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ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

MODEL ANSWER

PRE-TEST EXAMINATION– 2019

CLASS – XII

F.M.- 70
DATE -01.08.19

SUBJECT – CHEMISTRY
DURATION – 3 Hours 15mins

GROUP – A

1. Answer the following questions: **MARKS – 1X14=14**

1.1 $E^{o}_{Fe^{2+}/Fe}$ = -0.441V and $E^{o}_{Fe^{3+}/Fe^{2+}}$ =0.771V, standard EMF of the reaction

$Fe + Fe^{3+} \longrightarrow 3Fe^{2+}$ will be-

a) 0.111V b) 0.330V c) 1.653V d) 1.212V

Ans. d) **1.212V**

1.2 The standard emf of a cell, involving one electron change is found to be 0.591V at 25^{0}C. The equilibrium constant of the reaction is-

a) 10 (b) $1x10^{5}$ (c) $1x10^{10}$(d) $1x10^{30}$

Ans. c) **$1x10^{10}$**

1.3 In a first order reaction, the concentration of reactant decreases from 800mol/dm^3 to 50mol/dm^3 in $2x10^{4}$ s. The rate constant of the reaction in s^{-1} unit is-

a) $2x10^{4}$ b) $3.45x10^{-5}$c) $1.386x10^{-4}$ d) $2x10^{-4}$

Ans. c) **$1.386x10^{-4}$**

1.4 The shape of XeF_6-

a) Distorted Octahedral, b) Square planar c) Tetrahedral d) Trigonal Planar

Ans. a) **Distorted Octahedral**

1.5 Which of the following compound gives Benzoic acid on hydrolysis-

a) Chlorobenzene b) Benzoyl chloride c) Chlorophenol d) Chlorotoluene

Ans. d) **Chlorotoluene**

1.6 Which of the following has highest melting point?

a) Chlorobenzene (b) o-dichlorobenzene (c) m-dichlorobenzene (d) p-dichlorobenzene

Ans. d) **p-dichlorobenzene**

1.7 When Phenol is treated with CCl_4 and NaOH, the product formed-

a) Benzaldehyde b) Salicylaldehyde c) Salicylic acid d) Benzoic acid

Ans. c) **Salicylic acid**

1.8 How many isomers of $C_5H_{11}OH$ will be primary alcohols-

a) 5 b) 4 c) 2 d) 3

Ans. d) **3**

1.9 Reaction of RMgBr /Dry ether, H_3O^+ with Carboxylic acid produces-

a) Pinacolone b) Pinacol c) Alcohol d) Alkane

Ans. d) **Alkane**

1.10 Which branched chain isomer of the hydrocarbon with molecular mass 72u gives only one isomer of the mono substituted alkyl halide-

a) Tertiary butyl chloride b) Neo-pentane c) iso hexane d) Neo hexane

Ans. b) **Neo-pentane**

1.11 An organic compound A(C_4H_9Cl) on reaction with Na/diethyl ether gives a hydrocarbon which on monochlorination gives only one chloro derivative then, A is

a) t-butyl chloride b) s-butyl chloride c) iso pentyl chloride d) n-butyl chloride

Ans. a) **t-butyl chloride**

1.12 Order of acidic strength (descending Order)-

a)$HClO_4>HClO_3>HClO>HClO_2$ b)$HClO_3>HClO_4>HClO>HClO_2$

c) $HClO_4>HClO_3>HClO_2>HClO$ d) $HClO_4>HClO_2>HClO_3>HClO$

Ans. c) **$HClO_4>HClO_3>HClO_2>HClO$**

1.13 Reagent used for distinguishing between an aldehyde and a ketone-

a) Tollens reagent b) Collin's reagent c) Lucas reagent d) Jones reagent

Ans. a) **Tollens reagent**

1.14 The compound formed on heating chlorobenzene with chloral in the presence of concentrated sulphuric acid is-

a) Phosgene b) Freon c) chlorine gas d) DDT

Ans. d) **DDT**

GROUP – B

2. Answer the following questions. (Alternatives are to be noted) : **Marks: 1X4=4**

2.1 Although Phenol is an acid, yet it doesn't react with sodium bicarbonate solution. Why?

Ans. **Acidic nature and stability of the conjugate base.**

2.2 Write down the chemical composition of Fehling's solution.

Ans. Fehling A (**$CuSO_4$, $5H_2O$**) and Fehling B (**Sodium Potassium Tartrate**)

OR

How methyl bromide be preferentially converted to methyl isocyanides?

