2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer the following :   1 × 8

   a) Ethylenediammine is a ____ ligand.
                    (Monodentate or Bidentate)

   b) Write the formula of Diammine diaqua dicyano cobalt (III) chloride.

   c) Write any two pi-back bonding ligand.

   d) The general electronic configuration of second row transition series is ____.

   e) How many number of unpaired electron present in $[Mn(NH_3)_6]^{+2}$?

   f) How many number of elements present in 4f-block elements ?

   g) Write two important ores of iron.

   h) One haemoglobin carries ____ oxygen at a time.

[Turn over

Part-II

2. Answer any *eight* of the following : $1\frac{1}{2} \times 8$

   a) Calculate the EAN of Co in $[Co(NH_3)_6]^{+3}$.

   b) Calculate the crystal field splitting energy of $[Cr(H_2O_6)]^{+3}$ complex.

   c) Is $[Cu(NH_3)_3]^{+2}$ complex ion, tetrahedral or square planner ?

   d) Write down the number of stereoisomer possible in $[Cr(NH_3)_3Cl_3]$ complex.

   e) Out of Ti^{3+} and Fe^{2+}, which one is colour ?

   f) What is heme ?

   g) Why Mn^{2+} is more stable than Fe^{2+}.

   h) Why blood is red in colour ?

   i) Is Ce^{+4} paramagnetic or diamagnetic ?

   j) Describe the role of metal ions in biological systems.

Part-III

3. Answer any *eight* of the following :   2 × 8

   a) What are the limitations of CFT ?

   b) What is Chelate effect ? Give one example.

   c) What are the factors affecting on crystal field splitting energy ?

   d) Explain why $[Fe(H_2O)_6]^{+3}$ has a megnetic moment value of 5.92 BM whereas $[Fe(CN)_6]^{3-}$ has a value only 1.74 BM.

   e) Why Fe^{3+} is more paramagnetic than Fe^{2+} ?

   f) What are Cooperativity effects ?

   g) Explain Magnetic properties of lanthanides.

   h) Why Eu exibits +2 stable oxidation state ?

   i) Write the function of myoglobin in biological system.

   j) Draw the structure of MnO_2.

Part-IV

4. a) Discuss the postulates of Werner's Theory of cooridination compounds.   6

OR

b) Explain the crystal field splitting of d-orbital in octahedral complexes.   6

5. a) Why do transition metals show variable oxidation states and paramagnetic in nature ?   6

OR

b) Write notes on the following :   3 + 3

   i) Catalytic property

   ii) Colour of transition elements.

6. a) Discuss the various oxidation state of Cobalt with examples.   6

OR

b) What is lanthanide contraction ? What are its important consequences ?   6

7. a) Explain structure and functions of Carboxy peptidase enzyme.   6

OR

b) Write notes on the following :   3 + 3

   i) Sodium (Na^+) / Potassium (K^+) pump

   ii) Toxicity of Hg.

□□

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer the following : 1×8

   a) Carylamine reaction is used to detect ___ .

   b) Ethyl amine is ___ basic than NH_3.

   c) Aryl diazonium chloride is stable at ___ temperature.

   d) Nitrogen in amines is ___ hybridised.

   e) What is the increasing order of aromaticity of the following compound ?
   (Pyrrole, furan, Pyridine, benzone)

   f) Electrophilic substitution reaction in pyridine preferably occurs at ___ position.

   g) Cocaine is obtained from ___ .

   h) Reserpine is an example of ___ alkaloid.

Part-II

2. Answer any *eight* of the following : $1\frac{1}{2} \times 8$

   a) Complete the reaction :

   $$C_6H_5NH_2 \xrightarrow{\text{conc.}H_2SO_4/\Delta}$$

[Turn over
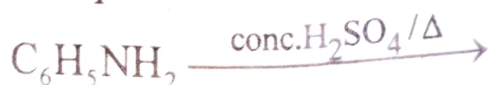
b) Complete the reaction :

$$(CH_3)_2 CH - NH_2 \xrightarrow{HNO_2} A, \text{ what is A ?}$$

c) How aniline can be converted into chlorobenzene ?

d) Give two examples of five membered aromatic heterocyclic compound.

e) How can you prepare pyrrole from furan ?

f) What is Sandmeyer's reaction ?

g) Complete the reaction :

$$C_{10}H_8 \xrightarrow{O_3/CH_2Cl_2} A \xrightarrow{Zn/H_2O} B \text{ what are A and B ?}$$

h) What are the basic difference between terpenes and terenoids ?

i) Define alkaloids.

j) What is the name of isoperene Unit ?

