

U.G. 5th Semester Examination - 2021

CHEMISTRY

[HONOURS]

Course Code : CHEM-H-CC-T-12

Full Marks : 40

Time : 2½ Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **five** questions: 2×5=10
- i) Explain why Alum is used for cleaning muddy water.
 - ii) What is 'work of adhesion' and 'work of cohesion'?
 - iii) Explain why all adsorption processes are exothermic in nature.
 - iv) Explain why N₂ shows Raman spectrum but it does not show microwave or IR spectrum.
 - v) Explain how does population of energy levels influence the intensity of rotational spectral lines.

- vi) What is the significant of fingerprint region in the IR spectra?
- vii) Write the drawbacks of Grotthus-Draper law for photochemical changes.
- viii) What do you mean by Larmour precision?

2. Answer any **two** questions from the followings :5×2=10

- i)
 - a) Explain ESR spectrum of Benzene anion radical.
 - b) What magnetic field strength is required for proton magnetic resonance at 220 MHz? Given the factor 'g' for proton is 5.585. 2.5+2.5=5
- ii) Draw the different types of adsorption isotherm and explain these in the light of BET adsorption equation. 5
- iii) Write the quantum mechanical energy expression of a nonrigid rotator and hence show that energy levels are not equispaced. Also show that spacing is less than that of a rigid rotator. 1+2+2=5
- iv) Draw Jablonski diagram and write the difference between fluorescence and phosphorescence. 2+3=5

[Turn over]

3. Answer any **two** questions from the following :

$$10 \times 2 = 20$$

- i) a) What do you mean by quenching of fluorescence? Deduce Stern-Volmer equation and write its significance. 1+3+2
- b) An Uranyl oxalate actinometer is irradiated for 15 minutes with the radiation of 435 nm. At the end of this time, it is found that oxalic acid equivalent to 12 cc of 0.001 (M) KMnO_4 has been decomposed by the radiation, where the quantum efficiency is 0.58. Find the average intensity of the radiation used. 4
- ii) a) Write Morse potential and explain its significance with potential energy diagram. 2
- b) Compare hot fundamental band with normal fundamental band indicating the position of band centre and band width. 3
- c) The fundamental and first overtone transitions of NO gas are centred at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate the equilibrium vibration frequency, anharmonicity constant, zero point energy,

force constant, and the dissociation energy of the molecule. 5

- iii) a) Calculate the excess pressure inside a bubble floating in air. 2
- b) How does surface tension of a liquid vary with temperature? 2
- c) Deduce Gibbs adsorption equation. 4
- d) When 2.3×10^{-5} gm stearic acid ($M=284$) was placed on water as a surface film, the film could be compressed to an area of 100 cm^2 as monolayer. Find the cross section of acid molecule. 2