## SARDAR PATEL UNIVERSITY
## B. Sc. [ SEMESTER – VI ] EXAMINATION
Saturday , 9th April – 2016
02 : 30 pm To 05 : 30 pm
## PHYSICAL CHEMISTRY : USO6CCHEO6

**Total marks : 70.**

Q.-1. Choose and rewrite the correct options for the following MCQs. [10]

1. At a given temperature ,if the activation energy is high then rate of reaction will be,------------
   (a) Slow     (b) Moderate     (c) Fast     (d) None of these

2. A substance which can increase the rate of reaction is known as,----------
   (a) Catalyst     (b) Catalysis     (c) Promoter     (d) All of these

3. From the Arrhenius equation : $k = A e^{-Ea/RT}$ , if Ea = 0 then k = A , which represents, ------------
   (a) Every collisions between the molecules leads to the no chemical reaction
   (b) Every collisions between the molecules leads to the chemical reaction
   (c) Activation energy of the reaction increases
   (d) None of these

4. A water molecule can vibrate in three ways, corresponding to three vibrational degree of freedom is given by the expression : ----------
   (a) 3n – 5     (b) 3n – 6     (c) 3n     (d) All of these

5. Which of the following is dimensionless quantity ?, -----------
   (a) Rotational energy (b) Heat capacity     (c) Partition function     (d) All of these

6. Which of the following is the heart of HPLC ? -----------
   (a) Detector     (b) Recorder     (c) Column     (d) Pump

7. Which of the following separation techniques are possible with great success in HPLC ? -----------
   (a) Adsorption     (b) Partition     (c) Ion exchange     (d) All of these

8. Which of the following solvent is expected to have maximum compressibility factor at $25^0$C ? ----------
   (a) n-Hexane     (b) n-Heptane     (c) n-Pentane     (d) n-Octane

9. When succinic acid or oxalic acid is shaken with ether and water it,------------ in water.
   (a) Remains insoluble   (b) Dissociates into ions   (c) No change   (d) All of these

10. For the study of distribution law, the two solvent should be, ---------------
    (a) Immiscible     (b) Miscible     (c) Volatile     (d) All of these

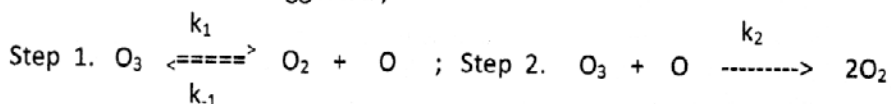Q.-2. Give the answer of ANY TEN questions. [20]

1. What value of the rate constant is predicted by the Arrhenius equation ? If T -----> α ? Is this value physically reasonable ?
2. Define the terms : (1) Temperature coefficient     (2) Activated complex
3. How does catalyst increase the rate of reaction ?
4. Define the terms : (1) Heat capacity     (2) Degeneracy of energy levels
5. State Dulong – Petit generalization. What are its limitations ?
6. State assumptions involved in Boltzmann distribution law.

7. Enlist different stationary phase used in HPLC.
8. Describe any two types of column packing in HPLC ?
9. Define symmetry factor and capacity factor in HPLC.
10. Explain modifiers with example.
11. Name the factors that promotes rate and selectivity of an extraction process.
12. What is sequestering agent ? Give its uses.

Q.-3. (a) Derive the well known Eyring equation for the rate constant of simple [05]
bimolecular gaseous reaction using activated complex theory.
(b) Calculate the rate constant of a second order reaction at $25^0$ C using [05]
Arrhenius equation. [ Given : A = $2.01 \times 10^5$ dm$^3$ mole$^{-1}$ s$^{-1}$, R = 8.314 J k$^{-1}$ mole$^{-1}$,
Ea = 54.48 K J mole$^{-1}$ ].

OR

Q.-3. (a) Give Rice-Herzfeld mechanism for the reaction between $H_2$ and $Br_2$ and [05]
discuss about each step of the mechanism.
(b) For the thermal decomposition of Ozone to Oxygen, the following [05]
mechanism has been suggested ;

Step 1. $O_3$ $\underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}}$ $O_2$ + O ; Step 2. $O_3$ + O $\overset{k_2}{\longrightarrow}$ $2O_2$

Use the steady state approximation and other suitable approximation to account
for the observed rate law , viz., r = - k$[O_3]^2$ / $[O_2]$.

Q.-4. Explain the term partition function. Derive the equations for the translational , [10]
rotational and vibrational partition functions.

OR

Q.-4. Define thermal energy. Derive the equations for translational , rotational and [10]
vibrational thermal energies.

Q.-5. (a)What is HPLC ? Write the advantages of HPLC. [05]
(b) Describe various types of pumps used in HPLC. [05]

OR

Q.-5. (a) Which types of detectors are used in HPLC ? Discuss the UV detector in [05]
detail with proper diagram.
(b) Give brief account on choice of supporting materials for separation in HPLC. [05]

Q.-6. (a)Explain solid-liquid extraction by some examples. Give brief account of [05]
extraction of solute from solid sample by discontinuous infusion type extractor.
(b) Explain applications of solvent extraction in metallurgy. [05]

OR

Q.-6. (a) Write short notes on : (1) Batch extraction (2) Continuous extraction. [05]
(b) The solubility of a substance is twice in ether than in water. Calculate the [05]
quantity extracted in 100 ml aqueous solution, (1) One extraction using
100 ml ether (2) Two extraction using 50 ml ether.

*********** ALL THE BEST ***********