Pattern Classes

Pre-Test - 2023
H.S. 2nd Year
Sub : Chemistry (Theory)

Time : 3 Hrs. **Full Marks : 70**

The figures in the margin indicate full marks for the questions.

Answers prepared by Brajen Baishya

Pattern Classes

General Instructions :

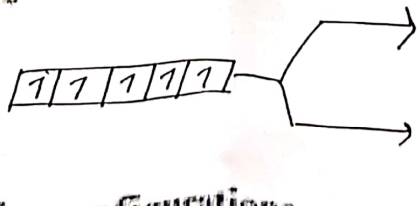
(i) All questions are compulsory.
(ii) Marks for each question are indicated against it.
(iii) Answer should be specific and to the point.
(iv) Question numbers 1 to 8 consist of eight very short answer type questions and carry 1 mark each.
(v) Question numbers 9 to 18 consist of ten short answer type questions and carry 2 marks each.
(vi) Question numbers 19 to 27 consist of nine short answer type questions and carry 3 marks each.
(vii) Question numbers 28 to 30 consist of three long answer type questions and carry 5 marks each.

SECTION - A

1. Under what condition two different solutions can be isotonic in nature Two solutions must have same osmotic pressure across a semipermeable membrane.

2. What happens when chloroform is added to acetone?
It will show negative deviation from Raoults law.

3. On the basis of Crystal Field Theory, write the electronic configuration of d^5 in terms of t_{2g} and e_g in octahedral field when $\Delta_0 < P$.



$t_{2g}^3 e_g^2$

4. Low spin configurations are rarely observed in tetrahedral coordination entity formation. Explain. (pairing energy > splitting energy)
$\Delta_t = \frac{4}{9}\Delta_0$ Δ_t are not sufficiently large for forcing pairing of electrons in the tetrahedral complex formation

Pattern Classes

5. Identify the compound that on hydrogenation produces an optically active compound from the following compounds:

(a) $CH_3C(Cl)=CH_2$ (b) $Cl(Br)C=CCH_3$, C_2H_5

Sol: - ND reduction

optically active, ④ different group present Chiral carbon

6. Explain why HNO_3 when exposed to a glass bottle for a long time turns yellow.

On decomposition it give out nitrogen di oxide (NO_2) which impart yellow colour to the acid

7. What is the oxidation number of iron in $[Fe(H_2O)_5(NO)]SO_4$?

$[Fe(H_2O)_5(NO)]SO_4$ $\quad x+0+1-2=0 \Rightarrow x=1$

8. What are the products formed during hydrolysis of Sucrose?

Sucrose $\xrightarrow{H_2O}$ Glucose + Fructose

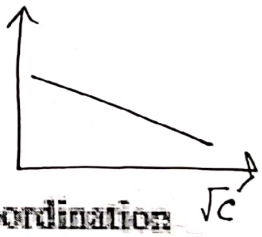
$C_{12}H_{22}O_{11}$ $\quad C_6H_{12}O_6$ $\quad C_6H_{12}O_6$

SECTION - B

9. Write down the intercept and slope of the straight line obtained by the plot of Λ_m vs $C^{1/2}$ for a strong electrolyte.

$\Lambda_m = \Lambda_m^\circ - a\sqrt{C}$ $\quad$ intercept : Λ_m° $\quad \Lambda_m^c$

$y = c + mx$ $\quad$ slope $= -A$



10. Write the IUPAC nomenclature of the following coordination compounds.

dichloridobis(ethane-1,2-diamine)cobalt(III)chloride

(a) $[Co(en)_2Cl_2]Cl$ (b) $[PtCl_4]^{2-}$ Tetrachloridoplatinate(II)ion

11. Write the Nernst equation of the following redox reaction

$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$

$Zn(s)+Cu^{2+}(aq) \rightarrow Zn^{2+}(aq)+Cu(s)$

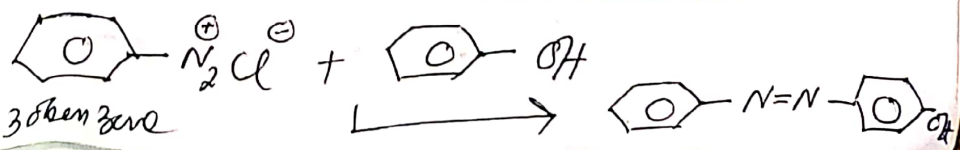
12. What is SHE? What is the E° of SHE cell? $E^\circ_{cell} = 0$

13. What is the role of anh. $ZnCl_2$ in Lucas reagent? (anhyd. $ZnCl_2$ + HCl)

Act as a dehydrating agent, remove water formed in the reaction and prevents the reverse reaction

Alcohol with HCl produces R-Cl which form cloud(reversible rxn)

14. What happens when phenol is treated with benzene diazonium chloride?



p-Hydroxyazobenzene

$K_4[Fe(CN)_6] \rightarrow 4K^{\oplus} + [Fe(CN)_6]^{4-}$

$i = \frac{\text{after dissociation}}{\text{before dissociation}} = \frac{5}{1} = 5$

15. What is the Van't Hoff factor of

(a) $K_4[Fe(CN)_6]$ (b) S_8 $i = 0$

16. In a plot of Λ_m against the square root of concentration ($C^{1/2}$) for strong and weak electrolyte, the value of limiting molar conductivity of a weak electrolyte cannot be obtained graphically. Suggest a way to obtain this value. Also state the related law.