Part-III
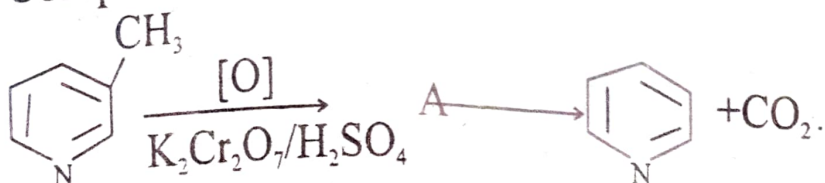
3. Answer any *eight* of the following :   2 × 8

a) What is Gabriel Phthalimide Reaction ?

b) Explain Mannich Reaction with mechanism.

c) Complete the reaction :

$$\xrightarrow[\text{AlCl}_3]{\text{CH}_3\text{-}\overset{\overset{O}{\|}}{C}\text{-Cl/}} A \xrightarrow[\text{reaction}]{I_2/\text{NaOH}}$$

'B' what are A and 'B' ?

d) Complete reaction :

$$\text{(structure with CH}_3\text{)} \xrightarrow[K_2Cr_2O_7/H_2SO_4]{[O]} A \longrightarrow \text{(pyridine ring)} + CO_2.$$
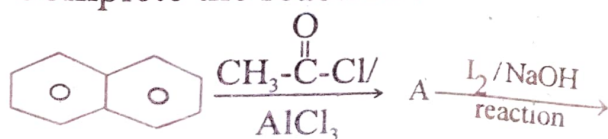
What is the product of 'A' ?

e) Explain pyridine is stronger base than aniline.

f) Explain Ficher-indole synthesis with mechanism.

g) Why an electrophile prefer to attack at C_3-in pyridine ?

h) What is modelung synthesis of indole ?

i) What are the general structural features of alkaloid ?

j) Write notes on geometrical isomers of citral.

Part-IV

4. a) How can you differentiate between Primary, Secondary and Tertiary amines using Hinsberg's reagent.   6

OR

b) Write notes on the following :   3 + 3

   i) Carbylamines Reaction

   ii) Hoffmann Bromamide Reaction.

5. a) Elucidate the structure of Napthalene.   6

                        OR

    b) How can you prepare benzene diazonium chloride from aniline ? How did you synthesis the following compounds it : $3+1\frac{1}{2}+1\frac{1}{2}$

        i) Bromobenzene

        ii) Phenol.

6. a) How will you prepare furan from furfural ? Explain the elecrophilic substitution reaction of furan with examples.   6

                        OR

    b) Write notes on the following : $3+3$

        i) Hantzsch synthesis of pyridine

        ii) Paal-Knorr synthesis.

7. a) Explain the structure elucidation and synthesis of Nicotine.   6

                        OR

    b) What is α-terpineol ? Elucidate its structure with synthetic evidence ?   6

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer the following :   1 × 8

    a) The unit of cell constant ____.

    b) The specific conductance ____ with dilution.

    c) What is the degree of dissociation for strong electrolyte ?

    d) What is weak electrolyte ? Give one example.

    e) ΔG^0 related to E^0 cell as ____.

    f) The movements of the ions towards oppositely charged electrodes are called ____.

    g) What is the value of ionic product of water at 25°C temperature ?

    h) Write the cell reaction for the cell :

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

Part-II

2. Answer any *eight* of the following :   1½ × 8

    a) What is the relation between equivalent conductance and molar conductance ?

[Turn over

b) The molar conductance of a solution of aluminium chloride is found to be $130 SCm^2mol^{-1}$ at 25°C. What should be equivalent conductance at the same temperature ?

c) The electrical resistance of a column of 0.05 M NaOH solution of diameter 1cm and length 50cm is $5×10^3$ Ohm. Calculate specific conductance of the solution.

d) What is meant by ionic mobility ?

e) Transport number of Li^+ ion is smaller than K^+ ion – Explain.

f) Calculate the equilibrium constant for the reaction,

$Sn + CuSO_4 \rightleftharpoons Cu + SnSO_4$

$(E^0(Cu^{+2} / Cu) = 0.337V$, and $E^0 (Sn^{+2}/Sn) = -0.136V)$

g) What are chemical cell ?

h) What is meant by polarization.

i) What is meant by dipole moment ?

j) What is the main function of salt bridge ?

