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OR

MnO<sub>2</sub> is fused with fusion mixture with a pinch of KNO<sub>3</sub> followed by extraction in dil. H<sub>2</sub>SO<sub>4</sub>. Give balanced chemical reactions and explain with reasons of colour changes. 2

- b) What happens when CH<sub>3</sub>I is added to THF solution of Fe(CO)<sub>5</sub> in presence of metallic sodium and AlEt<sub>3</sub> at dry oxygen free condition followed by passage of CO and addition of mineral acid ? Write chemical reaction of the steps. 2
- c) Upon addition of KCN to Co(II)-acetate solution a purple crystalline compound (A) is precipitated from green supernatant. Give the structure of species which show purple and green coloration. 1  $\frac{1}{2}$
- d) Write note on (any **one**) : 1  $\frac{1}{2}$
- i) Fe-NO complexes; ii) Dioxygen cobalt complexes; iii) Multinuclear manganese complexes
7. a) Name two ores of nickel.
- b) Discuss the different steps involved in the extraction of nickel from Sudbury Ore.
- c) Explain the procedures with reactions, in appropriate cases, the isolation of rhodium, iridium and osmium from the 'Concentrate'. 1+3+3

*General Proficiency 1*

Ex/FCH/I/XIII/34/2017

**FINAL B. SC. EXAMINATION, 2017**

( 1st Semester )

**CHEMISTRY (HONOURS)**

**PAPER - XIII**

**INORGANIC CHEMISTRY**

Time : Two hours

Full Marks : 50

Answer **all** questions

1. a) In crystal field theory why the octahedral splitting is more predominant than tetrahedral splitting ? Calculate the CFSE of the octahedral Co(III) complexes in its paramagnetic and diamagnetic states. 2+1
- b) What is Irving-Williams stability order and why Cu(II) system do not follow this stability order ? Does this affect the geometry of the Cu(II) octahedral complexes ? Explain with reason. 1+1+2
2. a) In brief explain how the mechanism of nuclear beta decay was established. 2  $\frac{1}{2}$
- b) Discuss the energy terms associated with the concept of the liquid drop model of the nucleus. Which of these change significantly when a nucleus undergoes fission. 2

OR

Describe the formation and decay of the compound nucleus in artificial radioactivity describing important aspects. 2

[ Turn over

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- c) Mention two applications of gamma rays in analytical techniques. 1
- d) Mention three differences between fission and spallation reactions.  $1\frac{1}{2}$

OR

What is fusion ? Discuss the process with regard to any one established mechanism.  $1\frac{1}{2}$

3. a) What is Zeigler-Natta catalyst ? Discuss the probable mechanism for its functioning.
- b) How very pure titanium can be extracted from its important ore ?
- c) Magnetic susceptibility measurement indicates that chromium (II) acetate monohydrate is diamagnetic in nature. How will you take into account the observed result ?
- d) Write a short note on polyvanadates. 2+2+1+2
4. a) The effective magnetic moment of **Mohr's** salt is 5.51 BM at 300 K, higher than that of spin value only – Explain ?
- b) Explain why the ferricyanide ion  $[\text{Fe}(\text{CN})_6]^{3-}$  displays two intense absorptions, one in the visible and one in the UV while the ferrocyanide ion  $[\text{Fe}(\text{CN})_6]^{4-}$  shows only one intense band in the UV. Address the nature of the

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transition and to include a simple energy level diagram to aid your explanation.

- c) Determine the possible atomic term symbols arising from a  $3s^1 3d^1$  electron configuration. Give the degeneracy of each term symbol. 2+3+2
5. a) Find out the Symmetry Point group of the following species (any **four**) :
- i)  $\text{XeO}_3$ , ii)  $[\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2]$ , iii)  $\text{XeF}_5^-$ ,  $\text{B}_2\text{H}_6$ ,  
iv)  $[\text{Mn}_2(\text{CO})_{10}]$  v)  $\text{H}_2\text{CCCH}_2$ , vi) *cis*- $[\text{CoCl}_2(\text{en})_2]^+$
- b) Construct the group multiplication table of  $C_{2h}$  point symmetry group with the aid of matrix multiplication.
- c) Find out orbital symmetry notation of the following orbitals : The 2s and 2p (collinear with  $C_3$  axis) AOs of boron in  $\text{BF}_3$

OR

$4d_{x^2-y^2}$  and  $4d_{xy}$  AOs in  $[\text{PdCl}_4]^{2-}$

- d) Find out the genuine operations under  $S_3$  symmetry element. 2+2+2+1
6. a) How do you synthesize pure  $\text{KMnO}_4$  ? Standardization of  $\text{KMnO}_4$  solution using standard oxalic acid solution shows that initial reaction is very slow under warm condition while reaction becomes faster with time. Explain. 2

[ Turn over