |
| <b>2</b>         |                |
| <b>3</b>         |                |
| <b>4</b>         |                |
| <b>5</b>         |                |
| <b>6</b>         |                |
| <b>7</b>         |                |
| <b>8</b>         |                |
| <b>9</b>         |                |
| <b>Section B</b> |                |
| <b>10</b>        |                |
| <b>Total</b>     |                |

This document consists of **14** printed pages and **2** blank pages.

**SECTION A**

1 Sand is accidentally added into a beaker containing iodine crystals.  
Iodine crystals sublime on heating while sand does not sublime.

(a) Draw, in the box below, the arrangement of particles in solid iodine.



[2]

(b) Explain the sublimation of solid iodine in terms of the kinetic particle theory.

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

(c) Explain why sand does not sublime together with iodine on heating.

.....  
..... [1]

(d) State the group and period number of the Periodic Table in which Silicon is found.

group.....  
period.....

[2]

**[Total: 7]**

2 (a) Fig. 2.1 shows a light ray passing from water to air.

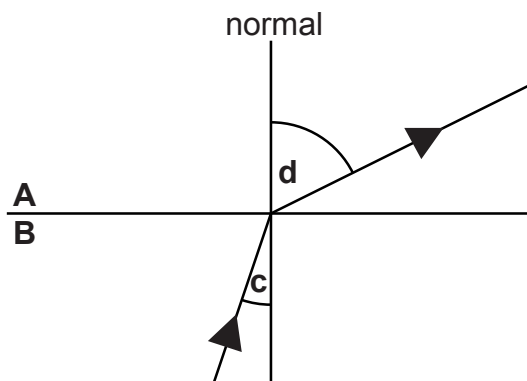


Fig. 2.1

(i) Name the process occurring in Fig. 2.1.  
..... [1]

(ii) Explain why medium A is air.  
.....  
.....  
..... [2]

(iii) Name the angle c in Fig. 2.1.  
..... [1]

(b) Fig. 2.2 shows a parallel beam of light incident on a convex lens.

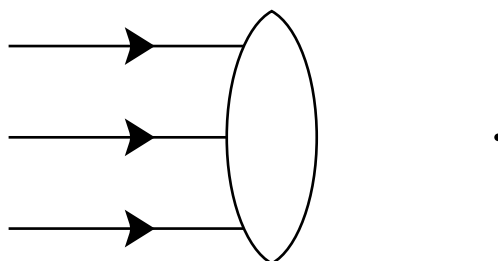


Fig. 2.2

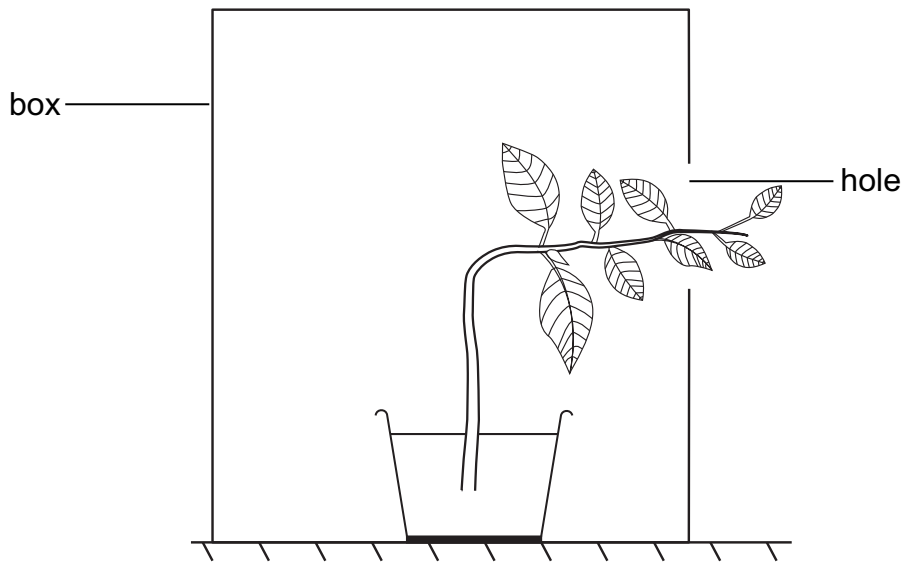
(i) Complete the ray diagram in Fig. 2.2 to show the direction of the beam of light after it passes through the lens. [2]

(ii) The convex lens is then replaced with a concave lens.  
State the effect this has on the beam of light as it passes through the lens.  
..... [1]

(iii) State **one** use of a convex lens in our daily life.  
..... [1]

[Total: 8]

- 3 Fig.3.1 shows a diagram of a plant growing inside a dark box with a hole on the side.



