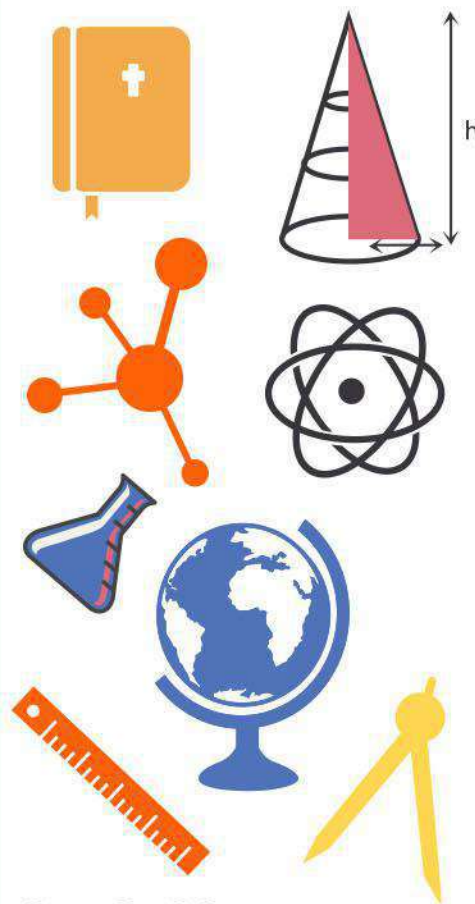


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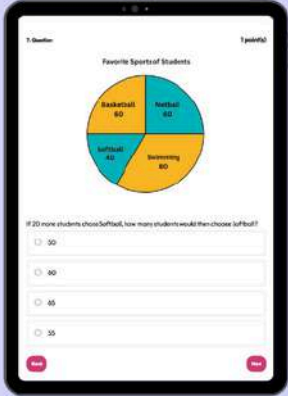


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CHEMISTRY

PAPER 3
(80 marks)

Monday 3 JUNE 2024 12:00 NOON–1:30 P.M.
(1 hr. 30 mins)

Additional materials:
Graph paper
Calculator

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** questions in **Section A** in the spaces provided on this question booklet and any **TWO** questions from **Section B** on the lined paper provided at the back of this question booklet.

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 printed on page 2.

ADDITIONAL INFORMATION

s.t.p. ($t = 0^{\circ}\text{C}$, $p = 1 \text{ atm.}$)

The volume of one mole of gas at room temperature and pressure (r.t.p.) is $24\,000 \text{ cm}^3$ (24 dm^3).

For Examiner's Use	
Section A	
1	
2	
3	
4	
Section B	
5	
6	
7	
TOTAL	

This question paper consists of 14 printed pages, 2 blank pages and 4 lined pages.



The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
1 H Hydrogen 1																	
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	98 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	209 Po Polonium 84	209 At Astatine 85	209 Rn Radon 86
87 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 60 150 Sm Samarium 62 152 Eu Europium 63 157 Gd Gadolinium 64 162 Dy Dysprosium 66 165 Ho Holmium 67 167 Er Erbium 68 169 Tm Thulium 69 175 Lu Lutetium 71																	
232 Th Thorium 90 238 U Uranium 92 238 Np Neptunium 93 238 Pu Plutonium 94 238 Am Americium 95 238 Cm Curium 96 238 Bk Berkelium 97 238 Cf Californium 98 238 Es Einsteinium 99 238 Fm Fermium 100 238 Md Mendelevium 101 238 No Nobelium 102 238 Lr Lawrencium 103																	

