

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

M.A./M.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2015

FIRST YEAR [BATCH 2015-17]

APPLIED CHEMISTRY

Date : 28/12/2015

Time : 11 am – 1 pm

Paper : III

Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

Answer **any one** question :

[1×15]

1. a) What are Stokes and Anti Stokes Raman scattering? Explain why Stokes scattering are generally more intense than anti-Stokes scattering. [1+1+2]
b) The vibrational potential energy of a diatomic molecule can be represented approximately by the Morse function, $V = D[1 - \exp\{a(r_{eq} - r)\}]^2$ where terms have their usual significance. Show that V has a minimum value at $r = r_{eq}$. [4]
c) How will you determine the bond length of CO molecule using microwave spectroscopy? [4]
d) What are overtones and hot bands in vibrational spectroscopy? [3]
2. a) Explain the phenomenon of Fluorescence and phosphorescence with the help of the potential energy diagram. [4]
b) What are the essential conditions for a molecule to be Raman active? Explain Raman activity of different vibrational modes of CO₂ with the help of the change in shape and size of the polarizability ellipsoid. [2+3]
c) The force constant of CO is 1840 Nm⁻¹. Calculate the oscillation frequency and wave number in cm⁻¹. [3]
d) Explain qualitatively the selection rule $\Delta J = 0, \pm 2$ for Rotational Raman spectroscopy. [3]

Group – B

Unit - I

Answer **any two** questions :

[2×5]

3. a) Can the quantum efficiency be greater or less than 1?-----Explain. [1]
b) What is Photosensitized reaction? How does a chemical actinometer work? Explain it in case of oxalic acid actinometer. [4]
4. a) Calculate the energy of one photon of light of wavelength 2000 Å. Will it be able to dissociate a bond in diatomic molecule which absorbs this photon having bond energy equal to 90 kcal per mole. [3]
b) Why does chain inhibition step occur in HBr chain reaction? [2]
5. a) Draw the Jablonski diagram showing all the radiative and non radiative transitions. [3]
b) What are the utilities of fluorescence? [2]

Unit - II

6. a) Write notes on (i) Dipole moment (ii) Surfactants (iii) Fuel cell. [3×2]
b) Write the full form of SDS. [1]

Answer **any three** questions : [3×6]

7. Derive and compare between Langmuir and Freindlich adsorption isotherm. [6]
8. a) Chlorobenzene has $\mu=1.4$ D and nitrobenzene $\mu=3.9$ D. Estimate the dipole moment of ortho-meta-and para-chloronitrobenzene. [2×5]
b) What is orientation polarization ? [2]
c) Write the clausius mossotti equation. [1×5]
9. a) What is Fuel cell? [3]
b) Make a note on electro-catalysis. [3]
10. a) How can Gibbs adsorption isotherm be used to identify surface active and surface inactive reagents? [3]
b) What is heterogeneous catalyst and its use? [3]

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