PART- A.

1. Answer the following questions (Alternatives are to be noted) $2 \times 4 = 8$

a) Find out the packing efficiency in a simple cubic unit cell. 2

OR

Metallic gold (Au) crystallises in a face-centred cubic lattice (fcc). What is number of unit cells in 2·0 g of gold? [Au = 197] 2

b) What will happen if a few drops of HCl is added to freshly prepared precipitate of $Fe(OH)_3$? 2

OR

Write two differences between physisorption and chemisorption 2

c) Why is Co^{2+} easily oxidised to Co^{3+} in presence of a strong-field ligand? 2

d) i) Name the organic compound formed when methyl cyanide reacts with alkaline hydrogen peroxide.

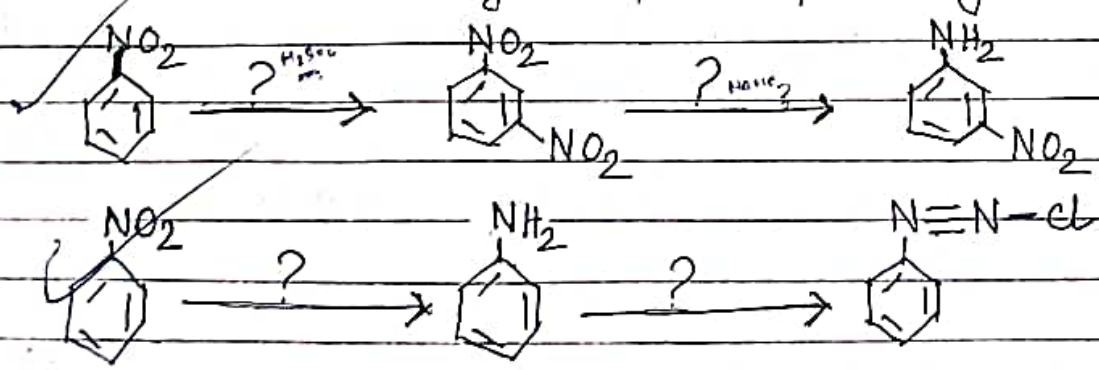
ii) Complete the following reaction:

$$R{-}C{\equiv}N \xrightarrow[\text{Dry ether}]{R'MgX} ? \xrightarrow[\text{hydrolysis}]{\text{Dil. HCl}} ?$$

$Fe(OH)_3 + HCl \rightarrow FeCl_3 + H_2O$ 1+1

OR

Write down the reagents for the following reactions:



1+1

7. Which of the following complex ions has no 'd' electron(s) in the central metal atom —
(a) $[Cr(H_2O)_6]^{3+}$ (b) $[Co(NH_3)_5Cl]^{2+}$
(c) $[Fe(CN)_6]^{3-}$ (d) $[MnO_4]^-$

8. Which one of the following compounds will undergo cannizzaro reaction —
(a) CH_3CHO (b) $(CH_3)_2CHCHO$ (c) $(CH_3)_3CCHO$ (d) $Ph.CH_2CHO$

9. When methyl amine and nitrous acid reacts which one of the following will be produced —
(a) NH_3 (b) N_2 (c) H_2 (d) C_2H_6

10. Which one is present in nucleotide but absent in nucleoside —
(a) pentose sugar (b) base like pyrimidine
(c) base like purine (d) phosphate group.

2. Answer the following questions (Alternatives are to be noted) : 1x2=2

i) The reaction $2A + B \rightarrow C$ is zero order with respect to each of the reactant. Write the rate equation for the reaction.

ii) Why $BaSO_4$ is used in Rosenmund reaction?

OR

With the help of a chemical reaction establish the reducing property of formic acid.

2. Answer the following questions (Alternatives are to be noted). 3×5 = 15

a) A 0·9g sample of a non-volatile, non-electrolyte solid solute is dissolved in 87·9g of benzene. Elevation of boiling point of this solution is 0·25°C. If the molar mass of the solute is 103, calculate the molal boiling point elevation constant (K_b) for benzene. 3

OR

500 ml of 2·5% aqueous urea solution was mixed with 500 ml of 2% aqueous sucrose solution at 300K. Calculate the osmotic pressure of the mixed solution.
[Molecular masses of urea and sucrose are 60 and 342 respectively and $R = 0·082\ L\,atm\,mol^{-1}K^{-1}$] 3

b) i) Write down Kohlrausch's law of independent migration of ions.
ii) Find out the molar conductivity of ammonium hydroxide at infinite dilution (Λ°_m) at 298K. Given that (Λ°_m) values for NH_4Cl, NaCl and NaOH are 149, 126 and 248 $S.cm^2mol^{-1}$ respectively at 298K. 1+2

OR

i) Write the anode reaction and cathode reaction occurring in H_2-O_2 fuel cell.
ii) A current of 3·5A is passed through acidulated water for 5 min 50 s. How many grams of hydrogen will be liberated at the cathode? 1+2

What do you mean by isoelectric point? Define Kraft temperature. Mention one use of Tyndall effect. 1+1+1

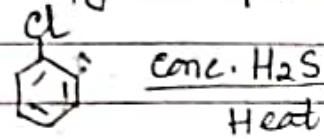
i) Identify A and B in the following reaction:

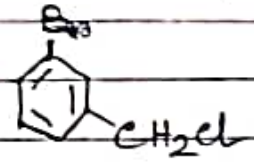
$$CH_2CH_2Cl \xrightarrow{NaCN} A \xrightarrow[Ni/H_2]{Reduction} B$$

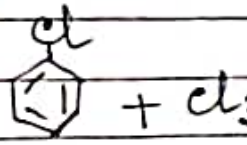
11. Why boiling point of n-butyl bromide is higher than that of t-butyl bromide? 1+2

OR

Identify the products in the following reactions:

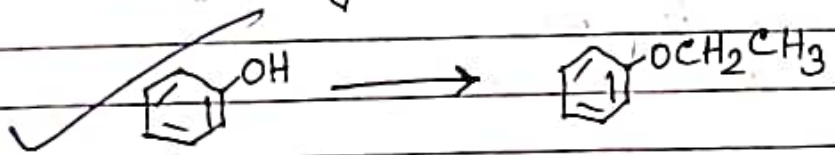
i)  $\xrightarrow[\text{Heat}]{\text{conc. } H_2SO_4}$?

