Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE ORDINARY LEVEL

4323/2

PAPER 2

2 hours

Marks 100

2018

Additional Materials: Non-programmable calculator
Ruler

INSTRUCTIONS AND INFORMATION TO CANDIDATES

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces provided on top of this page.
- Write in dark blue or black pen.
- You may use a soft pencil for any diagrams, graphs or rough working.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.
- Answer **all** questions.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will lose marks if you do not show your working or if you do not use appropriate units.
- Take the weight of 1 kg to be 10 N (i.e acceleration of free fall g = 10 m/s^2).
- The Periodic Table is printed on page 17.

For Examiner's Use	
1	
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Total	

Marker	
Checker	

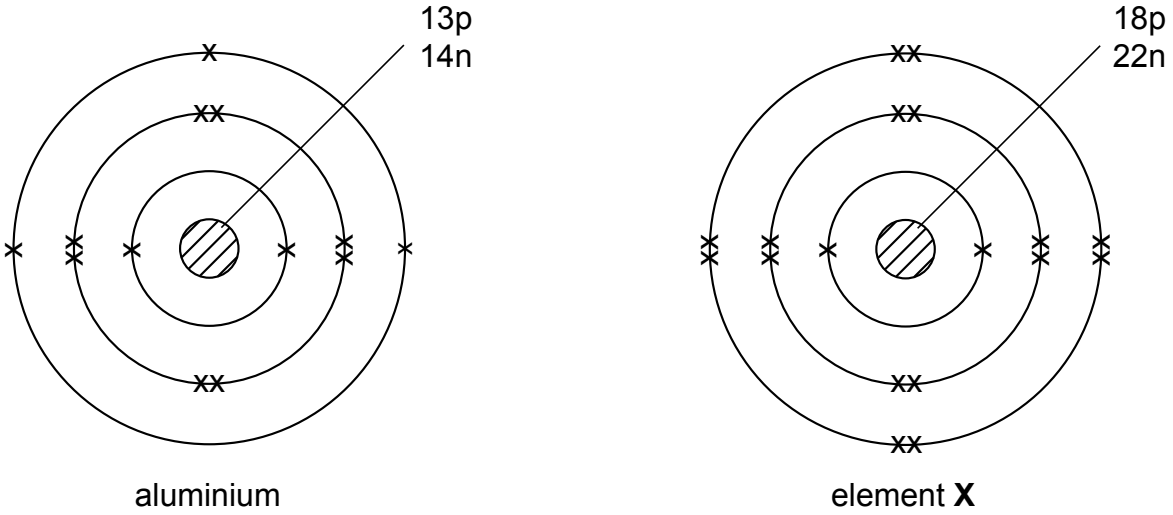
This document consists of **17** printed pages and **3** blank pages.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

For Examiner's Use

1 Fig. 1.1 shows the structures of atoms of aluminium and element **X**. Element **X** is unreactive.



aluminium element **X**

Fig. 1.1

(a) (i) Identify element **X**.

..... [1]

(ii) State the period number of aluminium and element **X**.

..... [1]

(iii) By referring to the structure, explain why element **X** is unreactive.

.....

..... [1]

(b) Aluminium reacts with chlorine to form aluminium chloride.

(i) Write a balanced chemical equation for this reaction.

..... [2]

(ii) Describe how the chloride ion is formed from chlorine atom.

..... [1]

(c) Describe a test for aluminium ions.

Test .....

Result.....

..... [3]

[9]

2 Two students have flu symptoms and take medicine to relieve the symptoms. Student **A** swallows a pill with water and student **B** uses an effervescent tablet that is to be dissolved in water. Each medicine has three active ingredients. The table in Fig. 2.1 shows the content of these ingredients in the two medicines.

active ingredients	mass of active ingredients in the pill/mg	mass of active ingredients in the effervescent tablet/mg
asprin/mg	226.8	453.6
paracetamol/mg	162.0	324.0
caffeine/mg	32.4	64.8

Fig. 2.1

(a) State the number of pills student **A** should take to have the same effect as one effervescent tablet.

