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) Write the formula of Zeise's salt.

   b) Calculate the effective atomic number (EAN) of $Ni(CO)_4$.

   c) Write the structure of Grignard reagent in ether solution.

   d) Write the Zieglar-Natta catalyst used for preparation of polyethylene.

   e) Name the group reagent used to analyze various cations of Group-IIA.

   f) Write the formula of water gas.

   g) What is the incoming ligand in aquation reaction of octahedral complexes ?

   h) Write down the relation between stepwise and overall formation constants of metal complexes.

Part-II

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

a) What do you mean by organometallic compounds ? Out of $Fe(C_6H_5)_2$ and NaCN, which one is not an organometallic compound.

b) Write the types of CO groups shown by the infrared (IR) spectra of $Fe_2(CO)_9$.

c) Explain the meaning of hapticity of organic ligand with one example.

d) What do you mean by Mannich condensation ?

e) What is the role of Ziegler-Natta catalyst ?

f) Draw the structure of Wilkinson's catalyst.

g) What is *trans* effect in square planar complexes ?

h) Comment on the effect of strength of metal-ligand bond in metal complexes on the rate of reaction and equilibrium constant value.

i) Write down the structure of *cis*-and *trans*-platin.

j) Find out the solubility product of Ag_2CrO_4 at 85°C, if the solubility of Ag_2CrO_4 is 8.0×10^{-5} moles/litre at 85°C.

Part-III

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

a) The metal-metal bond distance in $Mn_2(CO)_{10}$ is longer than that in $Fe_2(CO)_9$. Explain.

b) Write the balanced chemical equation to prepare acetaldehyde through Wacker process.

c) Describe the π-acceptor behaviour of CO.

d) Write the chemical reactions involved for preparation of ferrocene in laboratory.

e) Write the structure of $Al_2(CH_3)_6$.

f) Calculate the solubility of $BaSO_4$ in 0.10M $BaCl_2$, if the solubility product of $BaSO_4$ is 1.5×10^{-9}.

g) What do you mean by kinetic stability and thermodynamic stability of metal complexes ?

h) Describe the effect of chelate ring on the stability of metal complexes.

j) Discuss the importance of Kurnakov test in square planar complexes with example.

i) Write the preparation of *cis*-platin from $[PtCl_4]^{2-}$.

Part-IV

4. a) Explain 18 electron rule in metal carbonyls with one suitable example. 2

b) Write down the method of preparation and structure of Zeise's salt. 4

OR

c) How can you prepare $Cr(CO)_6$ from $CrCl_3$? 2

d) Describe the structure of $Cr(CO)_6$ using VBT. 4

5. a) Write down the chemical reactions involved in iodination of ferrocene. 2

b) Discuss the acetylation and alkylation reactions of Ferrocene. 4

OR

c) Discuss the structural aspects of $(CH_3Li)_4$ in details. 6

6. a) Explain common ion effect with one suitable example. 2

b) Discuss the role of Wilkinson's catalyst in homogeneous hydrogenation of alkenes. 4

OR

c) Mention the role of NH_4OH solution for the analysis of group-V cations. 2

d) Describe the mechanism of Fischer Tropsch reaction. 4

7. a) Describe how the size and charge of the ligand influence the stability in metal complexes. 2

b) Discuss the details about π-bonding theory of *trans*-effect. 4

OR

c) Discuss the effect of metal ions on the stability of metal complexes. 2

d) Explain the associative and dissociative reaction mechanism for substitution reaction in octahedral complexes. 4

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Part-I

1. Fill in the blanks : 1×8

   a) Amino acids with an additional COOH group in the side chain are called ___ amino acids.

   b) Cbz(Z)-protection is commonly used for the protection of ___ functional group(s).

   c) Based on chemical compositions, the enzymes are classified into ___ categories.

   d) The repeating units of the nucleic acids are ___.

   e) The lipid found abundantly in olive oil is ___.

   f) During glycolysis, glucose is oxidised to ___.

   g) The dyes which are applied to fabrics in the colourless reduced state and then oxidised to coloured are called as ___.

h) ____ is a Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) commonly used as painkiller.