Ans. **AgCN** needs to be used.

2.3 What is meant by Pseudo first order reaction?

Ans. **The chemical reaction which are not actually of first order but behave so due to altered conditions. In such a chemical reaction between two substances, one reactant is present in large or excess amount as compared to the other. e.g. Inversion of cane sugar and ester hydrolysis.**

2.4 What is a disproportionation reaction?

Ans. **It is a redox reaction in which a compound of intermediate oxidation state gets converted to two different compounds, one of higher and one of lower oxidation state.**

OR

What is an azeotropic mixture?

Ans. **Azeotropic mixture: A constant boiling point mixture with a definite chemical composition.**

e.g. 95% ethanol and 5% water.

GROUP-C

3. Answer the following questions. (Alternatives are to be noted) : **Marks: 2X5=10**

3.1 A first order reaction takes 40 minutes for 30% decomposition. Calculate T_{50}.

Ans. T_{50} = **78.75** minutes

OR

Why we can't determine the order of a chemical reaction by taking into consideration the balanced chemical equation?

Ans. **Order of a chemical reaction can only be calculated by considering all the steps involved in the overall chemical reaction. It can't be calculated by observing the reaction coefficients of the reactants. Thus it is an experimental parameter of a reaction.**

3.2 If a current of 0.5A flows through a metallic wire for 2 hours, then how many electrons would flow through the wire?

Ans. **2.25×10^{22} number of electrons.**

OR

Why does the conductivity of a solution decrease with dilution?

Ans. **With decrease in the number of particles present in the aq. Solution, the particles which carry the charge also decreases, which decrease the conductivity of the solution.**

3.3 Why is sulphuric acid not used during the reaction of alcohols with KI?

Ans. **In presence of strong oxidizing agent H_2SO_4, the KI gets converted into I_2.**

OR

Mention the factor on which the colligative properties of a solution depend. And explain how?

Ans. **The colligative properties of a solution depend on the number of solute particles present within the solution.**

3.4 Find the geometry and shape of the following molecules: i) ClF_3 ii) IF_5

Ans. **i) ClF_3 [sp^3d hybridization, TBP (G), T-shaped (S)]**

ii) IF_5 [sp^3d^2 hybridization, Octahedral (G), square pyramidal (S)]

3.5 Arrange the following compounds in the ascending order of their reactivity towards nucleophilic addition reaction and also explain the reason.

Ethanal, Propanal, Propanone, Butanone

Ans. **Butanone < Propanone < Propanal < Ethanal (Factors: Steric effect and electronic effect)**

GROUP-D

4. Answer the following questions. (Alternatives are to be noted) : **Marks: 3X9=27**

4.1 i) Mention the function of a salt bridge.

Ans. i) **a) Permits the passage of electric current internally.**

b) Maintains electrical neutrality of the solution.

ii) Calculate the potential of hydrogen electrode in contact with a solution whose pH is 11.

Ans. ii) – **0.619V**

OR

What is activation energy? Explain the effect of catalyst and inhibitor on the overall rate of a chemical reaction.

Ans. **Activation energy: The additional minimum energy barrier required to be surmounted by the reactant molecules to form the products in a chemical reaction.**

Effect of catalyst: It lowers down the activation energy barrier and accelerates the rate of a chemical reaction.

Effect of Inhibitor: It enhances the activation energy barrier and retards the rate of a chemical reaction.

4.2 i) The rate of the chemical reaction doubles for an increase of 10K in absolute temperature from 298K. Calculate E_a

Ans. E_a = **52.898KJ/mol**

4.3 i) Write down the symbolic structure of standard hydrogen electrode.

Ans. i) **$Pt(s) \mid H_2(g) \mid H^+(aq)$**

ii) State the products of electrolysis obtained on the cathode and the anode, when an aqueous solution of $AgNO_3$ with silver electrodes used.

Ans. **ii) Silver at the cathode and oxygen at the anode.**

Since, Silver is below hydrogen in the spectrochemical series, it tends to get reduced over hydrogen, similarly, since NO_3^- is above OH^-, it tends not to get oxidized, therefore giving oxygen.