..... [1]

(b) Student **B** dissolves the tablet in water and observed that the glass feels cold to touch.

State the type of reaction that took place.

..... [1]

(c) In another occasion, student **B** dissolved the tablet in warm water.

With reference to collision theory, state and explain the effect this has on the time it takes the tablet to dissolve.

.....

.....

.....

.....

.....

..... [3]

[5]

For Examiner's Use

3 Excess sodium carbonate reacts with aqueous nitric acid to form sodium nitrate, water and carbon dioxide. The equation of the reaction is shown.

$$Na_2CO_3 + 2HNO_3 \longrightarrow 2NaNO_3 + H_2O + CO_2$$

(a) State why excess sodium carbonate is used in the experiment.

.....

..... [1]

(b) Sodium nitrate salt produced in the reaction is in aqueous solution.

(i) Give the name of the anion of the sodium nitrate salt.

..... [1]

(ii) Describe how dry crystals of sodium nitrate can be obtained from the mixture.

.....

.....

.....

.....

.....

..... [3]

(c) In the reaction, a volume of 6 000 cm^3 of carbon dioxide gas was produced.

(i) Convert 6 000 cm^3 to dm^3 ..... [1]

(ii) Calculate the number of moles in 6 000 cm^3 of carbon dioxide gas at room temperature and pressure.

No. mol ..... [2]

(iii) Calculate the number of moles of nitric acid reacted in the reaction.

No. mol ..... [2]

(iv) Calculate the mass of sodium carbonate reacted in the reaction.

Mass ..... g [2]

[12]

For Examiner's Use

4 Zinc, iron and lead are metals found in ores. They can be extracted using different methods and have different uses.

(a) State the name of an ore of lead.

..... [1]

(b) State, with a reason, the method of extraction of iron from its ore.

Method .....

Reason.....

.....

..... [2]

(c) Zinc is used to galvanise iron to prevent rusting.

(i) Describe how galvanising prevents iron from rusting.

.....

.....

.....

..... [2]

(ii) State **two** other methods of rust prevention.

1 .....

2 ..... [2]

(iii) Zinc is also used in making alloys.

Explain how alloying affects the electrical conductivity of zinc.

.....

.....

.....

..... [2]

[9]

For Examiner's Use

5 Fig. 5.1 shows functional groups of different homologous series.

(a) Use Fig. 5.1 to match the molecules on the left with their functional groups on the right.

The first one has been done for you.

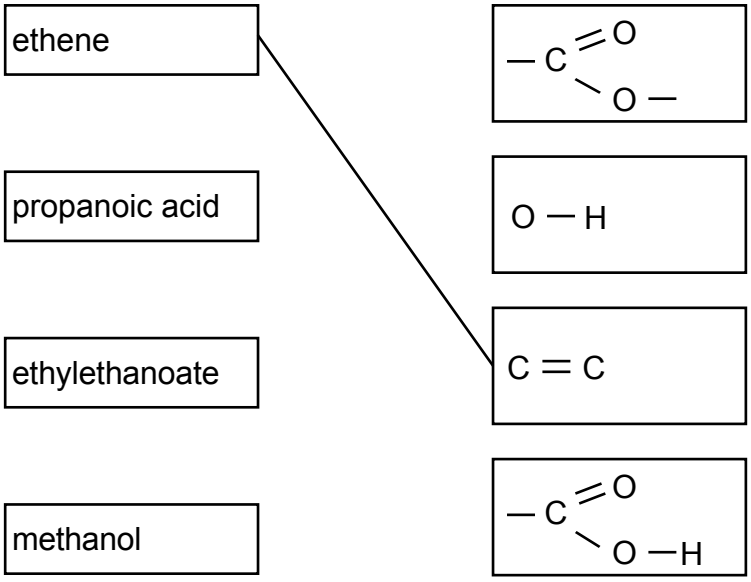


Fig. 5.1

[3]

(b) Propane is found in the same homologous series as ethane.

