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

Answer ANY FOUR of the following **(4 x 10 = 40)**

1. Explain the electronic configuration of 3d, 4d and 5d transition metal series. Account for the statement that the electronic structure for Ti^{3+} is $[Ar]3d^1$ and not $[Ar]4s^1$.
2. a) Rationalise that the atomic radii decrease very gradually from scandium to copper.
   b) Name the coinage metals. (5+5)
3. a) Explain in detail how do you find out the oxidation states of the metals in each of the following ores. (i) Ilmenite (ii) Magnetite.
   b) Iron rusts neither in oxygen-free pure water nor in moisture-free pure oxygen – Reason out. (5+5)
4. Explain that transition metal ions are generally coloured due to presence of unpaired d-electrons.
5. Discuss the magnetic properties of transition metal ions.
6. a) Calculate the mass defect of oxygen atom, $_8O^{16}$ which has a mass of 15.994910 amu. Given that the mass of a neutron = 1.008665 amu, the mass of a proton = 1.007277 amu, and the mass of an electron = 0.0005486 amu.
   b) State Fajan, Russel and Soddy's group displacement law. (5+5)
7. Write the characteristics of alpha and beta particles.
8. a) Radioactive actinium $_{89}Ac^{227}$ undergoes the series of disintegration leading to the formation of lead $_{82}Pb^{207}$. How many alpha particles are involved?
   b) Write any five applications of Radio isotopes. (5+5)

SECTION B

Answer ANY THREE of the following **(3 x 20 = 60)**

9. Write a note on Kroll's Process and Froth Flotation Process.
10. a) Write a note on half-life of radioactive element.
    b) Explain Stellar Energy. (10+10)
11. a) Write a note on Ellingham Diagram and its uses.
    b) Describes the metallurgical processes such as smelting and calcination. (10+10)
12. a) Discuss the separation of lanthanides using solvent extraction method.
    b) Explain lanthanide contraction. (10+10)
13. Describe the uses of neutron activation analysis and radiopharmaceuticals.
14. Define nuclear fission. Discuss the characteristic features of nuclear reactors

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