School Number	Candidate Number
Surname and Initials	

CHEMISTRY

PAPER 3 3051/3

Thursday 2 JUNE 2011 12.30 P.M. – 2.00 P.M.

Additional materials:
Line paper
Graph paper

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS AND INFORMATION TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, surname and initials at the top of this page as well as at the top of all lined paper submitted.

Answer **ALL** the questions in **Section A** in the spaces provided on the question paper and any **TWO** questions from **Section B** on the lined paper provided.

Equations and diagrams should be given wherever they are helpful. Essential working must be shown.

The intended marks for each question or part question are given in brackets [ ].

Relative atomic masses are given in the Periodic Table of elements printed on page 2.

ADDITIONAL INFORMATION

s.t.p. (t = 0 °C, p = 760 mmHg)
The volume of one mole of gas at room temperature and pressure (r.t.p.) is 24 000 cm^3.

FOR EXAMINER'S USE	
Section A	
1	
2	
3	
4	
Section B	
5	
6	
7	
TOTAL	

This question paper consists of 16 printed pages and 4 blank pages.

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 Sulphur 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 †															

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

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

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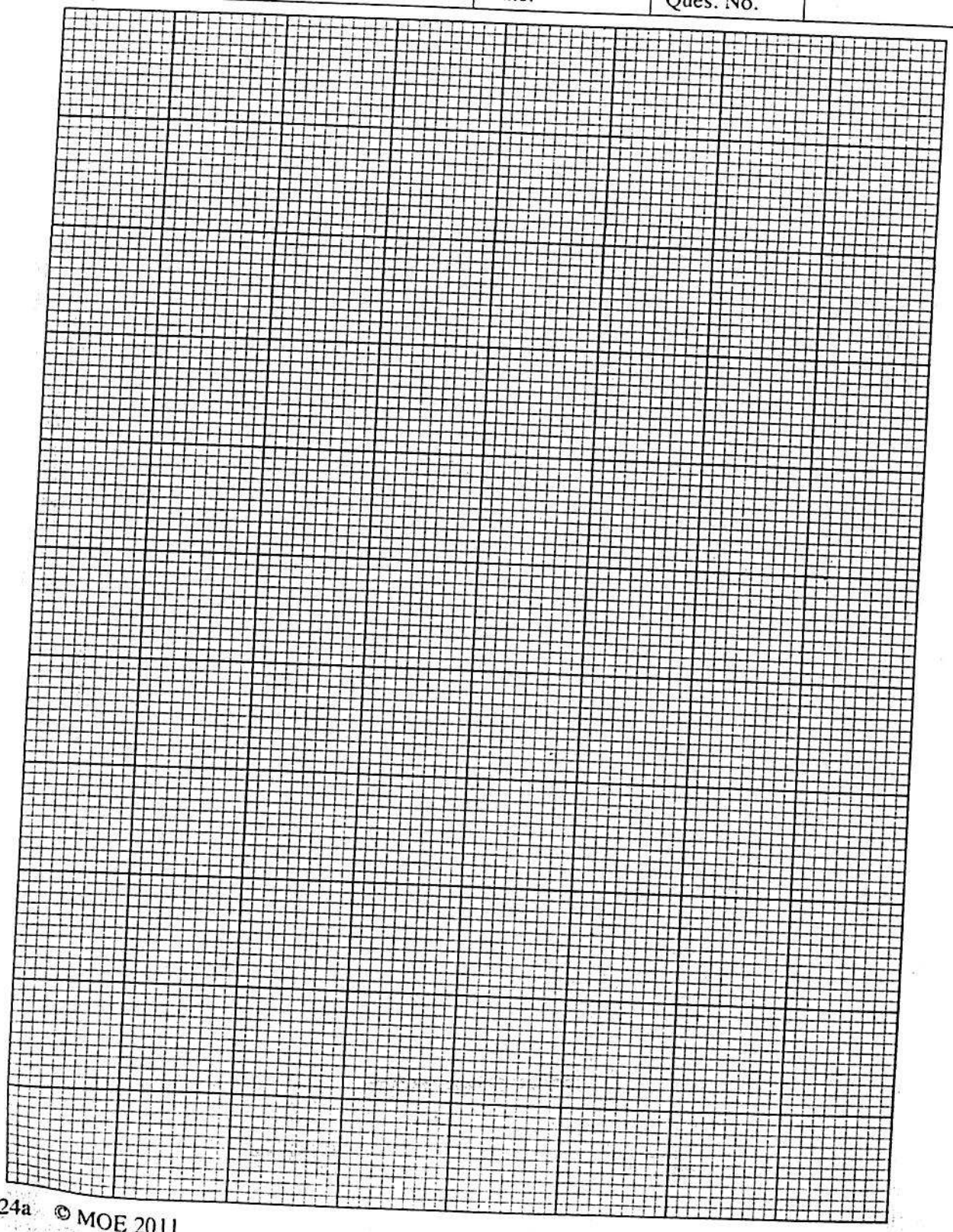
AB7

