Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE ORDINARY LEVEL

4323/3

PAPER 3

1 hour 30 minutes

Marks 60

2017

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 rough working, diagrams or graphs.
- 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 15.
- Chemistry Practical Notes are printed on page 16.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
TOTAL	

Marker	
Checker	

This document consists of **15** printed pages and **1** blank page.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

For Examiner's Use

1 In an experiment a Grade 12 student suspends a spring to which a weight hanger is attached as shown in Fig. 1.1.

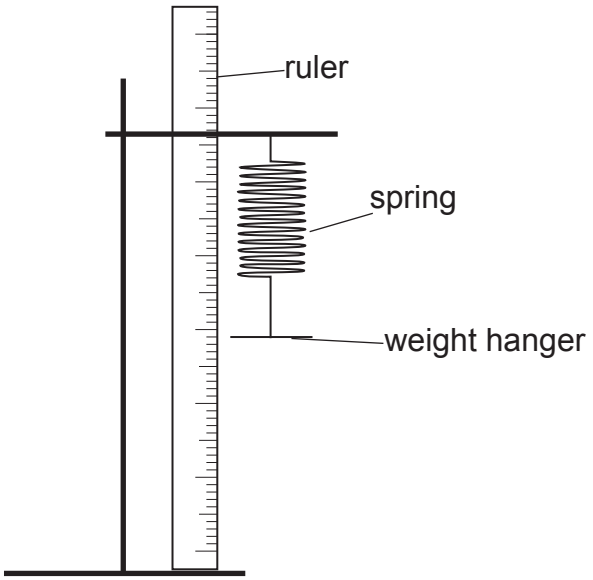

Fig. 1.1

The student uses the ruler to measure the length of the spring without any mass added (x_0) and found it to be 15 mm.

She then adds slotted masses onto the mass hanger and records the new length of the spring for each mass added.

Fig. 1.2. shows the spring when 20 g and 50 g masses are hanging from it.

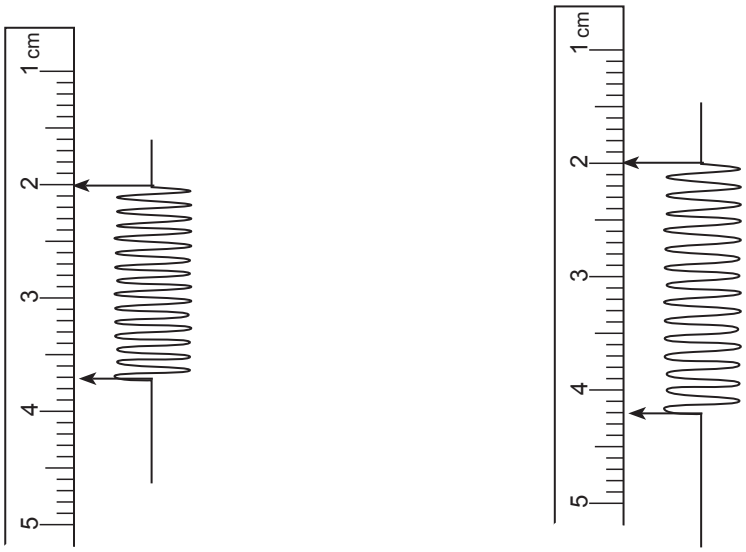

Fig. 1.2

(a) Read the spring lengths from Fig. 1.2 for the 20 g mass and the 50 g mass and record them in the table in Fig. 1.3. [2]

mass added/g	spring length (x_0)/mm	new length (x)/mm	extension ($x - x_0$)/mm
0	15	-	-
10	15	16	
20	15		
30	15	18	
40	15	19	
50	15		
60	15	26	
70	15	31	
80	15	36	

Fig. 1.3

(b) Complete the table in Fig. 1.3 by determining the extension ($x - x_0$) of the spring for each mass added. [4]

(c) Use the information in Fig. 1.3 and the grid in Fig. 1.4 to draw the graph of extension (y-axis) versus mass (x-axis). Draw the line of best fit. [4]

