



Register Number:  
Date: /04/2020

**ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27**  
**B.Sc. CHEMISTRY – VI SEMESTER**  
**SEMESTER EXAMINATION: APRIL 2020**  
**CH 6115: INORGANIC CHEMISTRY**

**Time: 2 ½ hrs**

**Max Marks:70**

**This paper contains THREE printed pages and THREE parts**

Element	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Rh
At. No.	21	22	23	24	25	26	27	28	29	30	45

**PART A**

Answer any **SIX** of the following questions.

**6 x 2 = 12**

1. Identify the coloured species among  $Ti^{3+}$ ,  $Sc^{3+}$ . Give reason for your answer.
2. Transition metals form complexes easily. Why?
3. Give an example each for an ambidentate ligand and a bidentate ligand.
4. Write the chemical reaction and catalyst composition to represent Monsanto acetic acid process.
5. Mention any two roles of  $Ca^{2+}$  in biological systems.
6. Write the general outer electronic configuration of lanthanides.
7. Give any two consequences of lanthanide contraction.
8. What does Pourbaix diagram depict?

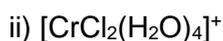
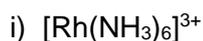
**PART B**

Answer any **EIGHT** of the following:

**8 X 6 = 48**

9. a) Give the IUPAC name for the following complexes:  
i)  $[Pt(NH_3)_4BrCl]Cl_2$     ii)  $Ag_2[Hgl_4]$     iii)  $[Co(NH_3)_6][FeCl_6]$

b) Calculate EAN of the central metal ion in the following complexes.



**(3+3)**

10. What are the postulates of Werner's theory? Explain how this theory accounts for the non-ionic nature of  $\text{CoCl}_3 \cdot 3\text{NH}_3$ .
11. The complex ion  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is octahedral and diamagnetic and the complex ion  $[\text{CoF}_6]^{3-}$  is also octahedral but paramagnetic. Explain this observation using Valence Bond Theory.
12. Draw and explain the crystal field splitting of d orbitals in a tetrahedral field of ligands. Calculate the CFSE for a tetrahedral  $d^4$  system.
13. Identify the complex from each pair which has higher value of  $\Delta_o$ . Give reason for your choice.
- i)  $[\text{Fe}(\text{CN})_6]^{3-}$  and  $[\text{Fe}(\text{CN})_6]^{4-}$
- ii)  $[\text{Co}(\text{NH}_3)_6]^{3+}$  and  $[\text{Rh}(\text{NH}_3)_6]^{3+}$
- iii)  $[\text{Co}(\text{Cl})_6]^{4-}$  and  $[\text{Co}(\text{en})_3]^{2+}$
14. Explain the mechanism of co-operativity in the binding of oxygen to haemoglobin.
15. Give the synthesis and draw the structure of the following organometallic compounds.
- i)  $\text{Ni}(\text{CO})_4$                       ii)  $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$
16. Discuss the bonding in transition metal carbonyls. Explain the synergic effect in M-CO bonding.
17. Explain the separation of lanthanide ions by ion-exchange chromatography.
18. Discuss the extraction of lithium from lepidolite.

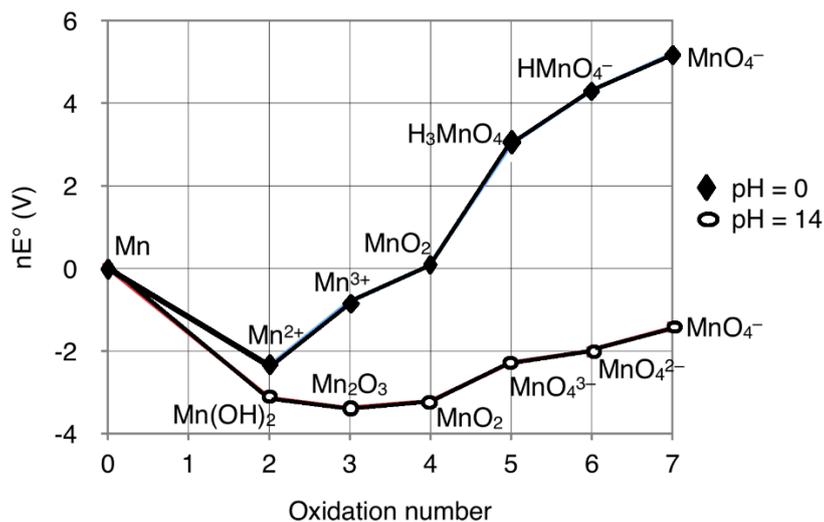
### PART C

Answer any **TWO** of the following:

**2 X 5 = 10**

19. An octahedral complex of Co(III) with two ethylene diamine, one  $\text{Cl}^-$ , and one  $\text{NO}_2^-$  ligands has been prepared. Give the structures of a pair of linkage isomers and optical isomers each.
20. A first row transition metal ion  $\text{M}^{3+}$  forms two octahedral coordination complexes A and B. The CFSE of A =  $-6 Dq$  and B =  $-16 Dq$ . Identify the metal ion with proper explanation.

21. The Frost diagram of Mn is given below. Identify,



- The most stable species under acidic medium
- The species that likely to undergo disproportionation under basic medium.
- The redox couple with highest reduction potential
- The best reducing agent.
- Potassium permanganate can be used to oxidize chloride ions to produce chlorine gas and  $Mn^{2+}$ . Which medium will be the best to run this reaction?

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