

(i) Printed Pages : 3

Roll No.

(ii) Questions : 9

Sub. Code :

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Exam. Code :

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

1128

CHEMISTRY

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

Paper : XIX Physical Chemistry-A

Time Allowed : Three Hours]

[Maximum Marks : 22

Note :— (1) Attempt FIVE questions in all.

(2) Attempt at least **one** question each from Unit I, II, III and IV.

(3) Question No. 9 of Unit V is compulsory.

UNIT—I

1. (a) How classical mechanics failed when applied to the case of black body radiation ? Briefly describe the spectral distribution of black body radiation.
- (b) Work function for platinum metal is 8×10^{-19} J. Will a radiation of wavelength 200nm be able to cause photoelectric effect in it ? If so what will be the velocity of the electron ejected from the surface (Given 10^{-19} J = 5035.7 cm^{-1} , $m_e = 9.1 \times 10^{-31}$ Kg, $c = 3 \times 10^{10}$ ms^{-1} . 2+2
2. (a) A particle of mass m is confined to move in one dimension (x) only between $x = 0$ and $x = L$. The potential energy of the particle is $V = 0$ between $x = 0$ and $x = L$ and $V = \infty$ at $x < 0$ and $x > L$. Apply Shrödinger wave equation to obtain expression for eigen function and eigen value of energy.

- (b) What do you mean by the concept of expectation values ? Calculate expectation value of x , x^2 and p for a particle of one dimensional box of length L (where x is position and p is momentum). 2+2

UNIT—II

3. (a) Give quantum mechanical principles of hybridization and apply them to calculate the coefficients of atomic orbitals in sp^2 hybrid orbitals.
(b) What do you understand by radial probability ? Draw and discuss radial probability distribution curves for $1s$, $2s$, $3s$, $3p$ and $3d$ orbitals. 2+2
4. (a) What are the main points of similarities and differences between VBT and MOT ?
(b) Discuss variations of electron density along internuclear axis in bonding and antibonding molecular orbitals through graphical representations. 2+2

UNIT—III

5. (a) Obtain an expression for Lambert's law of transmission of light. What is the physical significance of extinction coefficient ?
(b) Explain the mechanism of fluorescence and phosphorescence showing various ground and excited state of a molecule. 2+2
6. (a) Define photosensitization. Illustrate the photosensitized reactions by using mercury and chlorine as photosensitizers.
(b) What do you understand by the term quantum efficiency of a photochemical reaction ? How is it determined experimentally ? 2+2

UNIT—IV

7. (a) State and explain first and second law of photochemistry. What do you understand by one Einstein of energy ?
(b) A certain system absorbs 3×10^{18} quanta of light per second. On irradiation for 20 minutes 0.03 moles of the reactant was found to have reacted. Calculate the quantum yield for the reaction. 2+2
8. (a) What is the phenomenon of quenching ? Discuss the mechanism of quenching.
(b) What do you mean by luminescence ? Briefly explain different types of luminescence. 2+2

UNIT—V (Compulsory Question)

9. (a) Find expression for the square of the operator $\left(\frac{d}{dx} + x \right)$.
(b) Which of the functions, $\sin 3x$, $6\cos 4x$, $1/x$, $3e^{-5x}$ are eigen functions of $\left(\frac{d^2}{dx^2} \right)$?
(c) Explain Born's interpretation of the wave function.
(d) What mechanism has been proposed for photolysis of ammonia ?
(e) What are photoinhibitors ? How do they work ?
(f) Show that the functions $\Psi_1 = (1/2\pi)^{1/2}$ and $\Psi_2 = (1/\pi)^{1/2} \cos x$ are orthogonal to each other in the interval $x = 0$ to $x = 2\pi$. $6 \times 1 = 6$