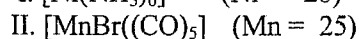
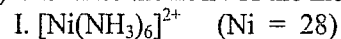
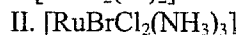
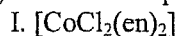


Part B- Structured Essay (110 marks)

1. (a)(i) Calculate the EAN of the metal centre in each of the following complexes



(ii) Draw all the possible isomers of each of the following complexes.



(iii) Ethylenediaminetetraacetic acid (H_4Y) can act as a hexadentate ligand. Its tetraacetate ion Y^{4-} can complex with a variety of metal ions (Mg^{2+} , Ca^{2+} , etc) and this forms the basis of Complexometric titrations. Draw the structure of complex CaY^{2-} .

(35 marks)

(b) (i) Crystal Field Splitting Energy (Δ_0) for $[\text{Ir}(\text{NH}_3)_6]^{3+}$ is $41,000 \text{ cm}^{-1}$ [$\text{Ir} = 6s^2 5d^7$]. What is the wavelength of maximum absorption (λ_{max})? ($h = 6.63 \times 10^{-34} \text{ Js}$; $c = 3 \times 10^8 \text{ ms}^{-1}$).

(iii) Using Crystal Field Theory, calculate the magnetic moment (μ) of the complex $[\text{CrCl}_6]^{3-}$. Indicate whether it is diamagnetic or paramagnetic.

($\mu = [n(n+2)]^{1/2}$ B.M, where n is the number of unpaired electrons).

(20 marks)

(c)(i) Write down the main assumptions made in the Valence Bond Theory (VBT)

(ii) If the magnetic moment of $[\text{MnBr}_4]^{2-}$ is 3.8 BM (i.e., it contains 3 unpaired electrons), what is the geometry of this complex ion?

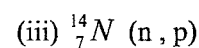
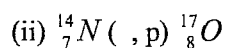
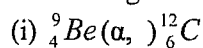
(15 marks)

2. (a)(i) Write down the relationship between half-life ($t_{1/2}$) and the decay constant (λ)

(ii) The half-life ^{14}C is 5600 years. How long would it take for a sample containing 104mg of ^{14}C to become 3.125%?

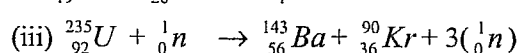
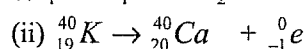
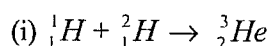
(10 marks)

(b) Write complete nuclear equations for the nuclear reactions represented by the following:



(15 marks)

(c) Identify the following reactions as radioactive decay, fission, fusion and chain reactions.



(15 marks)

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