$Ag^+ + e^- \longrightarrow Ag(s)$ [at the cathode]

$4OH^- \longrightarrow O_2 + 2H_2O + 4e^-$ [at anode]

OR

i) Write down the combined law of Faraday.

Ans. i) **Combined law of Faraday: W= Zit and $W_1/W_2 = E_1/E_2$; W=Z/E x (I x t)**

ii) Zinc rod is dipped in 0.1 M solution of $ZnSO_4$. The salt is 95% dissociated at this dilution at 298K. Calculate the electrode potential. Given: $E^o_{Zn^{2+}/Zn}$=-0.76V.

Ans. ii) – **0.7902V**

4.4 Write short notes on the following reactions:

Benzoin condensation, Iodoform reaction and Williamson's synthesis

Ans. **Benzoin condensation: Reactant- Benzaldehyde, Reagent- aq. Ethanolic KCN, Product- Benzoin**

Iodoform Reaction: Reactant- Keto methyl group containing carbonyl, Reagent- I_2, KOH, Product- Iodoform, Potassium salt of carboxylic acid

Williamson's synthesis: Reactant- Sodium alkoxide +Alkyl halide, Reagent- Heating, Product- Symmetrical and unsymmetrical ether

4.5 Compound A having molecular formula **$C_9H_7O_2Cl$** exists in keto form and predominantly in enolic form B On oxidation with KMnO4. A gives m-Chlorobenzoic acid. Identify A and B.

Ans. **A**= m-$ClC_6H_4COCH_2CHO$ and **B**= m-$ClC_6H_4COCH{=}CHOH$

(**Factor**: Intramolecular hydrogen Bond formation in enol form between (-OH) and Cl)

OR

An organic compound A having molecular formula $C_8H_{16}O_2$ was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and alcohol(C). Oxidation of C with Chromic acid produced B. C on dehydration gives but-2-ene. Write chemical equations for the reactions involved.

Ans. **A= $CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3$**

B= $CH_3CH_2CH_2COOH$

C= $CH_3CH_2CH_2CH_2OH$

4.6 Why is it necessary to avoid even traces of moisture during the use of Grignard reagent?

Ans. **Grignard reagent reacts with moisture to form an alkane.**

Arrange the following according to the reactivity order with respect to S_N2 reaction and explain:

$CH_3CH_2CH_2Br$, CH_3CH_2Br, $(CH_3)_3CCH_2Br$, $(CH_3)_2CHCH_2Br$

Ans. **$CH_3CH_2Br > CH_3CH_2CH_2Br > (CH_3)_2CHCH_2Br > (CH_3)_3CCH_2Br$**

Factor: Less bulkiness of the alkyl substituents

4.7 Complete the following reactions:

i) $CH_3CH_2CH=CH_2$ + HBr $\xrightarrow{\text{Peroxide}}$?

ii) $CH_3CH(OH)CH_3$ $\xrightarrow{I_2/NaOH}$? $\xrightarrow{\text{Ag-powder}}$?

Ans.

i) $CH_3CH_2CH=CH_2$ + HBr $\xrightarrow{\text{Peroxide}}$ $CH_3CH_2CH_2CH_2Br$

ii) $CH_3CH(OH)CH_3$ $\xrightarrow{I_2/NaOH}$ CHI_3 $\xrightarrow{\text{Ag-powder}}$ C_2H_2

Mention the drawbacks of intermolecular dehydration between two unsymmetrical aliphatic alcohols.

Ans. **Drawbacks: Chances of formation of mixed ether (both symmetrical and unsymmetrical) and alkene products.**

4.8 i) What happens when, Aniline is heated with few drops of chloroform and alcoholic KOH.

Ans. **i) Phenyl isocyanide (C_6H_5NC) will be formed.**

ii) Transform the following:

Benzoic acid ⟶ Benzamide

Benzaldedyde ⟶ Cinnamic acid

Ans.

Benzoic acid ⟶ Benzamide (Benzoic acid to Benzoyl chloride by using $SOCl_2$, followed by treatment with Ammonia)

Benzaldedyde ⟶ Cinnamic acid (Perkin reaction: Acetic anhydride and sodium acetate mixture)

4.9 Explain the following facts:

i) NF_3 is less Polar than NH_3

Ans. **i) Resultant dipole moment of NF_3 is having relatively smaller value than NH_3, due to electronegativity difference and lone pair moment.**

ii) PCl_5 remains in $[PCl_4]^+$ $[PCl_6]^-$ form in solid state.