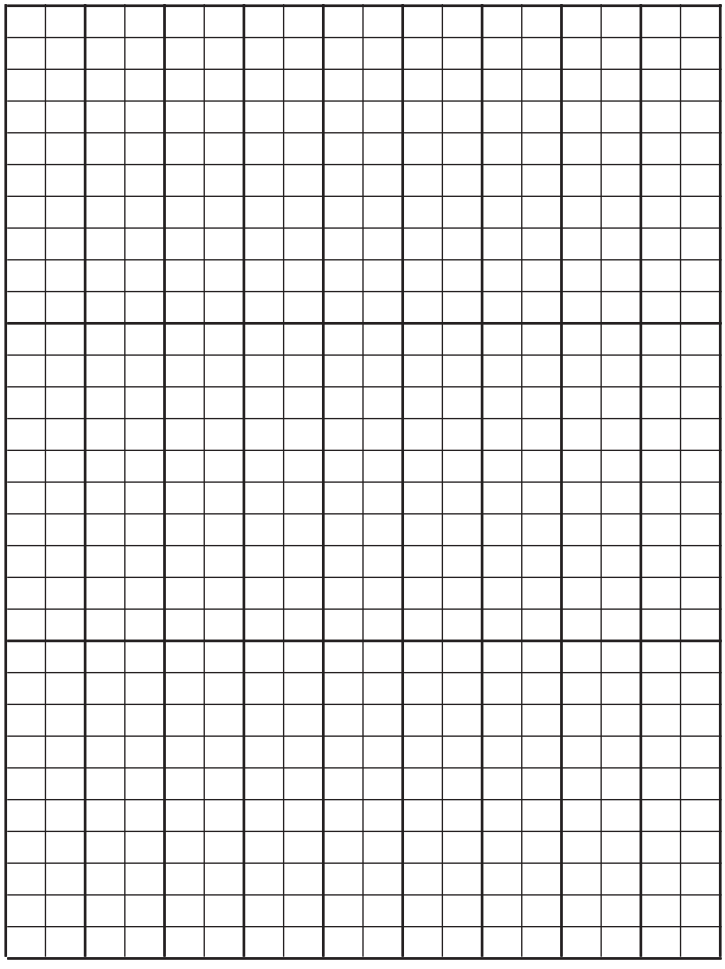

Fig. 1.4

(d) On your graph identify the limit of proportionality of the spring and label it P. [1]

[11]

2 Describe a chemical test to distinguish between each of the following pairs of substances.

For Examiner's Use

An example is given.

Example: oxygen and carbon dioxide

Test ..glowing splint.....

Result with oxygen...relight the glowing splint.....

Result with carbon dioxide ..extinguish the glowing splint.....

(a) Ammonia and chlorine

Test .....

Result with ammonia.....

.....

Result with chlorine.....

..... [3]

(b) Acidic solution and basic solution

Test .....

Result with acidic solution.....

Result with basic solution..... [3]

(c) Ethene and ethane

Test .....

Result with ethene .....

Result with ethane ..... [3]

[9]

3 Grade 12 students are given the pieces of apparatus listed below.

ammeter **electronic balance** **meter ruler**

50 cm³ beaker **50 cm³ measuring cylinder** **voltmeter**

stopwatch

tape measure **clock** **spring balance**

25 cm³ pipette

(a) Complete the table in Fig. 3.1 by inserting the name of one piece of apparatus from the list that is the most suitable for measuring each quantity described.

quantity to be measured	most suitable apparatus
25 cm³ of water	
a distance of about 50 m	
the mass of a coin	
the force required to lift a school book	
the potential difference across a cell	

Fig. 3.1

[5]

(b) Using some of the apparatus above, describe an experiment to determine the density of an irregular shaped stone.

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..... [3]

[8]

For Examiner's Use

4 Peter investigates the speed of thermal decomposition of three unknown metal carbonates, **A**, **B** and **C**. Fig. 4.1 shows the apparatus he uses.