**Fig. 3.1**

- (a) State the characteristic of living things shown by the plant in Fig. 3.1.

..... [1]

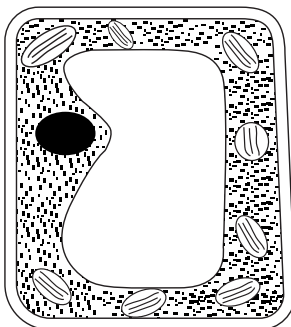
- (b) Explain why the plant grows towards the hole at the side of the box.

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

- (c) Describe **two** characteristics of the plant on Fig. 3.1 that show it is dicotyledonous.

1.....  
 2..... [2]

- (d) Fig. 3.2 shows a diagram of a leaf cell.



**Fig. 3.2**

Label, using a label line and the letter **A** on Fig. 3.2, the part that cannot be found in a red blood cell.

[1]

**[Total: 6]**

- 4 Magnesium is a metal.

- (a) State **one** physical property of magnesium that shows it is a metal.

.....  
 ..... [1]

Magnesium ribbon burns in air.

- (b) Describe **two** observations made when magnesium ribbon burns in air.

1.....  
 2..... [2]

- (c) Explain why the burning of magnesium ribbon is:

- (i) an exothermic reaction,

.....  
 ..... [1]

- (ii) a chemical change.

.....  
 ..... [1]

- (d) Write down the word equation for the burning of magnesium in air.

..... [2]

**[Total: 7]**

- 5 (a) Fig. 5.1 shows a strong man pushing a door at the pivot and a small boy pushing the same door, the opposite way at the handle.



Fig. 5.1

- (i) The small boy exerts a force of 20 N at 0.75 m away from the pivot.  
Calculate the moment of force that the boy is exerting about the pivot.

moment = .....Nm [2]

- (ii) Explain why the strong man would not succeed in closing the door.

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

(b) Fig. 5.2 is an example of a lever.



Fig. 5.2

(i) Label, using a line and the letter **B**, the force in Fig. 5.2. [1]

(ii) Define the term *lever*.

.....  
..... [1]

[Total: 6]

6 (a) Complete, by filling in the blanks, the paragraph describing the role of the tongue in coordination and response.

The tongue is a ..... organ. The tongue has .....  
cells which convert ..... to nerve impulses. The .....  
neurone transmits the nerve impulse to the brain. [4]

(b) The abuse of drugs like alcohol and cannabis has increased among young people.

(i) Explain why alcohol can be classified as a drug.

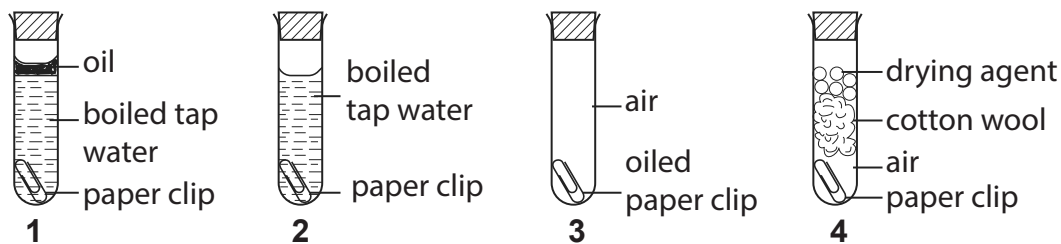
.....  
.....  
..... [2]

(ii) Describe **two** effects on the body caused by the abuse of cannabis.

1.....  
2..... [2]

[Total: 8]

- 7 Fig. 7.1 shows an experiment to investigate the conditions necessary for rusting to occur.



**Fig. 7.1**

After 24 hours, it was observed that only the paper clip in test-tube **2** has rusted.

- (a) Explain why rusting did not occur in test-tube **1**.

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

- (b) Oiling and galvanising are methods of rust prevention.

Explain why galvanising is a better method of rust prevention than oiling.

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

- (c) Two alloys of iron are mild steel and stainless steel.

