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**6 SEM TDC CHMH (CBCS) C 13**

**2025**

( May )

**CHEMISTRY**

( Core )

Paper : C-13

**[ Inorganic Chemistry  
( Organometallic Chemistry ) ]**

*Full Marks : 53*

*Pass Marks : 21*

*Time : 3 hours*

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

1. Choose the correct answer from the following : 1×7=7

(a) The total electron count for the complex  $[\text{Fe}_4\text{N}(\text{CO})_{12}]^-$  is

(i) 60

(ii) 62

(iii) 72

(iv) 59

- (b) EAN for  $[\text{CoNO}(\text{CN})_5]^{3-}$  is
- (i) 35
  - (ii) 36
  - (iii) 37
  - (iv) 38
- (c) Which of the following has minimum *trans*-effect?
- (i)  $\text{H}_2\text{O}$
  - (ii)  $\text{NH}_3$
  - (iii) Py
  - (iv)  $\text{Cl}^-$
- (d) Which of the following complexes obeys 18  $e^-$  rule?
- (i)  $(\eta^5\text{-C}_5\text{H}_5)\text{Mn}(\text{CO})_3$
  - (ii)  $\text{Cr}(\eta^5\text{-C}_5\text{H}_5)_2$
  - (iii)  $\text{Co}_2(\text{CO})_8$
  - (iv)  $\text{Fe}(\text{CO})_3(\eta^5\text{-C}_5\text{H}_5)$

- (e) Cations of which of the following groups are precipitated in alkaline medium?
- (i) Group I
  - (ii) Group II
  - (iii) Group IV
  - (iv) None of the above
- (f) Which of the following combinations of basic radicals belongs to group III?
- (i) Fe, Al, Cr
  - (ii) Fe, Mg, Ba
  - (iii) Mg, Ba, Ca
  - (iv) Mg, Ba, Fe
- (g) Find the hapticity of  $\text{C}_5\text{H}_5$  ligand in  $\text{Fe}(\text{C}_5\text{H}_5)_2$  complex.
- (i) Monohapto ligand
  - (ii) Trihapto ligand
  - (iii) Pentahapto ligand
  - (iv) Dihapto ligand

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2. Answer any *five* questions from the following :  
2×5=10
- (a) Why is  $H_2S$  passed in alkaline medium for the precipitation of group IV basic radicals? 2
- (b) Define solubility product and ionic product of a solution. 2
- (c) What is the importance of Zeise's salt in organometallic chemistry? How was it prepared? 1+1=2
- (d) Give an example of reaction in which  $HCo(CO)_4$  is used as a catalyst. 2
- (e) What is Wilkinson's catalyst? Mention one use of this catalyst. 2
- (f) How is  $18 e^-$  rule helpful in determining the number of metal-metal bonds in metal carbonyl compounds? 2

#### UNIT—I

3. Answer any *two* from the following questions :  
3×2=6
- (a) How will you detect the presence of phosphate as interfering radical in a salt mixture? How does phosphate interfere in the detection of basic radicals? 1+2=3

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- (b) What is common ion effect? Explain why during the precipitation of group III radicals,  $NH_4OH$  is added in presence of  $NH_4Cl$ . 1+2=3
- (c) What is the group reagent for group V? Write the chemical form of the precipitate of group V. How will you confirm the presence of  $Ba^{2+}$  ion in a salt mixture? 1+1+1=3

#### UNIT—II

4. Answer any *four* from the following questions :  
3×4=12
- (a) The CO molecule has JR stretching frequency of  $2143\text{ cm}^{-1}$ , but it shifts to different regions in metal carbonyls. Explain. 3
- (b) What is Ziegler-Natta catalyst? Discuss its use in the polymerization of ethane. 1+2=3
- (c) What is synergic effect in metal carbonyls? Draw the molecular orbital energy-level diagram of CO molecule. 1+2=3
- (d) What is ferrocene? Write its preparation. Write the Friedel-Crafts acylation reaction of ferrocene. 1+1+1=3

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(e) Give one method of preparation for each of the following : 1+1+1=3

(i) Metal carbonyl

(ii) Zeise's salt

(iii) Binuclear carbonyl

### UNIT—III

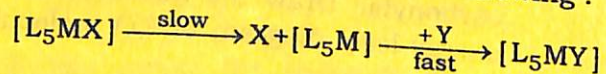
5. Answer any four from the following questions : 3×4=12

(a) Write a note on acid hydrolysis of cobalt (III) compounds with suitable example. 3

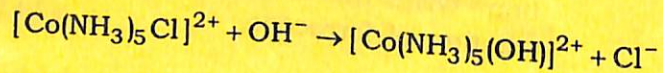
(b) Draw the structures of the intermediates that are formed in  $S_N1$  and  $S_N2$  mechanisms of  $[MA_3X]^{n+}$ . Compare their stability. 2+1=3

(c) What is *trans*-effect? Outline the synthesis of *cis*- and *trans*-dichlorodiammineplatinum (0). How will you distinguish between them? 3

(d) Explain the mechanism of the following : 3



(e) Explain the  $S_N1$  CB mechanism for the following reaction : 3



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### UNIT—IV

6. Answer any two from the following questions : 3×2=6

(a) Discuss Wilkinson's catalyst's role in hydrogenation of alkyne. 3

(b) Discuss the method of synthesis of gas by metal carbonyl complexes. 3

(c) Write a note on synthetic gasolin. 3

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**6 SEM TDC CHMH (CBCS) C 14**

**2025**

( May )

**CHEMISTRY**

( Core )

Paper : C-14

( **Organic Chemistry** )

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct answer from the following : 1×5=5

(a) Natural rubber is a polymer of

(i) 2-methyl-1, 3-butadiene

(ii) 2-chloro-1, 3-butadiene

(iii) 2-methyl but-2-ene

(iv) 1, 3-butadiene

( 2 )

(b) The different types of energies associated with a molecule are

- (i) electronic energy
- (ii) vibrational energy
- (iii) rotational energy
- (iv) All of the above

(c) Among the following the NMR active nucleus is

- (i)  $^{12}\text{C}$
- (ii)  $^{19}\text{F}$
- (iii)  $^2\text{H}$
- (iv)  $^{16}\text{O}$

(d) Which of the following is a basic dye?