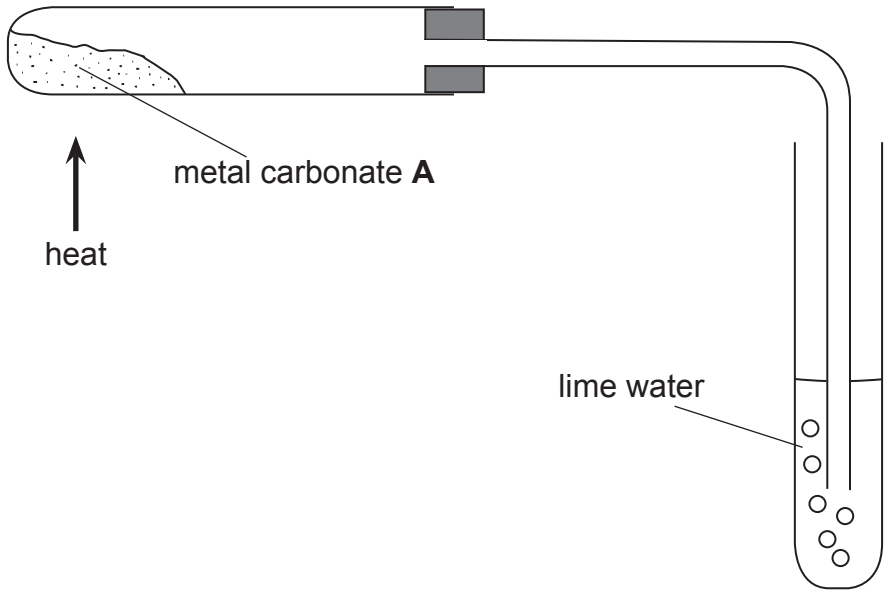


Fig. 4.1

- He places about 1 cm depth of metal carbonate **A** in the hard-glass test-tube.
- He heats it and at the same time starts a stop clock.
- When the limewater turns milky, he stops the clock and records the result in the table in Fig. 4.2.
- He also records any colour change of the metal carbonate **A** in the table in Fig. 4.2.
- He repeats the experiment using metal carbonates **B** and **C**.
- He makes a conclusion on ease of decomposition of the metal carbonates.

metal carbonate	time taken for lime water to turn milky/s	colour change	conclusion on ease of decomposition
A		white to yellow when hot	fairly easy
B	never turned milky	remains white	
C		green to black	easy

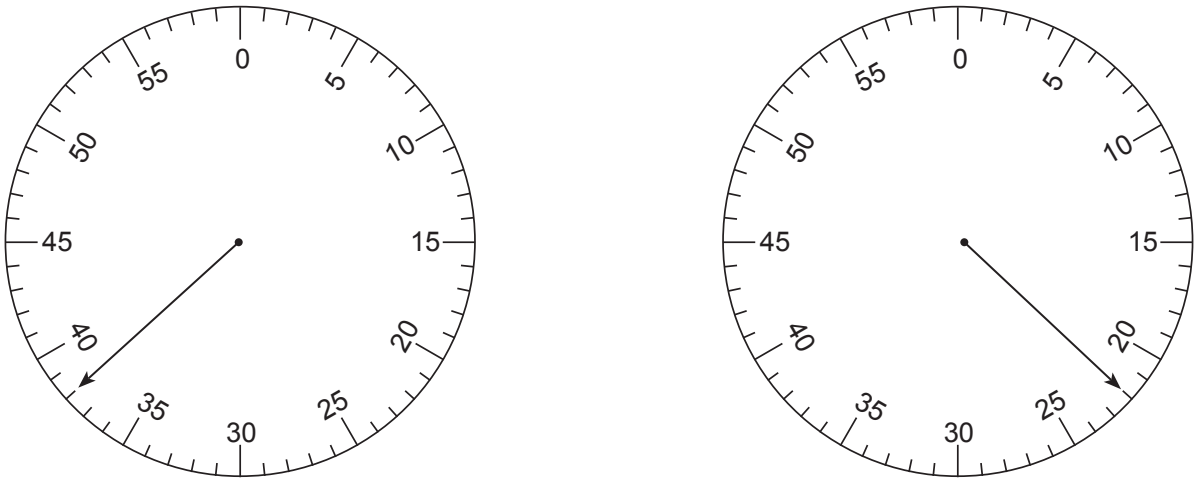
Fig. 4.2

(a) State the conclusion on ease of decomposition Peter would make for metal carbonate **B**.

