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3 (Sem-6/CBCS) CHE HC 1

2023

CHEMISTRY

(Honours Core)

Paper : CHE-HC-6016

(Inorganic Chemistry-IV)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following : 1×7=7
- (a) What are fluxional organometallic compounds ?
- (b) The most suitable route to prepare the *trans*- isomer of $[PtCl_2(NH_3)(PPh_3)]$ is :
- (i) $[PtCl_4]^{2-}$ with PPh_3 followed by reaction with NH_3
- (ii) $[PtCl_4]^{2-}$ with NH_3 followed by reaction with PPh_3

Contd.

(iii) $[P(NH_3)_4]^{2+}$ with HCl followed by reaction with PPh_3

(iv) $[P(NH_3)_4]^{2+}$ with PPh_3 followed by reaction with HCl

(c) $[Ni(CM)_4]^{2-}$ is kinetically _____ but thermodynamically _____.

(d) 'Low spin complexes are labile but prefer associative mechanism'.

[True or False]

(e) How many metal-metal (M-M) bonds are there in $Ir_4(CO)_{12}$?

(f) Why metal-carbonyl complexes always obey 18 electron rule?

(g) Why interfering radicals do not interfere till group II in the analysis of basic radicals?

2. Explain why/how : $2 \times 4 = 8$

(a) Square planar complexes are generally labile.

(b) Solubility product plays an important role in qualitative analysis.

(c) Direct nitration of ferrocene is not possible.

(d) Ferrocene undergoes electrophilic substitution 10^6 times faster than benzene.

3. Answer **any three** of the following :

$5 \times 3 = 15$

(a) Discuss the dissociative nucleophile substitution reaction in the light of CFT.

(b) Discuss the methods of removal of fluoride and phosphate ions during the qualitative analysis of salt mixtures.

$2\frac{1}{2} + 2\frac{1}{2} = 5$

(c) Explain the mechanism of inner sphere redox reaction of coordination compounds.

(d) Write the plausible mechanism for the catalytic hydrogenation of alkenes using Wilkinson's catalyst, $ClRh(PPh_3)_3$. Identify the reaction type of each step.

(e) Discuss the bonding in M-CO fragments. How, IR spectra can be used to distinguish between terminal and bridging CO groups? $3 + 2 = 5$

4. Answer **any three** of the following :

$10 \times 3 = 30$

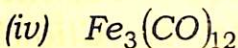
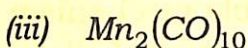
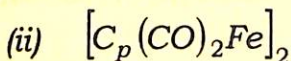
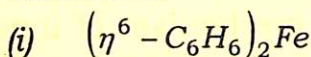
(a) Write notes on the following: $5 \times 2 = 10$

(i) Multicenter bonding in methyl-lithium.

(ii) Stepwise and overall formation constants of a reaction.

(b) The compound $W(\eta^5-C_5H_5)((H)(CO)_3)$ reacts with C_3H_6 to give three products A, B and C. Identify and draw the structure of compounds A, B and C. Each compound obeys the 18-electron rule.

(c) For the following species, calculate the number of electrons in the valence shell, give their reasonable structures and comment on their relative stabilities. $2\frac{1}{2} \times 4 = 10$



(d) Discuss the preparation and structure of ferrocene. Explain the mechanism of acetylation reaction. $2\frac{1}{2} + 2\frac{1}{2} + 5 = 10$

(e) On the basis of VBT, how will you explain lability and inertness of transition metal complexes? Discuss how the following factors affect the lability of a complex: $4 + (2 \times 3) = 10$

(i) Geometry of the complex

(ii) Oxidation state of the metal ion

(iii) Ionic radius

(f) What are metal alkyls? Discuss the structural features of methyl lithium and trialkyl aluminium. $2 + 4 + 4 = 10$

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3 (Sem-6/CBCS) CHE HC 2

2023

CHEMISTRY

(Honours Core)

Paper : CHE-HC-6026

(Organic Chemistry-V)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : $1 \times 7 = 7$

(a) What do you mean by fingerprint region ?

(b) Which of the following is a chromophore ?

(i) $-SO_3H$

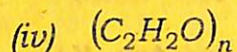
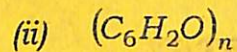
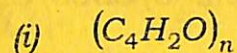
(ii) $-OH$

(iii) $-COOH$

(iv) $-NO_2$

Contd.

(c) The general formula of carbohydrate is—



(d) Which of the following compounds do not absorb light above $200m\mu$?

(i) Ethanol

(ii) Diethyl ether

(iii) 2-Butanone

(iv) Benzene

(e) At what wavelength range the coloured compounds absorb?

(f) Give *one* example of a thermosetting plastic.

(g) What are the expected products of hydrolysis of Lactose?

