Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE ORDINARY LEVEL

4323/3

PAPER 3

1 hour 30 minutes

Marks 60

2019

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 at the 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 may use a non-programmable calculator.

- 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 13.
- Chemistry practical notes are printed on page 14.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	
Marker	
Checker	

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

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

1 A student wants to find out the density of three cubes **X**, **Y** and **Z** with the same dimensions. She uses a balance to find the mass of each cube.

The balance readings are shown in Fig. 1.1.

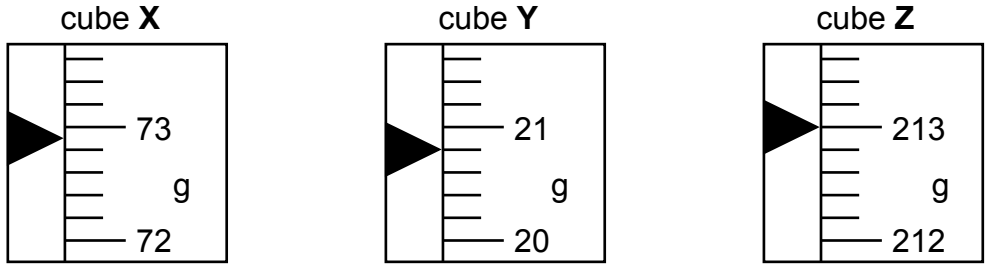

Fig. 1.1

(a) Record the masses for cubes **X**, **Y** and **Z** in Table 1.1. [3]

Table 1.1

cube	mass/ g	volume/ cm^3	density/ g/cm^3
X			
Y			
Z			

(b) Fig. 1.2 shows an outline for the representation of cubes **X**, **Y** and **Z**.

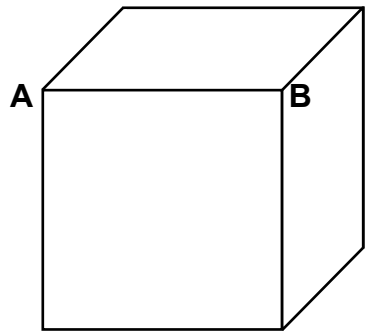

Fig. 1.2

(i) Measure the length, in cm, of side **AB** of the cube.

length = ...cm [1]

(ii) Use your answer in **(b) (i)** to calculate the volume of each of the cubes. Record your answer in Table 1.1.

[2]

(c) Complete Table 1.1 by calculating the density of each of the cubes **X**, **Y** and **Z**. Use the formula

$$\text{density} = \frac{mass}{volume} .$$

[3]

(d) Which of the cubes **X**, **Y** or **Z** do you think would float when placed in water?

Give a reason for your answer.

.....

.....

.....

..... [2]

(e) Suggest **one** way in which the student ensures accuracy in this experiment.

.....

..... [1]

[12]

For Examiner's Use

2 In an experiment, a student extracts and investigates the green pigment chlorophyll from spinach. The student carried out the experiment in five steps.

Step 1 She crushed the spinach with sand.
Step 2 She placed the crushed spinach in a beaker containing 100 cm^3 ethanol.
Step 3 She stirred the mixture.
Step 4 She separated the solution from the rest of the mixture.
Step 5 She investigated the colours present in the solution.

(a) Explain why the spinach is crushed.

.....

.....

.....

..... [2]

(b) Suggest why the spinach is crushed with ethanol rather than water in Step 2.

.....

..... [1]

(c) Name **three** pieces of apparatus needed to carry out Step 4.

1 .....

2 .....

3 ..... [3]

(d) Describe how Step 5 is carried out.

.....

.....

.....

.....

.....

..... [4]

(e) In similar experiments, Step 6 could be added in which a **locating agent** is used.

State why it is sometimes necessary to use a locating agent.

.....

..... [1]

[11]

3 A student demonstrates to a class what happens when an enclosed coloured liquid, which is initially at room temperature, is placed in a bath of hot water as shown in Fig. 3.1.

