MCH43 — PHYSICAL CHEMISTRY — IV

Time : Three hours　　　　　　　Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

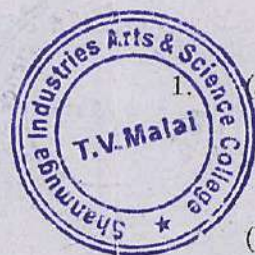1. (a) Draw a Jablonski diagram and explain the pathways of molecular excitation and deactivation.

Or

(b) Explain the fluorescence and phosphorescence.

2. (a) Discuss the photo substitution and photo redox reactions with suitable example.

Or

(b) Discuss the determination of life time of an excited state.

3. (a) (i) A cricket ball weighing 100g is to be located within 0.1A° What is its uncertainty in its velocity?

(ii) What is meant by Compton effect?

Or

(b) What is Hermitian operator? Explain the properties of Hermities operator.

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4. (a) Discuss the valence bond theory of hydrogen molecule.

Or

(b) Obtain an eigen value and eigen function for ethylene molecule by using HMO theory.
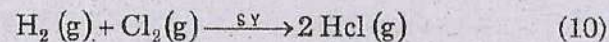
5. (a) Derive Sackur tetrode equation.

Or

(b) Explain the Debye theory of heat capacity of solids.

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. Derive the Stern Volmer equation for quenching and comment on the information obtainable from quenching study..

7. (a) Discuss the kinetics of the following photochemical reactions.

$$H_2(g) + Cl_2(g) \xrightarrow{\text{ }h\nu\text{ }} 2\,Hcl(g) \qquad (10)$$

(b) Discuss the mechanism of photosensitization reactions with suitable examples. (5)

8. (a) Obtain an eigen value and eigen function for particle in a ring. (10)

(b) Set up the Schrodinger wave equation for a Simple harmonic oscillator and solve it for the eigen values. (5)

9. Using the variation method solve the Schrodinger wave equation for the ground state energy of helium atom.

10. (a) Obtain an expression for internal energy and Gibbs free energy in terms of partition function (5)

(b) Discuss the Onsagar reciprocal relationship. (10)

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