B.Tech. Second Semester (PTOPU) Polymer (Plastic) (CGS)

11708 : Applied Physical Chemistry - I

2 SCT 1

P. Pages : 3 **AW - 2931**

Time : Three Hours 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) Define activity coefficient and describe the experimental method of determination of activity and activity coefficient. **6**

b) Explain in brief, Heisenberg's uncertainty principle. **4**

c) What is an ideal solution ? Write the statement of Raoult's law. **3**

OR

2. a) Discuss the application of Schrodinger equation for determination of energy of a particle confined in one dimensional potential well. **6**

b) Show that, $\lambda = \frac{h}{p}$, where h is plank constant, λ is wave length and p is momentum. **4**

c) Define : **3**
i) Rigid rotator
ii) Zero point energy and
iii) Wave number

3. a) State the law of corresponding state and deduce the reduced form of Van-der-Waals equation. **4**

b) Define the terms : **3**
i) Mean free path
ii) Co-volume of gas
iii) Compressibility factor

c) Derive an equation $PV = \frac{1}{3}mnc^{-2}$ **6**

OR

4. a) Discuss the Maxwell Boltzmann's law of distribution of molecular speed and express the formula for average velocity. **6**

b) Write the assumptions of kinetic theory of gases. **4**

c) Calculate the pressure exerted by 6.6 g of CO_2 in a 1.32 dm^3 vessel at 48°C using Van-der-Waal's equation. The Van-der-Waal's constants are, $a = 3.59\ dm^6\ atm\ mol^{-2}$ and $b = 0.0427\ dm^3\ mol^{-1}$ ($R = 0.08206\ dm^3\ atm\ k^{-1}\ mol^{-1}$). 3

5. a) What is collision frequency ? Derive an expression for collision number. 6

b) Define : 4
i) Root mean square velocity
ii) Average velocity
iii) Most probable velocity
iv) Collision diameters

c) Calculate r.m.s and average speed of oxygen molecule at 273 k. 4
($R = 8.314\ kg\ m^2\ s^{-2}\ k^{-1}\ mol^{-1}$)

OR

6. a) Express the three critical constants in terms of Van-der-Waal's constants using Van-der-Waal's equation. 6

b) Discuss the heat conduction in gases. 4

c) The density of carbon monoxide at 0°C at 1 atm is $1.2504\ kg\ m^{-2}$. Calculate the average and most probable speeds. 4

SECTION - B

7. a) Give the difference between order and molecularity. 4

b) Define zero order reaction with suitable examples. 3

c) Derive an integrated rate equation of second order reaction for equal initial concentration of reactants. 6

OR

8. a) Discuss the effect of following factors on reaction rate : 6
i) Surface area of reactant
ii) Temperature

b) Show that, if one of the reactant is present in large excess in reaction vessel, the second order reaction follows first order kinetic equation. 3

c) In a second order reaction, where the initial concentration of the reactants is the same, half of the reactants are consumed in 60 minutes. If the specific reaction rate is $5.2 \times 10^{-3}\ mol^{-1}\ dm^3\ min^{-1}$, what is the initial concentration of the reactants. 4

9. a) Discuss the Ostwald isolation method. 4

b) The half life period of decomposition of a compound is 50 minutes. When initial concentration is halved, the half-life period is 25 minutes. What is order of reaction ? 3

c) What is energy of activation ? How does it calculate from Arrhenius equation ? 6

OR

10. a) Discuss the following methods of determination of order of reaction. 8
    i) Van't - Hoff's differential method.
    ii) Fractional change method.

b) Write the limitations of Integration method. 2

c) The specific rate constants of second order reaction are 0.03466 mol^{-1} dm^3 min^{-1} and 0.13864 mol^{-1} dm^3 min^{-1} at temperatures 300 k and 350 k respectively. Calculate energy of activation (R = 8.314J) 3

11. a) Define the following thermodynamic systems and processes. 4
    i) Open system ii) Isolated system
    iii) Adiabatic process iv) Isobaric process

b) Write any two statements of second law of thermodynamic. 4

c) Define Gibb's free energy and explain the spontaneity of chemical reaction. 6

OR

12. a) State the first law of thermodynamics and derive its mathematical equation. 4

b) What do you mean by state function ? Give any three examples of state functions. 4

c) Derive Gibb's Helmholtz equation. 6

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