

B.Tech. Second Semester (Food, Pulp, Oil, Petrochemical) Polymer (Plastic) (Old) (CGS)
Applied Physical Chemistry - I : 2 SCT 1

P. Pages : 3

Time : Three Hours



AU - 3106

Max. Marks : 80

- Notes :
1. Answer **three** question from Section A and **three** question from Section B.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Diagrams and chemicals equations should be given wherever necessary.
 5. Illustrate your answer necessary with the help of neat sketches.
 6. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - 'A'

1. a) Derive an expression for energy of particle confined in one dimensional potential well. 6
b) State Heisenberg's uncertainty principle. 3
c) Derive Gibb's-Duhem equation. 4

OR

2. a) What do you mean by activity and activity coefficient? Discuss the method of determination of activity coefficient. 6
b) Explain the dual nature of light. 4
c) Calculate the wave length of electron with a rest mass of $9.109 \times 10^{-31} \text{ kg}$ moving with a velocity of $2 \times 10^1 \text{ ms}^{-1}$ ($h = 6.626 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$). 3
3. a) State the essential postulates of kinetic theory of gases and derive an equation, $PV = \frac{1}{3} mnc^2$. 6
b) Deduce the law of corresponding states from Van-der-Waals equation. What is the significance of the law. 4
c) Discuss the effect of temperature on molecular speed using Maxwell-Boltzmann's consideration. 4

OR

4. a) State and explain the Maxwell's law of distribution of molecular speed amongst the molecules of a gas. 6
b) Deduce the following gas laws from the Kinetic gas equation. 4
i) Avagadro's law ii) Dalton's law of partial pressure

- c) Define mean free path and derive its equation for calculation. 4
5. a) The density of carbon monoxide at 273K and 1atm is 1.2504 kg m^{-3} . Calculate root mean square and average speed. 4
- b) Discuss the correction due to volume and molecules attraction suggested by Van-der-Waals and derive the values of T_C , V_C , & P_C in terms of Van-der-Waal's constants. 6
- c) An ideal gas cannot be liquefied, give reason. 3

OR

6. a) Define the terms, collision diameter and collision numbers. Derive the expression for the number of collision per unit time per unit volume. 6
- b) What is compressibility factor? Explain the variation of compressibility factor with pressure for nitrogen and hydrogen at given temperature. 4
- c) Calculate the root mean square velocity of hydrogen molecule at 0°C .
($R = 8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$). 3

SECTION - B

7. a) What is first order reaction? Give any two examples of such reaction and derive expression for specific rate constant. 6
- b) Distinguish molecularity from order of reaction. 4
- c) At 25°C temperature ethyl acetate on saponification gave following results. 4
- | | | | | | |
|---|----|------|-----|-----|----------|
| Time (minute) | 0 | 5 | 25 | 55 | ∞ |
| Volume of 0.1N acetic acid used to titrate 10ml unreacted alkali (ml) | 16 | 10.2 | 4.3 | 2.3 | 0 |
- Show that it is a second order reaction.

OR

8. a) Define the followings with suitable example. 4
- i) Zero order reaction ii) Third order reaction
- b) Derive an expression for velocity constant of following reaction. 6
- $A + B \rightarrow \text{product}$, $[A] \neq [B]$.
- c) From the following data at a certain temperature show that the decomposition of H_2O_2 in aqueous solution is a first order reaction. 4

Time (seconds)	0	300	600	900
Volume of KMnO_4 solution used	22.8	17.7	13.8	10.6

9. a) Discuss the following methods for determination of order of reaction. 6
i) Van't-Hoff's method
ii) Isolation method
- b) What is energy of activation? How does it determine from Arrhenius equation. 4
- c) In a particular reaction the time required to complete half of the reaction was found to increase nine times when initial concentration of the reactant was reduced to one third. What is the order of reaction? 3

OR

10. a) What is half life period? Discuss the equifractional change method for determination order of reaction. 6
- b) Discuss the theory of Bi-molecular reaction. 4
- c) Write the limitations of integration method. 3
11. a) For adiabatic expansion of an ideal gas, show that $P(v)^r = \text{constant}$, where r is the ratio of specific heat at constant pressure and at constant volume. 6
- b) Write the limitations of First law of thermodynamics. 3
- c) Define: 4
i) Entropy and ii) Free energy

OR

12. a) Discuss the thermodynamic scale of temperature. 6
- b) Give the difference between isothermal and adiabatic processes. 3
- c) Derive Gibbs-Helmholtz equation. 4

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