

6/H-23 (viii) (Syllabus-2015)

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(May/June)

CHEMISTRY

(Honours)

(Part—A : Physical Chemistry-II)

(Chem-H-602)

Marks : 38

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

1. Give the mathematical expression for Boltzmann distribution law for degenerate energy levels and define the terms. $2\frac{1}{2}+2\frac{1}{2}=5$

OR

2. Show that the total molecular partition function (Q) is the product of individual partition functions. Mention the applications of molecular partition function (Q). $3+2=5$

(2)

3. (a) Discuss briefly the spectral distributions of black-body radiation and mention the interpretations therein.

$$2\frac{1}{2} + 2\frac{1}{2} = 5$$

- (b) Give the conditions under which an eigenfunction ψ is said to be *ortho-normal*. Give the interpretations of wave function ψ .

$$2 + 3 = 5$$

OR

4. (a) A photon of wavelength 4000 Å strikes a metal surface, the work function (ϕ) of the metal is 2.13 eV. Calculate (i) the energy of the photon in eV and (ii) the kinetic energy of the emitted photo-electrons. (Given, 1 eV = 1.602×10^{-19} J, mass of electron = 9.1×10^{-31} kg)

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- (b) Solve the Schrödinger wave equation for a particle in a one-dimensional box of length a .

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5. (a) Obtain a mathematical expression for rotational constant B , using rigid rotor model and explain why the rotational lines are equally spaced.

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(3)

- (b) The wave number of the fundamental vibrational transition of $^{35}\text{Cl}_2$ is 564.9 cm^{-1} . Calculate the force constant (k) of the bond.

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OR

6. (a) What is spectroscopy? Mention various spectroscopies associated with different regions of the spectrum.

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- (b) Calculate the theoretical numbers of vibrational degrees of freedom in (i) CO_2 and (ii) H_2O .

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- (c) Explain the origin of overtone bands in vibrational spectra.

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7. Write briefly about photochemical and photosensitized reactions, giving examples.

$$2\frac{1}{2} + 2\frac{1}{2} = 5$$

OR

8. Draw Jablonski diagram and explain all the photophysical processes involved in it.

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9. (a) Discuss in brief the theory of strong electrolytes proposed by Debye-Hückel-Onsager. Write the expression of the equation and signify the terms involved.

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(4)

- (b) Calculate the ionic strength of 0.001 molal solution of Na_2SO_4 . 3

OR

10. (a) What are the advantages of potentiometric titrations over conventional titrations? Discuss the curves obtained when a strong acid is titrated with a strong base using a potentiometer. 5
- (b) Define liquid junction potential. How can it be minimized? 3

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