THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

132/1 **CHEMISTRY 1**

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2024**

Instructions

1. This paper consists of a total of **ten (10)** questions in sections A and B.
2. Answer **all** questions in section A and **two (2)** questions from section B.
3. Each question carries **ten (10)** marks in section A and **fifteen (15)** marks in section B.
4. Mathematical tables and non-programmable calculators may be used.
5. All writing must be in **blue** or **black** ink, **except** drawings which must be in pencil.
6. Communication devices and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. For calculations you may use the following:
   - Gas constant, R = 8.31 J mol^{-1} K^{-1} or 0.0821 atm mol^{-1} K^{-1} dm^3
   - GMV = 22.4 dm^3 = 22400 cm^3
   - Standard temperature = 273 K
   - Standard pressure = 760 mm Hg = 1.0 x 10^5 N m^{-2} = 1 atm
   - Planck's constant, h = 6.626 x 10^{-34} J s
   - Velocity of light, c = 3.0 x 10^8 m/s
   - Mass of an electron = 9.1 x 10^{-31} kg
   - Atomic masses: H = 1, C = 12, O = 16, Ca = 40

SECTION A (70 Marks)

Answer **all** the questions in this section.

1. (a) Briefly explain the following concepts by giving one example for each:
   (i) Nucleophilic addition reaction.
   (ii) Elimination reaction.
   (iii) Substitution reaction.
   (iv) Mesomeric effect.
   (v) Negative inductive effect. **(05 marks)**

   (b) A 20 cm^3 volume of gaseous hydrocarbon was mixed with 140 cm^3 of excess oxygen and exploded. After cooling, the mixture occupied 100 cm^3. Absorption of the gas by concentrated potassium hydroxide solution reduced the volume by 60 cm^3 and the unabsorbed gas relighted the glowing splint. Determine the molecular formula of the hydrocarbon. **(05 marks)**

2. (a) What is the difference between the following?
   (i) Subsidiary quantum number and magnetic quantum number.
   (ii) Orbitals and degenerate orbitals. **(02 marks)**

   (b) By using a line diagram method, indicate the distribution of electrons in the following orbitals of atoms:
   (i) 2*p* of magnesium.
   (ii) 3*d* of manganese.
   (iii) 2*p* of carbon.
   (iv) 4*s* of potassium.
   (v) 3*p* of silicon. **(2.5 marks)**

   (c) (i) Given the principal quantum number $n = 2$, tabulate the related quantum numbers and provide the total number of electrons present in this energy level.
   (ii) Comment on the difference of the de Broglie wave lengths between a ball of 0.2 kg moving with a velocity of 3×10^8 m/s and that of an electron moving with the same velocity. **(5.5 marks)**

3. (a) While giving an example in each case, differentiate;
   (i) homogenous equilibrium from heterogeneous equilibrium.
   (ii) equilibrium constant from reaction quotient. **(04 marks)**

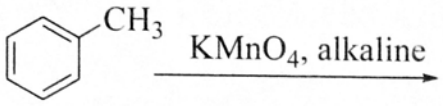
(b) When 0.4 mol of PCl_5 was heated in a 10 dm^3 vessel, it decomposed according to the equation: $PCl_5(g)$ É $PCl_3(g) + Cl_2(g)$. When the equilibrium was established, the amount of Cl_2 in the vessel was found to be 0.25 mol. Calculate;

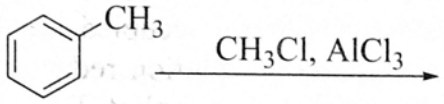
(i) The number of moles of PCl_5 and PCl_3 present at equilibrium.

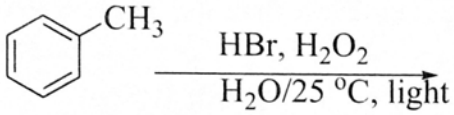
(ii) The equilibrium concentrations for all the three components.

(iii) The equilibrium constant (K_C) for the decomposition reaction. **(06 marks)**

4. (a) Complete the following organic reactions by giving the major product(s) only:

(i) 

(ii) 

(iii) 

(03 marks)

(b) (i) What is the difference between a side chain reaction and an electrophilic substitution reaction?