Part-III

3. Answer any *eight* of the following :   2 × 8

a) What is Debye-Falkenhagen effect ?

b) The equivalent conductance of HCl, NaCl and CH$_3$COONa, at infinite dilutions are 426, 126 and 91 SCm^{2}equi^{-1} respectively. Calculate the equivalent conductance of acetic acid at infinite dilution.

c) What is Wein effect ?

d) Molar ionic conductance at infinite dilution of Na$^+$ and Cl$^-$ ions are 50×10^{-3} and 75×10^{-3} Sm^{2}mol^{-1} respectively. What are the transport number of Na$^+$ and Cl$^-$?

e) Explain the term common ion effect.

f) What are irreversible cell ? Give one example.

g) What is electrode potential ? Write its unit.

h) The standard reduction potential E^0 for the half cell reaction are follows :

Zn $\rightarrow$ Zn^{+2} + 2e, E^0 = +0.76V

Fe $\rightarrow$ Fe^{+2} + 2e, E^0 = +0.41V

Calculate EMF for cell reaction :

Fe^{+2} + Zn $\rightarrow$ Zn^{+2} +Fe

i) How is the activity related with activity coefficient ? For ideal solution, what is the value of activity coefficient ?

j) Discuss the advantages of potentiometric titration.

Part-IV

4. a) Derive Debye-Huckel-Onsager equation for equivalent conductance of strong electrolyte.   6

OR

b) Give an account of Arrhenius theory of electrolytic dissociation.

5. a) Discuss the titration curve obtained in conductometric titration of aqueous solution of HCl with an aqueous solution of NaHO.   6

OR

b) What is meant by transport number ? Describe Hittorf's methods for determination of transport number.

6. a) State and explain Faraday's 1st and 2nd law of electrolysis.   6

OR

b) Write notes on the following :   3 + 3
   i) Electromotive force of a cells
   ii) Electrochemical series.

7. a) What is concentration cell ? Derive EMF of a concentration cell with transference.   6

OR

b) Derive thermodynamically an expression for the EMF of a concentration cell without transference.

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

1. a) Define law of chemical equilibrium. How can it be derived thermodynamically. 10

   b) Derive the relation between Kp, Kc and Kx. 5

   ## OR

   c) Calculate the bond energy of HBr give that H–H bond energy is 434 Kj/mole, Br–Br bond energy is 232 Kj/mole, Δ Hf for HBr is 95 Kj/mole. 2

   d) State and explain third law of thermodynamics. Define absolute entropy and derive it. How enthalpy of a reaction varies with temperature ? 13

2. a) What is common ion effect ? Discuss the usefulness of solubility product and common ion effect in qualitative analysis. 10

L-628   [Turn Over

b) i) Calculate the p^H of a solution obtained by mixing equal volumes of the solutions having p^H 2 and p^H 6. 2½

ii) A solution of 0.1m acetic acid is found to be dissociated to extent of 1.43% calculate the dissociation constant of the acid. 2½

OR

c) i) What is degree of ionisation ? 2

ii) Determine the degree of hydrolysis, hydrolysis constant and pH of 0.02M of sodium acetate. The dissociation constant of acetic acid is 1.8×10^{-5}, $KW - 10^{-14}$. 3

d) What is salt hydrolysis ? Derive an expression for degree of hydolysis, hydrolysis constant and pH of a salt of weak acid and weak base. 10

3. a) Discuss benzyne mechanism. 4

b) Explain the mechanism, Kinetics and stereo chemistry of SN and SN_1 reaction. 8

c) How benzene is prepared from benzene sulphonic acid ?

3

OR

d) Why Vinyl Chloride is less reactive than alkyl halide ?

2

e) Discuss the effect of substituents on the reactivity of aryl halides in nucleophilic substitution reaction.

5

f) Wrie notes on the following :

4×2

i) Williamson's ester synthesis.

ii) Friedel Craft alkylation.

4. a) Write notes on the following with mechanism :

5×3
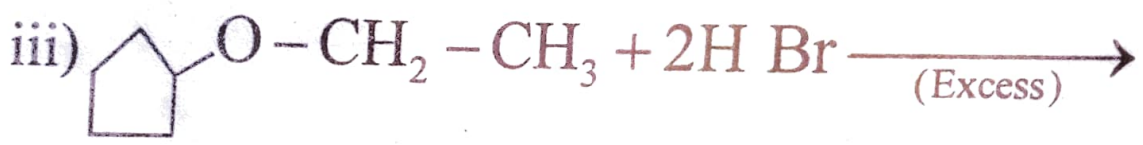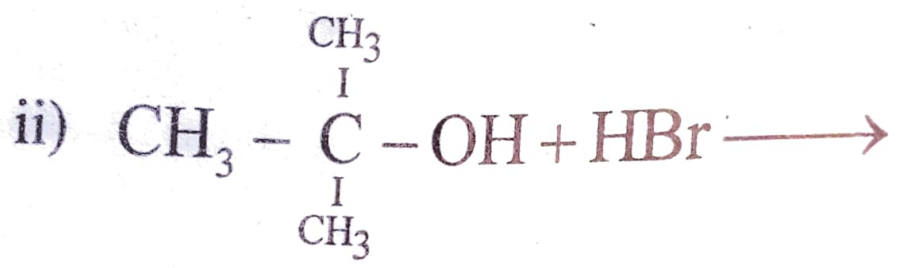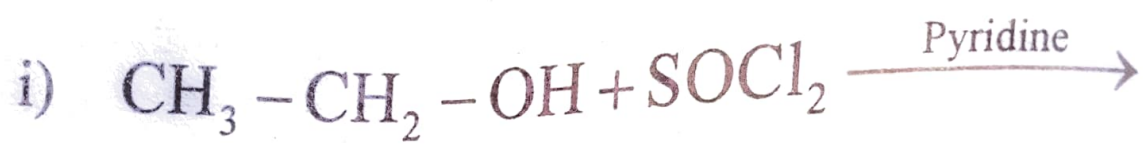
i) Cannizaro's reaction

