Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 4024/2

PAPER 2 Theory

SPECIMEN PAPER 1 hour 45 minutes

Candidates answer on the question paper.

Additional materials: Electronic calculator

Allow candidates 5 minutes to count pages before the examination

This booklet should not be punched or stapled and pages should not be removed.

TIME 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and centre number and candidate number on top of the right corner of every page of this paper. Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **four** questions.

Write your answers on the spaces provided on the question paper

Do not fasten the booklet

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question paper.

A copy of the periodic table is on page 20.

This question paper consists of 20 printed pages.

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[Turn over

Section A

Answer **all** the questions in the spaces provided.

1 **(a)** A student prepared a blue solution, **P**, by adding black copper (II) oxide powder to nitric acid as shown in **Fig.1.1**.

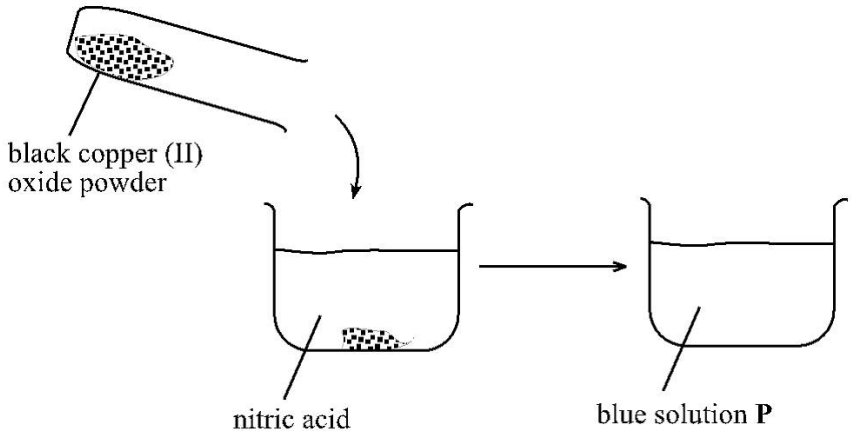


Fig.1.1

(i) Name **two** chemical substances in the blue solution.

1. _____

2. _____ [2]

(ii) State **two** observations made by the student.

1. _____

2. _____ [2]

(iii) Write a balanced chemical equation for the reaction.

_____ [2]

1 **(b)** Write a balanced chemical equation for the reaction that will occur when

(i) zinc granules are added to copper sulphate solution,

_____ [1]

(ii) calcium carbonate is heated strongly.

_____ [1]

[Total:8]

2 **(a)** In a titration, 25 cm^3 of aqueous ammonia required 21.50 cm^3 of 0.1 mol dm^{-3} sulphuric acid for complete neutralisation. The equationfor the reaction is:

$$H_2SO_{4(aq)} + 2NH_4OH_{(aq)} \rightarrow (NH_4)_2SO_{4(aq)} + 2H_2O_{(aq)}$$

(i) Calculate the number of moles of sulphuric acid in 21.50 cm^3 of the solution.

[2]

(ii) Deduce the number of moles of ammonia in the 25 cm^3 of ammonia.

_____

_____

_____ [2]

(iii) Calculate the concentration of the ammonia solution.

[2]

(b) **(i)** Give **one** physical property in which the oxides, CO_2 and SO_2, are similar.

_____ [1]

(ii) Name the industrial process by which $CO_{2(g)}$ is obtained from air.

_____ [1]

[Total :8]

3 **(a)** **Table. 3.1** showssome of the gaseous pollutants.

Complete **Table 3.1** by stating a use and an effect of the gases on the environment.

gas	use	effect on the environment
CO_2		
SO_2		

[4]

3 **(b)** Explain why **no** chemical reaction takes place when

(i) aluminium powder that has been exposed to air is added to a solution of iron (II) sulphate,

_____

_____ [1]

(ii) magnesium powder is added to a solution of calcium chloride,

_____

_____ [1]

(iii) zinc oxide is heated in a stream of hydrogen,

_____

_____ [1]

(iv) carbon dioxide is bubbled through a solution of hydrochloric acid.

_____

_____ [1]

[Total:8]

4 **(a)** **Fig.4.1 s**hows how an organic compound, **Q**,is produced from ethene.

