

Name:			
Enrolment No:			
UPES End Semester Examination, May 2023			
Course: Inorganic Chemistry III Program: B Sc (H) Chemistry Course Code: CHEM-2023		Semester : IV Time : 03 hrs. Max. Marks: 100	
Instructions: Write your Roll No. on the top immediately on receipt of this question paper. There shall be three Sections (Section A, Section B and Section C) in the Question Paper & TWO pages. Section A contains 5 Questions of 4 marks each. All are compulsory. Section B- This section shall have 4 Questions of 10 marks each, Q9 has internal choice. Section C shall have 2 Questions of 20 marks each, Q11 has internal choice.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	a) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is square planar, while CuCl_4^{2-} is tetrahedral. Give reason. b) Why do transition metals acts as a good catalysts ?	4	CO1 CO2
Q2	Calculate in kJmol^{-1} , the crystal field stabilization energy (CFSE) attained by Fe^{2+} ion in an octahedral oxide ion environment. Given, Δ_o , for Fe^{2+} in oxide ion environment is 124 kJmol^{-1} . What will be the value of CFSE in a tetrahedral environment of oxide ion.	4	CO1
Q3	Given below are the Latimer diagram for Cr in acidic medium: $\text{Cr}_2\text{O}_7^{2-} \xrightarrow{1.33} \text{Cr}^{3+} \xrightarrow{-0.41} \text{Cr}^{2+} \xrightarrow{-0.91} \text{Cr}$ Answer the following questions: a) Write the half reaction for the conversion, $\text{Cr}_2\text{O}_7^{2-} \longrightarrow \text{Cr}^{3+}$ b) Is there any tendency of Cr^{2+} reduce to Cr ? Give reasons. c) Calculate the skip step emf for $\text{Cr}^{3+} \longrightarrow \text{Cr}$ change.	4	CO2
Q4	What is lanthanoid contraction? What are the major consequences of lanthanoid contraction?	4	CO3
Q5	${}^{235}_{92}\text{U} + \text{A} \longrightarrow {}^{236}_{92}\text{U} + \text{A} \longrightarrow \text{B} \xrightarrow[t_{1/2} \text{ 6.7 days}]{\beta} \text{C}$ Find A , B and C from the above reaction.	4	CO3
SECTION B (4Qx10M= 40 Marks)			
Q6	Explain the MO (molecular orbital) diagram for a complex of tetrahedral symmetry. Draw the correct structures of <i>cis</i> - $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$ and <i>trans</i> - $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$	10	CO1

Q7	Discuss trends in stability of oxidation states and magnetic properties of transition elements.	10	CO2
Q8	Describe ion exchange method for the separation and purification of the lanthanides.	10	CO3
Q9	Write the actinides in series with their atomic number, element correct name or symbol. Describe preparation of the actinides: a) Through nuclear fission of $^{235}_{92}\text{U}$ to Np isotopes and Pu isotopes. b) Isotopes of element Pu by succession of (n, γ) reactions. <i>or</i> Illustrate occurrence, extraction and uses of Uranium (U) and Thorium (Th) elements of actinide series.	10	CO3
SECTION-C (2Qx20M=40 Marks)			
Q10	a) Based on the VBT explain the geometry and magnetic property of a complex $[\text{Fe}(\text{CN})_6]^{4-}$. b) From the following Latimer diagram, calculate the value of E° for the reaction: $2 \text{HO}_2(\text{aq}) \rightarrow \text{O}_2(\text{g}) + \text{H}_2\text{O}_2(\text{aq})$. $\text{O}_2 \xrightarrow{-0.125} \text{HO}_2 \xrightarrow{+1.510} \text{H}_2\text{O}_2$ Comment on the thermodynamic tendency of HO2 to undergo disproportionation.	20	CO1 CO2
Q11	a) Compare the general properties of actinides with lanthanides. b) How protactinium (Pa) is extracted and discuss (+IV) and (+V) oxidation states compound of Pa. <i>or</i> a) Illustrate chemical properties of Uranium (U) and discuss in brief about hydrides, oxides and halides of U. b) Discuss about occurrence, extraction and stable oxidation states of Neptunium (Np), Plutonium (Pu) and Americium (Am).	20	CO3