..... [1]

For Examiner's Use

(b) Fig. 4.3 shows the stop clock readings obtained for metal carbonates **A** and **C**. The readings are the times taken for the limewater to turn milky.



metal carbonate **A** metal carbonate **C**

Fig. 4.3

Record these readings in the table in Fig. 4.2. [2]

(c) The metal carbonates used were potassium, zinc and copper.

Use the information in Fig. 4.2 to suggest the identity of the metal carbonates **A**, **B** and **C** as either potassium, zinc or copper carbonate.

A .....

B .....

C ..... [2]

(d) Use the Chemistry Practical Notes on page 16 to describe experiments to confirm the identity of copper carbonate.

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.....

..... [4]

(e) Peter's teacher advised him not to include lead carbonate as part of his experiment.

For Examiner's Use

With reference to health and safety, suggest **one** reason why Peter's teacher advised him not to include lead carbonate.

.....

..... [1]

[10]

For Examiner's Use

5 Johanna is conducting an experiment to demonstrate the expansion of liquids when heated. She is comparing the expansion of water, ethanol and methanol. The apparatus is shown in Fig. 5.1.

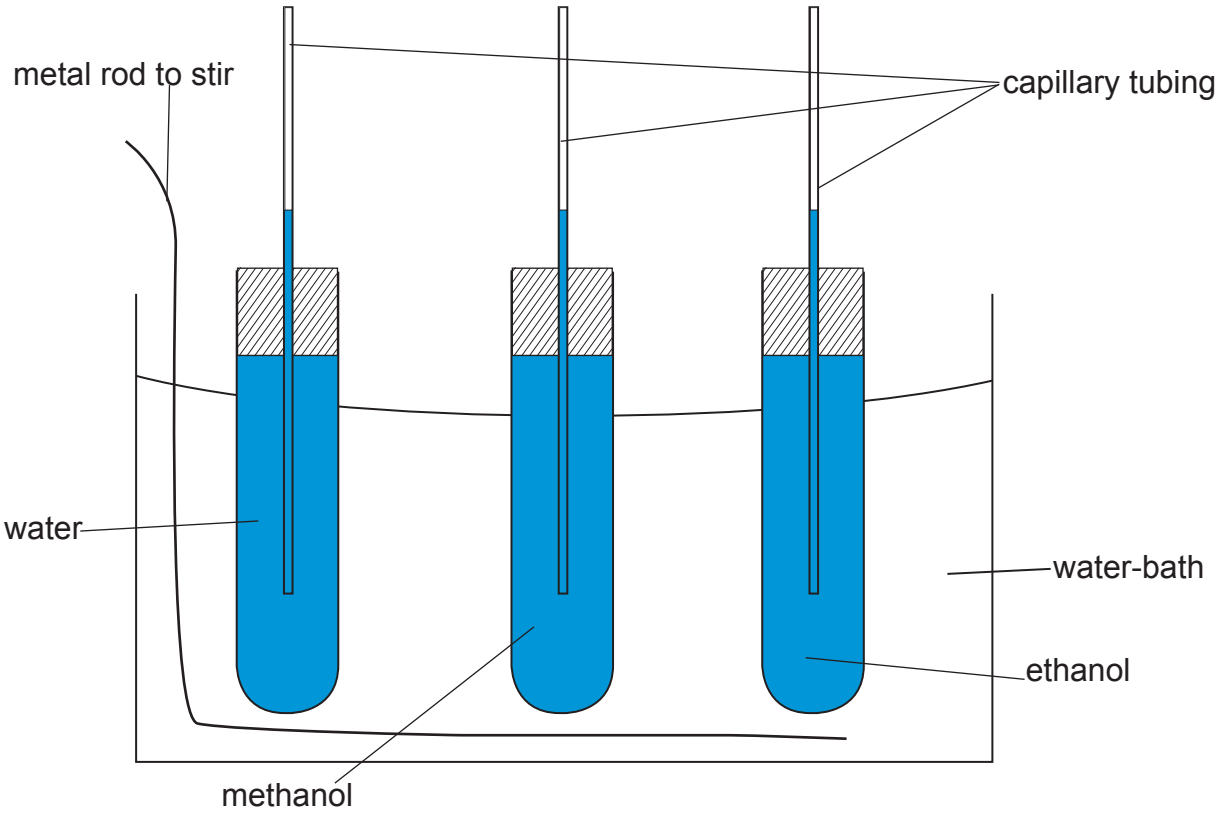

Fig. 5.1

- Each test-tube is filled with the same volume of liquid.
- Three drops of blue ink are added to each liquid.
- Capillary tubes are inserted so that there is no air in the tubes.
- The initial level of the liquid is marked.
- The water-bath is gently heated and carefully stirred.
- After a few minutes, the new levels of the liquids in the capillary tubes are marked.

(a) Suggest the reason why drops of blue ink are added to each liquid.

..... [1]

(b) Explain why the tubes are placed in the same, stirred water-bath.

.....

.....

..... [2]

(c) Johanna observed that the liquid levels in the capillary tubes dropped first before they started rising. Suggest an explanation for this observation.

.....

..... [1]

(d) Fig. 5.2 shows the levels of the liquids in the capillary tubes before and after heating.