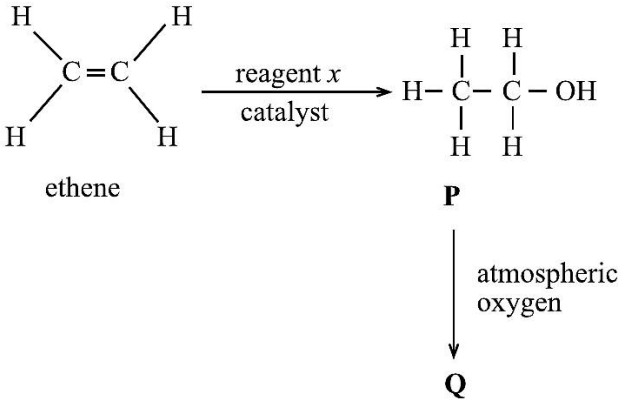


Fig.4.1

(i) Name

1. reagentx, _____

2. compound **P**._____ [2]

(ii) Draw the displayed structural formula of **Q**.

[1]

(iii) Give any**two** uses of **P**.

1. _____

2. _____ [2]

4 **(a)** **(iv)** Describe any**one** chemical test that is used to distinguish ethenefrom**P**.

_____

_____

_____ [1]

(b) **Fig.4.2** shows the structure of a protein molecule.

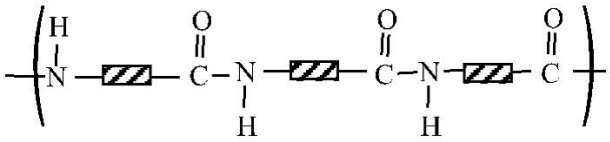


Fig.4.2

(i) Name the smaller units (monomers) that make up the protein molecule.

_____ [1]

(ii) Describe how the protein molecule can be broken down into the smaller units.

_____

_____ [1]

[Total:8]

5 **Fig.5.1** shows a set up of apparatus that was used to identify a blue pen that was used to write a bad message by a student.The ink that was used to write the message is marked **M.** Sample inks 1,2 and 3 were taken from pens suspected to have been used.

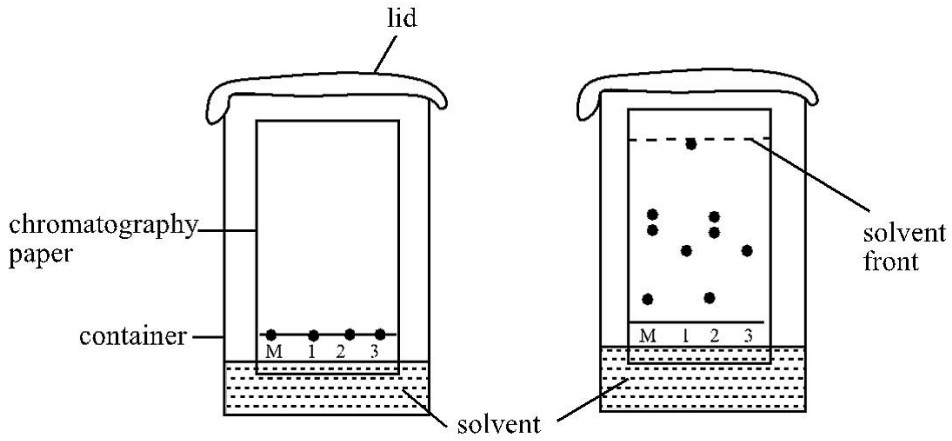


Fig.5.1

(a) **(i)** State the number of dyes in ink **M.**

_____ [1]

(ii) Describe **one** difference and **one** similarity between inks in samples 1 and 3.

difference _____

_____

similarity_____

_____ [2]

5 **(a)** **(iii)** Identify with reasons the sample ink that could have been used to write the bad message.

ink _____

reason _____ [1]

(b) **(i)** Name **one** property that determines the distance travelled by a dye in chromatography.

_____ [1]

(i) The solvent travelled 8.0 cm and the dye in ink 3 travelled 3.0 cm.

Calculate the R_f value of the dye into 3.

[1]

(iii) State the importance of R_f values.

_____

_____ [1]

(c) Explain why the container in **Fig.5.1** was covered.

_____ [1]

[Total: 8]

Section: B

Answer any **four** questions from this section.

6 **(a)** Define the term ionic bonding.

_____

_____ [2]

(b) The table shows some physical properties of three compounds.

compound	electrical conductivity	melting point
naphthalene	does not conduct	low
copper (II) chloride	good conduction when in solution	high
ethane	does not conduct	low

(i) Explain why

1. copper (II) chloride has a higher melting point than ethane,

_____

_____

_____ [2]

2. naphthalene does not conduct electricity.

