b) Draw a schematic line diagram of a spectrofluorometer and explain every part. Why are two monochromators placed perpendicularly?

c) Design a molecule for FRET and mention its advantages.

6. a) How is X-ray fluorescence useful for element detection? 2

b) "Although Cr(III) is paramagentic, $[Cr(NH_3)_6]^{3+}$ is eligible for photo-assisted aquation reaction." Explain. 2

Or

7. The fluorescence lifetime of a molecule in a solution is 5×10^{-9} s. The sum of all non-radiative rate constants (Σk_{nr}) for the decay of excited state is 1.2×10^{5} s^{-1}.

What is the value of the fluorescence Quantum Yield of the molecule? 4

8. a) What happens when a solution of $K_2C_2O_4$ is added to a solution of $[Ru(bpy)_3]^{3+}$ obtained by the electrochemical oxidation route in acetonitrile? Write chemical reaction and explain. $2\frac{1}{2}$

b) Explain the role of Chlorophyll in the water oxidation process. $2\frac{1}{2}$

M. Sc. Chemistry Examination, 2022

(4th Semester)

Inorganic Chemistry Special

Paper – XV-I

Time : Two hours Full Marks : 50

(25 marks for each unit)

Use a separate answer script for each Unit.

UNIT: I-4151

1. What is the role of carbonic anhydrase in the mammalian system? Draw the core unit of carbonic anhydrase B present in humans. Using the diagram mark or mention the portion that is the "apo enzyme"? Co^{2+} carbonic anhydrase B shows usual catalytic activity as the native enzyme. How do you think this was established? Why then did nature not select Co^{2+} over the metal ion it selected? $1\frac{1}{2}+1\frac{1}{2}+1\frac{1}{2}+1+1$

2. Answer ***any two*** questions: $3\frac{1}{2}\times2$

a) Compare and contrast the mechanism of action of *cis*-Platin and vanadocene dichloride as DNA targeting agents? $3\frac{1}{2}$

b) With at least two examples, highlight alkyl group transfer reactions on to a substrate with Vitamin B_{12} as co-enzyme. What is the mechanism for any one of them? $1\frac{1}{2}+2$

c) Mention the essential criteria to be kept in mind in designing a chelating agent that may be used as a drug. With two examples show how chelating agents have so far been used in biology. $1\frac{1}{2}+2$

3. a) Draw the active site structure of ascorbic acid oxidase. Mention different types of Cu centers present in it. 3

b) Mention the role of superoxide dismutase, catalase and peroxidase. What type of metal centers is present in them? $3\frac{1}{2}$

c) Draw the structure of 8Fe-8S ferredoxin. Mention the role of ceruloplasmin. 2+1

d) Draw the active site structure of cytochrome c oxidase and mention magnetic, EPR properties of different metal centers present. $1\frac{1}{2}+1\frac{1}{2}$

UNIT: I-4152

4. Answer ***any five*** questions : 5×2

a) Phenol shows higher acidity at excited state while 2-hydroxybenzaldehyde does not with reference to its ground state. Explain.

b) What happens upon irradiation of light to a mixture of methylene blue and Mohr's salt in dilute sulfuric acid? Explain your response.

c) $T_1 + \Delta \rightarrow S_1;\ S_1 \rightarrow S_0 + hv$

Account on the feasibility of such reaction and explain giving an example.

d) Irradiation of a hexane solution of 4-N, N′-Dimethylbenzonitrile (DMBN) shows emission at < 400 nm while tetrahydrofuran solution of DMBN shows broad high intense longer wavelength (>550 nm) emission band. Explain this observation.

e) Account for the quenching mechanism at different concentration of Quencher [Q] added to a solution of flurophore. Also determine Φ_F^0 / Φ_F^Q (where Φ_F^0 refers to absence of Quencher and Φ_F^Q refers to presence of Quencher).

f) Discuss the effect of the concentration of pyrene on the nature and energy of fluorescence spectrum in methanol.

g) Account on the effect of metal ions (M^{n+}) on the fluorescence process of a fluorogenic ligand. Consider M^{n+} to be a transition metal ion.

h) "Photodecomposition is sometimes observed at a lower energy than that of the chemical dissociation energy." Explain with quantum mechanical reasons.

5. Write notes on any ***two*** of the following : 3×2

a) Use of fluorescence technique for quality control of food products.