School No.	Candidate No.	Level:	For Examiner's Use
Subject Number & Title:		Paper:	
Surname & Initials:		Section:	
Signature:	Date:	Ques. No.	



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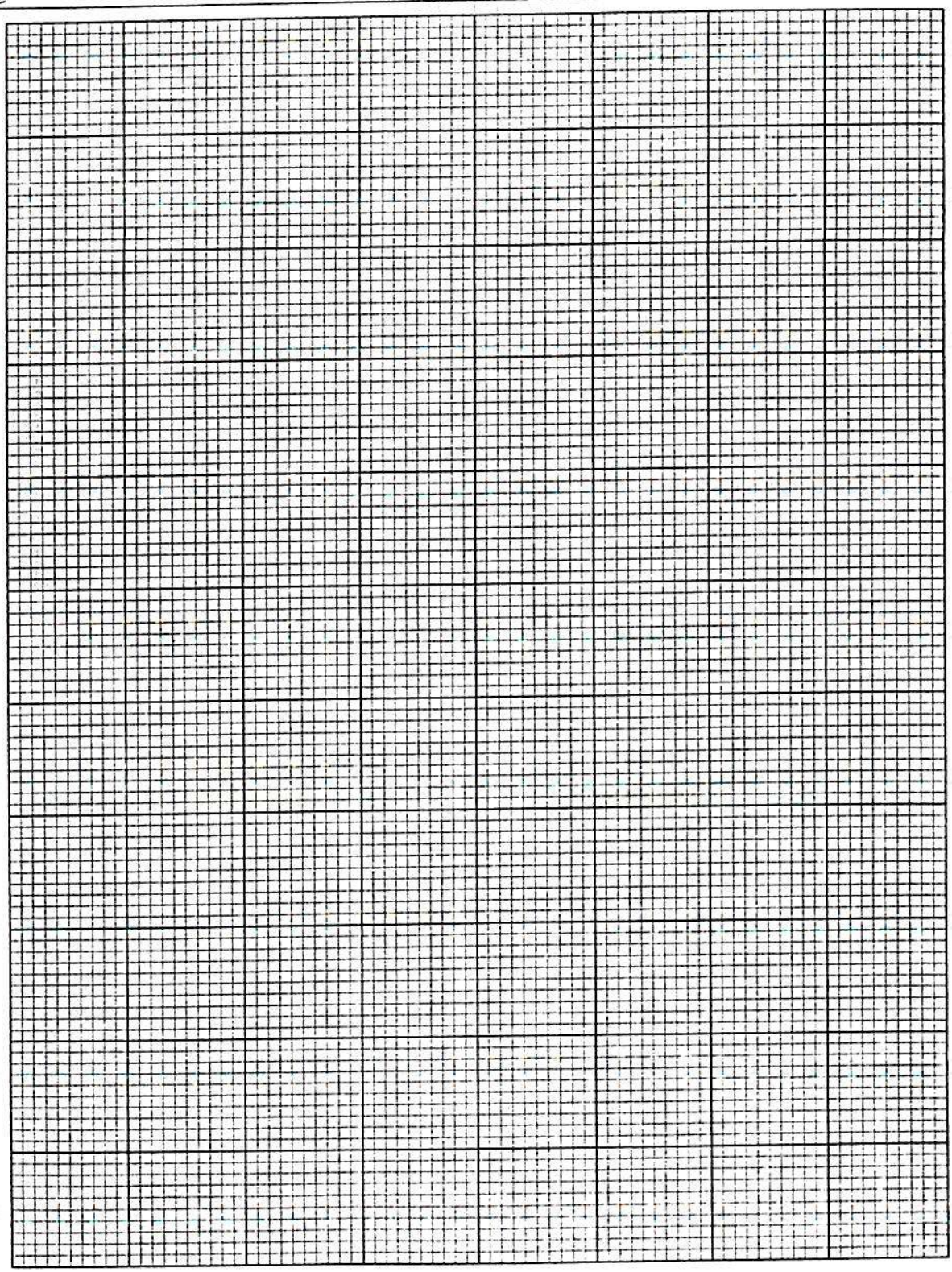