_____

_____

_____ [3]

6 **(b)** **(ii)** Describe and explain what happens when

1. solid naphthalene is added to water,

_____

_____ [2]

2. an electric current is passed through a concentrated solution of copper (II) chloride

_____

_____ [2]

(c) Element **X** has 9 protons and 10 neutrons.

(i) Draw a diagram showing the full electronic structure of X,

(i) State **two** physical properties of the compound formed when X reacts with sodium

1. _____

2. _____ [2]

[Total:15]

7 **(a)** Cast iron from the blast furnace contains 4 to 5 % carbon and other impurities.

(i) Name **one** other impurity in cast iron.

_____ [1]

(ii) Describe how the impurities are removed in the oxygen lance furnace.

_____

_____ [3]

(b) The structural formulae of butenedioic acid is shown in **Fig. 7.1.**

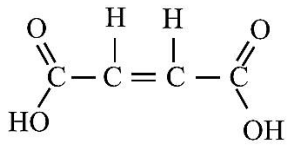


Fig. 7.1

(i) Give the empirical formulae of butenedioicacid

_____ [1]

(ii) Describe how butenedioic acid reacts with

1. aqueous bromine

_____ [1]

2. sodium carbonate

_____ [1]

3. Magnesium

_____ [1]

7 **(b)** **(iii)** Draw the structural formula of the product formed when butenedioic acid reacts with bromine.

[1]

(c) **Fig.7.2** shows the reaction ofethene molecules to produce **N**.

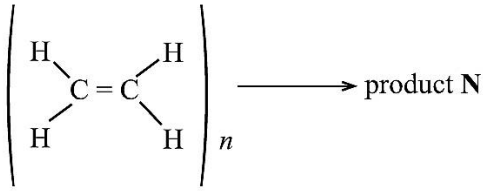


Fig. 7.2

(i) Name

1. this type of reaction,

_____ [1]

2. product **N**.

_____ [1]

(ii) Draw the displayed structural formula of **N.**

[1]

7 **(c)** **(iii)** State any **two** uses of the product **N.**

1. _____

2. _____ [2]

(iv) Describe how product **N** can be safely disposed from the environment.

_____

_____ [3]

[Total:15]

8 **(a)** Describe how a pure sample of sodium chloride can be prepared fromsolutions of hydrochloric acid and sodium hydroxide of known concentrations.

_____

_____

_____

_____

_____ [4]

8 **(b)** **Fig.8.1** shows chemical tests carried out on a salt to identify the ionspresent in the salt.

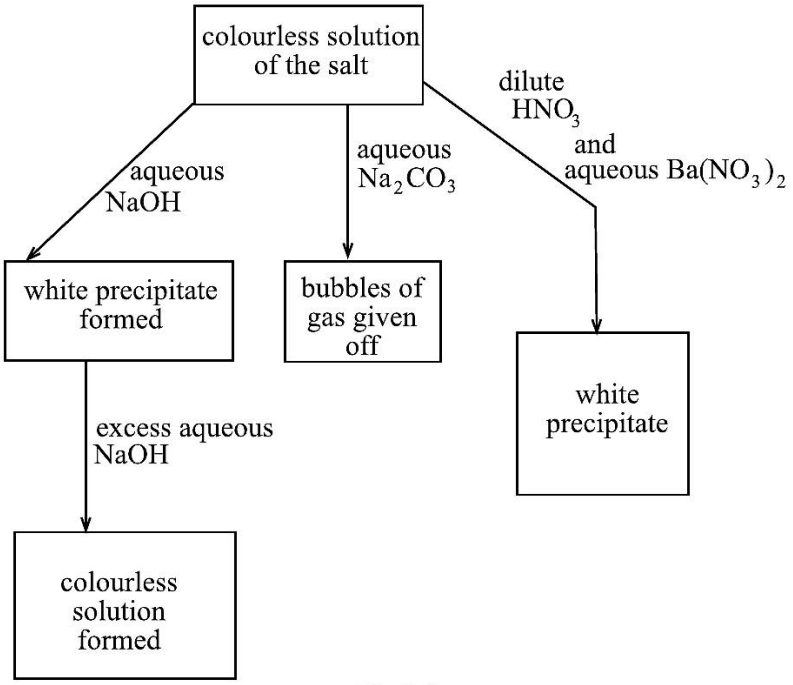


Fig.8.1

8 **(b)** **(i)** Deduce the cations and anions in the salt.

cations _____ [2]

anions _____ [2]

(ii) Iodide ions were suspected to be present in the salt.

