

[22/A-9]

**SARDAR PATEL UNIVERSITY**  
**B.Sc. EXAMINATION (SEM-VI)**  
**APRIL-2018**  
**PHYSICAL CHEMISTRY**  
**US06CCHE06**

DATE : 06/04/2018 (Friday)

TIME : 10.00 to 1.00 PM

Marks: 70

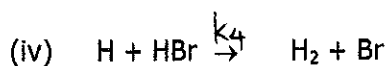
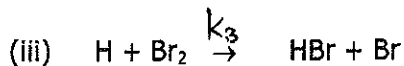
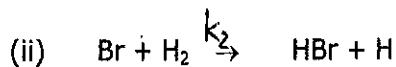
**Q-1 Choose one most appropriate option out of four provided to you. (10)**

- (i) Which of the following is used for elucidating the mechanism of complex reaction?  
 (a) The equilibrium approximation (b) the steady state approximation  
 (c) Both a and b (d) None of these
- (ii) At a given temperature, if activation energy is very high then the rate of reaction will be  
 (a) Medium (b) Fast (c) Slow (d) Very high
- (iii) The reaction coordinate which have maximum potential energy is called  
 (a) Simple complex (b) Ionic complex  
 (c) Catalytic complex (d) Activated complex
- (iv) The symmetry number for HCl and HCN is  
 (a) 1 (b) 2 (c) 3 (d) 4
- (v) The rotational energy of the molecule depends on \_\_\_\_\_ of the molecule.  
 (a) Molar mass (b) Moment of inertia  
 (c) Stiffness of bond (d) Size of container
- (vi) The degeneracy of  $J^{\text{th}}$  rotational energy level is given by  $g_J =$   
 (a)  $2J+1$  (b)  $2J-1$  (c)  $J=1$  (d)  $J-1$
- (vii) Electrochemical detector belongs to  
 (a) Bulk property (b) universal  
 (c) Solute property (d) Selective
- (viii) Which of the following solvent is expected to have maximum compressibility factor?  
 (a) n-pentane (b) n-hexane (c) n-heptane (d) n-octane
- (ix) When oxalic acid is shaken with ether and water, it \_\_\_\_\_ in water.  
 (a) Associates (b) Dissociates  
 (c) Remains same (d) Remains unaffected
- (x) When the solute undergoes association in one of the solvent then the Nernst distribution law is modified as  
 (a)  $C_1 = C_2^{1/2} \times K$  (b)  $C_2^{1/2} \times C_1 = K$   
 (c)  $C_1 = K \times C_2^2$  (d)  $C_1 = K \times C_2^3$

**Q-2 Give answers of any ten questions. (20)**

- (i) Explain Franck-Rabinovich effect.
- (ii) Suggest a probable mechanism for the reaction:  $\text{Hg}_2^{+2} + \text{Ti}^{+3} \rightarrow 2\text{Hg}^{+2} + \text{Ti}^{+}$
- (iii) Can the activation energy of a reaction be zero or negative? Why?
- (iv) State assumptions involved in Boltzmann distribution law.
- (v) Define: Thermal energy, Degeneracy of energy levels
- (vi) Give the importance and limitations of Boltzmann distribution law.
- (vii) What are the most important advantages of UV detector?
- (viii) Describe any two types of column packing in HPLC.
- (ix) Enlist the different stationary phase used in HPLC.
- (x) What are the limitations of distribution law?
- (xi) Write the characteristics of liquid which can be proved as good extractant.
- (xii) Name the factors that promote rate and selectivity of an extraction process.

**Q-3 (a)** The mechanism for the reaction  $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$  is as follows. (5)



Using the mechanism and steady state approximation for  $[\text{H}]$  and  $[\text{Br}]$ , derive the rate law expression for the formation of  $\text{HBr}$ .

**(b)** Discuss the activated complex theory for bimolecular gaseous reaction. (5)

**OR**

**Q-3 (a)** Discuss the kinetics of opposing reaction in which the forward as well as backward reactions are both first order. (5)

**(b)** Discuss the Lindemann theory of unimolecular reaction. (5)

**Q-4 (a)** Derive equations for partition function of one dimensional and three dimensional translational motions. (5)

**(b)** Derive equations for partition function and thermal energy of rotational motion. (5)

**OR**

**Q-4 (a)** Derive equations for partition function and thermal energy of vibrational motion. (5)

**(b)** State and explain different types of energy possessed by a gas molecule at any temperature. Enlist the molecular properties on which these different energies depend. (5)

**Q-5** Draw the schematic diagram of HPLC. Give principle, apparatus and basic functions of each part of HPLC. (10)

**OR**

**Q-5** Discuss the effect of temperature on HPLC. Also give the advantages and applications of HPLC. (10)

**Q-6 (a)** Discuss briefly the various factors that are responsible for affecting the process of extraction. (5)

**(b)** Distribution ratio of  $\text{PdCl}_2$  in tri-n-butyl-phosphate (TBP) towards 3M  $\text{HCl}$  is 2.3. How many times the extraction should be carried out using 5 ml TBP each time to extract 99.5%  $\text{PdCl}_2$  from 15 ml 3M  $\text{HCl}$  solution? (5)

**OR**

**Q-6 (a)** Write a note on batch extraction and continuous extraction. Give the advantages of solvent extraction. (5)

**(b)** In presence of dithiozane at  $\text{pH}=6$ , a metal X gets 95% extracted with  $v$  ml of methylenechloride to  $V$  ml of aqueous solution. Under the same condition metal Y is 5% extracted. Calculate the efficiency of separation of metal X and Y. If volume of methylenechloride and aqueous solution is same. (5)