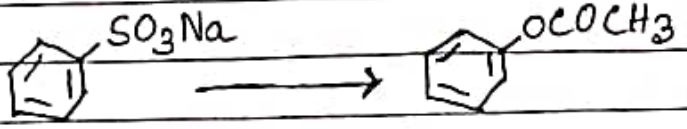
ii)  $\xrightarrow[CH_3OH]{CH_3O^-Na^+}$?

iii)  $+ Cl_3CCHO \xrightarrow[\text{Heat}]{\text{conc. } H_2SO_4}$? 1+1+1

e) i) What reagent would you use to differentiate between a secondary and a tertiary alcohol?

ii) How would you convert ?





1+1+1

OR

An organic compound A(C_2H_6O) reacts with sodium to form compound B and hydrogen gas. When heated with conc. H_2SO_4 at 413K, A produces C($C_4H_{10}O$). C on reaction with conc. HI at 373K forms D. C is also obtained when B is heated with D. Identify A, B, C and D. Write chemical equations for the formation of B from A and the formation of C from B and D. 3

H.S. Test Examination - 2021

Sub. - Chemistry. F.M. - 50

PART - B

1. Write the correct answer choosing from the options given against each question: 1×10 = 1

In which kind of defects cations are present in the interstitial sites -

(a) Frenkel defect (b) Schottky defect (c) Vacancy defect (d) metal deficiency defect.

2. Maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent does not depend upon —

(a) temperature (b) nature of solute (c) pressure (d) nature of solvent.

3. The cell constant of a conductivity cell —

(a) Changes with cange of electrolyte
(b) Changes with change of concentration of electrolyte
(c) Changes with temperature of electrolyte
(d) remains constant for a cell.

4. 50% of a first order reaction is completed in 1.26×10^{14} s. How much time would it take for 100% completion —

(a) 1.26×10^{15} s (b) 2.52×10^{14} s (c) 2.52×10^{28} s (d) infinite

5. The highest covalency of nitrogen is —

(a) 3 (b) 5 (c) 4 (d) 6

6. Which of the following titanium compounds cannot be prepared (Atomic No. of Ti = 22)

(a) TiO (b) TiO_2 (c) K_2TiO_4 (d) $TiCl_2$

3. Answer the following questions (Alternatives are to be noted) 5×3

a) What is meant by a zero order reaction? Explain with an example.
The half-life of a zero order reaction is x second. If the reaction takes t_1 second to complete, calculate t_1 in terms of x.
1+1+3

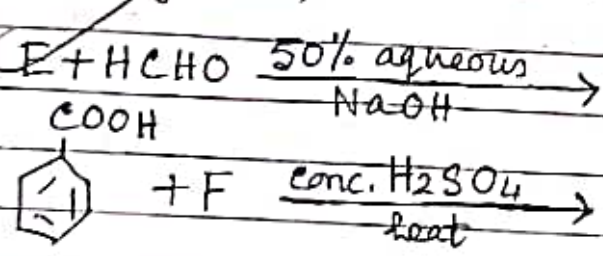
OR

Establish the integrated rate equation for a first order reaction. Draw a graph between reaction rate and concentration of reactant for a first order reaction. On the basis of rate equation show that a first order reaction does never go to completion.
2+1+2

b) Write down the balanced chemical equation for the reaction of H_2S with aqueous solution of SO_2 and write the roles (oxidant, reductant) of the reactants in the reaction.
Why nitric acid is more acidic than nitrous acid?
Draw the structure of XeO_2F_2 molecule.
1+1+2+1

c) i) Benzoic acid on reaction with $SOCl_2$ gives (A). (A) on reduction with Pd-$BaSO_4$, H_2 in presence of quinoline affords (B). (B) reacts with $NH_2OH.HCl$ in presence of CH_3COONa in aqueous ethanol to furnish (C). (C) on reaction with PCl_5 gives (D). Write the structures of (A), (B), (C) and (D).

ii) Identify E, F, G and H in the following reactions:



P.T.O →

$CH_3COCH_3 + SeO_2 \xrightarrow{CH_3COOH} G_1$

$(CH_3COO)_2Ca + H \xrightarrow{heat} CH_3CHO$

iii) Distinguish between ethanal and propanal by a suitable chemical test. 2+2+1

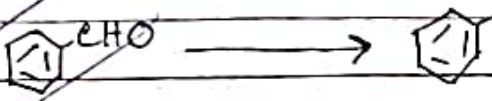
OR

Give examples of the following reactions:

i) Gattermann-Koch reaction.

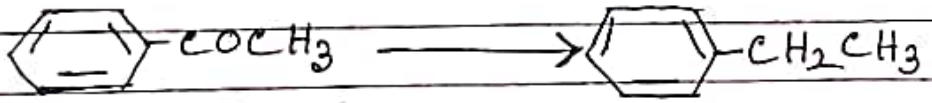
ii) Tischenko reaction.

How would you convert?

i) 

ii) $CH_3COOH \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3$

Mention the reagent for the following conversion in a single step:



1+1+1+1+1