- (i) Name the element that is added to iron to form mild steel.

..... [1]

- (ii) State **one** use of stainless steel.

..... [1]

**[Total: 6]**



8 A man lifts a brick using a force of 50 N from the floor to a shelf that is 2 m high.

(a) Calculate the amount of work he does.

work = .....J [2]

(b) The man uses energy to do the work.

State the energy conversions that take place as the man does the work.

..... → ..... → ..... [2]

(c) Solids, liquids and gases expand when heated.

State **one** application and **one** consequence of thermal expansion in solids.

application .....

.....

consequence .....

.....

[2]

[Total: 6]

9 Fig. 9.1 shows the cross section of a male reproductive system.

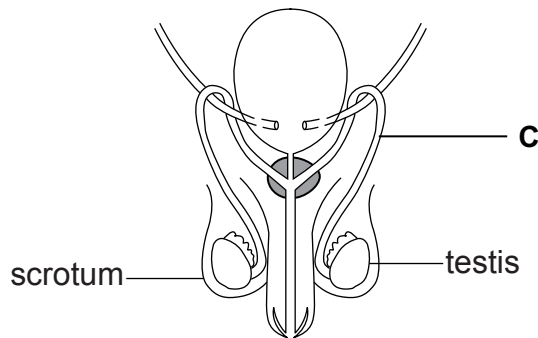


Fig. 9.1

(a) Name the part labelled **C** in Fig. 9.1.

..... [1]

(b) Testes produce sperms.

Describe the function of the sperm during the formation of an offspring.

.....

..... [2]

(c) A condom can be used during sexual intercourse to prevent pregnancy.

Describe how the condom prevents pregnancy.

.....  
..... [1]

(d) Gonorrhoea is a sexually transmitted infection.

(i) Describe the symptoms of gonorrhoea in man.

.....  
..... [1]

(ii) State how gonorrhoea is treated.

..... [1]

**[Total: 6]**

## SECTION B

- 10 (a) A student carries out an experiment to compare the reactivity of the metals **E**, **F**, **G** and **H**.

She uses metal strips of equal sizes and reacts them with the same amount of dilute acid.

Table 10.1 shows the observations she makes.

Table 10.1

| metal    | observations           |
|----------|------------------------|
| <b>E</b> | few bubbles produced   |
| <b>F</b> | no bubbles produced    |
| <b>G</b> | fewer bubbles          |
| <b>H</b> | most number of bubbles |

- (i) State the reason for the observation made for metal **F**.

..... [1]

- (ii) List the metals in order of reactivity, starting with the most reactive metal.

most reactive .....

.....

.....

least reactive .....

[3]

- (iii) The student collects the hydrogen gas produced.

Describe how she will test for the presence of hydrogen gas.

test.....

result.....

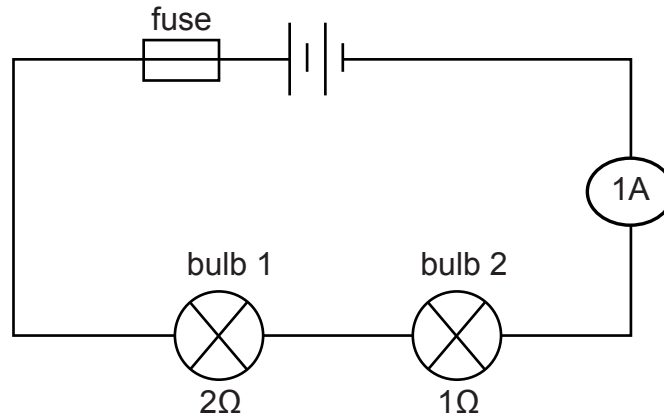
[2]

- (iv) Describe how the student can increase the speed of the reaction between metal **E** and dilute acid.

.....

.....[1]

(b) A student connects a circuit as shown in Fig. 10.1.



**Fig. 10.1**

- (i) State the value of the current flowing through the  $2\Omega$  bulb in Fig.10.1.  
..... [1]
- (ii) Describe the function of the fuse in Fig. 10.1.  
.....  
..... [1]
- (iii) The voltage across the  $2\Omega$  bulb is  $2\text{V}$ .

Calculate the power of the  $2\Omega$  bulb in Fig. 10.1.