a

X

b

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

Key

a

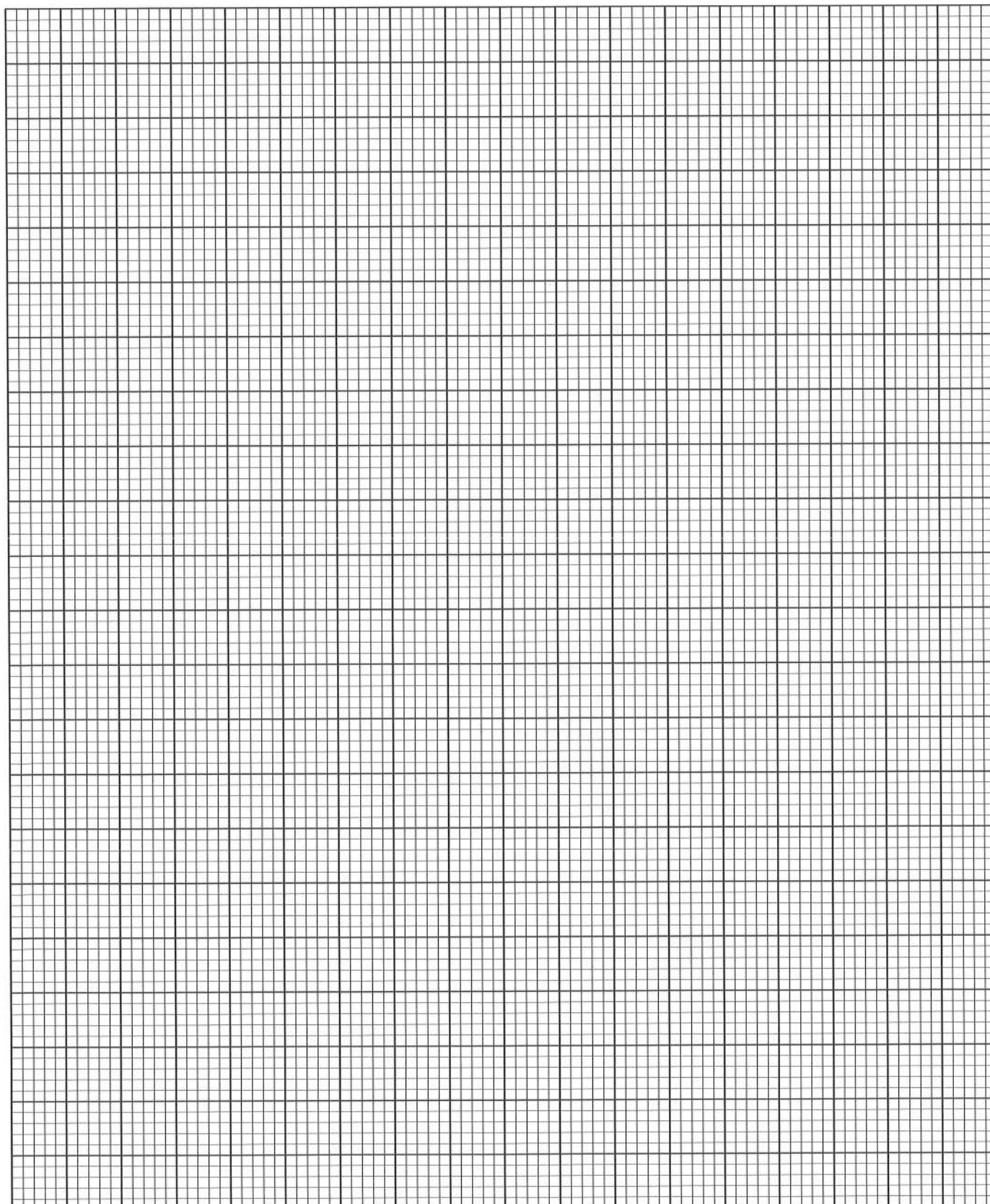
X

b

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

**BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION
EXAMINATION**

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



EXAMINATION

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

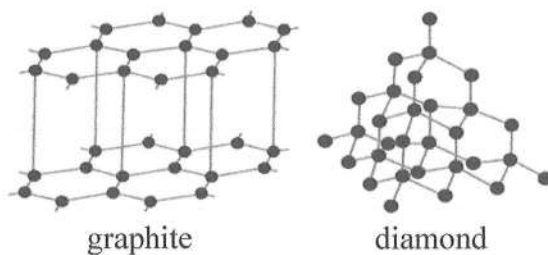
This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin black lines. There are no margins, text, or other markings on the page.