For Examiner's Use

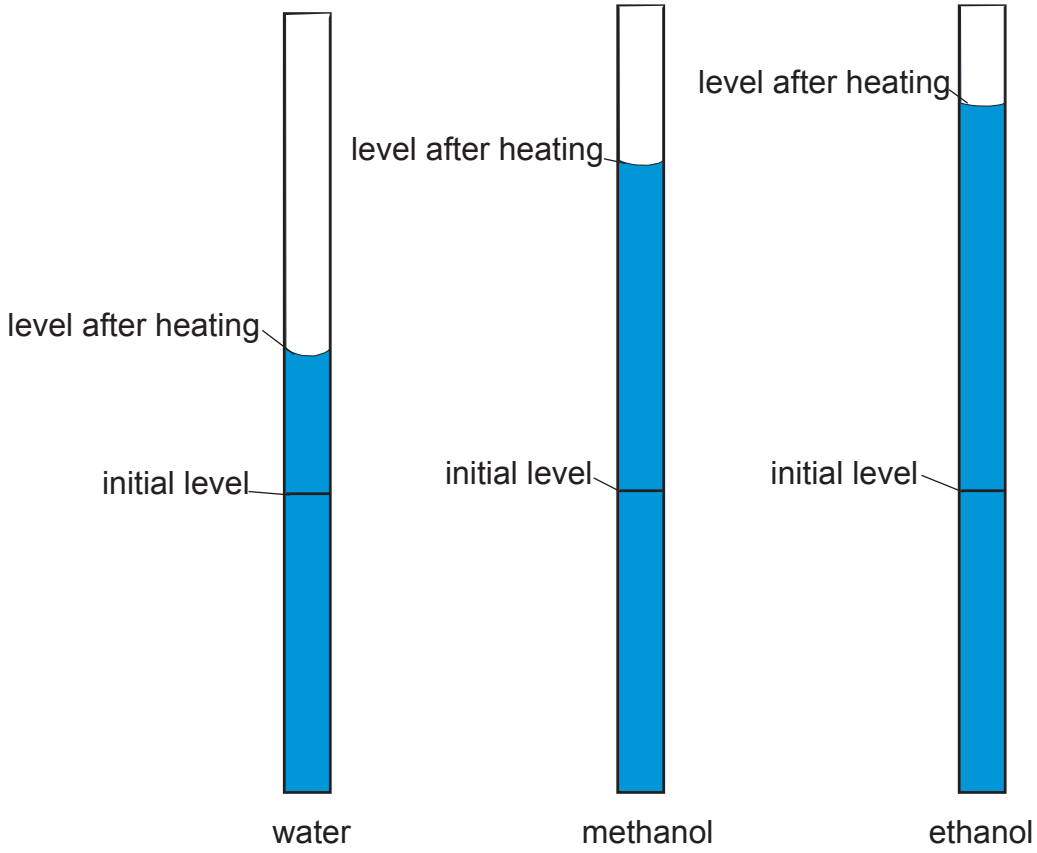

Fig. 5.2

Use a ruler to measure the increase in height of the liquid in each tube. Give your measurements in millimetres and record them in the table in Fig. 5.3. [3]

liquid	water	methanol	ethanol
increase in height / mm			

Fig. 5.3

(e) Ethanol expands more than water when heated.

Explain this difference with reference to the Kinetic Particle Theory.

.....

.....

..... [2]

(f) Use the experimental observations to explain how the liquid-in-glass thermometer works.

.....

.....

..... [2]

[11]

