[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1075 **I**

Unique Paper Code : 2172012301

Name of the Paper : DSC 7: Chemistry of d and f Block Elements & Quantitative Inorganic Analysis (NEP-UGCF-2022)

Name of the Course : **B.Sc. (Hons.) Chemistry**

Semester : III

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** questions in all.
3. **All** questions carry equal marks.

P.T.O.

1. Explain :

(a) (i) The factors responsible for formation of a large number of complexes by transition metals.

(ii) Actinides have a greater tendency to form complexes than lanthanides. (5)

(b) Electronic spectra of Ln^{3+} complexes are similar irrespective of change of ligand. (5)

(c) The coordination numbers of the elements of second and third transition series tend to be greater than for the first transition series. (5)

2. Explain why :

(a) (i) Fewer number of oxidation states are available at each end of the first transition series than in the middle?

(ii) Transition metals in high oxidation states are generally available as fluorides or oxides? (5)

(b) Lanthanides predominantly exhibit a +3 oxidation state while actinides exhibit other than +3 oxidation states. (5)

(c) (i) Transition elements and their compounds act as good catalysts.

(ii) Absorption spectra of transition metal ions are broad. (5)

3. (a) (i) Write the number of unpaired electrons in Ce^{4+}(At. No.=58) and Eu^{3+}(At. No.=63).

(ii) Why aqueous solutions of Eu^{3+} is pale pink while Ce^{4+} is orange red? (5)

(b) Calculate the magnetic moment of Europium (III) (L=3). Explain the discrepancy between observed (3.4-3.6 BM) and calculated value. (5)

(c) Explain **(any one)** :

(i) Micas are harder than clay.

(ii) Structure of cyclic phosphazene (trimer).

(2.5)

(d) Advantages and disadvantages of digestion in gravimetric analysis. (2.5)

4. (a) Given below are the Latimer diagrams of Mn (Reduction potential, E° in Volt) in acidic medium and basic medium :

Acidic medium:

$$MnO_4^- \xrightarrow{+0.56} MnO_4^{2-} \xrightarrow{+2.27} MnO_2 \xrightarrow{+0.95} Mn^{3+} \xrightarrow{+1.51} Mn^{2+} \xrightarrow{-1.18} Mn$$

Basic medium:

$$MnO_4^- \xrightarrow{+0.58} MnO_4^{2-} \xrightarrow{+0.6} MnO_2 \xrightarrow{+0.15} Mn^{3+} \xrightarrow{-0.25} Mn(OH)_2 \xrightarrow{-1.56} Mn$$

Answer the following questions with the help of above diagrams :

(i) Write the balanced half reaction for the reduction of MnO_4^- to Mn^{2+} in acidic medium. Find the standard reduction potential for the reaction.

(ii) In which of the medium, acidic or basic Mn(III) is more stable? Justify your answer.

(iii) Using the given Latimer diagram for manganese in acidic medium, construct the Frost diagram to determine the most stable oxidation state of manganese. Explain your reasoning based on the diagram.

(2+1.5+4=7.5)

(b) (i) Explain the reason for the validity of spin only expression to calculate the magnetic moment for ions of first transition series.

(ii) A M^{2+} ion of first transition series has been observed to have four unpaired electrons. Calculate its magnetic moment using spin-only formula,

(iii) What is the effect of curie temperature in ferromagnetism? (2.5×3=7.5)

5. (a) (i) Write a short note on borates.

(ii) Discuss the primary differences in the general properties of inorganic and organic polymers (any three). (2.5×2)

(b) (i) What is the structural difference between pyroxines and amphiboles?

(ii) Draw the structures of following ions :

$Si_2O_7^{2-}$, $Si_3O_9^{6-}$ (2+3)

(c) (i) Mention the criteria while selecting a wash solution in the gravimetric analysis.

(ii) Which is more effective for washing a precipitate in the gravimetric analysis: using two portions of 50 mL or ten portions of 10 mL of each? Justify your answer. (2+3)

6. (a) (i) What are silicones? What are the chain building and chain stopping units in silicones?

(ii) Identify the industries from the following which use silicones:

Rubber, Glass, Oil, Cement (5)

(b) Match the uses with the polymers

Gemstones	montmorillonites
Textiles	orthosilicates
Fertilizers	polyphosphazenes
Paints	phosphates
Corrosion protection	Borates

(5)

(c) Write short note on **any one** of the following :

(i) Ion exchange method for separation of lanthanides

(ii) Lanthanide contraction and its consequences

(5)