$P = \dots\dots\dots$ [2]

- (iv) The student adds a third cell to the circuit.  
State and explain how the brightness of the bulbs in the circuit is affected.  
effect on brightness.....  
explanation.....  
..... [2]
- (v) One of the bulbs in the circuit in Fig. 10.1 blows off.  
State the observation made by the student after the bulb blows off.  
..... [1]

- (c) A student investigates the need for carbon dioxide in photosynthesis. He destarches two potted plants **K** and **L** and puts them in sunlight for a few hours as shown in Fig. 10.2.

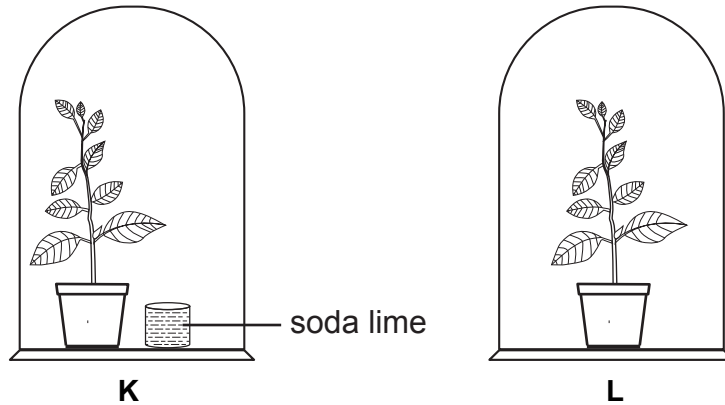


Fig. 10.2

- (i) Describe how the student destarches the plants.

.....  
 ..... [1]

- (ii) He puts a leaf from plant **K** in boiling water for two minutes. He then removes chlorophyll from the leaf.

Describe how the student removes the chlorophyll.

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

- (iii) He rinses the leaf in cold water after removing chlorophyll.

He then spreads the leaf on a tile and adds some drops of a reagent on the leaf to test for starch.

Name the reagent he uses.

..... [1]

- (iv) State and explain **one** difference that would be observed in the results of the test for starch if a leaf from plant **L** was used.

difference .....

.....

explanation.....

.....

..... [2]

[Total: 20]