ii) Aldol condensation

iii) Pinacol - Pinacolone rearrangement.

OR

[4]

b) How can you prepare 1^0, 2^0 and 3^0 alcohol from $CH_3 Mg Br$?

6

c) Complete the reaction with mechanism : 3×3

i) $CH_3 - CH_2 - OH + SOCl_2 \xrightarrow{\text{Pyridine}}$

ii) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH + HBr \longrightarrow$

iii) $\triangle\text{--}O - CH_2 - CH_3 + 2H Br \xrightarrow[(\text{Excess})]{}$

□□

2019

Full Marks - 40

Time - 2 hours

The questions are of equal value

Answer any *four* questions

1. a) Discuss the classification of pestisides according to their mode of action.

   b) Discuss about natural on plant insectisides.

2. Discuss preparation, mode of action and adverse effect of BHC.

3. a) What are fumigants. With example explain their working.

   b) What are fungicides ? Give two examples. Discuss their preparations and chemical actions.

4. a) Write down two phosphate based pestisides. Give their preparation.

   b) Discuss, how the general population is exposed to pesticides.

[Turn Over

5. a) Upon alide factors, the persistent of pesticides depends.

   b) Discuss about the degradation of pesticides.

6. a) What is the importance of carbomates classes pesticides. Give their preparation.

   b) Discuss preparation, chemistry, use and adverse effect of a quinones pesticides.

□□

2019

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer **all** questions

1. a) How do metals occour in nature ? Describe the general procedure of extracting a metal from its Ore.　　8

    b) What is an Ellingham diagram. Discuss briefly the applications of this diagram.　　7

OR

    c) Discuss the various properties of Group-14 elements with reference to (i) oxidation state, (ii) Catenation (iii) Electronegativity and (iv) Metallic character.　　8

    d) How is nickel obtained from its Ore by Mond's process ?　　7

L-268　　　　　　　　　　　　　　　　[Turn Over

2. a) Name the hydrides of Nitrogen. Discuss the variation in their properties with reference to (i) basic character (ii) thermal stability (iii) reducing character (iv) bond angle and (v) covlent nature.   8

   b) Compare and contrast the properties of HF, HCl, HBr and HI.   7

   OR

   c) Write methods of preparation, properties and uses of $LiAlH_4$.   8

   d) What are Wade's rules ? Discuss the application of these rules in classifying carboranes into closo, nido and anachno carboranes. How carboranes and prepared ?   7

3. a) Deduce (i) ideal gas equation, (ii) Graham's law of diffusion (iii) Dalton's law of partial pressure from kinetic gas equation.   7

   b) Surface tension of a liquid vanishes at its critical temeperature. Explain.   4

c) Describe capillary rise method for determining surface tension of a liquid. 4

OR

d) Derive expressions for (i) most probable velocity (ii) averege velocity and (iii) root mean square velocity from Maxwell distribution of velocities. Also derive relationship between them. 7

e) What is Poiseulle's equation ? How is it employed to find the viscocity of a liquid ? 4

f) How is the molecular weight of polymers determined using co-efficient of viscocity ? 4

4. a) Derive an expression for rate constant of second order reaction involving two different reactants with different initial concentrations. 8

b) What are Miller indices ? How are they used to describe a plane ? 4

c) A crystal plane has intercepts on three axes of crystal in the ratio of $\frac{3}{2} : 2 : 1$. What are the Miller indices of that plane ? 3

OR

d) Discuss about the defects in crystalline solids with respect to two dimensional and three dimensional patterns. Write notes on Schottky defect and Frenkel defects. 8

e) Write Arnhenius equation for the effect of temperature on rate of reaction. 4

f) Discuss transaction state theory of absolute reaction rates. 3

□□