Draw the molecular structure of the propane molecule.

[2]

(c) Ethane undergoes a chemical reaction to form a polymer.

(i) State the name given to this reaction.

..... [1]

(ii) Describe how polymers are formed.

.....

..... [2]

[8]

For Examiner's Use

6 The decomposition of limestone produces lime and carbon dioxide. Lime is used in controlling acidity in the soil.

(a) Write the word equation for the decomposition of limestone.

.....

..... [2]

(b) Describe **two** other ways carbon dioxide can be produced.

1 .....

.....

2 .....

..... [2]

(c) Explain the importance of using lime in controlling soil acidity.

.....

.....

.....

..... [2]

(d) The fertility of the soil can be improved by adding fertilisers.

(i) State the advantage of fertilisers containing potassium.

.....

..... [1]

(ii) Explain the danger of overuse of fertilisers to aquatic life.

.....

.....

.....

.....

.....

..... [3]

[10]

7 The table in Fig. 7.1 shows how the speed of a drone changes with time as it flies in a straight line between two points.

speed/$\frac{m}{s}$	0	20	40	60	80	80	80	100	120	90	60
time/ seconds	0	2	4	6	8	10	12	14	16	18	20

Fig. 7.1

(a) Use the table in Fig. 7.1 to describe the motion of the drone from

(i) 0 – 8 seconds of the journey.

..... [1]

(ii) 8 – 12 seconds of the journey.

..... [1]

(b) Calculate the acceleration of the drone in the last 4 seconds.

Show your working.

Acceleration ..... m/s^2 [3]

(c) 300 KJ of chemical energy is transferred into other forms of energy as the drone travels the first 8 s.

(i) State **one** form of energy into which the chemical energy is transferred.

..... [1]

(ii) Convert 300 kilojoules into joules.

..... [1]

(iii) Calculate the power developed by the drone.

Show your working.

Power.....W [2]

For Examiner's Use

(d) The total pressure exerted by all four tyres on a car is 2.0×10^5 Pa. The area of each of the four tyres in contact with the road is 100 cm^2.

Calculate

(i) the total contact area of the tyres.

Area ..... cm^2 [1]

(ii) the force exerted by the four tyres of the car on the ground.

Force .....N [2]

[12]