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Question 6 is on page 12

6 Dilute hydrochloric acid was added to excess calcium carbonate in a flask as shown in Fig. 6.1.

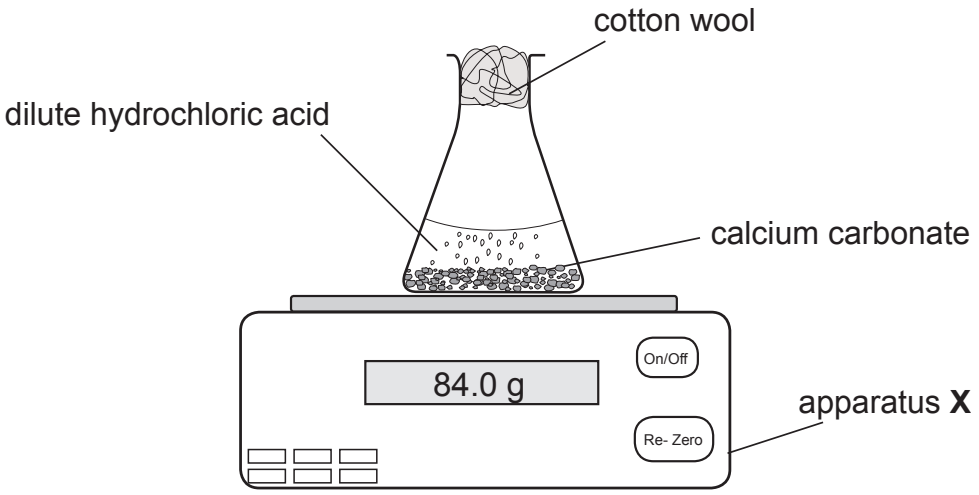

Fig. 6.1

(a) Name apparatus **X**.

..... [1]

(b) The flask was placed on apparatus **X.** The table in Fig. 6.2 shows the mass of the flask and contents recorded every minute during the experiment.

mass of flask and contents /g	84	78	75.6	74.5	74	74
time / min	0	1	2	3	4	5

Fig. 6.2

Plot the results from the table in Fig. 6.2 on Fig. 6.3.

Draw a smooth line graph.

