

PD-164-S.E.-CV-19

M.Sc. (I-SEMESTER) CHEMISTRY
Examination, Dec.-2020
Paper-III
PHYSICAL CHEMISTRY

Time : Three Hours]

[Maximum Marks : 80]

Note : Answer from both the Sections as directed. The figures in the right-hand margin indicate marks.

Section-A

1. Write the answer of the following questions:-

1x10=10

- (a) Write the value of zero point energy of a particle of mass 'm' moving in one dimensional box of width 'a'.
- (b) Define Hamiltonian operator.
- (c) Write the atomic term symbols for electrons for which $L=2$ and $S=1$.
- (d) Write the Huckel secular equation for 1, 3-Butadiene.
- (e) What is integrated Arrhenius equation? Give the relationship.
- (f) Write Michaelis-Menten equation for enzyme catalyzed reaction.
- (g) According to Laplace equation give the value of pressure difference across the meniscus.
- (h) Triton X-100 is, which type of surfactant?
- (i) What is a polydispersity index (P.D.I.) of a polymer sample?
- (j) Write the formula by which you can calculate mass-average molar mass.

2. Answer the following questions:-

2x5=10

- (a) Explain the postulates of quantum mechanics.
- (b) Discuss Huckel molecular orbital theory for conjugated systems.
- (c) For a given reaction at temperature T , the velocity constant K is expressed as $K = A \cdot e^{-27000K/T}$. Given, $R = 2 \text{ cal mole}^{-1} \text{K}^{-1}$. Calculate the value of energy of activation. Comment on the result.
- (d) Describe the factors affecting CMC in aqueous media.
- (e) Equal number of molecules with $M_1 = 10,000$ and $M_2 = 100,000$ are mixed. Calculate \overline{M}_N and \overline{M}_M .

Section-B

12x5=60

Answer all questions.

3. Discuss variation theory of approximate methods. How does it overcome the demerits of perturbation theory. Apply variation theory to He atom.

OR

Calculate the energy and wave function of a particle moving in one dimensional box of width 'a', with the help of Schrodinger wave equation.

4. Explain the following terms:-

- (a) Russell-Saunders term (b) Zeeman splitting

OR

- (a) Discuss the Huckel molecular orbital theory for Ethylene molecule
- (b) Explain Bond order and charge density calculations.

5. What are characteristics of chain reactions? Discuss the reaction kinetics of photochemical $H_2 - Cl_2$ reaction.

OR

Discuss Lindemann theory of unimolecular reactions. Explain its limitations also.

6. (a) Derive Gibbs adsorption equation.

(b) How are surface active agents classified? Give suitable examples.

OR

(a) Discuss micellization with examples. Explain mass action model for the thermodynamics of micellization.

(b) Derive Kelvin equation for vapour pressure of droplets.

7. (a) How the molecular mass of macromolecules determined by Osmometry method.

(b.) Explain the Kinetics of polymerization.

OR

(a) Discuss briefly light scattering method for the determination of molecular mass of macromolecules.

(b) Explain the classification of polymers on the basis of molecular forces.