8 Fig. 8.1 shows a solar hot water system.

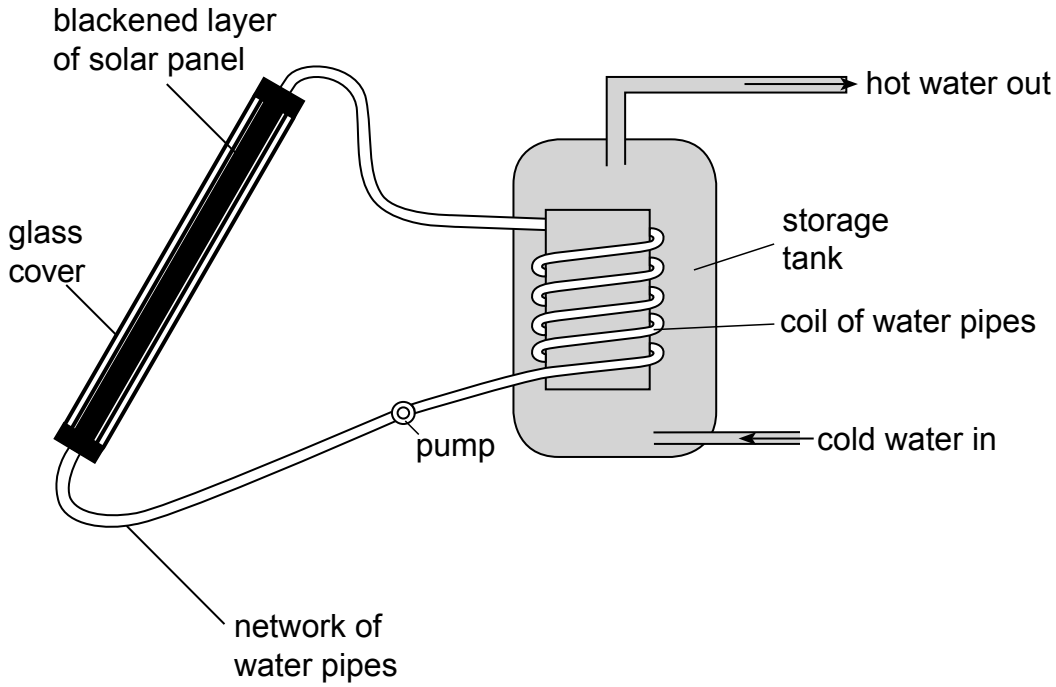


Fig. 8.1

(a) Name the main method by which heat is transferred from

(i) the sun to the solar panel.

..... [1]

(ii) the water in the coil to the storage tank.

..... [1]

(b) With reference to density, explain why hot water leaves the storage tank from the top.

.....

.....

.....

..... [2]

(c) Use the phrases in the list to complete the sentences.

white **shiny white** **matt black** **silver**

The surface which is the

(i) best absorber of radiation is ..... . [1]

(ii) worst emitter of radiation is..... . [1]

(iii) best reflector of radiation is ..... . [1]

[7]

9 Fig. 9.1 shows a ray of light from the sun striking a triangular prism.

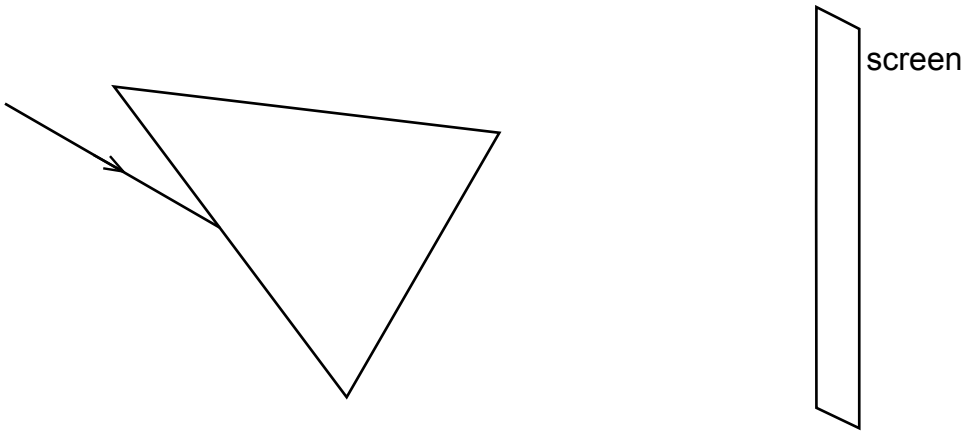


Fig. 9.1

(a) (i) On Fig. 9.1 draw a normal line where the light ray strikes the prism. [1]

(ii) Complete the diagram in Fig. 9.1 to show the path of light as it enters and leaves the triangular prism. [1]

(b) When light rays from the triangular prism hits the screen, a continuous light spectrum is formed.

Explain why this spectrum is formed.

.....

.....

.....

..... [2]

(c) Fig. 9.2 shows an object placed 5.0 cm from the centre C, of a convex lens which has focal length of 3.0 cm as shown in Fig. 9.2.

