LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **CHEMISTRY**

FIFTH SEMESTER – **APRIL 2025**

UCH 5504 – TRANSITION ELEMENTS AND NUCLEAR CHEMISTRY

Date: 06-05-2025 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**True or False**	
a)	Transition metals have high atomic volumes and therefore, their densities are not very high.	
b)	Smelting is the process of oxidation.	
c)	Yttrium occurs with lanthanides.	
d)	$_{92}U^{235}$ is a fertile nuclide.	
e)	Liquid Na is used as moderator in a nuclear reactor.	
2.	**Fill in the blanks**	
a)	Number of unpaired electrons present in Mn(II) ion is _____.	
b)	Sulphide ores are usually purified by _____ .	
c)	Compared to s, p and d orbitals shielding power of 'f' orbital will be _____ .	
d)	Modern unit of radioactivity is _____ .	
e)	Rocks can be detected by following the decay of _____ .	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Multiple Choice Questions**	
a)	Which one of the following electronic configuration represents transition elements? (a) $ns^2\ np^6$ (b) ns^2 (c) $ns^2\ (n-1)d^{1-10}$ (d) $ns^2\ np^{1-5}$	
b)	Calcination refers to (a) roasting in air (b) reduction (c) heating an ore with Ca (d) roasting in absence of air	
c)	Which of the following rare earth elements does not occur naturally? (a) Praseodymium (b) promethium (c) thulium (d) lutetium	
d)	^{24}Na and ^{24}Mg are examples of (a) isobars (b) isotones (c) isotopes (d) nuclear isomers	
e)	The thermal neutrons are associated with the energy of order of (a) 10 MeV (b) 1 MeV (c) 100 eV (d) less than 1 eV	
4.	**Define the following**	
a)	Amalgam formation	
b)	Ore dressing	
c)	Inner transition elements	
d)	Average life period	
e)	Magic numbers	

SECTION B - K3 (CO2)		
Answer any TWO of the following		**(2 x 10 = 20)**
5.	(a) Explain the colour and magnetic properties of first row transition elements.	(5)
	(b) Transition elements can form complexes in zero or negative oxidation states. Justify.	(5)
6.	(a) How are ores classified?	(5)
	(b) Name the various furnaces that are used in metallurgical processes. What are their special features?	(5)
7.	(a) Explain the important consequences of lanthanide contraction.	(5)
	(b) Discuss the separation of lanthanides using ion exchange chromatography.	(5)
8.	(a) What are the important properties of nucleus?	(5)
	(b) Write a note on meson exchange theory of nuclear forces.	(5)
SECTION C – K4 (CO3)		
Answer any TWO of the following		**(2 x 10 = 20)**
9.	(a) List the characteristic chemical properties of d-block elements.	(5)
	(b) Though transition elements possess high electrode potential, yet they are not good reducing agents. Explain.	(5)
10.	Explain the following: (i) Electrolytic refining and (ii) Zone refining.	(5+5)
11.	(a) The lanthanides resemble alkaline earth metals more than they do for the transition metals. Explain.	(5)
	(b) Compare the complex formation tendency and magnetic properties of lanthanides and actinides.	(5)
12.	(a) How are binding energies related to mass numbers? Give the significance of this relationship.	(5)
	(b) Explain the term K electron capture with suitable examples.	(5)
SECTION D – K5 (CO4)		
Answer any ONE of the following		**(1 x 20 = 20)**
13.	(a) What is meant by spin-only magnetic moment? Give the unit of that quantity. Calculate the spin-only magnetic moments of the following complexes: (i) $[Ni(CO)_4]$ (ii) $K_4[Fe(CN)_6]$ (iii) $[CoCl_4]^{2-}$ (iv) $[Co(H_2O)_6]^{2+}$	(10)
	(b) Explain the properties and heat treatment of iron.	(5)
	(c) Analyse the mechanism of electroplating of metals.	(5)
14.	(a) Analyse the choice of reduction of metals by using Ellingham diagram.	(12)
	(b) Explain the extraction of titanium from its ore.	(8)
SECTION E – K6 (CO5)		
Answer any ONE of the following		**(1 x 20 = 20)**
15.	(a) Name an economically viable source of uranium. How is uranium extracted from it? What are the uses of uranium?	(10)
	(b) Write the comparative account of lanthanides and actinides.	(10)
16.	(a) Explain the working principle of breeder reactor and discuss the fuels, moderators and coolants used in it.	(10)
	(b) Discuss the measurements of radioactivity by any two methods.	(10)
