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S. No. of Question Paper : 811

Unique Paper Code : 217601

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Name of the Paper : Inorganic Chemistry—V (CHHT 615)

Name of the Course : B.Sc. (Honours) Chemistry

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

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

Attempt any *Five* questions.

*All* questions carry equal marks.

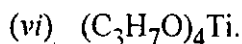
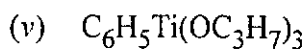
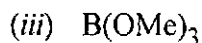
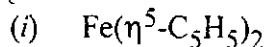
1. (a) Explain the following observations in qualitative inorganic analysis :
- (i)  $Pb^{2+}$  may precipitate as sulphide in Group II of cations even if  $PbCl_2$  has been removed as an insoluble residue by boiling the mixture of salts with dilute HCl.
  - (ii) In the presence of bromide, nitrate has to be confirmed by the aluminium powder test.
  - (iii) Presence of phosphate needs to be re-confirmed after removing Group II of cations in case arsenic is present.

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- (b) How are borate and oxalate ions confirmed in a mixture of salts ? Why do they need to be removed before precipitating Group III of cations in alkaline medium ? 4
- (c) Why is cadmium toxic ? What are the symptoms associated with its toxicity ? Give possible antidotes to cadmium poisoning. 3
- (d) IR stretching frequencies of C—O bond are in the order  $M-CO > M_2-CO > M_3-CO$  for a metal in carbonyl complexes. Explain why. 2
2. (a) Where and in what form is iron stored in the human body ? How is iron taken from its storage sites to the sites for incorporation into haemoglobin ? 5
- (b) With the help of molecular orbital diagram of CO, explain :
- (i) why carbon is considered to be the donor atom to transition metals in carbonyl complexes.
- (ii) the synergy effect which plays a major role in stabilising carbonyl complexes. 5
- (c) Why is sodium carbonate extract prepared to perform confirmatory tests of anions in qualitative analysis ? Why is the extract acidified before adding any reagent ? 2
- (d) How is the concept of solubility product applied in the precipitation of Group II and IV of cations in qualitative inorganic analysis ? 3

3. (a) Define organometallic compounds. Which of the following are classified as organometallic compounds ?



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(b) What is meant by 'hapticity' in organometallic chemistry ? Give examples of ligands with hapticities of 2, 3, 4, 5 and 6.

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(c) Describe the Perutz mechanism of oxygenation of haemoglobin. What is the trigger for this mechanism ?

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4. (a) How are the following ions tested for in the presence of each other :

(i) Sulphate and sulphite

(ii)  $\text{Sb}^{3+}$  and  $\text{Sn}^{2+}$ .

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(b) A mixture of salts, when treated with dilute sulphuric acid, gave a sulphurous smelling gas, which turned acidified dichromate solution green. The reaction mixture turned turbid.

When silver nitrate solution was added to the acidified soda extract of the mixture, a

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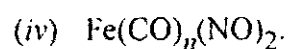
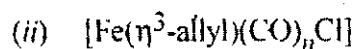
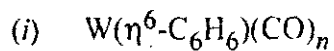
white precipitate was formed which quickly darkened. When heated with sand and concentrated sulphuric acid, the mixture gave a pungent gas which left an oily appearance in the tube and formed a white deposit on a moist glass rod. An alkaline solution of the mixture gave a pale brown precipitate with  $H_2S$ . When sodium bismuthate was added to the nitric acid solution of the precipitate, a pink coloured solution was obtained. When subjected to the flame test with the help of a platinum wire, the mixture gave a lilac flame. Identify the anions and cations present in the mixture, giving chemical equations as required.

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- (c) Which metal is present at the active site in the enzyme carbonic anhydrase? What is its coordination number and how is it satisfied?
- 4
5. (a) What is an ion pump? Show how the sodium-potassium pump maintains concentration gradient of the relevant ions as well as charge gradient across the cell membrane. What is the evidence that sodium channels are large and hydrated and potassium channels are smaller and dehydrated?
- 5
- (b) How are :
- (i) zirconyl nitrate and
- (ii) ammonium polysulphide
- used in inorganic qualitative analysis? Explain with reactions.

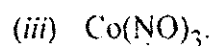
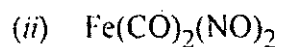
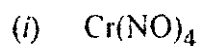
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(c) Using 18-electron rule, deduce the probable number of carbonyl ligands in the following :



4

(d) Give the formula of the corresponding neutral metal carbonyls which are isoelectronic with the following species in terms of total valence electrons of the central metal :



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6. (a) Why are iron and copper essential in the human body? What are the diseases associated with excess of these metals?

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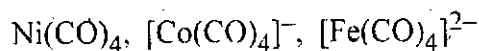
(b) What are the special properties possessed by *cis*-diamminedichloroplatinum (II) that make it an effective anti-tumour drug? How does the molecule block cell proliferation?

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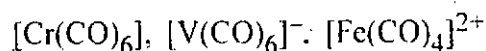
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(c) Select the best option in each of the following with brief justification :

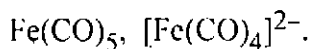
(i) Shortest C–O bond



(ii) Lowest C–O stretching frequency



(iii) Highest Fe–C bond order



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7. (a) Describe the active site of the enzyme carboxypeptidase A and list the various interactions that help the enzyme to function. 5

(b) How is ferrocene prepared ? How does it react with the following ?

(i) Butyl lithium

(ii) Excess of methyl chloride in the presence of anhydrous aluminium chloride

(iii) Formaldehyde and secondary amine. 4

(c) Why are the shapes of the oxygen saturation curves of haemoglobin and myoglobin different ? 4

(d) Where is cobalt present in the human body ? What is the disease associated with cobalt deficiency ? 2