RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, MARCH 2022

FIRST YEAR [BATCH 2021-24]

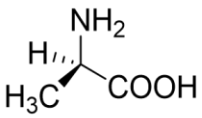
Date : 12/03/2022 **CHEMISTRY (GENERAL)**

Time : 11 am – 1 pm **Paper : I** Full Marks : 50

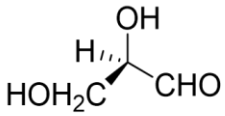
Group : A

Answer **any four** questions of the following: [4×5]

1. a) What is racemization? Illustrate with example.
   b) Describe the principle of resolution of racemic mixture.
   c) Illustrate the difference between racemic mixture, meso compound. [1+2+2]
2. a) Draw the Fischer projection of (2R, 3R)-tartaric acid and convert it into Newman projection.
   b) What is symmetry element and symmetry operations.
   c) How many planes of symmetry and C_2 axis of symmetry is present in water? [2+2+1]
3. a) State Biot's law and define specific rotation.
   b) Does specific rotation change with concentration?
   c) Assign absolute (R/S) configuration for P & Q molecule and relative configuration (E/Z) for the R & S molecule. [2+1+2]



P



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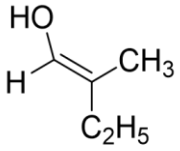

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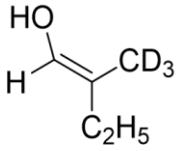
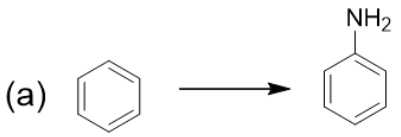
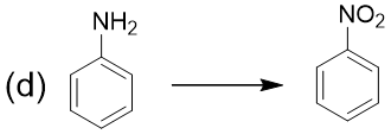
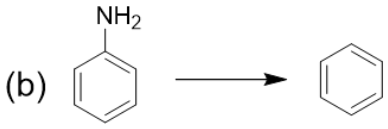


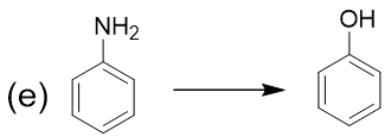
S

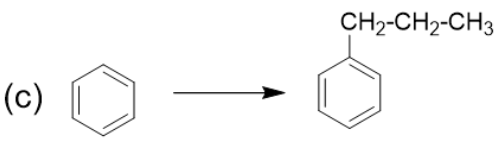
4. a) Explain why halogens (Cl or Br) are electron withdrawing group but ortho-para directing?
   b) Compare the rate of chlorination reaction of toluene, anisole, nitrobenzene and aniline. [3+2]
5. Carry out the following conversions (Any Four). Write down the steps and respective reagents on that step. [5]











6. a) What is Wheland Intermediate?
   b) Discuss the mechanism of nitration reaction of benzene and draw the energy profile diagram.

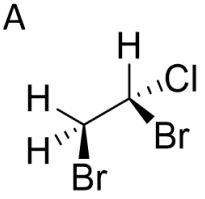
c) Does the reaction show primary kinetic isotopic effect? [1+3+1]

7. a) State the difference between conformation and configuration.

b) Define conformational and configurational isomers with examples.

c) Identify the relationship (Enantiomers & Diastereomers) of the following molecules (A, B & C).

A



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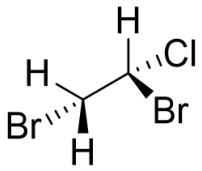

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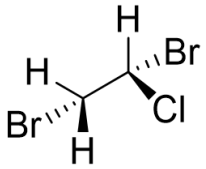

[2+2+1]

Group : B

Answer **any six** questions of the following: [6×5]

1. a) Which one is more covalent among $SnCl_4$ and $SnCl_2$ and why?

b) Write short note on equivalent and non-equivalent orbital.

c) Write 'Bent's rule'. [2+2+1]

2. a) What is lattice energy? Mention the factors on which it depends.

b) Explain the sequence of solubility of lithium halides in an organic solvent. [(1+2) +2]

3. a) Write the limitations of radius ratio rule.

b) Comment on the square planar geometry of $[Ni(CN)_4]^{2-}$. What is the hybridisation of Ni^{2+} in this complex? [2+(2+1)]

4. a) What is primary and secondary valencies in $[Co(NH_3)_5Cl]Cl_2$ respectively?

b) Which species have the greater molar conductance among 1M aqueous solution of $[Co(NH_3)_6]Cl_3$ and $[Co(NH_3)_3Cl_3]$- explain.

c) What would be the oxidation state of Fe in complex cation and complex anion in the complex $[Fe(en)_3]\ [FeCl_4]_3$ [2+1+2]

5. a) What is homoleptic and heteroleptic complexes? Give examples.

b) Predict the structure of the following compounds from their IUPAC nomenclature:

i) hexaammine cobalt(III) tetrachlorodiammine chromate(III)

ii) ammonium heptafluorozirconate

c) What is Flexidentate ligands? Explain with proper examples. [1.5+2+1.5]

6. a) Write the molecular orbital diagram of O_2 molecule with proper explanation of bond order and magnetic behaviour.

b) Predict the IUPAC nomenclature of the following compound:

i) $[Cr(NH_3)_6]\ [Co(C_2O_4)_3]$

ii) $Fe_4[Fe(CN)_6]$ [3+2]

7. a) What is inert pair effect? Explain with example.

b) CO_2 exists as monomeric gas while SiO_2 are polymeric solid- why?

c) Discuss 3c-2e bonds in B_2H_6. [1+2+2]

8. a) Draw the molecular orbital diagram of I_3^-.

   b) Describe the structure and preparation of hydroxyl amine.

   c) Dipole moment of NH_3 molecule is larger than that of NF_3 molecule- why? [2+2+1]

9. a) Trimethyl amine is pyramidal while trisilyl amine is planar trigonal- explain. Which one would be more basic in nature?

   b) Explain why ICl_7 does not exist while IF_7 exists. [3+2]

10. a) Write down the similarities and dissimilarities of inorganic benzene with normal benzene molecule?

    b) What happen when B_2H_6 is treated with dry HCl in presence of $AlCl_3$? [(2+2)+1]

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