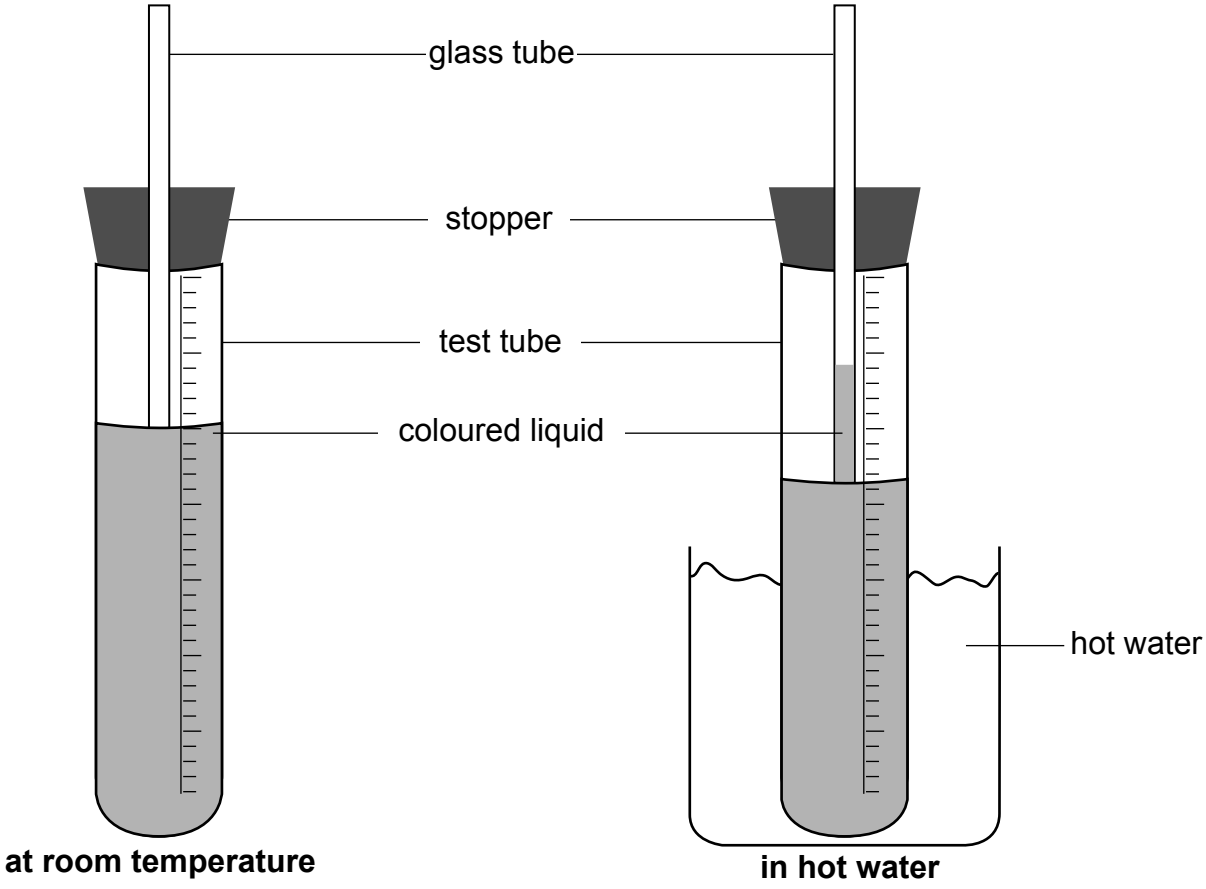

Fig. 3.1

(a) Use the kinetic particle theory of matter to explain what happens to the coloured liquid when the test tube which is initially at room temperature is placed in a bath of hot water.

.....

.....

.....

.....

.....

..... [3]

(b) Another student suggests that this apparatus could be used as a thermometer.

Describe how you would calibrate this thermometer.

.....

.....

.....

.....

.....