2. Give answer of the following : $2 \times 4 = 8$

(a) What are the different types of electronic transitions that occur in an organic molecule?

(b) Find out the products A and B in the following reaction :



(c) What is a mordant dye? Give *one* example. $1+1=2$

(d) Give *one* example of each of the following polymers : $1+1=2$

(i) Polyamides

(ii) Polyesters

3. Answer **any three** of the following :

$5 \times 3 = 15$

(a) (i) How can you distinguish between intra and inter-molecular hydrogen bonding with the help of IR spectroscopy? 3

(ii) How can you distinguish the following pair of compounds using IR spectroscopy Propanone and Propanal? 2

(b) Fructose contains a keto group, but still it gives silver mirror test on treatment with Tollen's reagent. Explain by showing the rearrangement reactions involved. What is the name of the rearrangement reaction? $2+2+1=5$

(c) Match the following in 'A' with those given in 'B' : $1 \times 5 = 5$

'A'	'B'
(i) D-Sorbitol	(a) Anomeric carbon
(ii) L-Ascorbic acid	(b) A disaccharide
(iii) Glycoside	(c) A sugar lactone
(iv) C-L of glucose	(d) Sugar alcohol
(v) Maltose	(e) A reducing sugar

(d) Write the synthesis of Congo red dye. Show the structural changes involved due to which it changes color from red to blue in acid solution. $2+3=5$

(e) (i) Write the full form of the following terms : 2

- (i) PAN
- (ii) PTFE
- (iii) PCTFE
- (iv) BSR

(ii) What are polyolefins and polydienes? Give *one* example of each. $1+2=3$

4. Answer **any three** of the following : $10 \times 3 = 30$

(a) (i) Draw the Fisher's Projection formula of *D*-glucose.

(ii) What do you mean by the term anomerization? Show the mechanism of anomerization of *D*-glucose.

(iii) Draw the chair conformers of both the α -*D*(+) and β -*D*(+) glucopyranose.

(iv) How do you explain the greater stability of β -*D*(+)-glucopyranose from their conformers? $1+3+3+3=10$

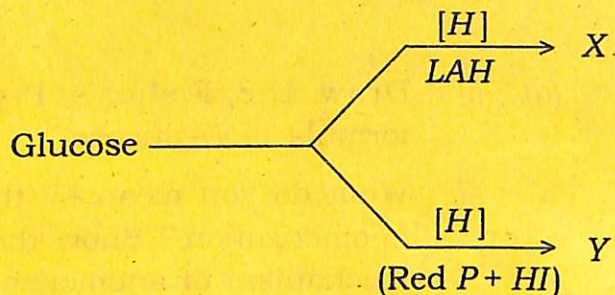
(b) (i) How will you bring the following conversions? $3 \times 2 = 6$

(A) An aldopentose to an aldohexose

(B) *D*-fructose to *D*-glucose

(ii) How many stereoisomers are possible for both aldohexoses and 2-ketohexose? 2

(iii) Find X and Y in the following reactions : 2



(c) (i) Give the classification of dyes on the basis of their functional group or chemical constitution. 5

(ii) What are acid and basic dyes? Give *one* example of each dye. Name the fabric to which they can be applied. 5

(d) (i) What are the two monomers of Dacron? 2

(ii) Give *two* differences between linear polymers and branched chain polymers. 2

(iii) Write a note on biodegradable polymers. 2

(iv) Fill in the blanks : 1×4=4

(A) Polymers which have (—COO—) linkages are known as _____.

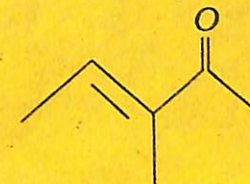
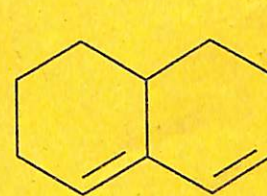
(B) Polyethene is obtained by the polymerisation of _____.

(C) Polystyrene is obtained by the polymerisation of styrene in presence of _____ as initiator.

(D) Proteins are the examples of _____ polymers.

(e) (i) How many electronic transitions are expected for benzene? 1

(ii) Use Woodward-Fieser rule to determine the λ_{max} of the following compounds : 2+2=4



- (iii) Predict the chemical shift positions for the protons in 1-bromoethane and hence draw a rough sketch of the ^1H NMR spectrum. 3
- (iv) In a ^1H NMR spectrum, the protons of ethene appear at a more downfield region than expected. Why? 2
- (f) (i) Explain the basic principle of NMR spectroscopy. 5
- (ii) Explain, why ESR spectrum is recorded in derivative mode? 2
- (iii) Predict and draw the hyperfine structure of CH_3 using ESR spectroscopy. 3
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