- (i) Congo red
- (ii) Aniline yellow
- (iii) Alizarin
- (iv) Indigo

( 3 )

(e) Which of the following is the general formula of carbohydrates?

- (i)  $(\text{C}_4\text{H}_2\text{O})_n$
- (ii)  $(\text{C}_6\text{H}_2\text{O})_n$
- (iii)  $(\text{CH}_2\text{O})_n$
- (iv)  $(\text{C}_2\text{H}_2\text{O})_n\text{COOH}$

### UNIT—I

2. Answer the following questions (any five) :  
2×5=10

- (a) Polar solvent shift  $\pi \rightarrow \pi^*$  transition to higher wavelength. Explain.
- (b) The nuclei of  $^{12}\text{C}$  is NMR inactive but  $^{13}\text{C}$  is NMR active. Explain.
- (c) Conjugate diene has higher  $\lambda_{\text{max}}$  than isolated diene. Explain.
- (d) Chemical shift depend upon applied magnetic field but spin spin coupling N coupling constant is independent of the applied magnetic field. Explain.
- (e) How can you study H-bonding using IR spectroscopy?
- (f) What do you mean by fundamental band and overtone band?

3.  $\text{CH}_3\text{OH}$  is good solvent for UV spectroscopy but bad solvent for IR spectroscopy. Explain. 3

4. Answer the following questions (any two) :  
4×2=8

(a) The mass spectrum of an organic compound shows an abundant molecular ion peak at  $\frac{m}{2} = 72$ . The compound gives a characteristic band at 275 nm ( $\lambda_{\text{max}} = 17$ ) in its UV spectrum. The IR spectrum shows prominent peak at  $2940 \text{ cm}^{-1}$ ,  $2855 \text{ cm}^{-1}$  and  $1715 \text{ cm}^{-1}$ , PMR spectrum of the compound is as follows :

$\delta 2.5(q, 2H)$ ,  $\delta 2.12(s, 3H)$  and  $\delta 1.07(t, 3H)$

Determine the structure of the compound and explain the peaks.

(b) Three isomeric dienes A, B and C with molecular formula  $\text{C}_5\text{H}_8$  shows  $\lambda_{\text{max}}$  178, 211 and 215 nm. All the dienes or hydrogenation yield *n*-pentane. What are the possible structure of A, B and C? Given that  $\lambda_{\text{max}}$  of pent-1-ene is 176 nm. Justify your answer.

(c) (i) NMR signal of ethylenic proton is observed at higher  $\delta$  value than acetylenic proton. Explain. 2

(ii) What do you mean by finger print region? 2

## UNIT—II

5. Answer the following questions (any three) :  
2×3=6

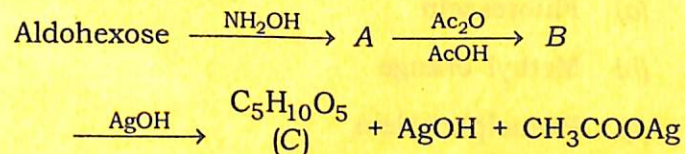
(a) How will you show that D glucose is reducing sugar?

(b) Sketch the stable conformer of the anomer of  $\alpha$ -D-glucopyranose.

(c) How do you establish that configuration at  $\text{C}_3$ ,  $\text{C}_4$  and  $\text{C}_5$  of D-glucose and D-mannose are same?

(d) Convert D-glucose to epimeric aldohexose.

6. Assign the structures (A) to (C) from the following reaction : 3



Or

What product do you expect when methyl-D-(+)-glucopyranoside is subsequently subjected to periodic oxidation,  $\text{Br}_2\text{—H}_2\text{O}$  oxidation, strontium salt formation and hydrolysis with dil HCl.

( 6 )

**UNIT—III**

3  
4  
7. Answer the following questions (any three) :  $2 \times 3 = 6$

- (a) What are requisites for a compound to be true dye?
- (b) Write one method for the synthesis of indigo.
- (c) Discuss briefly the Witt's theory for colour and constitution.
- (d) Explain the following terms with suitable example :  $1 + 1 = 2$
- (i) Hypsochromic shift
- (ii) Auxochrome

8. Write one synthesis each of the following (any two) :  $1 \frac{1}{2} \times 2 = 3$

- (a) Fluorescein
- (b) Methyl orange
- (c) Phenolphthalein

**UNIT—IV**

9. What is vulcanization of rubber? How does it affect the quality of the polymer?  $1 \frac{1}{2} + 1 \frac{1}{2} = 3$

Or

Write a short note on phenol-formaldehyde resin. 3

( 7 )

10. Answer the following questions :  $2 \times 3 = 6$

- (a) Write down the structure of the polymer-polyurethane and nylon-6.  $1 + 1 = 2$
- (b) Write the difference between addition and condensation polymerization.
- (c) Write a short note on biodegradable polymer.

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