..... [3]

(c) Name the property which is demonstrated by this experiment and describe how it compares in solids, liquids and gases.

.....

.....

.....

..... [2]

[8]

4 Fig. 4.1 shows different reactions involving organic compounds.

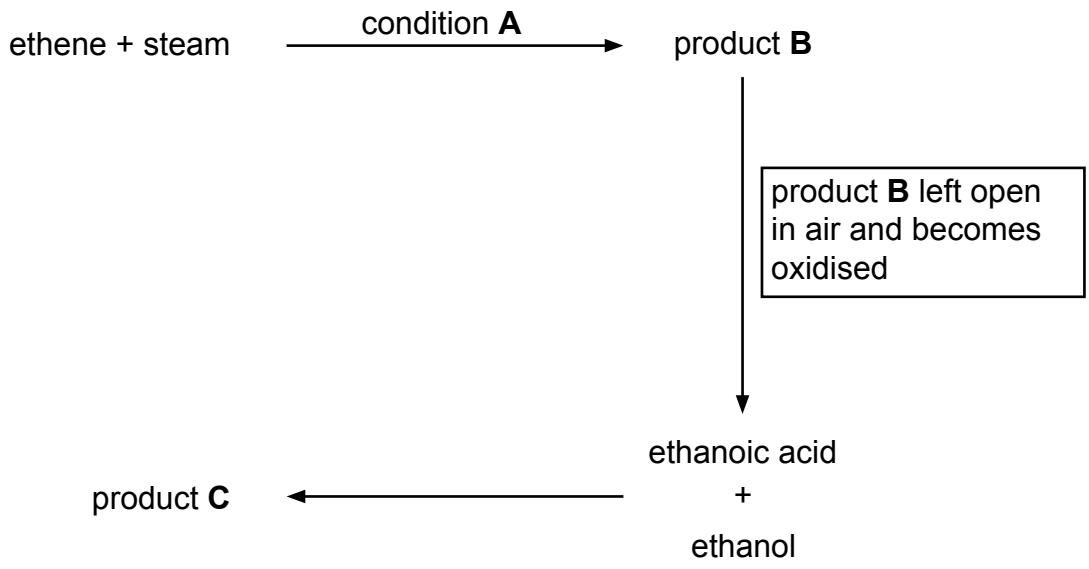

Fig. 4.1

(a) State what is represented by condition **A** and products **B** and **C**.

.....

.....

.....

.....

.....

..... [3]

(b) Ethene is an alkene.
Describe an experiment to distinguish between alkanes and alkenes.

.....

.....

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.....

.....

.....

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..... [4]

[7]

5 A student investigates how the resistance of a wire varies with length as shown in Fig. 5.1.

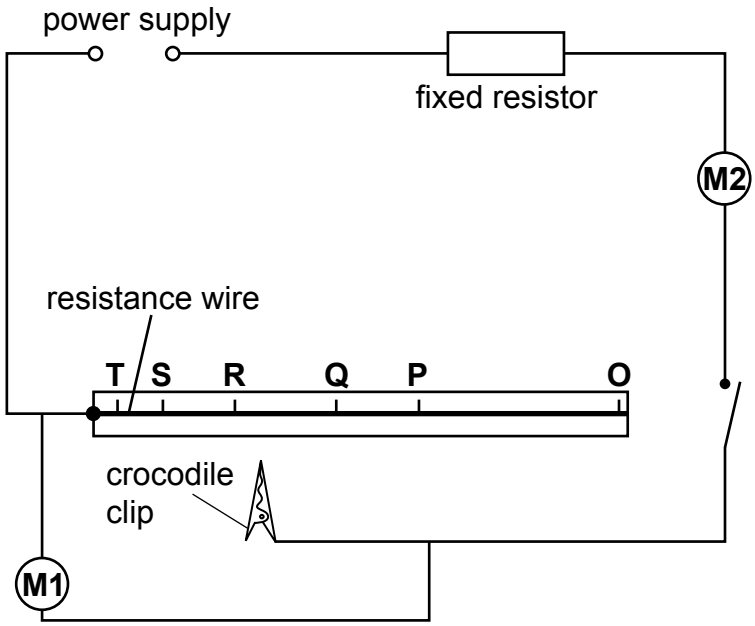


Fig. 5.1

(a) State the names of instruments **M1** and **M2** shown in Fig. 5.1 used to measure the potential difference across and the current through the resistance wire.