(ii) The alkoxy group (-OR) is an ortho-para directing group though oxygen is more electronegative than carbon. Explain briefly. **(05 marks)**

(c) Draw the structures of the principal organic products obtained on the nitration of each of the following:

(i) *p*-methylbenzoic acid

(ii) *m*-dinitrobenzene **(02 marks)**

5. (a) (i) What are the three conditions that must be fulfilled for a solution to exhibit colligative properties? Provide a brief explanation in each condition.

(ii) Assume you are given glucose solutions **A** and **B**, with concentrations of 1 and 2 M, respectively. Which of the solutions do you expect to have higher boiling point than the other? Give a reason to support to your answer.

(04 marks)

(b) The boiling temperature of a solution prepared by dissolving 5.0 g of an organic solid in 100.0 g of benzene is 82.42 °C. If the boiling temperature of pure benzene is 80.10 °C; determine the molecular weight of the organic solid. (K_b = 2.53 °C/m)

(04 marks)

(c) Addition of 1 mol of NaCl into 1 litre of water causes the boiling point of water to increase, while addition of 1 mol of methyl alcohol into 1 litre of water decreases the boiling point. How can you justify this statement? **(02 marks)**

6. (a) Complete the following table by filling in the missing information:

Compound	Type of bond	Number of lone pair(s)	Type of hybridization	Geometrical shape
PCl_3				
NH_3				
CF_4				

(06 marks)

(b) Briefly, comment on the following facts:

(i) H_2O and HF have higher boiling points than PH_3 and HS.

(ii) CO_2 and SO_2 have the same empirical formulae; however, CO_2 is non-polar while SO_2 is a polar compound.

(iii) The type of bond in ethyne is stronger than that present in ethane. **(04 marks)**

7. (a) "The carbonate of sodium exists on heating, while that of iron does not." Briefly, justify this statement while supporting your answer with appropriate chemical equations. **(03 marks)**

(b) Briefly explain five uses of metal carbonates in daily life activities. **(05 marks)**

(c) As a chemist in one of the fertilizer company in Tanzania, you are required to prepare sulphates in one of the synthetic stages in a small scale. Briefly, advise four methods that you can use to prepare soluble metal sulphates. **(02 marks)**

SECTION B (30 Marks)

Answer **two (2)** questions from this section.

8. (a) (i) Differentiate ion exchange from acidic soil reaction.

(ii) Why is nitrate more leached than ammonium from the soil? Briefly explain.

(iii) Why sand soils have zero Cation Exchange Capacity (CEC)? **(04 marks)**

(b) (i) Explain two roles of the following ions in liming:
CO_3^{2-}, O^{2-}, OH^-, SiO_3^{2-}

(ii) Calculate the amount of calcium carbonate required to lime an acidic soil that requires 100 g of calcium oxide for the same work. **(06 marks)**

(c) (i) Despite the importance of using fossil fuels, they have drawbacks to the environment. Briefly, explain two drawbacks of such fuels.

(ii) Briefly, explain three measures that can be taken to reduce depletion of mineral resources. **(05 marks)**

9. (a) Compare the heat capacity of 2 kg steel frying pan and that of a 2 g steel pin. Are the heat capacities of these objects different? Explain briefly. **(02 marks)**

(b) A person took an ice cream from a refrigerator and kept it on a table; unfortunately, after 30 minutes the ice cream changed into juice. Is the process of changing ice cream into juice, an endothermic or exothermic? Give reason for your answer. **(02 marks)**

(c) (i) Draw and label a complete born Haber cycle of magnesium nitride.

(ii) Enthalpy of solution of $BaCl_2.2H_2O$ and $BaCl_2$ are 8.8 and -20.6 kJ/mol, respectively. Calculate the enthalpy change (ΔH) of the following reaction:

$$BaCl_2(g) + 2H_2O(l) \rightarrow BaCl_2.2H_2O(s)$$ **(11 marks)**

10. (a) Predict what will happen to the average kinetic energy of ideal gas molecules when the conditions change as follows:

(i) The pressure of the gas is increased by reducing the volume at constant temperature.

(ii) The pressure of the gas is increased by increasing the temperature at constant volume.