Part-II

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

a) What is Merrifield approach of peptides synthesis ?

b) What is a mordant ?

c) Which is commonly used as an antidote for paracetamol poisoning/overdose ?

d) What is glycogen ?

e) What is acid value in fat ?

f) Sketch structure of guanine.

g) How nucleotides related to nucleosides ?

h) What are coenzymes ?

i) What is non-competitive enzyme inhibition?

j) What do you mean by isoelectric point of amino acids ?

Part-III

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

a) How amino acids are analyzed by electrophoresis process ?

b) What do you mean by 'DNA-denaturation' ?

c) What is allosteric inhibition ? Give an example.

d) Define active site of enzymes.

e) What is base pairing ?

f) What is significance of iodine number of fat ?

g) How cells obtain energy from food ?

h) How linked matabolic pathways help biosystems ?

i) Write medicinal properties of azadirachtin.

j) Write one preparation procedure of malachite green dye.

Part-IV

4. a) What are polypeptides ? Briefly discuss methods of polypeptide synthesis including 'solid phase synthesis'. 6

OR

b) Describe various methods for synthesis of α-amino acids. Mention their important properties and relationship with proteins.

5 a) Write a short note on various components and characteristics of nucleic acids. 6

OR

b) Discuss in brief the characteristics and importance in biological actions of various coenzymes and cofactors.

6. a) Distinguish between rancidification and flavour reversion. Explain rancidity in details with examples. 6

OR

b) Establish a relationship between catabolic pathways of carbohydrates, fats and protein.

7. a) Write down the synthesis of paracetamol and chloroquine. What are effects of co-administration of chloroquine with paracetamol. 6

OR

b) Give an account of the chemistry of triphenylmethane dyes.

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Part-I

1. Fill in the blanks with appropriate answer : 1 × 8

a) The molecular formula of baking soda is ___.

b) ___ acid is mostly found in acid rain.

c) ___ is the topmost region of the atmosphere.

d) Photchemical smog is generally formed in ___ season.

e) ___ poisonous gas can bind faster with haemoglobin than oxygen.

f) Coal, petroleum and natural gas are ___ fuels.

g) Byproducts of radioactive materials that generates at nuclear power stations are called as ___.

h) ___ are biocatalysts that increases rate of biochemical reactions in a living-system.

Part-II

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

a) How is industrial oxygen separated from the air ?

b) Find product for the equation :
$Ca(OH)_2 + Cl_2 \rightarrow$

c) What is poling process in matuallurgy ?

d) What is the biogeochemical cycle in an ecosystem ?

e) Which oxides of nitrogen are responsible for air pollution ?

f) What does the conductivity test of drinking water indicate ?

g) What are the effluents from the electroplating industry ?

h) What are different clean sources of energy ?

i) What are the general characteristics of biocatalyst ?

j) What are the hazards in the fertilizer industry ?

Part-III

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

a) What is Van Arkel method of obtaining ultra-pure metals ?

b) What is the enhanced greenhouse effect ?

c) How is hydrogen used as an energy source ?

d) What is the reverse osmosis-based water purification technique ?

e) How do biocatalysts help chemical industries in manufacturing ?

f) How is petroleom better than coal as a source of fuel ?

g) Define calorific values of fuels.

h) What are the applications and hazards of H_2O_2 ?

i) What is acid rain ? What are its consequences ?

j) How do nuclear accidents affect our environment ?

Part-IV

4 a) Write notes on industrial production, application, and uses of acetylene gas and highlight possible environmental hazards related to it. 6

OR

b) Give an account of preparation of various non-ferrous ultrapure metals and its uses for semiconductor technology.

5. a) What is biogeochemical cycles ? Explain biogeochemical cycle of nitrogen. 6

OR

b) Discuss the sources, sizes and chemical nature of various air pollutants. How air pollution due to SO_2 and NO_x can be controlled ?

6. a) What do you mean by water quality parameters of domestic water ? Write a short note on the ion-exchange method of water purification. 6

OR

b) What is hydrological cycle ? Discuss various processes and the impacts of water pollution on hydrologic cycle.

7. a) Explain conventional and non-conventional sources of energy. Discuss the advantages/ disadvantages of getting energy from hydrogen and geothermal souces of energy. 6

OR

b) What is biocatalysis ? Explain, how use of the biocatalysts in various industrial processes become revolutionary and one of the major components of green chemistry ?

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