



‘সমানো মন্ত্র: সমিতি: সমানী’

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 4th Semester Examination, 2023

GE2-P2-CHEMISTRY

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.***Use separate Answer scripts for Section-A (Inorganic) and Section-B (Physical)****SECTION-A**

Marks: 18

INORGANIC CHEMISTRY**GROUP-A**

1. Answer any **three** questions from the following: 1×3 = 3
- (a) Give one example each of the tridentate ligand and hexadentate ligand.
- (b) Calculate CFSE and spin only magnetic moment for $[\text{Fe}(\text{CN})_6]^{4-}$ complex ion.
- (c) Write down the IUPAC name of the complex
 $[\text{Co}(\text{en})_2(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$
- (d) What are d-block elements? Give examples.
- (e) Why does Europium (Eu) exhibit +2 oxidation state instead of +3 oxidation state?

GROUP-B

2. Answer any **one** question from the following: 5×1 = 5
- (a) (i) What is Jahn-Teller distortion? Explain with example. 3
- (ii) How many geometrical isomers are possible for $[\text{Mn}(\text{en})_2\text{Br}_2]$ complex? Draw their structures. 2
- (b) (i) Write down the consequences of lanthanide contraction. 2½
- (ii) The d-block elements are generally coloured — Explain. 2½

GROUP-C

3. Answer any **one** question from the following: 10×1 = 10
- (a) (i) Distinguish between $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$ and $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ with relevant chemical reaction. 2
- (ii) Explain why Δ_t is less than Δ_o . 2
- (iii) What is tetragonal distortion? Draw the approximate d-orbital energy level diagram for the same. 1+2
- (iv) Which of the following has a larger value of Δ_o and why: 3
 $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Rh}(\text{H}_2\text{O})_6]^{3+}$

- (b) (i) Explain why transition metals form large number of complexes. 3
(ii) Write down the differences between the properties of lanthanoids and actinoids. 3
(iii) Why are chelate complexes more stable than non-chelate complexes having similar metal-donor atom linkage? Explain with an example. 3
(iv) Give an example of coordination isomerism. 1

SECTION-B

Marks: 22

PHYSICAL CHEMISTRY

GROUP-A

4. Answer any *two* questions from the following: $1 \times 2 = 2$
- (a) The SI unit of viscosity is _____.
- (b) Compressibility factor of a real gas at high pressure is
- (i) $1 + \frac{Pb}{RT}$ (ii) $1 + \frac{RT}{Pb}$ (iii) $1 - \frac{Pb}{RT}$ (iv) $1 - \frac{RT}{Pb}$
- (c) Give one example of zero order reaction.

GROUP-B

5. Answer any *two* questions from the following: $5 \times 2 = 10$
- (a) (i) Explain the effect of temperature on viscosity of gases which is different from the liquid. 2
(ii) A second order reaction in which the initial concentration of both the reactants are same is 25% completed in 600 seconds. How long will it take for the reaction to go to 70% completion? 3
- (b) (i) What are the causes of deviation of real gases from an ideal behaviour? 2
(ii) Derive the expression for rate constant of a second order reaction. 3
- (c) (i) Calculate the activation energy of a reaction whose rate constant is tripled by a 10° rise in temperature in the vicinity of 27°C . 2
(ii) What is Miller indices? Write down the Bragg's law. 1+2

GROUP-C

6. Answer any *one* question from the following: $10 \times 1 = 10$
- (a) (i) What is the difference between order and molecularity of a reaction? 2
(ii) Elementary reactions with molecularity greater than 3 generally does not occur — Explain. 3
(iii) Cube has the highest symmetry — Explain. 2
(iv) Discuss the crystal structure of NaCl. 3
- (b) (i) What is mean free path? Discuss the effect of temperature on it. 1+2
(ii) State and explain the law of corresponding states. 3
(iii) Half life period of a first order reaction is independent of its initial concentration of reactants — Explain. 2
(iv) Discuss the effect of temperature on Maxwell's distribution of velocities. 2

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