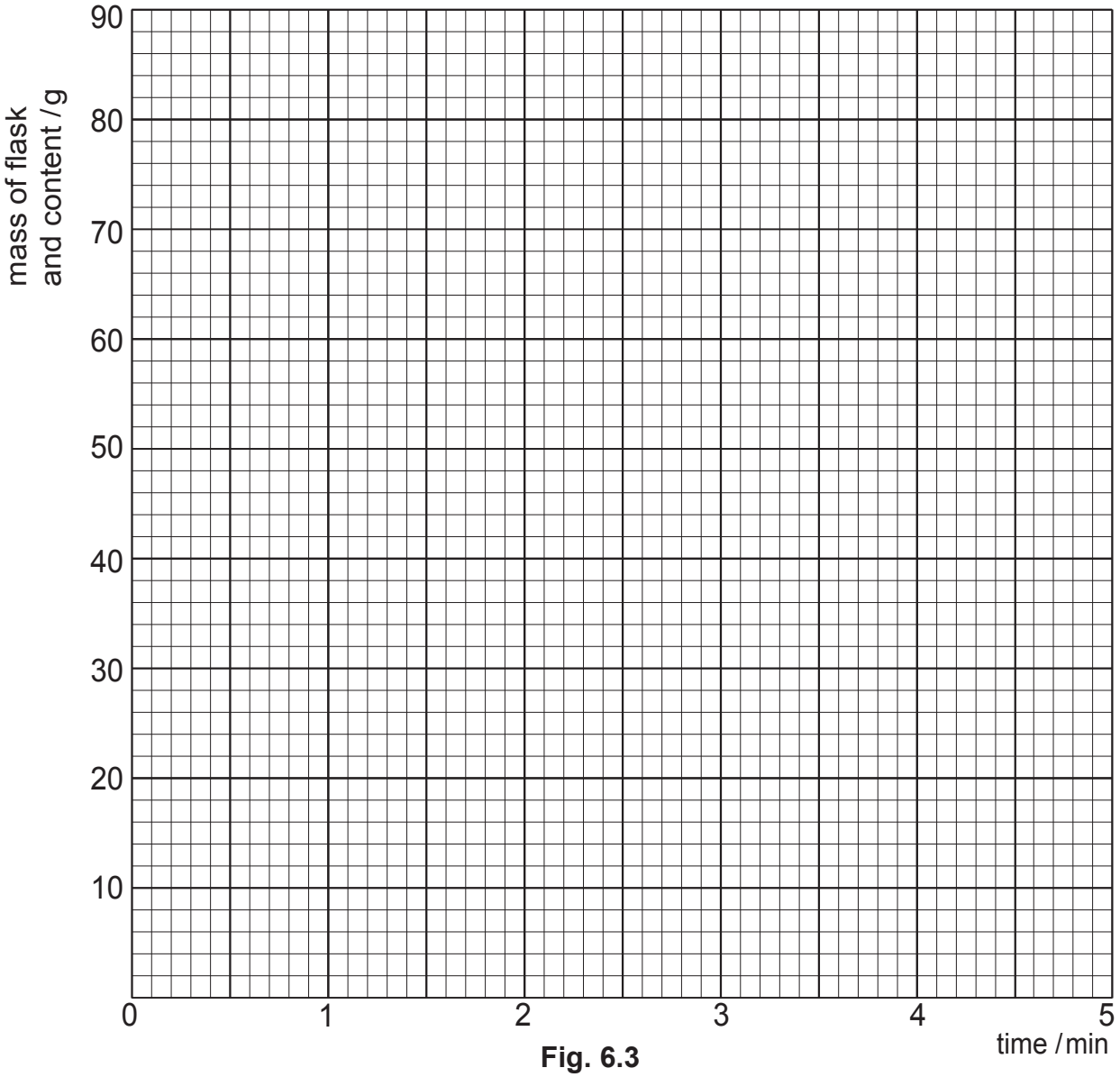

Fig. 6.3

[3]

(c) Use your graph to find

(i) the mass of the flask and its contents after 1 minute 30 seconds.
Show clearly on your graph how you worked out your answer.

..... [2]

(ii) the time the reaction finished.

..... [1]

(d) Explain why the mass of the flask and its contents decreases.

.....

..... [1]

(e) A second experiment was carried out using hydrochloric acid at a higher temperature. The amounts and concentrations of all reactants remain the same.

On the grid sketch a curve to show the expected results for this experiment. Label this curve T. [2]

(f) Suggest the reason for covering the flask with the cotton wool.

.....

..... [1]

[11]

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^-)	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^-)	add aqueous sodium hydroxide, then aluminium foil, warm carefully	ammonia produced
sulfate (SO_4^{2-})	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