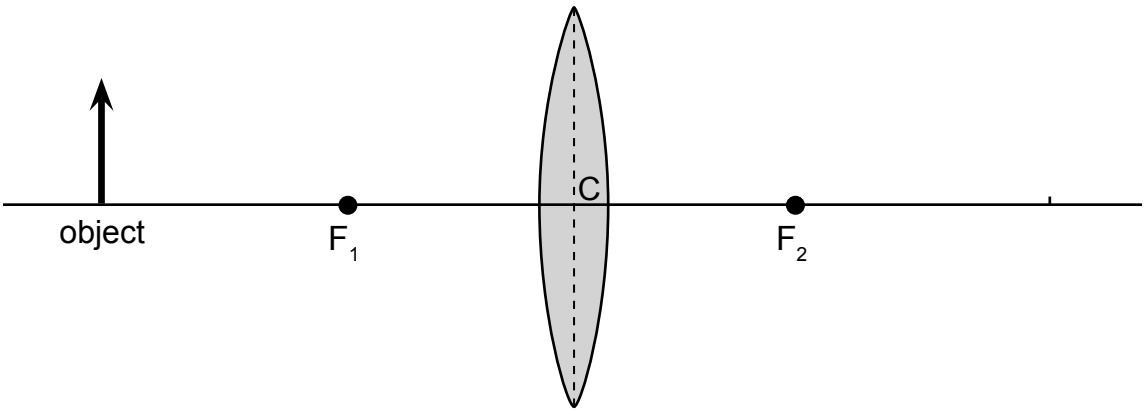


Fig. 9.2

On Fig. 9.2 draw

(i) **two** rays from the top of the object to locate the position of the image formed. [2]

(ii) the image and label it **I.** [1]

(d) The object is moved and placed 2.0 cm from the centre C, of the lens.

State **one** property of the new image formed.

..... [1]

[8]

For Examiner's Use

10 (a) Fig. 10.1 shows an insulated coiled wire (solenoid) connected to a cell.

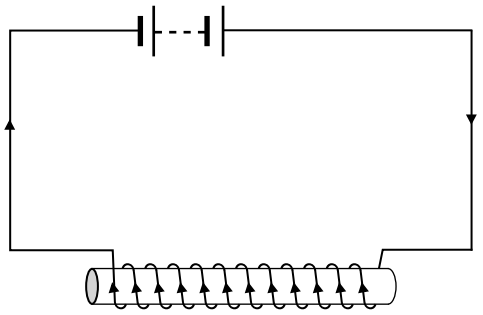


Fig. 10.1

A north pole of a permanent bar magnet is brought closer to the left hand side of the solenoid.

State and explain the observation made.

Observation.....

Explanation .....

.....

..... [2]

(b) Fig. 10.2 shows a model of an a.c generator.

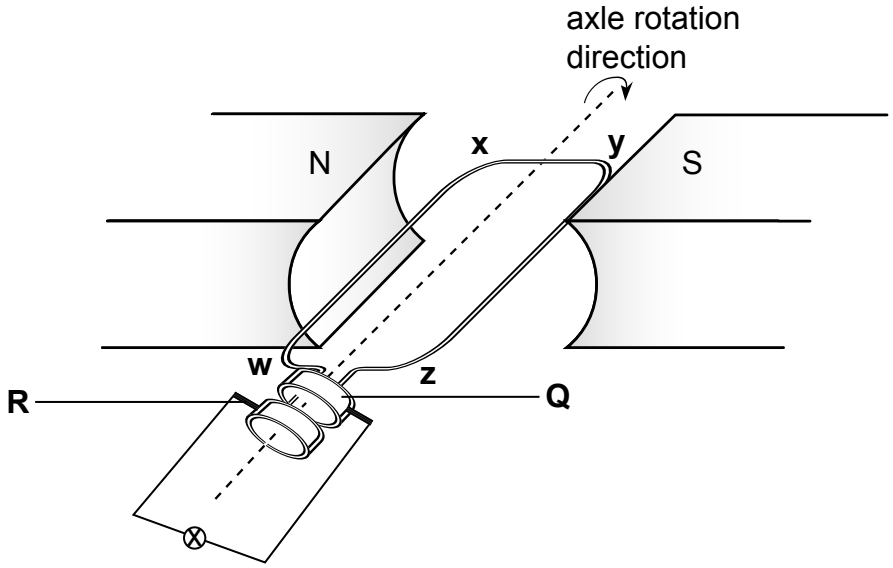


Fig. 10.2

The coil of wire labelled **w x y z** is rotated in the direction shown and e.m.f. is induced in the coil.