## DATA SHEET The Periodic Table of the Elements

Group

| I                            | II                           |                               |                              |                              |                               |                               |                               |                             |                               |                            |                             | III                          | IV                           | V                            | VI                            | VII                           | 0                          |  |  |  |  |  |                          |
|------------------------------|------------------------------|-------------------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|-------------------------------|----------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|----------------------------|--|--|--|--|--|--------------------------|
| 7<br><b>Li</b><br>Lithium    | 9<br><b>Be</b><br>Beryllium  |                               |                              |                              |                               |                               |                               |                             |                               |                            |                             | 1<br><b>H</b><br>Hydrogen    |                              |                              |                               |                               |                            |  |  |  |  |  | 4<br><b>He</b><br>Helium |
| 3<br><b>Li</b><br>Lithium    | 4<br><b>Be</b><br>Beryllium  |                               |                              |                              |                               |                               |                               |                             |                               |                            |                             | 5<br><b>B</b><br>Boron       | 6<br><b>C</b><br>Carbon      | 7<br><b>N</b><br>Nitrogen    | 8<br><b>O</b><br>Oxygen       | 9<br><b>F</b><br>Fluorine     | 10<br><b>Ne</b><br>Neon    |  |  |  |  |  |                          |
| 23<br><b>Na</b><br>Sodium    | 24<br><b>Mg</b><br>Magnesium |                               |                              |                              |                               |                               |                               |                             |                               |                            |                             | 27<br><b>Al</b><br>Aluminium | 28<br><b>Si</b><br>Silicon   | 31<br><b>P</b><br>Phosphorus | 32<br><b>S</b><br>Sulphur     | 35.5<br><b>Cl</b><br>Chlorine | 40<br><b>Ar</b><br>Argon   |  |  |  |  |  |                          |
| 39<br><b>K</b><br>Potassium  | 40<br><b>Ca</b><br>Calcium   | 45<br><b>Sc</b><br>Scandium   | 48<br><b>Ti</b><br>Titanium  | 51<br><b>V</b><br>Vanadium   | 52<br><b>Cr</b><br>Chromium   | 55<br><b>Mn</b><br>Manganese  | 56<br><b>Fe</b><br>Iron       | 59<br><b>Co</b><br>Cobalt   | 59<br><b>Ni</b><br>Nickel     | 64<br><b>Cu</b><br>Copper  | 65<br><b>Zn</b><br>Zinc     | 70<br><b>Ga</b><br>Gallium   | 73<br><b>Ge</b><br>Germanium | 75<br><b>As</b><br>Arsenic   | 79<br><b>Se</b><br>Selenium   | 80<br><b>Br</b><br>Bromine    | 84<br><b>Kr</b><br>Krypton |  |  |  |  |  |                          |
| 19<br><b>K</b><br>Potassium  | 20<br><b>Ca</b><br>Calcium   | 21<br><b>Sc</b><br>Scandium   | 22<br><b>Ti</b><br>Titanium  | 23<br><b>V</b><br>Vanadium   | 24<br><b>Cr</b><br>Chromium   | 25<br><b>Mn</b><br>Manganese  | 26<br><b>Fe</b><br>Iron       | 27<br><b>Co</b><br>Cobalt   | 28<br><b>Ni</b><br>Nickel     | 29<br><b>Cu</b><br>Copper  | 30<br><b>Zn</b><br>Zinc     | 31<br><b>Ga</b><br>Gallium   | 32<br><b>Ge</b><br>Germanium | 33<br><b>As</b><br>Arsenic   | 34<br><b>Se</b><br>Selenium   | 35<br><b>Br</b><br>Bromine    | 36<br><b>Kr</b><br>Krypton |  |  |  |  |  |                          |
| 85<br><b>Rb</b><br>Rubidium  | 88<br><b>Sr</b><br>Strontium | 89<br><b>Y</b><br>Yttrium     | 91<br><b>Zr</b><br>Zirconium | 93<br><b>Nb</b><br>Niobium   | 96<br><b>Mo</b><br>Molybdenum | 98<br><b>Tc</b><br>Technetium | 101<br><b>Ru</b><br>Ruthenium | 108<br><b>Rh</b><br>Rhodium | 106<br><b>Pd</b><br>Palladium | 108<br><b>Ag</b><br>Silver | 112<br><b>Cd</b><br>Cadmium | 115<br><b>In</b><br>Indium   | 119<br><b>Sn</b><br>Tin      | 122<br><b>Sb</b><br>Antimony | 128<br><b>Te</b><br>Tellurium | 127<br><b>I</b><br>Iodine     | 131<br><b>Xe</b><br>Xenon  |  |  |  |  |  |                          |
| 37<br><b>Rb</b><br>Rubidium  | 38<br><b>Sr</b><br>Strontium | 39<br><b>Y</b><br>Yttrium     | 40<br><b>Zr</b><br>Zirconium | 41<br><b>Nb</b><br>Niobium   | 42<br><b>Mo</b><br>Molybdenum | 43<br><b>Tc</b><br>Technetium | 44<br><b>Ru</b><br>Ruthenium  | 45<br><b>Rh</b><br>Rhodium  | 46<br><b>Pd</b><br>Palladium  | 47<br><b>Ag</b><br>Silver  | 48<br><b>Cd</b><br>Cadmium  | 49<br><b>In</b><br>Indium    | 50<br><b>Sn</b><br>Tin       | 51<br><b>Sb</b><br>Antimony  | 52<br><b>Te</b><br>Tellurium  | 53<br><b>I</b><br>Iodine      | 54<br><b>Xe</b><br>Xenon   |  |  |  |  |  |                          |
| 133<br><b>Cs</b><br>Caesium  | 137<br><b>Ba</b><br>Barium   | 139<br><b>La</b><br>Lanthanum | 178<br><b>Hf</b><br>Hafnium  | 181<br><b>Ta</b><br>Tantalum | 184<br><b>W</b><br>Tungsten   | 186<br><b>Re</b><br>Rhenium   | 190<br><b>Os</b><br>Osmium    | 192<br><b>Ir</b><br>Iridium | 195<br><b>Pt</b><br>Platinum  | 197<br><b>Au</b><br>Gold   | 201<br><b>Hg</b><br>Mercury | 204<br><b>Tl</b><br>Thallium | 207<br><b>Pb</b><br>Lead     | 209<br><b>Bi</b><br>Bismuth  | 209<br><b>Po</b><br>Polonium  | 210<br><b>At</b><br>Astatine  | 222<br><b>Rn</b><br>Radon  |  |  |  |  |  |                          |
| 55<br><b>Cs</b><br>Caesium   | 56<br><b>Ba</b><br>Barium    | 57<br><b>La</b><br>Lanthanum  | 72<br><b>Hf</b><br>Hafnium   | 73<br><b>Ta</b><br>Tantalum  | 74<br><b>W</b><br>Tungsten    | 75<br><b>Re</b><br>Rhenium    | 76<br><b>Os</b><br>Osmium     | 77<br><b>Ir</b><br>Iridium  | 78<br><b>Pt</b><br>Platinum   | 79<br><b>Au</b><br>Gold    | 80<br><b>Hg</b><br>Mercury  | 81<br><b>Tl</b><br>Thallium  | 82<br><b>Pb</b><br>Lead      | 83<br><b>Bi</b><br>Bismuth   | 84<br><b>Po</b><br>Polonium   | 85<br><b>At</b><br>Astatine   | 86<br><b>Rn</b><br>Radon   |  |  |  |  |  |                          |
| 223<br><b>Fr</b><br>Francium | 226<br><b>Ra</b><br>Radium   | 227<br><b>Ac</b><br>Actinium  | †                            |                              |                               |                               |                               |                             |                               |                            |                             |                              |                              |                              |                               |                               |                            |  |  |  |  |  |                          |
| 87<br><b>Fr</b><br>Francium  | 88<br><b>Ra</b><br>Radium    | 89<br><b>Ac</b><br>Actinium   | †                            |                              |                               |                               |                               |                             |                               |                            |                             |                              |                              |                              |                               |                               |                            |  |  |  |  |  |                          |