(iii) The average velocity of the molecules is increased by a factor of two. **(03 marks)**

(b) Quicklime (CaO) is produced by the thermal decomposition of calcium carbonate ($CaCO_3$). Calculate the volume of CO_2 produced at s.t.p. from the decomposition of 152 g of $CaCO_3$ according to the reaction, $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$. **(05 marks)**

(c) A colourless liquid was isolated from a petroleum sample and observed to have the properties of cyclohexane (C_6H_{12}). To determine the molar mass of the isolated liquid, Dumas' method was used and the following data were recorded:

Volume, (V) of the flask = 213 ml;

Mass of flask + gas = 78.386 g;

Mass of empty flask = 77.809 g;

Temperature, T = 100 °C;

Pressure (P) = 754 mm Hg;

Calculate the molar mass of the colourless liquid isolated and verify if the liquid was consistent with the suspected cyclohexane molecule. **(07 marks)**

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132/2 **CHEMISTRY 2**

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2024**

Instructions

1. This paper consists of a total of **six (6)** questions.
2. Answer a total of **five (5)** questions.
3. Each question carries **twenty (20)** marks.
4. Mathematical tables and non-programmable calculators may be used.
5. All writing must be in **blue** or **black** ink, **except** drawings which must be in pencil.
6. Communication devices and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. For calculations you may use the following constants:

   Gas constant, R = 8.31 J mol^{-1} K^{-1} or 0.082 atm mol^{-1} K^{-1} dm^3
   GMV = 22.4 dm^3
   Standard temperature = 273 K
   Standard pressure = 760 mm Hg = 1 atm = 1.0 x 10^{-5} N m^{-2}
   Atomic masses: H = 1, C = 12, O = 16, Na = 23, Cl = 35.5, Cr = 52, Ag = 108

Answer a total of **five (5)** questions.

1. (a) (i) How does the dilution with water affects the pH of a buffer solution? Briefly, explain.

(ii) Briefly, explain the role of hydrocyanic acid (HCN) in the mixture of sodium cyanide (NaCN) and hydrocyanic acid when sodium hydroxide is added. **(04 marks)**

(b) Calculate the mass of hydrochloric acid required to be added in a mixture of equal volumes of 0.5 M CH_3COONa and 0.5 M CH_3COOH to make 250 cm^3 of a solution with a pH of 4. (K_a of CH_3COOH is 1.77×10^{-5}). **(06 marks)**

(c) (i) Briefly, comment on the solubility of CuS(s) and AgCl(s) when added in acidic solution.

(ii) At 25 °C the solubility product of Ag_2CrO_4 is 1.9×10^{-12} mol^3 dm^{-9}. What would be the concentration of silver ions in g/dm^3? **(10 marks)**

2. (a) (i) Components of a binary mixture of liquid **A** and **B** were separated by distillation. After a certain amount of time, the separation of the components stopped and the composition of the vapour phase became the same as that of the liquid phase. Why this happened? Explain briefly.

(ii) When alcohols and water are mixed together, the resulting solution deviates positively from the ideal behaviour. Justify this statement.

(04 marks)

(b) The vapour pressure of chloroform ($CHCl_3$) and dichloromethane (CH_2Cl_2) at 298 K are 200 mm Hg and 415 mm Hg, respectively. Determine:

(i) the vapour pressure of the solution prepared by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at 290 K.

(ii) the mole fraction of each component in the vapour phase. **(08 marks)**

(c) (i) Briefly, comment on the statement that, "The boiling point of an immiscible solution is less than the boiling point of either of its pure components."

(ii) An aromatic compound **Z** was steam distilled at 98.6 °C and 1 atm pressure. The distillate was found to contain 25.5 g of water and 7.4 g of the aromatic compound **Z**. Given that the saturated vapour pressure of water at 98.6 °C is 720 mmHg, determine the molecular mass of the aromatic compound **Z**.

(08 marks)

3. (a) An alcohol **H** has the structure $CH_3CH_2CH_2CH(OH)CH_3$.

(i) What is the name of the compound **H** according to IUPAC rules?

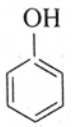
(ii) What type of the reaction would be involved if compound **H** reacted with concentrated H_2SO_4 at 170 °C ?