(i) On Fig. 10.2 draw arrows to indicate the direction of induced e.m.f. on side **w**-**x** and side **y**-**z**. [1]

(ii) Explain why the e.m.f. is induced in the coil as the coil rotates between the poles of the magnet.

.....

..... [1]

(iii) Identify the components labelled **R** and **Q** in Fig. 10.2.

R .....

Q ..... [2]

(c) Fig. 10.3 shows a simple transformer.

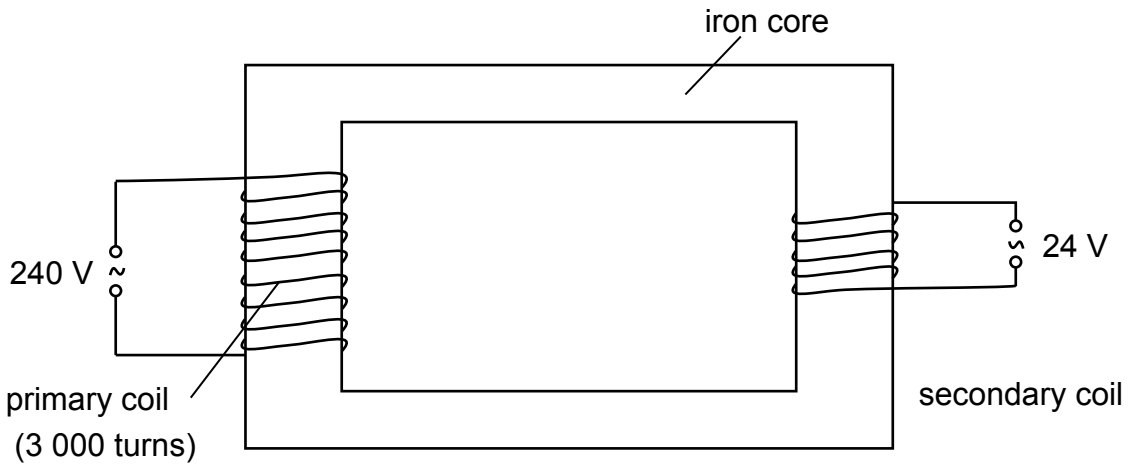


Fig. 10.3

(i) State the purpose of an iron core in a transformer.

.....

..... [1]

(ii) Calculate the number of turns on the secondary coil.

Number of turns ..... [2]

(iii) Calculate the current output of the secondary coil when there is a current of 0.25 A in the primary coil.

Current ..... A [2]

[11]

11 The list shows the nuclide notation of three radioactive atoms.

$^{238}_{92}\mathbf{J}$ $^{222}_{90}\mathbf{L}$ $^{239}_{92}\mathbf{M}$

(a) Identify **two** nuclides which are isotopes of the same element.

1 .....

2 ..... [1]

(b) Radioactive atom **L** is thorium.

(i) State the number of protons in a nucleus of thorium.

..... [1]

(ii) Thorium decays by emitting beta particles.

Complete the word equation when thorium decays by emitting two beta particles.

Thorium ⟶ ..... + two beta particles [1]

(c) A Grade 12 student investigates the radioactivity of material **L**.

(i) Define the term *half-life*.

.....

..... [2]

The student placed a sample of material **L** a few centimeters from the GM-tube.
The table in Fig. 11.1 shows the results obtained every hour for 5 hours.
The background radiation of 74 Bq was detected.

Time/hour	0	1	2	3	4	5
Activity/Bq	2110	1690	1356	1092	882	715
Correct activities/Bq						

Fig. 11.1

(ii) Complete the table to show the corrected activities of material **L** after each hour interval. [2]

(iii) Determine the half-life of material **L**.

.....

..... [2]

[9]

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** 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	**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** 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

Key

a
X
b

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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