M1 .....

M2 ..... [2]

(b) The crocodile clip is connected in turn to points **O**, **P**, **Q**, **R**, **S** and **T** as shown in Fig. 5.1.

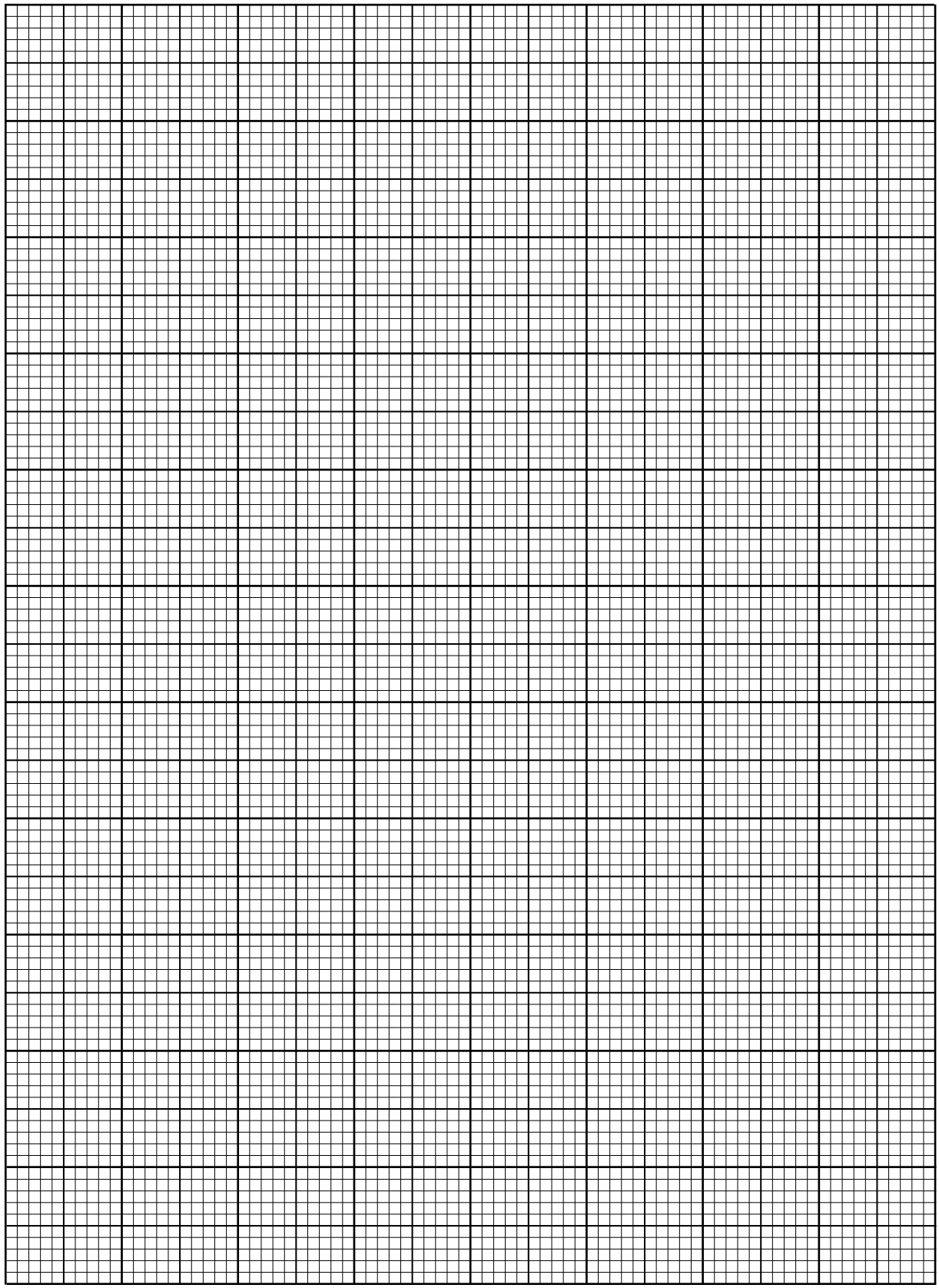
The potential difference, V, and the current, I, are measured for each position **O**, **P**, **Q**, **R**, **S** and **T** and recorded in Table 5.1.