(iii) Write the chemical equation for the reaction between compound **H** and I_2 in alkaline medium of NaOH. **(04 marks)**

(b) A Chemist visited a chemical store to collect some hydroxyl compounds and found that all the chemicals had lost their actual labels though the store register book showed that phenol, n-propanol, benzyl alcohol and ethanol were in the stock. Due to this, the bottles were re-labelled as **I**, **II**, **III** and **IV** and placed into two groups as follow;

(i) **A (I** and **II)**

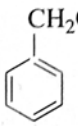
(ii) **B (III** and **IV)**



I

$CH_3CH_2CH_2OH$

II



III

CH_3CH_2OH

IV

How can you differentiate the chemicals in each group? Explain briefly while supporting your answer with appropriate chemical equations in each case. **(02 marks)**

(c) An organic compound **L** contains 60% carbon, 13.33% hydrogen and 26.67% oxygen. A 1.12 dm^3 volume of the gaseous organic compound **L** at s.t.p has a mass of 3 g. When reacted with iodine under dry ether, compound **L** gave a yellow compound and when reacted with PCl_5, it gave a colourless gas which on treatment with ammonia, gave white dense fumes.

(i) Determine the molecular formula of compound **L**.

(ii) Give the structure of compound **L**. **(05 marks)**

(d) (i) Classify polymers based on their structures. Give one example for each type.

(ii) Briefly, describe how branching and cross linking affect the physical properties of polymers.

(iii) Why rubber is an elastomer? Briefly, explain.

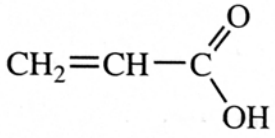
(iv) Addition polymerization is highly used in industrial production of plastics. How can you increase the rate of production of plastics if monomers, temperature and pressure are to be altered? **(09 marks)**

4. (a) Write the structural formula of the following organic compounds:
   (i) 4-Methylpentan-2-one.
   (ii) Pent-3-en-2-one. **(04 marks)**

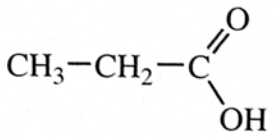
   (b) Briefly, account for each of the following observations:
   (i) Although propanal and acetone have the same molar mass, the boiling point of acetone is higher than that of propanal.
   (ii) Ethanol is more reactive than propanone towards nucleophilic addition reactions.
   (iii) Ethanal gives a positive silver mirror test while butan-2-one does not.
   (06 marks)

   (c) Compounds **H** and **I** have the same molecular formula, C_4H_8O. When compound **H** and **I** were treated with PCl_5, they gave an acidic gas. Compound **H** gives a positive iodoform test while compound **I** does not.
   (i) What are the possible structures of **H** and **I**?
   (ii) If compound **H** reacts with iodoform; what will be the chemical equation for the reaction? **(04 marks)**

   (d) Briefly, explain the following observations:
   (i) Methanoic acid has a larger value of K_a than ethanoic acid.
   (ii) 4-Hydroxybenzoic acid is less acidic than 4-nitrobenzoic acid.
   (iii) Acrylic acid is more acidic than propionic acid.



Acrylic acid



Propionic acid

(06 marks)

5. (a) You are given a reaction which exhibits a second order with respect to a reactant. Find out how its rate of reaction could be affected if the concentration of the reactant is;
   (i) doubled.
   (ii) reduced to half. **(02 marks)**

   (b) 0.25 g of a radioactive element remained after 5 years decomposition. If its initial weight was 10 g, calculate;
   (i) The rate constant for the decay of the radioactive element.
   (ii) The amount left after one year.
   (iii) The time required for half of the element to decay.
   (iv) The average life of the element. **(08 marks)**

(c) It is observed that, the rate of a chemical reaction doubles with every 10 °C rise in temperature. Assume that this generalization holds true for a reaction in the temperature range 298 to 308 K, compute the value of activation energy for this reaction. **(05 marks)**

(d) The decomposition of N_2O_5 at 318 K according to the following equation, obeys first order reaction:

$N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$

If the initial concentration of N_2O_5 was 1.24×10^{-2} mol dm^{-3}, calculate the concentration of N_2O_5 after 60 minutes, given that the rate constant of the reaction at 318 K is 0.0304/minute. **(05 marks)**

6. (a) (i) Differentiate between electron affinity and electronegativity.

(ii) The first ionization enthalpy of magnesium is higher than that of sodium. On the other hand, the second ionization energy of sodium is higher than that of magnesium. Explain briefly. **(04 marks)**

(b) Describe how the position of an element in the periodic table is located. **(05 marks)**

(c) (i) All the s-block elements form ionic compounds except lithium and beryllium. Briefly, justify this statement.

