

M. Sc. CHEMISTRY EXAMINATION, 2019

(4th Semester)

INORGANIC CHEMISTRY SPECIAL

PAPER - XV-I

Time : Two hours

Full Marks : 50

(25 Marks for each Unit)

Use a separate answerscript for each unit.

UNIT – I - 4151

Answer question *no. 1* and *any four* from the rest :

1. Answer *any five* : 1×5
 - a) What is the role of Na⁺ and K⁺ ions in animal cells ?
 - b) What do you mean by active transport ?
 - c) What is the role of structure specific recognition protein in DNA ?
 - d) What are chlorins systems ? Give one example.
 - e) Show hydrogen bonding interactions between thymine and adenine bases.
 - f) Why copper deficiency causes anaemia ?
2.
 - a) Discuss mechanism of anticancer activity of Cis-platin. 2
 - b) What are the different possible ways of metal complex binding with DNA ? 1

[Turn over

[2]

- c) What do you mean by LD₅₀ and LD₉₀ values ? Compare these values in case of NH₃ and alicyclic amines. 2
3. a) Schematically represent the role of photosystem I and photosystem II in photosynthesis. 2+2
- b) How water reduces photosystem II in presence of tetranuclear Mn(II) protein ? 1
4. a) What are the intermediate compounds formed during catalysis by peroxidase ? 1
- b) How the main intermediate compound in peroxidase differ from active site structure of Mb ? 2
- c) Schematically represent push-pull mechanism for peroxidase. 2
5. a) Draw active site structure of carbonic anhydrase (CA) and discuss plausible catalytic cycle for CA. 1+2
- b) pK_a value of CA is close to 7.0 whereas pK_a value of [Zn(OH₂)₆]²⁺ is about 9.0 – explain. 1
- c) Why sulfonamides are used in the treatment of glaucoma ? 1
6. a) Ascorbic acid oxisase and plastocyanin are what type of proteins ? 1
- b) Draw active site structure of Ascorbic acid oxisase. 2
- c) Show selective transport of mono and divalent ions by the tartarato crown ether. 2

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9. a) “Emission lifetime of Pyrene is 1.8×10^{-3} s which is much longer than Fluorescence life time (ns) but λ_{em} is the fluorescence wavelength.” Explain with plausible mechanism.
- b) “Benzoic acid is less acidic while phenol is more acidic at excited state.” Explain.

Or

- c) What happens when DNA is irradiated with UV light ? 3+2
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- g) "Upon light irradiation *trans*-rich isomer $[\text{Cr}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]^{2+}$ (where H_2O and Cl are in *trans* configuration) is formed from aqueous solution of $[\text{Cr}(\text{NH}_3)_5\text{Cl}]^{2+}$ while thermal reaction shows scrambling of isomers." Explain.
8. a) Account on the quenching mechanism at different concentration of Quencher [Q] added to the solution of fluorophore. Also determine $\phi_{\text{F}}^0 / \phi_{\text{F}}^{\text{Q}}$ (where ϕ_{F}^0 refers to in absence of Quencher and $\phi_{\text{F}}^{\text{Q}}$ refers to in presence of Quencher).
- b) "A molecule 'M' is irradiated and mixed with a second molecule 'X' to synthesise $[\text{M}^+\text{X}^-]$ while no such reaction is observed upon warming the mixture, in this case." Draw the state diagram of the process and explain.
- c) How does life time (τ) is related with intensity of emission? Is there any effect of M^{n+} (3d) on the value of τ of an organic fluorogenic ligand coordinated to the metal ion?

Or

- d) Write a short note on (*any one*) 'Design of Anion sensor' or 'Application of fluorescence technique in food quality control.'
- 4+3+3

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7. Answer the following questions (*any five*) : 2×5=10
- a) "7-Hydroxy-4-methylcoumarin and Fluorescein are pH sensitive." Are they following same mechanistic approach? Explain.
- b) "Photoaquation of $[\text{Cr}(\text{NH}_3)_5(\text{NCS})]\text{Cl}_2$ in slightly acidic medium is accelerated by 100 times upon addition of biacetyl." Explain.
- c) What happens when a solution of $\text{K}_2\text{C}_2\text{O}_4$ is added to coulometrically oxidized $[\text{Ru}(\text{bpy})_3]^{2+}$ solution at 1.26 V in acetonitrile? Write plausible mechanism of the reaction.
- d) "4-N, N-Dimethylbenzointrile in hexane and in tetrahydrofuran is irradiated with UV light." Draw the emission spectrum and explain the difference, if any.
- e) Upon addition of 4-N, N-diethylaniline to anthracene solution a new broad emission band at longer wavelength (585 nm) region to free anthracene (λ_{em} , 420 nm) is observed. The band intensity increases with increasing concentration of 4-N, N-diethylaniline but decreases on adding acid. Explain.
- f) What happens when aqueous solution of $\text{K}_3[\text{Cr}(\text{CN})_6]$ and $[\text{Ru}(\text{bpy})_3]\text{Cl}_2$ is irradiated with light of 450 nm. Explain your observation.

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