Table 5.1

position	potential difference/ V	current/ A
O	1.2	0.30
P	1.1	0.45
Q	1.0	0.73
R	0.8	0.86
S	0.7	1.10
T	0.5	1.33

For Examiner's Use

(i) On the grid below, plot a graph of potential difference, V, (y-axis) against current, I, (x-axis). Draw a line of best fit.



[5]

(ii) The gradient of the graph is numerically equal to the resistance of the wire. From the graph, determine the resistance, *R*, of the wire. Show clearly how you obtained the necessary information.

.....

.....

..... [3]

[10]

6 A student is given a bottle containing pieces of sodium metal which are covered by a liquid as shown in Fig. 6.1.

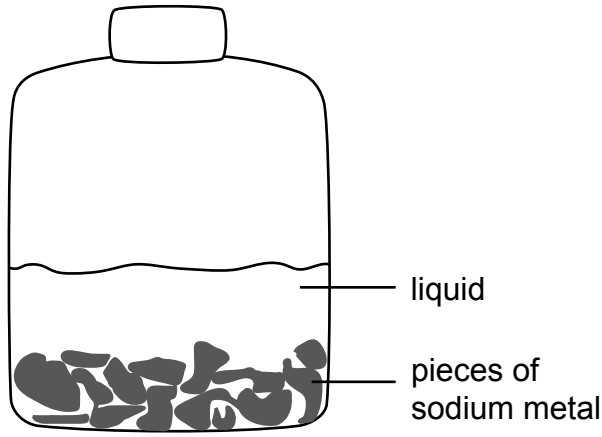


Fig. 6.1

The student uses some pieces of sodium to carry out a series of tests as outlined in Table 6.1.

Table 6.1

test	**observations**	**conclusions**
1. Add a piece of sodium to cold water.		hydrogen gas formed aqueous solution **P** formed
2. Add Universal Indicator to aqueous solution **P**.		
3. Add warm aqueous solution **P** with salt **R.**		aqueous salt **Q** formed ammonia gas formed
4. Add nitric acid and aqueous silver nitrate to aqueous salt **Q**.	white precipitate **S**	

(a) Suggest **three** observations that the student makes when sodium was dissolved in cold water.

1 .....

.....

2 .....

.....

3 .....

..... [3]

(b) The student adds Universal Indicator to aqueous solution **P**.
State the resulting colour of the Universal Indicator.

..... [1]

(c) Name

(i) aqueous solution **P**,

..... [1]

(ii) aqueous salt **Q**,

..... [1]

(iii) white precipitate **S**.

..... [1]

(d) Suggest the name of salt **R**.

..... [1]

(e) State what happens when the student leaves the sample of precipitate **S** in sunlight.

.....

..... [1]

(f) Suggest the liquid in which sodium is stored.

..... [1]

(g) Describe the test for the hydrogen gas.

Test .....

Result.....

.....

..... [2]

[12]

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.).

CHEMISTRY PRACTICAL NOTES

Test for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead (II) nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil, warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
aluminium (Al^{3+})	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Test for gases

gas	*test and test result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	‘pops’ with a lighted splint
oxygen (O_2)	relights a glowing splint

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