

CHEMISTRY PAPER-III

(Physical Chemistry-A)

Time Allowed : Three Hours

Maximum Marks: 22

Note: You have to attempt five questions in all, selecting one from each of Sections A, B, C & D. Section E is compulsory. Use of simple calculator is allowed.

SECTION-A

1. (a) If $x = 2^{\frac{-1}{3} \log_2 64}$ find value of x.

(b) If $z = \log(x^2 + y^2)$ find $\frac{dz}{dx}$ and $\frac{dz}{dy}$.

(c) Name the methods for improving accuracy of an analysis. 2, 1, 1

2. (a) What are determinate errors? How can they be classified into different types?

(b) Define standard deviation, average deviation and limit of a function. 2, 2

SECTION-B

3. (a) Deduce the following gas laws from kinetic gas equation:

- (i) Boyle's law
- (ii) Charles's Law
- (iii) Avogadro's Law.

(b) What are the units of Vander Waal's constants 'a' & 'b'? Also write their significance. 2, 2

4. (a) Derive the following:

$$P_c V_c = \frac{3}{8} RT_c.$$

(b) Define Ideal and Real gases. Explain in terms of compressibility factor.

(c) Calculate:

(i) Root mean square speed and

(ii) Most probable speed of methane molecule at 27 °C. 1, 1, 2

SECTION-C

5. (a) Define the terms average rate and instantaneous rate of a reaction. How can you represent them?

(b) Show that half life period of a 1st order reaction is independent of its initial concentration.

- (c) For a first order reaction $t_{1/2}$ is 100 sec. How long will it take for the reaction to be 75% complete? 1, 1, 2
6. (a) Briefly explain different methods for the determination of order of a reaction.
- (b) Derive an expression for rate constant for reactions of 1st order. Also write units of rate constant.
- (c) Briefly differentiate molecularity and order of a reaction. 2, 1, 1

SECTION-D

7. (a) Explain the effect of temperature on rate of reaction with the help of Arrhenius equations. How can you calculate activation energy?
- (b) Explain Transition State theory of reaction rates with proper example. 2, 2
8. (a) Define a chain reaction with example.
- (b) Explain Michaelis Menton equation for Enzyme catalysis for Unimolecular reaction.
- (c) What is Autocatalysis and Heterogeneous catalysis? 1, 2, 1

SECTION-E

(Compulsory)

9. (a) Define threshold energy.
- (b) Integrate $x^3 + 3x^2 - x + 5$ w.r.t. x
- (c) Define rate law.
- (d) What is Boyle's temperature?
- (e) Define Mean Free Path.
- (f) What is half life period of a reaction. $6 \times 1 = 6$