Kohlrausch's Law of independent migration of ions.

17. Which of the following compounds undergo S_N1 and S_N2 reaction

3°, so SN_1 1°, so SN_2

(a) $(CH_3)_3C\text{-}Cl$ (b) CH_3CH_2Cl

18. Name a disease caused due to deficiency of Vitamin D and name a fat soluble vitamin? D, E, K, A

Rickets in children & osteomalacia in adults.

SECTION - C

19. A first order reaction is 60% completed in 20 mins. Calculate the time required for the completion of 90% of the reaction.

$K = \frac{2.303}{20} \log \frac{100}{100-60}$ / $t = \frac{2.303}{K} \log \frac{100}{100-90} = 50$ min

20. Write the mechanism of the following reaction -

$CH_3OC_2H_5 + HI \rightarrow CH_3I + C_2H_5OH$

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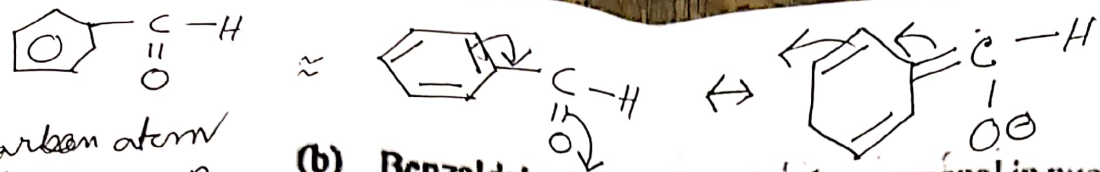
21. Give reason for the following statements:

(a) Benzoic acid does not undergo Fridel-Crafts reaction. is a electrophelic aromatic substitution rxn

due to presence of EWG (COOH) the ring becomes positively charged. Deactivates the ring.

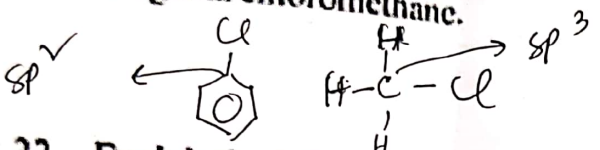


Carbon atom of (CO) group is less electrophilic compared to propanal

(b) Benzaldehyde is less reactive than propanal in nucleophilic addition reactions.

In benzaldehyde, polarity of carbonyl group decreases due to resonance.

(c) C-Cl bond length in chlorobenzene is shorter than C-Cl bond length in chloromethane.



pattern classes

22. Explain the following:

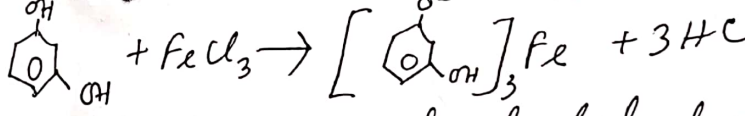
(a) Transition metals and their compounds are coloured.

vacant d - orbital / d-d transition and splitting of the d - orbital

(b) In the titrations of $FeSO_4$ with $KmnO_4$ in acidic medium, dilute HCl is not used.

Already answered.

23. Give chemical test to distinguish between the following pairs of compounds -



Resorcinol react with $FeCl_3$ to form blue colored solution

(a) Resorcinoll and Benzyl alcohol

Benzyl alcohol doesnot react with ferric chloride solution.

(b) Allyl chloride and Vinyl chloride

$CH_2=CH-Cl + NaOH \rightarrow$ NO Reaction

vinyl chloride

$CH_2=CH-CH_2-Cl + NaOH$

allylic chloride ↓

$CH_2=CH-CH_2-OH + NaCl$

24. Carry out the following conversion -

(a) Phenol to 2, 4, 6-Trinitrophenol

use $3HNO_3 + H_2SO_4$ (Conc^n)

(b) Chlorobenzene to Phenol

use NaOH at 623 K, 300 atm

25. Draw the Crystal Field Energy level diagram of an octahedral complex ML_6.

26. Two half-cell reactions of an electrochemical cell are given below:

$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l), E^\circ = +1.51V$

$Sn^{2+}(aq) \rightarrow Sn^{4+}(aq) + 2e^-, E^\circ = -0.15V$

Construct the redox equation from the two half-cell reactions and predict if this reaction favours formation of reactants or product shown in the equation.

