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I Semester M.Sc. Degree Examination, November/December 2019

(CBCS)

**INDUSTRIAL CHEMISTRY**

**Inorganic Chemistry**

Time : 3 Hours]

[Max. Marks : 70

**Instructions :** Answer any **five** from Part A and any **five** question from Part B. Figures to the right indicate marks.

PART - A

Answer **any five** questions :

(5 × 2 = 10)

1. (a) What are zeolites? Mention any two applications of them.
- (b) Complete the following reactions :
  - (i)  $\text{ClF}_3 + \text{SbF}_5 \rightarrow$
  - (ii)  $\text{XeF}_6 + \text{H}_2\text{O} \rightarrow$
- (c) Define the terms-pyrometallurgy and hydrometallurgy.
- (d) Indicate which of the following reactions is thermodynamically favourable and justify your answer :
  - (i)  $\text{Fe(s)} + \text{Cl}_2(\text{aq}) \leftrightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq}) \quad \Delta G^\circ = -347 \text{ kJ/mol}$
  - (ii)  $\text{Fe(s)} + 3\text{Cl}_2(\text{aq}) \leftrightarrow 2\text{Fe}^{3+}(\text{aq}) + 6\text{Cl}^-(\text{aq}) \quad \Delta G^\circ = -405 \text{ kJ/mol}$
- (e) Bis arenes of Cr, Mo or W are readily oxidized but not ferrocene. Explain.

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- (f) How many stretching modes are present in  $\text{CO}_2$  and  $\text{NO}_2$  molecules?
- (g) Find the result of the operation,  $S_n^n$  when (i)  $n$  is odd and (ii)  $n$  is even.
- (h) What are the essential symmetry elements present in one and missing in another of the pair  $D_{4h}$  and  $C_{4h}$ ?

### PART - B

Answer **any five** full questions :

(5 × 12 = 60)

2. (a) Write briefly on preparation and structures of oxyacids of sulphur.
- (b) Borazine is called as inorganic benzene. Substantiate this statement with appropriate reactions.
- (c) Give the importance of alkali metal complexes of cryptands and calixarenes. (5 + 3 + 4)
3. (a) How are  $(\text{NPCl}_2)_3$  and  $(\text{NPCl}_2)_4$  prepared? Discuss the bonding in the tricyclic compound.
- (b) What are pseudohalogens? Give the preparation and properties of any two.
- (c) Explain the bonding and possible structures for  $\text{B}_5\text{H}_9$  on the basis of 'STYX' number. (5 + 3 + 4)
4. (a) Draw the Ellingham diagrams showing the standard energies for the formation of different metal oxides and explain the salient features.
- (b) With the aid of Latimer diagrams, explain the redox chemistry of manganese in aqueous solution. (6 + 6)
5. (a) What oxidation state change does each metal undergo in the following reactions or half reactions?
- (i)  $[\text{Cr}_2\text{O}_7]^{2-} + 14\text{H}^+ + 6\text{e} \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$
- (ii)  $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$
- (iii)  $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$
- (iv)  $[\text{MnO}_4]^- + 2\text{H}_2\text{O} + 3\text{e} \rightarrow \text{MnO}_2 + 4[\text{OH}]^-$ .