T(6th Sm.)-Chemistry-H/CC-13/CBCS

## 2021

## CHEMISTRY — HONOURS Paper: CC-13

## (Inorganic Chemistry-5)

## Full Marks : 50

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

Answer question no. 1 and any eight questions from the rest.

- 1. Answer *any ten* questions:
  - (a) Name the basic radicals with their charges which are separated in qualitative analysis of mixtures with  $H_2S$  as the group reagent in alkaline medium in presence of ammonium chloride.
  - (b) What is the formal oxidation state of iron in  $Na_2[Fe(CN)_5NO]$ ?
  - (c) State the metal ion present in carboxypeptidase A.
  - (d) Which antidote is used to reduce the toxicity due to excess Pb?
  - (e) Indicate the possible hapticity of the following ligands: Ethylene, Cyclopentadienyl
  - (f) What is the actual catalytic species in the cobalt carbonyl based hydroformylation process?
  - (g) Which of the following obeys the 18-electron rule? RhCl(PPh<sub>3</sub>)<sub>3</sub>, [Rh(bipy)<sub>2</sub>Cl]<sup>+</sup>
  - (h) Show the possible bonding modes of CO in organometallic complexes.
  - (i) Why does Wilkinson's catalyst act in a selective manner?
  - (j) At what pH is phosphate separation carried out by FeCl<sub>3</sub>?
  - (k) State the origin of red colour of oxyhaemoglobin.
  - (1) Name a metal ion other than iron which is involved in the dioxygen transport in biological system.
- 2. (a) Cite the role of  $Fe^{3+}/Fe^{2+}$  in the basic chemical reactions of the biological systems.
  - (b) What is to be done in the detection of cations by group separation if copper phosphate and zinc phosphate are present in a salt mixture? Give reasons. 3+2
- **3.** (a) Draw the mechanistic steps for the generation of butanal from propene. Indicate the catalyst species and the 18e/16e intermediates formed.
  - (b) Draw the structure of the products for the reaction of Ferrocene with RCOCI and  $AlCl_3$ . 3+2

**Please Turn Over** 

1×10

**4.** (a) Draw the active site structure of Myoglobin and Hemerythrin and comment on the oxygen binding modes for each.

(2)

- (b) How is ferrocene converted to  $(\eta^5 C_5H_5)Fe(\eta^5 C_5H_4NH_2)$ ? 3+2
- 5. (a) In the IR spectrum of free MeCH =  $CH_2$ ,  $v_{C=C}$  comes at 1652 cm<sup>-1</sup>, but in the complex K[PtCl<sub>3</sub>(MeCH=CH<sub>2</sub>)], the corresponding absorption is at 1504 cm<sup>-1</sup>. Comment on the experimental result.
  - (b) What is the toxic effect of the presence of arsenic in drinking water? 3+2
- 6. (a) What is the group reagent for the precipitation of Gr.III-A cations? Why is NaOH not used as a reagent for the above separation?
  - (b) Name two metal dependant diseases. 3+2
- 7. (a) What is the function of Na-K ion pump?
  - (b) What is synergic effect and how does it relate to metal-carbonyl bonding? 3+2
- 8. (a) Explain the mechanism of action of carbonic anhydrase and how it helps in the transport of  $CO_2$  by Haemoglobin.
  - (b) Show by examples oxidative addition and insertion reactions in organometallic complexes. 3+2
- 9. (a) Explain the role of Glu-270 in the hydrolytic mechanism of Carboxypeptidase A.
  - (b) Draw the microenvironment of the active site of Hemocyanin. 3+2
- 10. (a) Show the role of  $[PdCl_4]^{2-}$  in the transformation of ethylene to acetaldehyde using mechanistic steps.
  - (b) What prevents simple iron-porphyrins from functioning as  $O_2$  carriers like Haemoglobin? 3+2
- **11.** (a) Illustrate by an example using its qualitative molecular orbital diagram the reason for the stability of 18e organometallic complexes.
  - (b) Give examples of a bulk and an ultra-trace element and identify them as essential or beneficial element of life. 3+2
- 12. (a) Discuss the structure and bonding of the Zeise's salt.
  - (b) On the basis of 18e rule, find 'z' and 'M' in the following:
    - (i)  $[Ni(NO)_3(SiMe_3)]^z$
    - (ii)  $[\eta^3 C_3H_3)(\eta^5 C_5H_5)M(CH_3)(NO)]$

NO has linear coordination in both cases.

- **13.** (a) Show the catalytic cycle for the polymerisation of propene using an organometallic catalyst.
  - (b) Why does  $Pb^{2+}$  appear both in Gr. 1 and Gr. IIA during qualitative analysis of inorganic salts?

3+2

3+2