SECTION A

Answer **all** questions in this Section.

1. Carbon exists in different structural forms of the same element in the same physical state.

- (a) Graphite and diamond are forms of carbon.



- (i) Give **one** structural difference between graphite and diamond.

graphite: _____

diamond: _____

[2]

- (ii) Explain why diamond has a very high melting point.

_____ [2]

- (iii) Give **one** reason why graphite conducts electricity and diamond does not.

_____ [1]

- (b) Carbon dioxide is a simple molecular substance.

State **two** properties of carbon dioxide.

1 _____

2 _____

[2]

[Turn over]

- (c) Copper oxide reacts with hydrogen to form copper and water.

The equation for the reaction is:



Explain how this reaction is both oxidation and reduction.

[3]

TOTAL MARKS [10]



2. (a) Describe the structure and bonding in metals.

- (b) Copper, nickel and silver are transition elements. Typical physical properties of transition elements are a high density and a high melting point.

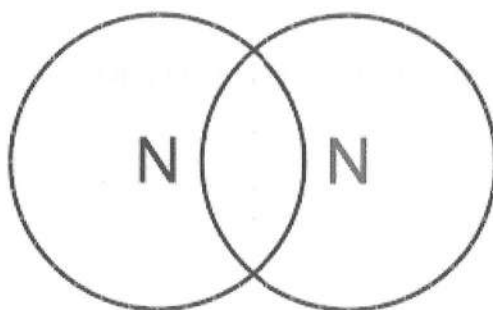
Give **two** different properties of transition metals which are **not** typical of other metals.

1

2

- (c) Complete the dot and cross diagram to show the covalent bonding in a nitrogen molecule.

(Show only the electrons in the outer shell.)



- (d) Explain why nitrogen is a gas at room temperature.

TOTAL MARKS [10]

[Turn over

3. Le Chatelier's Principle is a vital part of industrial chemistry. One process that relies on this principle is the Contact process which is used to manufacture sulphuric acid.

(a) Name the **three** conditions for the Contact process to take place.

1 _____

2 _____

3 _____

[3]

(b) In the Contact process sulphur dioxide reacts with oxygen to produce sulphur trioxide.

Write the balanced chemical equation for this reaction.

[2]

(c) (i) In order to make sulphuric acid, sulphur trioxide is dissolved in concentrated sulphuric acid to make a substance called oleum.

Give the chemical formula for oleum.

[1]

(ii) Explain why sulphuric acid is **not** made by simply adding sulphur trioxide to water.

[1]

(d) Sulphuric acid is a dehydrating agent.

Briefly describe the reaction in which sulphuric acid acts as a dehydrating agent. Include the reactants, products and observations made during the reaction.

[3]

TOTAL MARKS [10]



4. Devon added 30 cm^3 of potassium hydroxide with an unknown concentration into a conical flask using a pipette. The potassium hydroxide reacted with exactly 25 cm^3 of 0.4 mol/dm^3 hydrochloric acid.

The equation for this reaction is:



- (a) Name the apparatus used to deliver the hydrochloric acid into the conical flask.

_____ [1]

- (b) (i) Calculate the number of moles of hydrochloric that was used in the reaction.

[1]

- (ii) Determine the number of moles of potassium hydroxide in the reaction.

[1]

- (iii) Calculate the concentration of potassium hydroxide in grams per dm^3 (g/dm^3).

[2]

- (c) Acids can be strong or weak. Hydrochloric acid is an example of a strong acid.

Name a weak acid and state one way it is different from hydrochloric acid.

