(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 9 Sub. Code : 0 4 5 3

Exam. Code : 0 0 0 5

B.A./B.Sc. (General) 5th Semester

(1129)

CHEMISTRY

(Same for B.Sc. Microbiology and Food Technology)

Paper—XIX : Physical Chemistry—A

Time Allowed : Three Hours] [Maximum Marks : 22

Note :— Attempt **five** questions in all, selecting at least **one** question each from Units I to IV and Unit V is compulsory. Use of log tables and simple calculators is allowed.

UNIT—I

I. (a) Derive Planck's radiation law. How can it be verified experimentally ?

(b) Apply Schrodinger wave equation to a particle in one dimensional box and obtain the expression for the eigen function and eigen value of energy. 2,2

II. (a) Discuss the postulates of quantum mechanics.

(b) Find the commutator of the operators for momentum and position, the two conjugate properties of Heisenberg's uncertainty principle. 2,2

UNIT—II

III. (a) How are three dimensional contour diagrams used to represent the electron probability density for bonding and anti bonding molecular orbitals ?

(b) Apply quantum mechanical principles to calculate the coefficients of atomic orbitals in sp^2 hybrid orbitals. 2,2

IV. (a) Write expression for Ψ_{MO} for H_{2+} ion according to LCAO method. Starting from it, how do you arrive at the expression for $\Psi_{+(MO)}$ and $\Psi_{-(MO)}$?

(b) What do you understand by gerade and ungerade molecular orbitals ? What is the criteria to check whether a molecular orbital is gerade or ungerade ? Explain with suitable examples. 2,2

UNIT—III

V. (a) State and explain Grotthus-Draper law and Stark-Einstein's law of photochemical equivalence.

(b) The percentage transmittance of an aqueous solution of disodium fumarate at 250 nm and 298 K is 19.2% for a 5×10^{-4} molar solution in a 1 cm cell. Calculate the absorbance A and the molar absorption coefficient ε. What will be the percentage transmittance of a 1.75×10^{-3} molar solution in a 10 cm cell ? 2,2

VI. (a) What do you understand by the terms spin multiplicity, singlet states and triplet states ? Explain phenomenon of fluorescence and phosphorescence using Jablonski diagram.

(b) Calculate the value of Einstein in kilo joules for orange light with $\lambda = 600$ nm. 2,2

UNIT—IV

VII. (a) Explain why photosynthesis of HCl has very high quantum yield while that of photosynthesis of HBr is very low.

(b) What is photosensitization ? Explain with two suitable examples. 2,2

VIII. (a) What mechanism has been proposed for the photolysis of ammonia ?

(b) For the photochemical reaction $A \rightarrow B$, 1.0×10^{-5} moles of B were formed on absorption of 6.0 joules at 3600 Å. Calculate the quantum efficiency. 2,2

UNIT—V

(Compulsory Question)

IX. (i) What is sinusoidal wave equation ?

(ii) Compare the important characteristics of σ and π molecular orbitals.

(iii) Write expression for Compton shift and explain the results obtained for scattering angles of 0°, 90° and 180°.

(iv) What is resonance fluorescence ? Give one example.

(v) Briefly explain Kirchhoff's law about black body radiation.

(vi) What is the difference between a photochemical and thermo chemical reaction ? $6 \times 1 = 6$