[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1530

A

Unique Paper Code : 42177926

Name of the Paper : DSE : Organometallics, Bio-inorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy

Name of the Course : **B.Sc. (Prog.)**

Semester : VI

Duration : 3.5 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **three** questions from **Section A** and **three** from **Section B**.

SECTION A

(Attempt any **three** *questions)*

1. (a) Discuss different oxidation states displayed by Fe and Cu. Name any one compound in each oxidation state.

P.T.O.

(b) Classify the elements according to their role in biological system. Give examples.

(c) Using valence bond theory (VBT) explain the structure of $Co_2(CO)_8$ in solid state and in solution. (4,4,4.5)

2. (a) Using 18-electron rule predict :

(i) 3d metal in $M(CO)_5$.

(ii) The value of x in $Fe_3(CO)_x$.

(iii) Number of metal-metal bond in $Fe_3(CO)_{12}$

(iv) Number of metal-metal bond in $Mn_2(CO)_{10}$

(b) With the help of balanced chemical equations discuss the use of potassium dichromate for the detection of sulphite ions and chloride ions in an inorganic salt.

(c) Compare the structure and functions of haemoglobin and myoglobin. (4,4,4.5)

3. (a) What do you mean by active transport with reference to Na^+/K^+ pump? Give a diagrammatic explanation of the process.

(b) A lemon yellow crystalline compound A reacts with Zn(II) salt to give bluish white precipitate and reacts with Cu(II) salt to give red brown precipitate. These reactions are used to detect Zn^{+2} ions and Cu^{+2} ions respectively. Identify A and write the discussed chemical equations.

(c) What do you mean by the term hapticity? What hapticity is possible with following ligands

(i) cyclopentadienyl

(ii) cyclobutadiene

(iii) ethylene

(iv) benzene (4,4,4.5)

4. (a) Discuss synergistic effect in metal carbonyls. With the help of molecular orbital diagram of CO explain that the CO molecule acts as an electron pair donor through carbon atom and not through oxygen atom.

(b) Explain the role of Na^+ and K^+ ions in living organisms.

P.T.O.

(c) What is the oxidation state of Mn in $KMnO_4$? Give method of preparation of $KMnO_4$ from pyrolusite ore. With the help of chemical equations show how $KMnO_4$ acts as an oxidising agent in alkaline, neutral and acidic medium.

(4,4,4.5)

SECTION B

(Attempt any **three** *questions)*

5. (a) Write the products formed in the following reaction conditions :

(i) Anthracene is treated with Conc. H_2SO_4 at lower temperature and at higher temperature.

(ii) Naphthalene is oxidised with CrO_3/ CH_3COOH and V_2O_5/O_2.

(b) Aromatic electrophilic substitution reaction of naphthalene form α- substituted product predominantly. Explain.

(c) How the dimerization of carboxylic acids affects the O-H and C=O stretching frequencies? Explain.

(d) How will you carry out?

(i) Synthesis of butanoic acid from ethyl acetoacetate.

(ii) Conversion of ethyl acetoacetate to cyclopentyl methyl ketone.

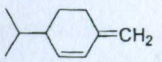
(e) What do you understand about blue shift and red shift? (2,2,2.5,4,2)

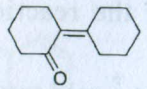
6. (a) Give the approximate IR bands and possible electronic transitions in the following compounds :

(i) $CH_3–CH_2–OH$

(ii) $CH_3–\underset{\underset{O}{\|}}{C}–CH_3$

(b) Calculate the absorption maximum (λ_{max}) for $\pi \rightarrow \pi^*$ transition in the following compounds using Woodward-fieser rules.

i. 

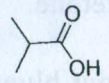
ii. 

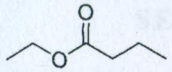
Parental/Base values	λ_{max} (nm)	Increments	(nm)
Acyclic/ Heteroannular dienes	214	Alkyl substitution/ Ring residue	+5
Homoannular dienes	253	Additional conjugation	+30
α, β unsaturated Acyclic ketones	215	Exocyclic double bond	+5
α, β unsaturated Aldehydes	210	α-alkyl substituent	+10
		β-alkyl substituent	+12

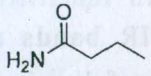
P.T.O.

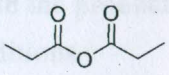
(c) Write notes on: Finger print region.

(d) Match the following compounds with suitable carbonyl frequency.

i.  1680 - 1630 cm^{-1}

ii.  1730 - 1700 cm^{-1}

iii.  1750 - 1735 cm^{-1}

iv.  1830 -1800 cm^{-1} and 1775 - 1740 cm^{-1}

(e) Explain the principle of UV spectroscopy. Write the electronic transitions responsible for UV spectra. (3,3,2,2,2.5)

7. (a) What is Claisen ester condensation. Discuss mechanism of the reaction.

(b) Explain the keto-enol tautomerism by taking ethyl acetoacetate.

(c) How will you prepare the following from ethyl acetoacetate : **(Attempt any three)**

(i) 2-methyl butanoic acid

(ii) Acetyl acetone

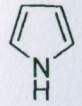
(iii) Methyl ethyl ketone

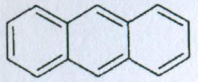
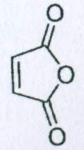
(iv) 4-methyl uracil (4.5,2,6)

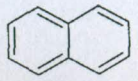
8. (a) Complete the following reactions :

(i)  $\xrightarrow[NaOAc]{HgCl_2}$?

(ii)  + $(CH_3CO)_2O \xrightarrow{H_3PO_4}$?

(iii)  + $2\,Br_2 \longrightarrow$?

(iv)  +  $\xrightarrow{\Delta}$?

(v)  $\xrightarrow[Boil]{Na/C_2H_5OH}$?

(b) How do you synthesize 2,5-dimethylfuran using Paal-knorr synthesis?

(c) Electrophilic substitution in pyridine takes place preferentially at 3-position rather than 2- or 4-position. Why?

(d) Arrange Pyrrole, piperidine and pyridine in decreasing order of basicity. Justify your answer.

(5, 3,2.5,2)