(i) Printed Pages: 4   Roll No. ....

(ii) Questions   : 9   Sub. Code : | 0 | 0 | 5 | 1 |

Exam. Code : | 0 | 0 | 0 | 1 |

B.A./B.Sc. (General) 1ˢᵗ Semester

(2123)

CHEMISTRY

(Same for B.Sc. Microbial & Food Tech.)

Paper–III Physical Chemistry–A

Time Allowed : Three Hours]   [Maximum Marks : 22

Note :—(1) Attempt **five** questions in all, including Question No. 9 (Unit V) which is compulsory and selecting **one** question from each Unit I–IV.

(2) Use of log tables and simple calculator is allowed.

UNIT–I

1. (a) Sketch the curve $y = x^2 + 2x - 3$.   2

   (b) Evaluate $\int \sqrt{\dfrac{1 + \cos x}{1 + \cos x}}\, dx$.   2

2. (a) What are different types of errors ? Why indeterminate errors are called so ?   2

   (b) A sample of iron ore on analysis gave following percentage values for the iron content,

   7.08, 7.21, 7.12, 7.09, 7.16, 7.14, 7.07, 7.14, 7.18, 7.11

   Calculate the Mean and Standard Deviation for these values.   2

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UNIT–II

3. (a) Derive reduced equation of state and hence define the law of corresponding states. Give its significance. 2

(b) What are ideal and real gases ? Explain graphically in terms of PV, how real gases show deviation from ideal behaviour. Briefly explain the concept of Boyle temperature. 2

4. (a) Define most probable velocity. Using expression for Maxwell's distribution of velocities, derive expression for most probable velocity. 2

(b) What is 'Mean Free Path' ? Derive the following expression for mean free path (l) when molecular diameter is σ.

$$l = \frac{1}{\sqrt{2}\pi\,\sigma^2} \cdot \frac{RT}{PN_0}$$ 2

UNIT–III

5. (a) Enumerate the various methods employed for the determination of the order of a reaction. Briefly explain the fractional change method. 2

(b) Derive an expression for the rate constant for reactions of first order. Prove that half-life period of first order reaction is independent of initial concentration. How is the rate constant of such reactions evaluated graphically ? 2

6. (a) A Second order reaction in which the initial concentration of both the reactants are same is 25% complete in 600 sec. How long will it take for the reaction to go to 75% completion ? 2

(b) Define pseudounimolecular reactions with the help of an example. Explain why the hydrolysis of ethyl acetate in the presence of dilute acid follows first-order kinetics.

2

UNIT–IV

7. (a) Briefly describe 'Transition state theory' or 'Theory of absolute reaction rates'. Derive an expression for the rate constant on the basis of Theory of absolute reaction rates. What are the advantages of this theory over the collision theory ?

2

(b) The rate constant, k, for the first-order gas phase decomposition of ethyl iodide, $C_2H_5I \rightarrow C_2H_4 + HI$ is $1.60 \times 10^{-5} s^{-1}$ at 600 K and $6.36 \times 10^{-3} s^{-1}$ at 700 K. Calculate the energy of activation of this reaction ($R = 8.314$ J mol^{-1} K^{-1}).

2

8. (a) Derive an expression for the rate of an enzyme catalysed reaction. Deduce the definition of Michaelis constant and explain how it can be determined. Also deduce the order of the enzyme-catalysed reaction when

(i) Concentration of the substrate is low.

(ii) Concentration of the substrate is high.

2

(b) What is homogeneous catalysis ? Give an example of homogeneous catalysis. Derive an expression for the rate of an acid catalysed reaction following the protolytic type of mechanism and discuss about general acid catalysis and specific acid catalysis.

2

UNIT–V

(Compulsory Question)

9. Attempt the following :

(a) Comment on the statement "A measurement may have good accuracy but poor precision. However converse is not true, i.e. good precision does not necessarily mean good accuracy."

(b) Explain the causes of deviation of gases from ideal behaviour.

(c) Why the rate of reaction becomes nearly double for $10°$ rise in temperature ?

(d) How the average life of a radioactive substance is related to its half-life ?

(e) What is the role of V_2O_5 along with Pt in the formation of SO_3 from SO_2 and O_2 in contact process ?

(f) Prove that $\log \dfrac{42}{55} = \log 2 + \log 3 + \log 7 - \log 11 - \log 5$.

$1 \times 6 = 6$