(ii) Differentiate effective nuclear charge from ionic radius. **(04 marks)**

(d) (i) Write the possible chemical equations representing the reduction of copper in the reverberator furnace.

(ii) Describe the process of obtaining pure copper from blister copper. **(07 marks)**

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132/3A

CHEMISTRY 3A
ACTUAL PRACTICAL A
(For Both School and Private Candidates)

Time: 3:20 Hours **Year: 2024**

Instructions

1. This paper consists of **three** (3) questions. Answer **all** the questions.
2. Question number **one** (1) carries **twenty** (20) marks and the other **two** (2) carry **fifteen** (15) marks each.
3. Qualitative Analysis Guide (QAG) sheet authorized by NECTA may be used.
4. Mathematical tables and non programmable calculators may be used.
5. Communication devices and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. You may use the following atomic masses: H = 1, C = 12, O = 16, S = 32, Na = 23, Cl = 35.5, K = 39, Mn = 55.

1. A chemist in a certain bakery industry has brought to you the product labelled **M1** containing 1 dm^3 of an aqueous solution of a mixture of sodium carbonate and sodium hydrogen carbonate. Use the following reagents to determine the percentage composition of sodium carbonate and sodium hydrogen carbonate in the product.

M2: 0.2 M hydrochloric acid solution;
MO: methyl orange indicator;
POP: phenolphthalein indicator.

Procedure

(i) Measure 75 cm^3 of **M2** and put into a 250 cm^3 beaker. Add 75 cm^3 of distilled water into the beaker containing **M2** and stir the mixture using a glass rod. Label the resulting solution as **M5**.
(ii) Put solution **M5** into the burette.
(iii) Pipette 20 or 25 cm^3 of **M1** into a conical flask and add two or three drops of **POP**.
(iv) Titrate **M5** against **M1** until the first colour change is observed. Record the first titre value.
(v) Add two or three drops of **MO** to the same solution in the conical flask.
(vi) Titrate until the second colour change is observed and record the second titre value.
(vii) Repeat steps (i) to (vi) three times and record the titre values.

Questions

(a) Record your results in a tabular form.

(b) (i) What was the volume of the pipette used?
(ii) Calculate the average titre values (cm^3) of **M5** when **MO** and **POP** were used.

(c) What is the colour change when:
(i) **POP** was used?
(ii) **MO** was used?

(d) Write the balanced chemical equation for the reaction under **POP**.

(e) Write the balanced chemical equation for the reaction under **MO**.

(f) Why **POP** was used first instead of **MO** in this experiment?

(g) Calculate the percentage composition of sodium carbonate and sodium hydrogen carbonate in the product.

2. Karibu plastic manufacturing industry aim at achieving optimum production. The production manager has been advised to operate at optimum activation energy by using the following reagents:

TZ: a solution made by dissolving 0.79 g of $KMnO_4$ in 0.25 dm^3 of distilled water.
TY: a solution made by dissolving 1.575 g of hydrated oxalic acid in 0.25 dm^3 of 0.5 M H_2SO_4.

Use the proposed reagents, **TZ** and **TY** to determine the required activation energy.

Theory

In acidic medium, oxalic acid is oxidized by potassium permanganate and the completion of the reaction is indicated by the disappearance of the purple colour of potassium permanganate.

Procedure

(i) Prepare a water bath using a 250 cm^3 or 300 cm^3 beaker. Heat the water to about 100 °C.

(ii) Measure 10 cm^3 of solution **TZ** and 10 cm^3 of solution **TY** and put into separate boiling test tubes.

(iii) Put a thermometer into the boiling tube containing **TZ** solution.

(iv) Warm both the boiling tubes to a temperature of 50 °C.

(v) Pour **TY** into **TZ** and immediately start the stop watch and record the time taken for the purple colour to disappear.

(vi) Repeat the steps (ii) to (v) at 60 °C, 70 °C and 80 °C temperatures.

(vii) Record your results in tabular form.

Questions

(a) Write the half ionic equations and overall reaction equation for the reaction in this experiment.

(b) Plot the graph of $\log(\frac{1}{\text{time}})$ against $\frac{1}{T}(K^{-1})$.

