

[ 4 ]

- b) With a proper use of the radioactive equilibrium and the aspect of transformation of a target nucleus on being struck by a projectile (say a neutron) show  $N_2 = N_1 \sigma f t$  where, symbols have their usual meaning.
- c) With a suitable graphical representation discuss "Fricke dosimetry".
- d) With a suitable example explain radiometric titration when *either* the titrant is radiolabelled *or*, the indicator used is radiolabelled.

Ex/SC/CHEM/PG/CORE/TH/XV-A/2022

**M. Sc. (CHEMISTRY) EXAMINATION, 2022**

( 4th Semester, CBCS )

**ANALYTICAL CHEMISTRY SPECIAL**

**PAPER – XV-A**

Time : Two hours

Full Marks : 40

**(20 marks for each unit)**

**Use a separate answer script for each Unit.**

**UNIT: A-4151**

1. Answer *any five* questions : 5×2
- a) Phenol shows higher acidity at excited state while 2-hydroxybenzaldehyde does not with reference to the ground state. Explain.
- b) What happens upon irradiation of light to a mixture of methylene blue and Mohr's salt in dilute sulfuric acid medium? Explain your response.
- c)  $T_1 + \Delta \rightarrow S_1$ ;  $S_1 \rightarrow S_0 + h\nu$   
Account on the feasibility of such reactions and explain with a suitable example.
- d) Irradiation of a hexane solution of 4-N, N'-Dimethylbenzointrile (DMBN) shows emission at  $< 400$  nm while tetrahydrofuran solution of DMBN shows broad high intense longer wavelength ( $> 550$  nm) emission band. Explain this observation.

[ Turn over

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- e) Account on the quenching mechanism at different concentration of Quencher [Q] added to the solution of fluorophore. Also determine  $\Phi_F^0 / \Phi_F^Q$  (where  $\Phi_F^0$  refers to absence of Quencher and  $\Phi_F^Q$  refers to presence of Quencher).
- f) Discuss the effect of concentration of Pyrene on the nature and energy of fluorescence spectra in methanol.
- g) Account on the effect of metal ions ( $M^{n+}$ ) on the fluorescence process of a Fluorogenic ligand. Considering  $M^{n+}$  is 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.
2. Write Notes on (any **Two**) : 2×3
- a) Use of fluorescence technique for quality control of food products.
- 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.

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3. a) How is X-ray fluorescence useful for element detection? 2
- c) "Although Cr(III) is paramagnetic,  $[Cr(NH_3)_6]^{3+}$  is eligible for photo-assisted aquation reaction." Explain. 2

**UNIT: A-4152**

3. a) How are crystalline water and coordinated water distinguished by TGA? Give an example of TGA of "Blue vitriol" from ambient temperature to 300°C and comment on the different types of water molecules present in the structure. 1+2
- b) What is a null point balance? How does it work in a thermo-gravimetric instrument? 1+2
- c) What is power compensation DSC? How does it differ from heat flux DSC? Give a line diagram of the instrument, power compensation DSC mentioning all components. 1+1+2
4. Discuss the working of an organic scintillator explaining the principle involved in detail. 4
5. Answer **any two** questions : 3×2
- a) Describe the principle behind functioning of any "gas ionization detector".

[ Turn over