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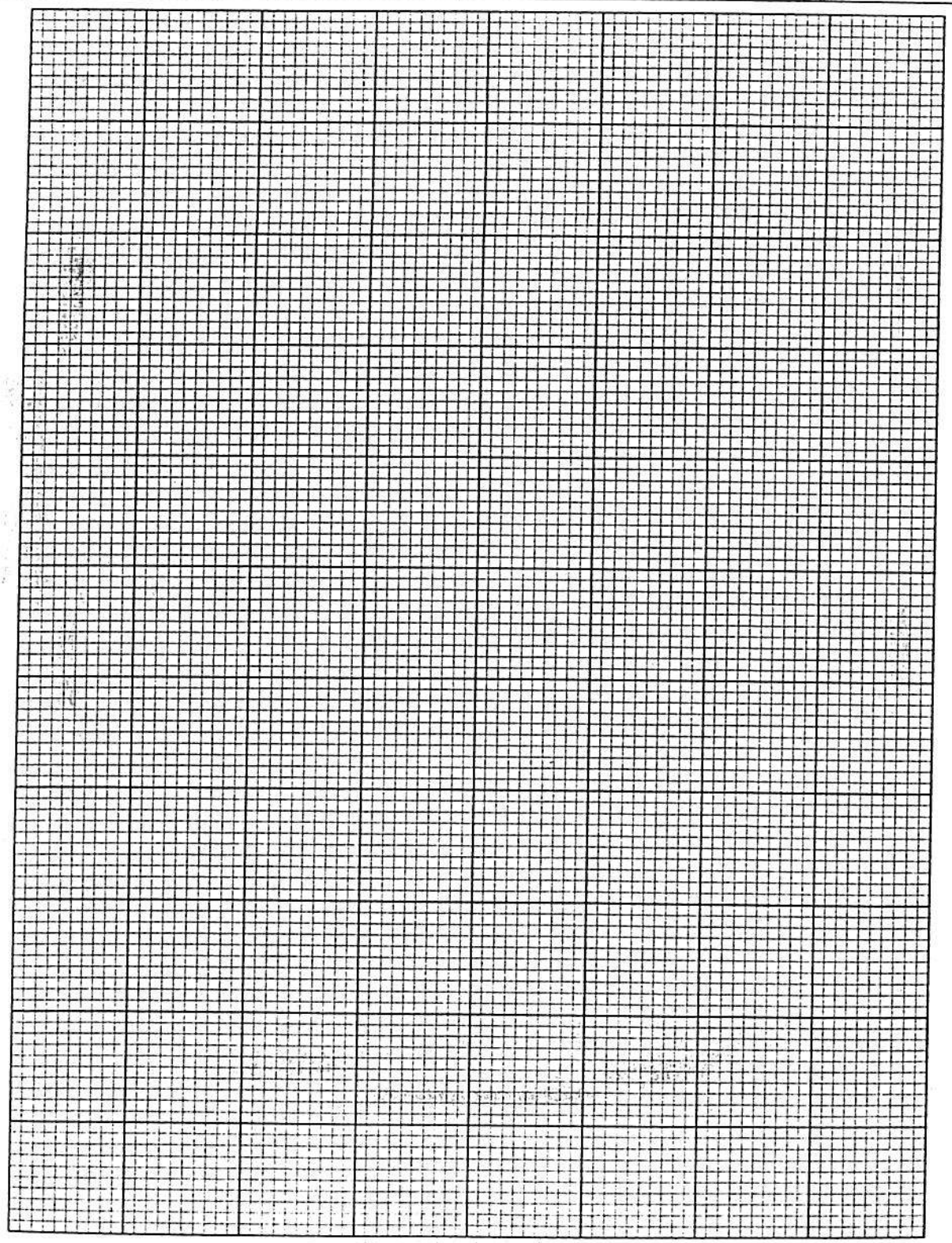