Ans **ii) To attain stable tetrahedral and octahedral configuration in dimeric form.**

iii) NCl_3 and PCl_3 undergo hydrolysis in a different manner.

Ans **iii) Due to present of vacant "d" orbital in Cl(NCl_3) and vacant "d" orbital in P(PCl_3)**

GROUP- E

5. Answer the following questions. (Alternatives are to be noted) : **Marks: 5X3=15**

5.1 i) Prove that, half-life of a first order reaction doesn't depend upon the initial concentration.

Ans. i) **T_{50}=0.693/K**

ii) What will be the order of a reaction with rate constant $1.5X10^{-3}$ $dm^3mol^{-1}s^{-1}$?

Ans. ii) **Second Order reaction.**

iii) At a fixed temperature half-life of a first order reaction is 12 mins.How much time is required to finish $3/4^{th}$ of that reaction?

Ans. iii) **24.3 minutes**

OR

i) Rate constant of a reaction varies with temperature by following the equation:

$\log k = E_a/2.303R(1/T)$, E_a= Energy of activation

if the slope of logK vs 1/T is (-)4686 k, then find out the value of Ea.

Ans. i) Ea = **89.723KJ/mol** or **21.443Kcal/mol**

ii) To complete 99.9%, a first order reaction takes time of 10 times of its half-life-establish the mathematical relation.

Ans. ii) **$T_{99.9} = 10xT_{50}$**

iii) Find out the rate constant of nth order reaction, when concentration of reactant and time is represented by $moldm^{3-}$ and second(s) respectively.

Ans.iii) **$mol^{(1-n)}$ $dm^{3(n-1)}s^{-1}$**

5.2 i) Find the basicity of the following acids:

a) H_3PO_4 b) H_2SO_4 c) H_3BO_3 d) H_3PO_2

ans.**i) H_3PO_4 = 3, H_2SO_4 = 2, H_3BO_3 = 1, H_3PO_2 = 1**

ii) What is the chemical composition of the following?

Ans. **a) Nessler's reagent : K2[HgI4]**

b) Nitrolim: CaCNC + Coke(C)

iii) Why $PbCl_2$ is more stable than $PbCl_4$?

Ans. **Inert pair effect and ionic potential.**

5.3) Why Formaldehyde can't be prepared by Rosenmund reaction?

Ans. i) **Rosenmund reaction requires presence of minimum two Carbon atoms in the Carbonyl compound.**

Give the structures of A, B and C

i) $CH_3CHO \longrightarrow CH_3COOC_2H_5$

A= Aluminium tertiary ethoxide, Al (OEt) $_3$]

ii) $C_6H_5CHO \longrightarrow C_6H_5CH=CHCHO$

B= [Acetic anhydride ($CH_3COOCOCH_3$), Sodium acetate, (CH_3COONa), external heating]

iii) $HCHO \longrightarrow (CH_2)_6N_4$

C= (Ammonia, NH_3)

Transform: Ethanoic acid ⟶ Propanoic acid

Ans. **[Hint: a) $LiAlH_4$, b) $SOCl_2$, c) Ethanolic KCN, d) H_3O^+]**

OR

An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B',which on heating with Br_2 and KOH forms a compound 'C'(C_6H_7N).'C' is soluble in dil HCl. Identify A, B and C.

Ans. A= C_6H_5COCl , B= $C_6H_5CONH_2$, C= $C_6H_5NH_2$

Give examples of the following reactions (Any Two)

i) Cannizzaro reaction: Reactant- Aldehyde/ketone without α- H, Reagent-Conc. 50% NaOH, Product- Alcohol + Sodium salt of carboxylic acid

ii) Fries Rearrangement: Reactant-Phenolic ester/Hydroxy aryl ketone, Reagent- Anhydrous $AlCl_3$, Product- ortho or para substituted (acyl) Phenol

iii) Wolff kishner reduction: Reactant- Aldehyde/Ketone, Reagent- Hydrazine, KOH, Heating, Product- Alkane

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