THE UNITED REPUBLIC OF TANZANIA

PRESIDENT'S OFFICE,

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

NJOMBE REGION

FORM SIX PRE – NATIONAL EXAMINATION

CODE: 132/2

CHEMISTRY 2

(For Both School and Private Candidates)

TIME: 03: 00 HOURS **THURSDAY, 14TH March 2024 A.M**

INSTRUCTIONS

1. This paper consists of a total of **six (06)** questions.
2. Answer **five (05)** 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 drawing which must be in pencil.
6. Cellular phones and any unauthorized materials are not allowed in the examination room.
7. Write your examination Number on every page of your answer sheet(s).
8. For calculations you may use the following.
    - $1dm^3=1litre=1000cm^3$
    - Universal gas constant(R)=$8.31Jmol^{-1}K^{-1}$
    - Standard temperature(T)=273K
    - Atomic masses; H=1, C=12, O=16, Na=23, N=14, S=32

1. a) Why do we study the rates of reactions?

(b)The rate of reaction is three times as fast at 300K as at 250K.Calculate the activation energy of this reaction.

(c)Nitrogen monoxide (nitric oxide) when released by nuclear bomb explosions in the upper atmosphere reacts with ozone hence contributing to destruction of ozone layer which shields the life on earth against the harmful UV-radiation of the sun.

$NO(g) + O_3(g) \longrightarrow NO_2(g) + O_2(g)$

Table1.Initial concentrations and rate of reactions

Experiment	[NO] in $moldm^{-3}$	$[O_3]$ in $moldm^{-3}$	$-d[O_3]/dt$ in $moldm^{-3}s^{-1}$
1	$2.1x10^{-6}$	$2.1x10^{-6}$	$1.6x10^{-5}$
2	$2.1x10^{-6}$	$4.2x10^{-6}$	$3.2x10^{-5}$
3	$2.1x10^{-6}$	$6.3x10^{-6}$	$4.8x10^{-5}$
4	$4.2x10^{-6}$	$6.3x10^{-6}$	$9.6x10^{-5}$
5	$6.3x10^{-6}$	$6.3x10^{-6}$	$14.4x10^{-5}$

(i) From the initial concentrations and rates given in the table 1 above, find the rate law for this reaction.

(ii) Calculate the rate constant.

(iii) Find the initial rate when the initial concentration are;

$[NO] = 9.0X10^{-6}moldm^{-3}$,

$[O_3] = 1.0X10^{-6}moldm^{-3}$

(d) Manganate (VII) ions can react in two different ways depending on the concentration of hydrogen ions in the solution. If the solution is rich in hydrogen ions, they react to make manganese(II) ions, $Mn^{2+}(aq)$. If there are few hydrogen ions, we say the reaction occurs in alkaline conditions and manganese(IV) oxide, MnO_2, is made. What will be the e.m.f of a cell made from a standard iodine/iodide half-cell. (i)in acid conditions and (ii)in alkaline conditions? In each case write down the cell reaction.

(Given $E^O(V)$; $MnO_4^-/Mn^{2+}=+1.51$, $I_2/I^-=+0.54$, $MnO_4^-/MnO_2=+1.59$*)*

2. (a) Briefly explain one (01) common application of distribution law in both laboratories and industries.

(b)An effort to reduce the amount of Iodine in water, Mariam was provided with $200cm^3$ of ether which she must use it to extract 5g iodine dissolved in $400cm^3$ of water. She has been provided with three alternatives;

(i) Using $200cm^3$ of ether at once.

(ii)The successive extraction using $100cm^3$ of ether.

(iii)Four successive extraction using $50cm^3$ of ether. Which alternative(s)she must adopt to extract a large mass of iodine as possible. (Kd=0.8)

(c) Explain the positive and negative deviations from ideality by providing suitable examples.

(d) At a pressure of 760mmHg, a mixture of nitrobenzene($C_6H_6NO_2$) and water boils at 99^0C.The vapour pressure of water at this temperature is 733mmHg.Find the proportions of water and nitrobenzene in the distillate obtained by steam distillation of impure nitrobenzene.

3. (a) (i) A student saw a bottle marked 'Acid: pH =5'on the label. He said to his friend that the bottle must contain a very weak acid. Was he correct?
(ii) 3.28g of sodium ethanoate are dissolved in 1dm^3 of 0.01molar CH_3COOH solution. What is the pH of the resulting solution?
(Ka for ethanoic acid=$1.84x10^{-5}moldm^{-3}$).
(b) Ethoxyethane (diethyl ether), $(C_2H_5)_2O$, is an organic molecule that has more than a passing similarity to water, H_2O.
(i)What allows ethoxyethane to behave as a Lewis acid?
(ii)Ethoxyethane can react with boron trifluoride. Predict what is made in the reaction.
(c) The solubility product of barium sulphate and barium carbonate are $1x10^{-10}mol^2dm^{-6}$ and $5.5x10^{-10}mol^2dm^{-6}$ respectively. What would happen, if anything if;
(i) solid barium carbonate was boiled with a solution containing sulphate ions.
(ii) solid barium sulphate were boiled with a solution containing carbonate ions?

4. a) Account on the following;
(i) The ionization potentials decrease going down the Group.
(ii) Performing chemical reactions with beryllium compounds is not recommended.
(iii) The alkali metals have a bright lusture which quickly fades.
(iv) The silvery lusture of alkali metals.
(v) Among the elements of Group13, boron has high melting point(MP)
(b) Write short notes on the following about transition elements.
(i) Paramagnetism
(ii) Colour formation
(iii) Melting and Boiling point
(iv) Nature of Bonds and Complex Formation
(v) Low atomic volume and high density.
(c) The Hall's method is used for purifying bauxite ore to alumina. Briefly describe how this method is used for such purpose.

5. (a) The triiodomethane (iodoform) test, the substitution by iodine is the basis of a test for carbonyl compounds that contain the structure -$COCH_3$.Basing on the information above, show the mechanism for the formation of triiodomethane from propanone in triiodomethane test.
(b) A substance S has the molecular formula C_4H_9Br.After boiling aqueous sodium hydroxide a product T of formula $C_4H_{10}O$, was formed. On oxidation, T formed U(C_4H_8O), which reacted to form an DNP derivative but gave no reaction with Fehling's solution. Identify S, T and U. Name a reagent that convert U into T.
(c) How can you synthesize the following;
(i) Phenyl ethanoate from Ethanoyl chloride
(ii) Ethyl ethanoate from Ethanoyl chloride
(iii) 4-(Phenylazo)phenylamine from Diazonium ion (Benzene diazonium chloride)
(iv) Benzoyl chloride to Benzoic acid.

(d) Give the structural formula of the following;
(i) (phenylmethyl)amine
(ii) 2,4,6-tribromophenylamine
(iii) Phenylamine
(iv) N-methylphenylamine

6. (a)Explain why phenol is acidic in solution where as phenylmethanol is neutral.
(b)Alcohol have varieties of uses in our daily life. Point five (5) uses of alcohols.
(c)Briefly describe the following;
(i) Linear polymers
(ii) Branched chain polymers
(iii) Network polymers
(iv) Copolymers
(v) Elastomers
(d) Give the repeat unit of the following polymers;
(i) Natural rubber
(ii) Perspex
(iii) Teflon
(iv)Poly(melamine-formaldehyde)
(v) Neoprene