

(Physical Chemistry-A)

Time Allowed : Three Hours

Max. Marks : 22

Note : You have to attempt five questions in all, selecting at least one question from each Section A, B, C, D and Section E is compulsory. Use of log tables and Si.

Section-A

1. (a) Prove that :  $\log \frac{a^2}{bc} + \log \frac{b^2}{ca} + \log \frac{c^2}{ab} = 0$  1
- (b) Show that the line joining  $(-3, -3)$ , and  $(-5, 1)$  is parallel to the line joining  $(2, -1)$  and  $(0, 3)$ . 2
- (c) Differentiate  $(1 - x^2 + x^3)(3x + 6)$  w.r. to  $x$ . 1
2. (a) How can you improve accuracy of an analysis ? 1
- (b) Explain least square method for curve fitting with example. 1
- (c) Calculate mean and standard deviation for the following data :  
mg/l of oxalic acid used 31, 27, 26, 35, 23, 31, 33 2

Section-B

3. (a) Derive various gas laws from Kinetic gas equation. 1
- (b) Calculate the root mean square velocity of  $\text{CO}_2$  at S.T.P. using S.I. Units. 2
- (c) Derive Vander Waal's equation of State for Real gases. What is the significance of this equation ? 1
4. (a) Prove that at Boyle's temperature, Vander Waals equation is reduced to ideal gas equation. 1
- (b) What do you know about critical temperature, volume and pressure? Derive the relationship between  $P_c$ ,  $V_c$  and  $T_c$  & Vander Waals constants 'a' and 'b'. 1
- (c) The Vander Waal's constants for  $\text{CH}_4$  are :  $a = 2.25 \text{ atm l}^2 \text{ mol}^{-2}$   
 $b = 0.043 \text{ litre mol}^{-1}$ . Calculate its critical constants. 2

Section-C

5. (a) Define and explain rate law and instantaneous rate of reaction. 1
- (b) Differentiate molecularity and order of a reaction. 1

- (c) Aqueous solution of Ammonium nitrate decomposes to evolve  $N_2$ . The volumes of  $N_2$  evolved at different times were measured to give the result :

Time (min)	Vol. of $N_2$ (CC)
20	10
70	33
$\alpha$	162

Show that it is a 1st order reaction and calculate rate constt. 2

6. (a) Explain the fact that radioactive decay is a 1st order phenomenon. 1  
 (b) Define the following :  
 (i) Mean Life of a reaction  
 (ii) Pseudoorder reaction 1  
 (c) Describe in detail the factors influencing the rate of reaction. 2

#### Section-D

7. (a) Explain Transition state theory of reaction rates for bimolecular reactions. 1  
 (b) Derive and explain the significance of Arrhenius equation. 1  
 (c) The value of rate constant of a first order reaction gets tripled when the temperature is changed from 293 K to 313 K. Calculate the activation energy of the reaction. 2
8. (a) How substrate affects the order of enzyme catalysed reaction ? Name the equation if any. 1  
 (b) Discuss kinetics of general acid base catalysed reaction with suitable example. 2  
 (c) With the help of energy level diagram, explain the effect of catalyst on the rate of a chemical reaction. 1

#### Section-E

#### Compulsory Question

9. (i) What are Catalytic promoters and inhibitors ?  
 (ii) What are units of rate constant for 2nd and 3rd order reaction ?  
 (iii) Give the units of Vander Waal's constants 'a' and 'b'.  
 (iv) Define Collision number.  
 (v) What is Joule Thomson Effect ?  
 (vi) Define mean, median and mode.

6×1=6