Name of acid _____

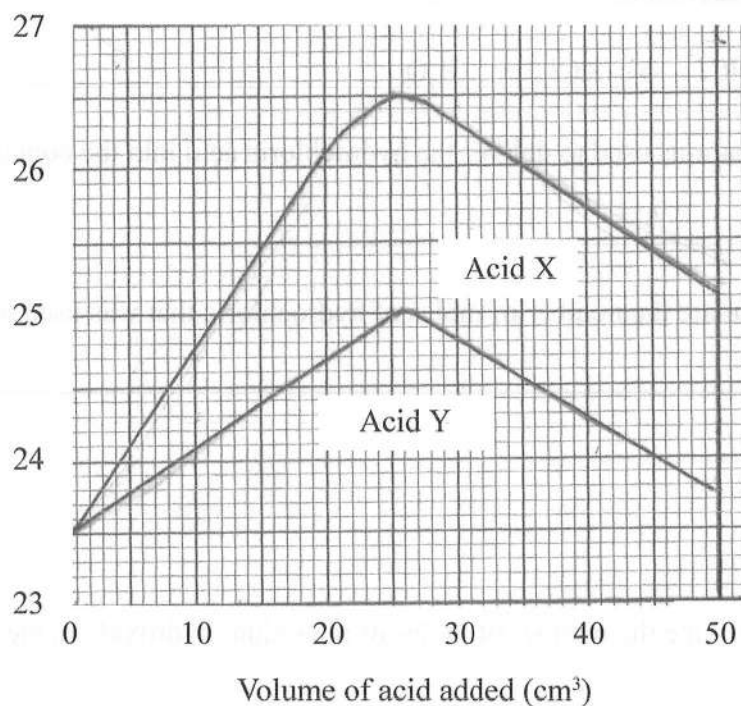
Difference _____

[2]

[Turn over]

- (d) The graphs show the temperature change when acids X and Y are added separately to a potassium hydroxide solution.

Temperature ($^{\circ}\text{C}$)



- (i) Use the graphs to find the volume of acid required to neutralise the potassium hydroxide in both experiments.

Acid X _____

Acid Y _____

[1]

- (ii) State the maximum temperature rise by acid X.

_____ [1]

- (iii) State which acid, X or Y, is more concentrated and give a reason for your answer.

_____ [1]

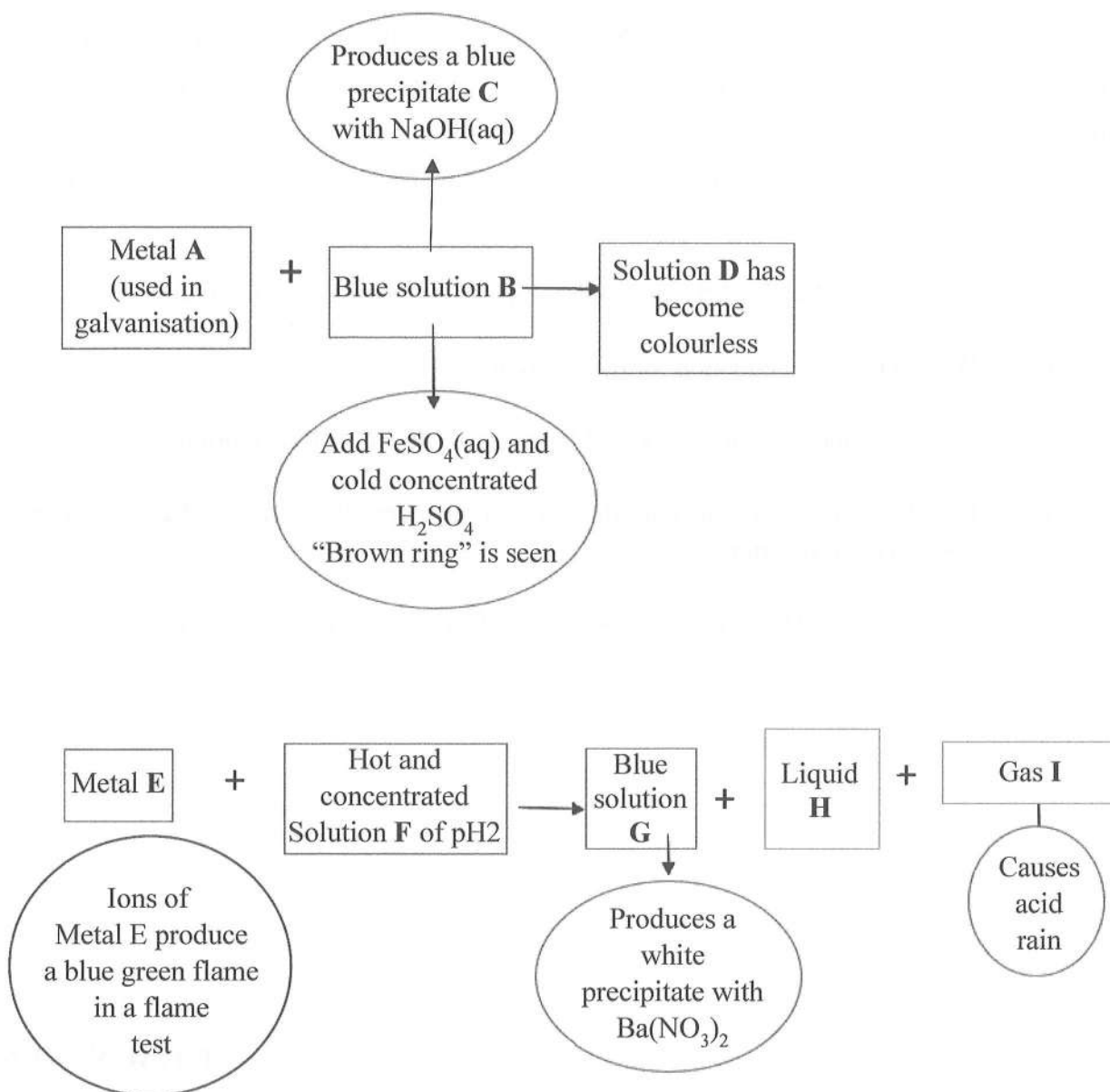
TOTAL MARKS [10]