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

**Key**

|   |   |
|---|---|
| a | X |
|---|---|

a = relative atomic mass  
X = atomic symbol  
b = atomic (proton) number

|                            |                                  |                               |                                |                              |                              |                                |                              |                                |                                |                             |                                 |                               |                                |
|----------------------------|----------------------------------|-------------------------------|--------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|--------------------------------|-----------------------------|---------------------------------|-------------------------------|--------------------------------|
| 140<br><b>Ce</b><br>Cerium | 141<br><b>Pr</b><br>Praseodymium | 144<br><b>Nd</b><br>Neodymium | 147<br><b>Pm</b><br>Promethium | 150<br><b>Sm</b><br>Samarium | 152<br><b>Eu</b><br>Europium | 157<br><b>Gd</b><br>Gadolinium | 159<br><b>Tb</b><br>Terbium  | 163<br><b>Dy</b><br>Dysprosium | 165<br><b>Ho</b><br>Holmium    | 167<br><b>Er</b><br>Erbium  | 169<br><b>Tm</b><br>Thulium     | 173<br><b>Yb</b><br>Ytterbium | 175<br><b>Lu</b><br>Lutetium   |
| 58<br><b>Ce</b><br>Cerium  | 59<br><b>Pr</b><br>Praseodymium  | 60<br><b>Nd</b><br>Neodymium  | 61<br><b>Pm</b><br>Promethium  | 62<br><b>Sm</b><br>Samarium  | 63<br><b>Eu</b><br>Europium  | 64<br><b>Gd</b><br>Gadolinium  | 65<br><b>Tb</b><br>Terbium   | 66<br><b>Dy</b><br>Dysprosium  | 67<br><b>Ho</b><br>Holmium     | 68<br><b>Er</b><br>Erbium   | 69<br><b>Tm</b><br>Thulium      | 70<br><b>Yb</b><br>Ytterbium  | 71<br><b>Lu</b><br>Lutetium    |
| 90<br><b>Th</b><br>Thorium | 91<br><b>Pa</b><br>Protactinium  | 92<br><b>U</b><br>Uranium     | 93<br><b>Np</b><br>Neptunium   | 94<br><b>Pu</b><br>Plutonium | 95<br><b>Am</b><br>Americium | 96<br><b>Cm</b><br>Curium      | 97<br><b>Bk</b><br>Berkelium | 98<br><b>Cf</b><br>Californium | 99<br><b>Es</b><br>Einsteinium | 100<br><b>Fm</b><br>Fermium | 101<br><b>Md</b><br>Mendelevium | 102<br><b>No</b><br>Nobelium  | 103<br><b>Lr</b><br>Lawrencium |

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



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