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PG CBCS

M.Sc. Semester-II Examination, 2022

CHEMISTRY

PAPER: CEM 201

(PHYSICAL CHEMISTRY - II)

Full Marks: 40 **Time: 2 Hours**

GROUP – A

1. Answer any four questions from the following questions: 2×4 = 8

a) What is relaxation time in a chemical reaction?

b) What are oscillatory chemical reactions?

c) What is a micelle?

d) What are micro emulsions? Give example.

e) Using atomic units, write the expression for the Hamiltonian for the electronic motion of hydrogen atom in spherical coordinates.

f) Write the radial and angular parts of hydrogen atom in spherical coordinates.

GROUP - B

2. Answer any four questions from the following questions: 4×4 = 16

a) Explain Rayleigh line, Stokes lines, and anti-Stokes lines in the Raman spectrum.

b) For a consecutive reaction, $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ calculate the time when concentration of B, C_B will be maximum.

c) Describe the rotation-vibrational Raman spectrum obtained for a diatomic molecule.

d) Explain the following in electronic spectroscopy:
(I) Vibrational Relaxation, (II) Internal Conversion, (III) Intersystem Crossing, (IV) Phosphorescence

e) Discuss the different types of enzyme inhibitions.

f) Discuss the inner sphere and outer sphere mechanism of a redox reaction with examples.

GROUP - C

3. Answer any two questions from the following questions: 8×2 = 16

a) Starting from the Schrödinger equation for the Hydrogen atom

$$\left[-\frac{h^2}{8\pi^2 m_e}\nabla_e^2 - \frac{h^2}{8\pi^2 m_n}\nabla_n^2 - \frac{ze^2}{4\pi\varepsilon_0 r}\right]\psi = E\psi$$

Deduce the Electronic Schrödinger equation for the Hydrogen atom in spherical polar coordinates.

(P.T.O.)

b) Derive an expression for relaxation time of the reaction

$$A + B \underset{k_2}{\overset{k_1}{\leftrightharpoons}} P$$

c) (I) Give an example of Auto Catalytic Reaction.
(II) Derive an expression for Michaelis Constant for homogeneous enzyme catalysis reaction. 2+6

d) Describe the method for the precise determination of dissociation constants of weak electrolytes by the method of conductance measurements.

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