16/5/19

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[This question paper contains 7 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **2204** **IC**

Unique Paper Code : 32171601

Name of the Course : **B.Sc. (Hons.) Chemistry**

Name of the Paper : Inorganic Chemistry IV

Semester : VI

Time : 3 Hours ***Maximum Marks : 75***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt any **five** questions.

(c) Question **No. 1** is compulsory.

(d) **All** questions carry equal marks.

1. Answer any **fifteen** questions from the following : 1×15=15

(i) Explain why CO is referred to as a π acid ligand.

(ii) $Fe(CO)_5$ is known while $[Fe(CO)_6]$ is not. Why ?

P.T.O.

(iii) Give the valence electron count of the metal in :

(a) $[Mn_2(CO)_{10}]$,

(b) $[Fe(\pi\, C_5H_5)(CO)]$,

(iv) Which is more basic towards a proton – $[Mn(CO)_5]^-$, $[Re(CO)_5]^-$

(v) What is meant by π acidity ?

(vi) Iron forms a pentacarbonyl but nickel forms a tetracarbonyl. Explain why ?

(vii) Name an important biomolecule containing cobalt.

(viii) Name the enzyme catalyzing this reaction $H_2O + CO_2 \rightleftharpoons H_2CO_3$

(ix) Give the name and chemical formula of the yellow precipitate obtained in the confirmatory test of potassium ions.

(x) Why is the Group II centrifugate boiled with a few drops of concentrated nitric acid before proceeding to Group III ?

(xi) Is the given compound organometallic compound ?

$Ti(CH_3)(OEt)_3$, $Al(OMe)_3$

(xii) Name a disease associated with cobalt deficiency.

Fill in the blanks :

(xiii) In the key step of the cycle of Ziegler Natta catalysis, ethene forms a .....with titanium.

(xiv) The rhodium complex used as Wilkinson's catalyst has the formula .....

(xv) Interfering ions must be removed before making the solution ..... for the precipitation of Group .....

(xvi) A common antidote for arsenic is .....

(xvii) The biomolecule involved in taking Fe from its storage sites to the sites for incorporation into haemoglobin is.....

2. (a) The cyclopentadienyl rings in ferrocene have aromatic character but cyclopentadiene itself has no such character. Explain. 5

(b) Draw the structure of dimeric trialkyl aluminium and explain why all Al – C bond lengths are not identical. 5

(c) (i) Which is more stable and why: $[Fe(\eta^5\text{–}C_5H_5)_2]$ or $[Co(\eta^5\text{–}C_5H_5)_2]$? 5

(ii) How will you prepare aminoferrocene from ferrocene ? 5

3. (a) (i) Despite having similar size and charge Zn(II) is an important biocatalyst in comparison to Cu(II), comment. 5

(ii) Which metal is present at the active site of the enzyme Carboxypeptidase A ? What is its coordination number and how it is satisfied ? 5

(b) What is an ion pump ? Show how the sodium potassium pump maintains the concentration gradient of the relevant ions as well as the charge gradient across the cell membrane. 5

(c) (i) Why does a minute concentration of vanadate inhibit the operation of the ATPase in the sodium - potassium pump ?

(ii) When EDTA is used for detoxification it is administered as the calcium salt. Why ? 5

4. (a) Give any **two** methods of preparation of metal carbonyls. What happens when $Fe(CO)_5$ reacts with bromine ? 5

(b) Two different structures of $Co_2(CO)_8$ are consistent with 18 electron rule. How will you predict the structure on the basis of IR studies ? 5

(c) Draw the structure of the anion of Zeise's salt and briefly discuss the nature of bonding. Give two evidences to indicate that back bonding occurs in this compound. 5

5. (a) Can Wilkinson's catalyst be used to produce enantioselective products ? Give an example. 5

(b) Differentiate between *homogeneous* and *heterogeneous* catalysis giving examples of each and mention **one** advantage and **one** disadvantage of each. 5

(c) Name the two gases involved in the formation of synthetic gasoline by Fischer-Tropsch process. What is the name given to the mixture of these gases ? 5

6. (a) An unknown salt **A**, when heated with NaOH solution, produced a pungent smelling gas **B**. **B** turned red litmus blue and gave dense white fumes of **C** when a glass rod dipped in HCl was held at the mouth of the test tube. **A**, on heating with concentrated sulphuric acid, gave a mixture of two odourless gases **D** and **E**. **D** burnt with a blue flame while **E** turned lime water milky. An aqueous solution of **A** gave a white precipitate with calcium chloride solution, the acid extract of which discharged the colour of acidified potassium permanganate solution. Identify **A**, **B**, **C**, **D** and **E** giving the reactions involved. 5

(b) (i) How can sulphite ions and carbonate ions be tested for in presence of each other in qualitative analysis ?

(ii) How can Cu^{2+} and Ni^{2+} ions present in a mixture be separated on the basis of common ion effect ? 5

(c) (i) Pb(II) ions are included in both Group I and Group II cations in qualitative inorganic analysis. Give reasons.

(ii) Limewater or barium chloride solution turns turbid on passing gas evolved by acidification of carbonates but the solution becomes clear on prolonged passage of gas. 5

7. (a) Which Characterstics of cis platin makes it an effective antitumour drug ? Explain. 5

(b) Why is it necessary to test Group V ions in the order : Ba^{2+}, Sr^{2+}, Ca^{2+} ? Explain. 5

(c) Why is it necessary to remove interfering ions before Group III analysis ? Explain. 5