

(4)

Ex./M.Sc/CH/II/U-1031/9/2018

M.Sc. CHEMISTRY EXAMINATION, 2018

(1st Semester)

INORGANIC CHEMISTRY

Paper - III

Time : Two hours

Full Marks : 50

(25 marks for each unit)

Use a separate answerscript for each unit.

UNIT - 1031

- (c) In your own words explain "Neutron Activation Analysis". Why do you think "Proton Activation Analysis" is not so well established technique ? $2+1/2$
- (d) ^{235}U can undergo fission with slow neutrons whereas ^{238}U require high energy neutrons to cause fission. Explain the fact. $2 1/2$
- (e) Write down and explain Fermi's four factor formula. $1/2+2$
- (f) From the concept of nuclear fission, derive the condition for the fission parameter Z^2/A . What is the significance of such a parameter ? $2+1/2$
- (g) What is a "fast breeder reactor" ? Explain with the help of appropriate equations. $1 1/2+1$

— X —

1. Answer the following questions :

- (a) The $[\text{CrF}_6]^{3-}$ shows three absorption bands at 14,900, 22,700, and 34,400 cm^{-1} , respectively. Assign the bands. Calculate 10 Dq and B values. What is the expected color of the complex ? 4
- (b) Construct the Ligand Group Orbitals (LGO) and hence the Symmetry Adopted Linear Combination (SALC) to form the bonding and antibonding orbitals in an octahedral complex of the type ML_6 including π -interactions and draw the appropriate MO diagram of the complex. 5
- (c) Taking suitable example how you will demonstrate the overlap between metal and ligand orbitals in an octahedral complex ? 2

(Turn over)

(2)

(d) Addition of a Fe^{3+} salt into an aqueous solution of $\text{K}_4[\text{Fe}(\text{CN})_6]$ leads to the formation of a deep blue color of the resulting solution. Explain the origin of the color. 2

2. Answer the following questions :

(a) With the help of molecular orbital diagram, explain why the octahedral transition metal carbonyls obey the 18 electron rule. 2

(b) Discuss the probable modes of addition reaction in square planar complexes. 2

(c) Discuss any one of the mechanisms of cyclometalation reaction. Mention the importance of transition metal cyclometalated complexes. 2+1

(d) Define oxidative addition and reductive elimination reactions. Discuss the concerted mechanism of oxidative addition reaction. 1+2

(e) Describe 1,1 and 1,2-insertion reactions with examples. 2

UNIT - 1032A

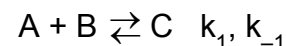
3. (a) Discuss with one example of a chemical system which is thermodynamically unstable but inert. $2\frac{1}{2}$

(b) $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]^+$ rapidly aquates although low-spin Co(III) is inert to substitution. Explain with proper reasoning. 4

(3)

(c) Consider the acid catalyzed aquation of $[\text{M}(\text{NH}_3)_5\text{X}]^{2+}$. When $\text{X} = \text{F}$, then the aquation rate is higher than that for $\text{X} = \text{Cl}, \text{Br}$ or I . What conclusions we can draw from this observation? $2\frac{1}{2}$

(d) For the reaction



where A and B are reactants to form an intermediate C in equilibrium (Equilibrium constant $K = k_1/k_{-1}$) and then C gives rise to products in the rate step k_2 . Given the initial condition $[\text{A}]_0 \ll [\text{B}]_0$, how could you determine K and k_2 ? $3\frac{1}{2}$

UNIT - 1032B

Answer any **five** questions.

4. (a) Derive the equation to calculate recoil energy of daughter nucleus based on energy of γ -photon and mass number related with Szilard-Chalmer reaction. $2\frac{1}{2}$

(b) In a $^{79}\text{Br} (n, \gamma) ^{80}\text{Br}$ reaction the energy of γ -photon is 5 MeV and C-Br bond energy is 2.16 eV. Comment on the formation of ^{80}Br from $\text{C}_2\text{H}_5^{79}\text{Br}$. How one can isolate $\text{Ag}^{38}\text{Cl}(\text{s})$ from an aqueous solution of $\text{Na}^{37}\text{ClO}_3$? $1\frac{1}{2}+1$

(Turn over)