Section A

Candidates are to answer **ALL** four questions in Section A.

1. The concentration of a solution is expressed in moles per cubic decimetre or mol/dm3.

Solid sodium hydroxide is deliquescent. A student takes a few pellets of sodium hydroxide out of the bottle and leaves them on a weighed watch-glass for a few minutes in the open air. Then she/he finds the total mass of the watch-glass and the sodium hydroxide using a balance. The mass of the pellets is calculated.

Mass of watch-glass + pellets = 17.8 g
Mass of watch-glass = 12.4 g

(a) (i) State the mass of the pellets.

_____ g [1]

(ii) Explain why this is **NOT** the accurate mass of the sodium hydroxide.

_____

_____ [1]

The pellets were dissolved in 250 cm^3 of water. The student wants to find the accurate concentration of sodium hydroxide in solution, by titration with hydrochloric acid of concentration 0.5 mol/dm^3.

(b) (i) Suggest the name of an indicator which can be used for the titration and give its colour in acid and alkali.

name of indicator _____

colour in acid _____

colour in alkali _____ [2]

(ii) Give **ONE** reason why the student repeats the titration to obtain three values.

_____

_____

_____ [1]

[Turn over

(iii) Write a symbol equation for the reaction that takes place.

_____ [1]

(c) In the titration, 25 cm^3 of the acid needs 27.5 cm^3 of the alkali for complete neutralisation.

(i) If the acid has a concentration of 0.25 mol/dm^3, what is the concentration of the sodium hydroxide in mol/dm^3?

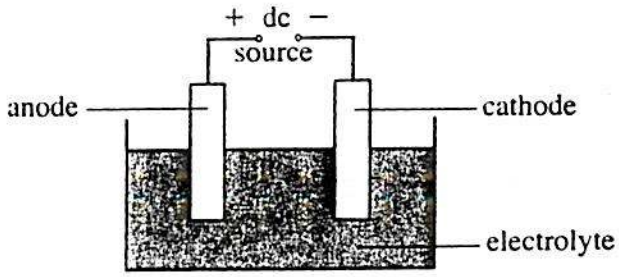
[2]

(ii) Calculate the accurate mass of sodium hydroxide that the student dissolved in 250 cm^3 of water.

[2]

Total marks [10]

2. Impure copper is extracted from its ore using a copper smelter. Using the process of electrolysis the impure copper obtained from the smelting process can be purified.



(a) Name

(i) the material of the anode, _____

(ii) the material of the cathode, _____

(iii) a solution that can be used

as the electrolyte. _____ [3]

(b) Write a balanced half-equation for the reaction occurring at the anode. [2]

(c) (i) For each mole of purified copper, what is the number of moles of electrons that will be exchanged?

_____ [1]

(ii) What type of reaction occurs at the cathode?

_____ [1]

(d) State the colour of the electrolyte at the end of the purification process.

_____ [1]

(e) (i) Name an important use for purified copper.

