

B.Tech. Second Semester ((Food, Pulp, Oil, Petro,Chem) Polymer (Plastic)) (CGS)

11708 : Applied Physical Chemistry - I : 2 SCT 1

P. Pages : 3

Time : Three Hours



AU - 2481

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 chemical equations should be given wherever necessary.
 5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

- | | | | |
|----|------|---|---|
| 1. | a) | Derive Schrodinger's wave equation with respect to space. | 6 |
| | b) | Define : | 3 |
| | i) | Linear harmonic oscillator | |
| | ii) | Wave number and | |
| | iii) | Activity coefficient | |
| | c) | Derive Gibb's - Duhem equation. | 4 |

OR

- | | | | |
|----|----|---|---|
| 2. | a) | Obtain an equation of energy of a particle confined to move within one dimensional potential well. | 6 |
| | b) | Describe the vapour pressure method employed for determination of activity coefficient. | 4 |
| | c) | How do you distinguish ideal solution from non - ideal solution? | 3 |
| 3. | a) | Discuss the Maxwell's distribution of molecular speeds showing the effect of temperature on its distribution. | 6 |
| | b) | State the assumptions of kinetic theory of gases. | 4 |
| | c) | Derive reduced form of Van - der Waal's equation and state law of corresponding state. | 4 |

OR

- | | | | |
|----|----|--|---|
| 4. | a) | Discuss the elementary account of mathematical aspects of theories of chemical bonding. | 6 |
| | b) | Calculate the mean free path of hydrogen gas at 0°C and 1atm. pressure. The coefficient of viscosity of hydrogen gas is 8.41×10^{-6} pas; its density is $9 \times 10^{-2} \text{ kg m}^{-3}$ and average velocity is $4.169 \times 10^3 \text{ ms}^{-1}$. | 4 |
| | c) | How do you obtain the formula of most probable velocity from Maxwell - Boltzmann's law of distribution of molecular speed? | 4 |

5. a) Discuss the Andrew's experiment of compression of CO_2 gas and define critical constants. 6
- b) Define the terms : 3
- i) Collision diameter
- ii) Collision frequency and
- iii) Mean free path
- c) The density of carbon monoxide at 25°C and 1atm is 1.2504 kg m^{-3} . Calculate the root mean square speed and average speed of the molecule. 4

OR

6. a) Derive an expression for coefficient of viscosity in gases. 6
- b) What is compressibility factor? How is it useful to describe the nature of gases? 3
- c) Express the relation between C_{rms} , $\bar{C}$ and C_{mp} . 4
- Calculate C_{mp} of nitrogen gas 30°C .
- ($R = 8.314\text{ J K}^{-1}\text{ mol}^{-1}$)

SECTION - B

7. a) Describe the method of determination of order and molecularity of complex reaction with suitable example. 6
- b) Show that : 4
- i) $t_{1/2} = \text{constant}$, for first order reaction
- ii) $t_{1/2} \propto \frac{1}{a}$, for second order reaction
- where $t_{1/2}$ is half life period and 'a' is initial concentration of reactants.
- c) Give the difference between molecularity and order of reaction. 3

OR

8. a) Derive an integrated rate equation of specific rate constant for the reaction, $2\text{A} \rightarrow \text{product}$. 6
- b) The optical rotation of cane sugar in presence of 0.5 N HCl at 27°C at various time intervals is given as under. From the data, show that this inversion is of a first order reaction. 4

Time (minutes)	0	15	30	45	∞
Angle of rotation (degree)	+ 32.4	+ 28.8	+ 25.5	+ 22.4	-11.00

- c) What is pseudo unimolecular reaction? Give any two examples. 3

9. a) Discuss the fractional change method for determination of order of reaction. 4
- b) What is meant by energy of activation? Explain how energy of activation is determined with the help of Arrhenius equation. 6
- c) How is the order of reaction determine using 'isolation method'? Explain with example. 3

OR

10. a) Discuss in details the collision theory of bimolecular reactions. What are the limitations of this theory? 6
- b) At a 400 °K the half life period of decomposition of certain compound is give as follows. From the data find the order of reaction. 4

Initial pressure (mm)	50	100	200
Relative half life (min)	3.52	1.82	0.93

- c) Describe the graphical method of determination of order of reaction. 3
11. a) Define Gibb's free energy and explain the spontaneity of chemical reaction using this thermodynamic function. 4
- b) State the Carnot's heat theorem and discuss Carnot cycle. 6
- c) Derive Gibbs - Helmholtz equation. 4

OR

12. a) Give the difference between; 4
- i) Reversible and irreversible processes.
- ii) Adiabatic and isothermal processes.
- b) The efficiency of Carnot heat engine is 45% calculate the heat that must be withdrawn from the reservoir at higher temperature to produce 210 cal. of work. 4
- c) Show that : $\Delta G = nRT \ln (P_2 / P_1)$ 6

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