SECTION B

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

5. (a) Identify compounds represented by the letters **A, B, C, D, E, F, G, H** and **I**. [9]



- (b) A student mixes solutions of halogens with solutions of their potassium salts. The table shows some of the observations made by the student when halogens reacted with the potassium halide solutions.

(i) Complete the table to record observations occurring at **R**, **S** and **T**

halogen	potassium chloride	potassium bromide	potassium iodide
chlorine (colourless)	R	S	Solution turns brown
bromine (orange)	No change	No change	T
iodine (brown)	No change	No change	No change

[3]

(ii) Explain how the reactivity of the halogens changes going down Group VII. [3]

(c) Write a balanced equation for the reaction:



(d) Use the equation to calculate the mass of silver produced from 1.6 g of copper in this displacement reaction.



[3]

TOTAL MARKS [20]



6. Hydrogen peroxide is a colourless solution that decomposes very slowly at 20 °C to produce water and oxygen. In an experiment 30 cm³ of hydrogen peroxide and 5g of manganese(IV) oxide, a catalyst, was used in the reaction. The chemical equation for the reaction is:



- (a) Define the rate of a chemical reaction. [2]
- (b) A small round flat-bottomed flask, a gas syringe, delivery tube and a stopper were used in this experiment.

Draw the part of the apparatus that is used to collect the oxygen gas in this experiment. [1]

- (c) (i) The table of results shows what happens when a student investigates the decomposition of hydrogen peroxide.

Time in minutes	1	2	3	4	5	6	7	8
Volume of O ₂ in cm ³	30.0	51.5	66.5	78.0	84.5	89.0	90.0	90.0

Plot a graph of the volume of gas against time in minutes.

Draw a smooth curve and label the curve. [4]

- (ii) The experiment was repeated using 30 cm³ of hydrogen peroxide that was half the concentration of the hydrogen peroxide used in the first experiment. The other conditions remained the same.