_____ [1]

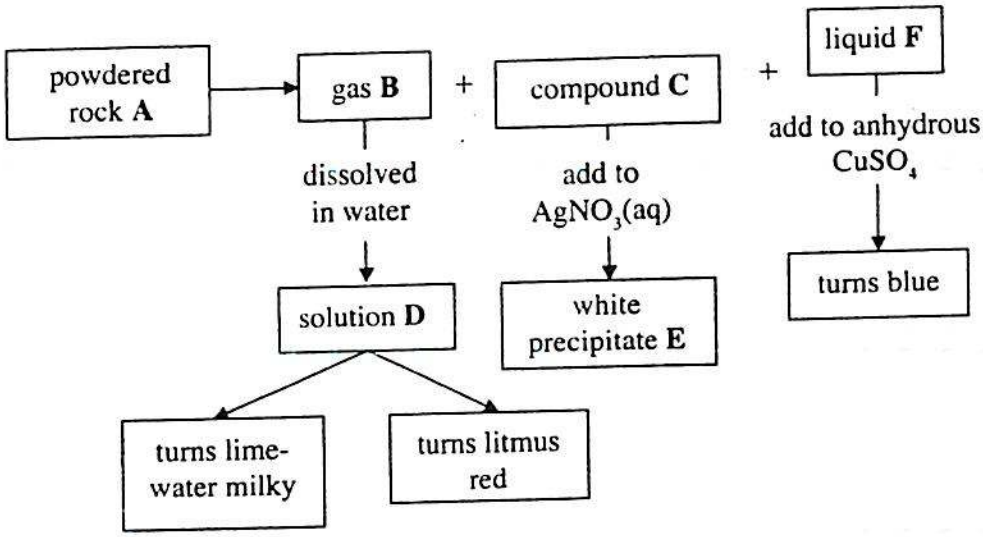
(ii) Explain why copper is the best material for this use.

_____

_____ [1]

Total marks [10]

3. Farmer Rolle invited a chemist to Andros for chemical analysis of a rock found in his field. The diagram shows the series of tests conducted by the chemist. The chemist first added dilute hydrochloric acid to powdered rock **A**.



(a) Identify the following substances

A _____

B _____

C _____

D _____

E _____

F _____ [6]

(b) Gas **B** can be used in fire extinguishers. Give one property of gas **B** that can make it suitable for use in fire extinguishers.

_____ [1]

[Turn over

(c) As a favour to the farmer the chemist also decided to test for the presence of nitrates in the soil. One of the reagents used to test nitrates is aqueous sulphuric acid.

Name the next reagent and describe the observation made if the result is positive.

name of reagent _____

observation _____ [2]

(d) Write the chemical formula of a nitrogen-containing fertilizer.

_____ [1]

Total marks [10]

4. The Nitrogen cycle exists in nature to ensure the continual supply of this most essential element.

(a) State the percentage of nitrogen gas which makes up the atmosphere.

_____ [1]

(b) Compounds of nitrogen, which are pollutants, are formed when fossil fuels are burned in power plants and in internal combustion engines. State the name of **TWO** such gases.

1 _____

2 _____ [2]

(c) Describe **TWO** adverse effects these gases have on the environment.

_____

_____ [2]

(d) Another compound of nitrogen is made by nitrogen-fixing bacteria in the roots of some plants.

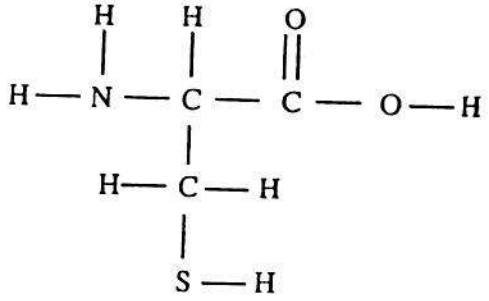
Name a compound of nitrogen formed by these bacteria.

_____ [1]

(e) Name the nutrient in which nitrogen is an essential building block.

_____ [1]

(f) The structural formula shows a compound containing nitrogen.