$E^\circ_{cell} = E^\circ_{R.P.\ cathode} - E^\circ_{R.P.\ anode}$

$= 1.51 - (-.15) = 1.66V$

27. (a) Indicate the types of isomerism's exhibited by the complex $[Co(NH_3)_5(NO_2)](NO_3)_2$. (At no. Co=27)

→ A pair of optical isomers. → Ionisation isomerism
→ linkage isomerism.

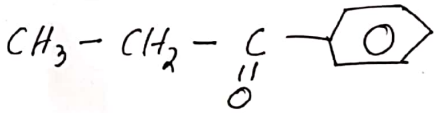
Double salt
Mohrs salt
$FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$

Complex
$K_4[Fe(CN)_6]$

(b) What is the difference between a double salt and complex? Give example.

Double salts can give simple ions when added to water. Complex salt don't give simple ions when added to water.

(c) Draw the structural formula of 1-phenylpropan-1-one molecule



SECTION - D

28. (a) Arrange the following compounds in an increasing order of their reactivity in nucleophilic addition reactions: ethanal, propanal, propanone, butanone.

Butanone < propanone < propanal < Ethanal

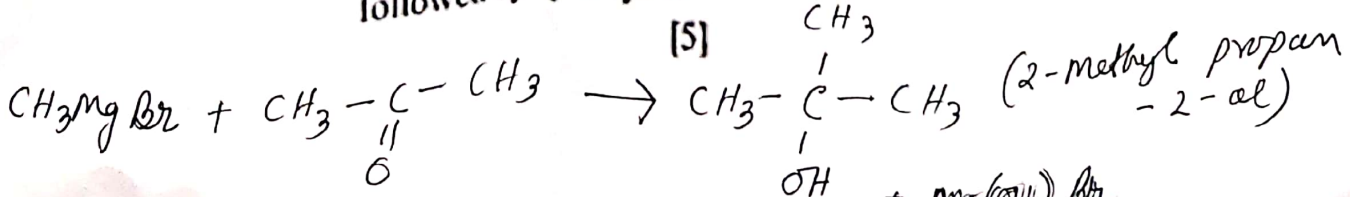
As the (+I) effect increases, chances of attack by a Nucleophile decreases

(b) Give a chemical test to distinguish between Ethanal and Propanal. 1

Iodoform test (methyl ketone is present in ethanal) → shows +ve iodoform test

(c) Give the structure and IUPAC name of the product formed when propanone is reacted with methylmagnesium bromide followed by hydrolysis. 3

[5]



29. (a) Explain why $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex. (At. no. Co=27, Ni=28)

sp^3d^2

d^2sp^3 → outer orbital complex

Find out the hybridisation. If d^2sp^3 than inner orbital complex.

(b) Show that in a first order reaction, time required for completion of 99.9% is 10 times of half-life ($t_{1/2}$) of the reaction. 3

$t_{99.9\%} = \frac{2.303}{k} \log \frac{100}{100-99.9}$ $\qquad T_{1/2} = \frac{0.693}{k}$

$t_{99.9\%} = \frac{2.303}{k} \log 10^3 = \frac{6.909}{k}$ $\qquad = 10 \times \frac{6.909}{k}$

$= 10 \times t_{99.9\%}$

30. (a) Carboxylic acids do not give characteristic reactions of carbonyl group. Explain why? 1

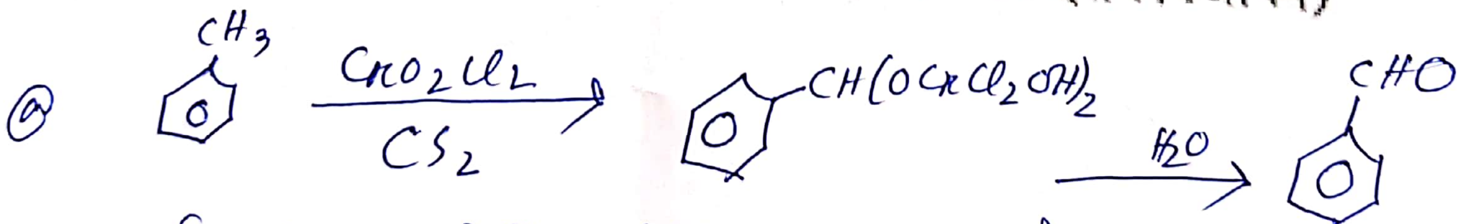
Lone Pair of Oxygen atom attached to hydrogen atom in COOH group are involved in resonance and hence making the carbon atom less electrophile.

(b) Write the reactions involved in the following : 2+2

তলত দিয়া বিক্ৰিয়াসমূহ লিখা।

(a) Etard reaction (ইটাৰ্ড বিক্ৰিয়া)

(b) Wolff-Kishner reduction (উলফ-কিছনাৰ বিজাৰণ)



[illegible]

(b) $CH_3-\underset{\underset{O}{\|}}{C}-H \xrightarrow{NH_2NH_2} \;^{CH_3}_{H}\!\!>C=NNH_2 \xrightarrow[\Delta]{\text{ethylene glycol}} \;^{CH_3}_{H}\!\!>CH_2 + N_2$

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