On the same axes, sketch a second graph to show how the volume of gas collected would vary with time in the second experiment. [2]

- (d) Calculate the number of moles of hydrogen peroxide decomposed to produce 90 cm³ of oxygen at r.t.p. [2]

- (e) (i) In this experiment, manganese(IV) oxide acts as a catalyst.

Outline a method to show that the manganese(IV) oxide is a catalyst and not a reactant. [2]

- (ii) The rate of reaction is different when manganese(IV) oxide is used as a fine powder rather than coarse lumps.

Explain why. [2]

- (f) Zinc and dilute hydrochloric acid are reacted together to produce zinc chloride, a soluble salt.

The rate of this reaction can be increased by heating the reaction mixture.

- (i) Explain in terms of the collision theory the effect of increasing the temperature of the reaction mixture. [3]

- (ii) Write a balanced symbol equation for the word equation:

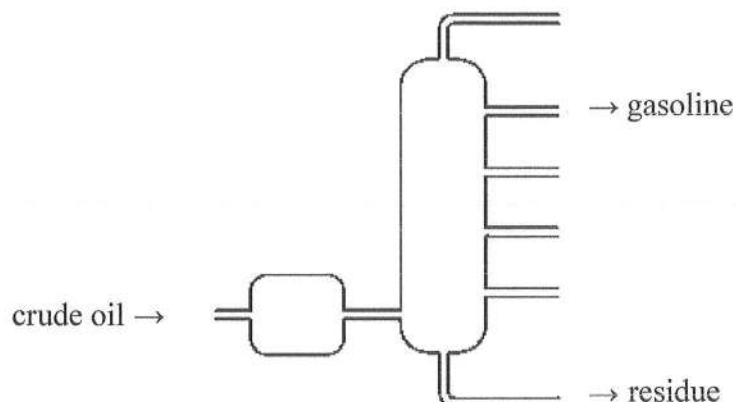


TOTAL MARKS [20]



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7. The diagram shows a fractionating column used to separate saturated hydrocarbons from crude oil.



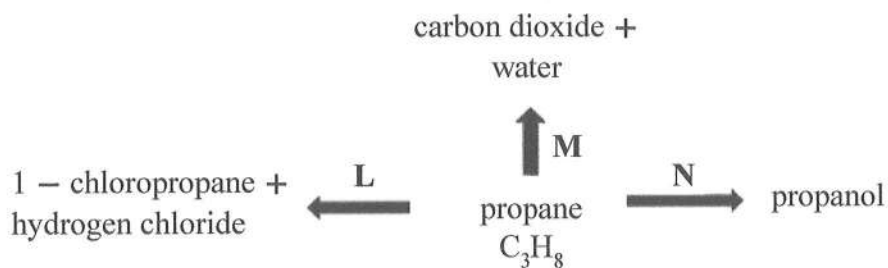
- (a) State **two** physical properties that are affected as the length of hydrocarbon chains are increased. [2]
- (b) Name the residue formed from the distillation of crude oil and state **one** use. [2]
- (c) Long chain hydrocarbon molecules can be broken down into smaller more useful molecules.

Name the process used to produce these smaller molecules.

[1]



- (d) The flow chart shows reactions that occur with propane (C_3H_8).



- (i) Write the name of the reactions **L**, **M** and **N**. [3]
- (ii) State the general formula of propane. [1]
- (iii) Write the chemical formula of propanol and correctly draw its structural formula. [3]
- (iv) Write the balanced chemical equation for 'Reaction **M**' from the flow chart. [2]
- (v) Calculate the volume (dm^3) of carbon dioxide produced at r.t.p., if 0.14 moles of propane (C_3H_8) was used in the reaction. [2]
- (e) Compound **W** contains 85.71% carbon and 14.29% hydrogen.
- (i) Calculate the empirical formula of Compound **W**. [3]
- (ii) Compound **W** has a relative molecular mass of 56.
Find its molecular formula. [1]

TOTAL MARKS [20]

Question
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Question
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Question
Write on both sides of the paper

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Question
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1. $2x^2 + 3x - 5 = 0$

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