(i) Calculate the relative molecular mass of this compound.

[1]

(ii) Write the formula and name for an organic functional group that can be seen in the above structural formula.

formula _____

functional group _____ [2]

Total marks [10]

Section B

Answer only **TWO** questions from this Section.

5. The table shows some alkanes with their names, formulas and boiling points.

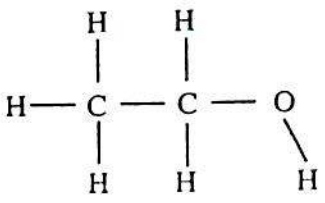
name	formula	boiling point (°C)
methane	CH_4	–164
ethane	C_2H_6	–89
propane		–42
butane	C_4H_{10}	1
pentane	C_5H_{12}	36
hexane	C_6H_{14}	
heptane	C_7H_{16}	98
octane	C_8H_{18}	126

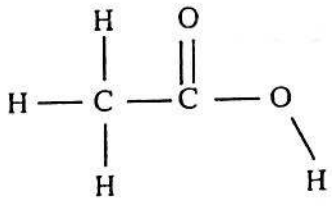
(a) (i) Write the formula for **propane** and predict the boiling point for **hexane**.

(ii) Describe how the boiling point changes as the chain length increases.

(iii) Explain why it is important to store liquid pentane in a tightly sealed bottle at a low temperature. [4]

(b) The structural formulas of some organic compounds are shown.





(i) Name the **TWO** compounds. [1]

(ii) Write the functional groups for each of these compounds. [2]

[Turn over

(c) Ethene is a naturally occurring compound that speeds up ripening of fruits and vegetables.

(i) Draw the structural formula of ethene.

An unsaturated alkene like ethene can be converted to a saturated alkane like ethane by adding hydrogen to the double bond.

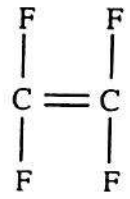
(ii) Write a chemically balanced equation for the reaction.

(iii) From your chemical equation, calculate the mass of ethane produced from 480 dm^3 of ethene gas at r.t.p.

(iv) Describe what is seen when ethene gas is bubbled through bromine water. [7]

(d) Tetrafluoroethene can be polymerized to Teflon which provides a good coating for making non-stick pots and pans.

The structural formula for a monomer of tetrafluoroethene is shown.



Using **THREE** monomers of tetrafluoroethene draw to show the polymerization tetrafluoroethene to Teflon. [2]

(e) Ribose, a slightly sweet sugar has a percentage composition of 40% of C, 6.67% of H and 53.3% of O. The RMM of the compound is 150.

Determine the empirical formula and molecular formula of ribose sugar. [4]

Total marks [20]

6. A student performs an experiment to produce hydrogen gas by reacting magnesium ribbon with excess hydrochloric acid at room temperature and pressure. The volume of hydrogen gas produced was measured every 10 s and recorded in a table format.

The table shows the results obtained in the experiment

time/s	0	10	20	30	40	50	60	70	80
volume of $H_2(g)/cm^3$	0	20	33	44.5	53.5	59	64	69	69

(a) (i) Draw a graph using the data given in the table and label it **A**.

From your graph determine

(ii) the volume of gas produced at 15 seconds;

(iii) the time taken to produce half of the total volume of gas. [8]

(b) (i) On the same axes, sketch a graph that would have been obtained if the same experiment was performed at a higher temperature of 35 °C and label **this graph as B**.

(ii) Explain the shape of the graph you have drawn in terms of the behaviour of the reacting particles. [4]

(c) The chemically balanced equation for the reaction is:

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

Use the equation to calculate the volume of hydrogen produced from 0.6 grams of magnesium at RTP. [3]

(d) Hydrogen reacts with heated copper(II) oxide. Hydrogen removes the oxygen and copper is left behind according to the equation.

$$CuO + H2 \rightarrow Cu + H_2O$$

State the oxidation number of

(i) copper in CuO

(ii) copper in elemental Cu [2]