(c) Determine the slope of the graph.

(d) Determine the activation energy.

3. Sample **X** contains two cations and anion. Using systematic qualitative analysis procedures, analyse the sample to identify the cations and anion present in sample **X**. Carefully, record your experiments, observations and inferences as shown in the experimental table.

Experimental Table

S/N	Experiments	Observations	Inferences

Questions

(i) Write the molecular formula for the sample.

(ii) What are the cations and anion in the sample?

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132/3A

CHEMISTRY 3A
ACTUAL PRACTICAL A

3 HOURS PRACTICAL ADVANCE INSTRUCTIONS

1.0 IMPORTANT

1.1 GREAT CARE MUST BE TAKEN **NOT** TO DIVULGE THESE INSTRUCTIONS TO BOTH CANDIDATES AND UNAUTHORIZED PERSONS EITHER DIRECTLY OR INDIRECTLY.

1.2 MAKE SURE THAT THE CANDIDATES ARE PROVIDED WITH CHEMICALS AND APPARATUSES AS INDICATED IN THESE 3 HOURS PRACTICAL ADVANCE INSTRUCTIONS ONLY AND **NOT** OTHERWISE.

2.0 PREPARATION AND LABELLING OF CHEMICALS AND APPARATUSES

2.1 Question 1

- Prepare 0.2 M HCl, label it **M2** and allow 100 cm^3 per candidate. Follow the following procedure to prepare the solution:

  Choose from the following table the appropriate volume of stock (concentrated) solution to be diluted to make 1 litre solution basing on the specification indicated on the bottle of the stock solution.

S/N	Percentage Purity/Assay or its Average when Given in a Range	Density of a Stock Solution (g/cc)	Volume of Stock Solution to be Diluted to make 1 L (cm^3)
1	31 - 32	1.16	19.96
2	≈ 34	1.18	18.18
3	≈ 35	1.18	17.66
4	≈ 36	1.18	17.17
5	≈ 37	1.18	16.70
6	≈ 38	1.18	16.26

- **Dissolve 4.24 g anhydrous sodium carbonate and 0.84 g sodium hydrogen carbonate in 1 dm^3 of solution and label the resulting mixture as M1. Provide each candidate with 100 cm^3 of the solution.**
- **Provide each candidate with a 10 cm^3 measuring cylinder.**
- **Provide the candidates with a 100 cm^3 measuring cylinder for sharing in the ratio of 1:4.**
- **Provide phenolphthalein indicator to each candidate, label it POP.**

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- Provide methyl orange indicator to each candidate, label it **MO**.
- Provide each candidate with 1 burette, 1 white tile, 1 pipette (20 cm^3 or 25 cm^3), 2 titration flasks and 1 retort stand with accessories.
- Provide each candidate with pipette filler.

2.2 Question 2

- Prepare 0.02 M by dissolving 3.16 of $KMnO_4$ in water to make 1 litre solution and label it **TZ**. Allow 50 cm^3 per candidate.
- Dissolve 1.575 g of $H_2C_2O_4.2H_2O$ in 0.25 dm^3 of 0.5 M H_2SO_4 and label it **TY**. Allow 50 cm^3 per candidate.
- Provide each candidate with a stop watch.
- Provide each candidate with a 250 or 300 cm^3 beaker.
- Provide each candidate with two measuring cylinder of 10 cm^3.
- Provide each candidate with 2 boiling test tubes.
- Provide each candidate with a thermometer (0 °C – 100 °C).
- Prepare a heat source or burner for sharing in the maximum ratio of 1:4.
- Provide each candidate with 2 test tube holders.
- Provide wire gauze and tripod stand.

2.3 Question 3

- Provide each candidate with 4 g of hydrated ammonium iron(II) sulphate ($FeSO_4(NH_4)_2SO_4.6H_2O$).
- Provide each candidate with 4 strips of both red and blue litmus papers.
- Provide about 300 cm^3 distilled water per candidate.
- Provide each candidate with 4 pyrex test tubes.
- Provide dilute hydrochloric acid, sodium hydroxide, barium chloride, lead ethanoate, ethanoic acid, concentrated sulphuric and hydrochloric acid, potassium hexacynoferrate(III) as bench reagents.
- Prepare heat source or burner for sharing in the maximum ratio of 1:4.