

CHEMISTRY PAPER-III

(Physical Chemistry-A)

Time Allowed : Three Hours

Max. Marks : 22

Note : Attempt *five* questions in all, selecting *one* question from each Section. All questions carry equal marks. Section-E is compulsory. Simple/ Non-programmable calculator is allowed. Compulsory question carries 6 marks.

Section-A

1. (a) If $y = \log (\sqrt{x+a} + \sqrt{x-b})$, find $\frac{dy}{dx}$.
- (b) Integrate the following function w.r.t. x ; $\int \frac{dx}{1-\sin x}$.
- (c) Find the slope of the line passing through the points P(2, 3) and Q(7, 9). 1,2,1
Or
2. (a) Determine the maxima and minima point for the function $f(x) = x^3 - 3x^2 - 9x - 7$. Also find the maximum and minimum value.
- (b) The volumetric analysis of oxalic acid solution with KMnO_4 solution gave the following titre values :
22.62, 22.75, 22.79, 22.84 and 22.92 ml.
Calculate :
(i) Average deviation of mean
(ii) Standard deviation

22

Section-B

3. (a) Define mean free path and collision diameter. Derive the relationship between them. Show how mean free path depends upon the temperature.
- (b) At what temperature the root mean square velocity of chlorine gas will be equal to that of SO_2 at N.T.P. 22

Or

4. (a) How does Van der Waals equation explain the behaviour of real gases under different conditions of temperature and pressure.
- (b) State the law of corresponding states and deduce the equation

$$\left[\left(\pi + \frac{3}{\phi^2} \right) \right] (3\phi - 1) = 80. \quad 22$$

Section-C

5. (a) Explain with suitable examples 'Zero Order Reaction'.
- (b) How can you prove that kinetically inversion of cane sugar is a unimolecular reaction.
- (c) Write expression for the rate constant for a reaction of second order of the type $2A \rightarrow \text{products}$. What are the units of the rate constant?

1,1,2

Or

6. (a) A first order reaction is 40% complete in 50 min. Calculate the value of the rate constant. In what time will the reaction be 80% complete.
- (b) Define disintegration constant. Give the units of disintegration rate.
- (c) Differentiate between Molecularity and Order of a reaction. 2,1,1

Section-D

7. (a) Write Arrhenius equation giving the effect of temperature on the rate constant of a reaction.
- (b) For bimolecular collisions of dissimilar molecules derive expression for rate constant K.
- (c) What is radioactive equilibrium? Prove that the amounts of different substances at equilibrium are inversely proportional to their decay constants. 1,1,2

Or

8. (a) What is autocatalysis? Explain with suitable examples.
- (b) Describe the mechanism of enzyme-catalysed reactions as proposed by Michaelis and Menton.
- (c) What are catalytic promoters and catalytic poisons. How do they work. 1,2,1

9. (a) Given $\log 3 = 0.4712$: find $\log 810$.
- (b) From kinetic gas equation explain the concept of absolute zero.
- (c) What are critical constants and how are they measured ?
- (d) Define 'Activation Energy'.
- (e) Give *one* example of homogeneous catalysis in the gaseous phase and in the liquid phase.
- (f) What is temperature coefficient of a reaction. 6×1=6