Describe a chemical test and observations to show the presence of the iodide ions.

_____

_____

_____

_____ [3]

8 **(c)** A student placed a few calcium granules in a flask containing cold water coloured with universal indicator. The gas given off was collected in a measuring cylinder inverted in water as shown in **Fig. 4.**

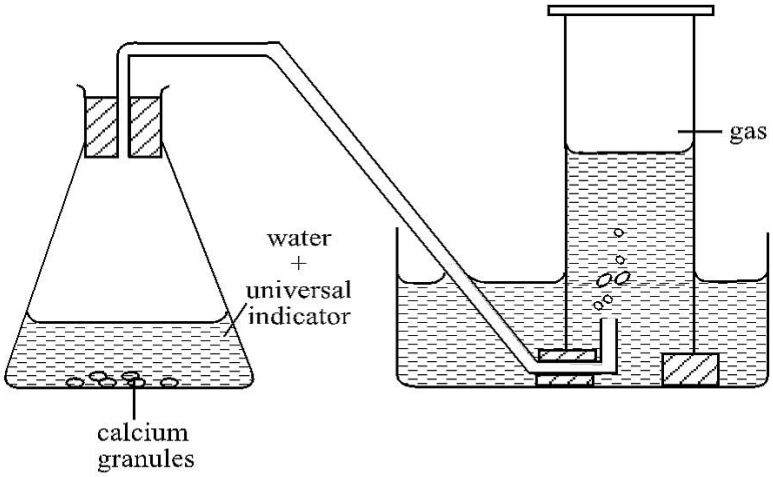


Fig. 4

(c) **(i)** State and explain any **one** observable change that occurs in the flask.

observation _____

_____

explanation _____

_____ [2]

(ii) Name the gas produced.

_____ [1]

(iii) Describe a test for the gas produced.

_____

_____

_____ [1]

[Total:15]

9 **Fig.5** shows the main steps in the manufacture of sulphuric acid.

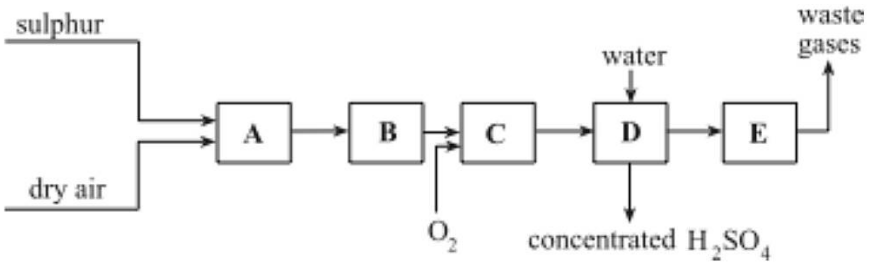


Fig.5

(a) **(i)** Choose from the letters **A - E**, the box that would be labelled

1. catalytic converter,

_____

2. chimney,

_____

3. purifier.

_____ [3]

(ii) Identify **one** error on the flow diagram and describe how this can be corrected.

_____

_____

_____ [2]

9 **(a)** **(iii)** State any **one** condition used in **C** and write the overall equation for the reaction which takes place.

condition_____

equation_____ [7]

(b) Describe how sulphuric acid is converted into ammonium sulphate fertilizer.

_____

_____

_____ [3]

[Total:15]

10 **(a)** State

(i) **two** different physical properties of bromine and iodine.

1. _____

2. _____

(ii) **two** similar chemical chemical properties of bromine and iodine.

1. _____

2. _____

(iii) any **two** uses of chlorine.

1. _____

2. _____ [6]

10 **(b)** Chlorine reacts with potassium bromide as shown.

$$2KBr_{(aq)} + Cl_{2(g)} \rightarrow 2KCl_{(aq)} + Br_{2(g)}$$

(i) State **one** observation made as the reaction occurs.

_____ [4]

(ii) Name this type of reaction giving a reason for your answer.

type of reaction _____

reason _____ [4]

(c) Explain why

(i) incineration is a controversial method of waste disposal

_____

_____

_____

(ii) the use of landfills as method of waste disposal is being discharged.

_____

_____ [5]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	O
							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 Bromide 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 Pd 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	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
†90-103 Actinoid series	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 = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)