

VITHALBHAI PATEL & RAJRATNA P.T. PATEL SCIENCE COLLEGE
VALLABH VIDYANAGAR
INTERNAL TEST – 2014
B.Sc. (SEMESTER - VI)

Date: 15.03.2014

Day: Saturday

Time: 3.30 pm to 5.00 pm

Total marks: 30

Subject: PHYSICAL CHEMISTRY (US06CCHE06)

- Q-1 Give answers of any three questions. (06)
- (i) Define the terms catalyst and temperature co-efficient.
(ii) State Arrhenius equation. Why 'A' is known as frequency factor?
(iii) Write the mathematical form of Boltzmann distribution law. Explain each term involved in it.
(iv) Calculate the rotational thermal energy of 3.2 gm of CH₄ gas at 100 °C. (at.wt. C = 12. H = 1 gm /mol. R = 8.314 JK⁻¹mol⁻¹)
(v) Name the components of a typical HPLC unit.
(vi) Describe any two types of column packing in HPLC.
- Q-2 (a) For the thermal decomposition of ozone to oxygen, the following mechanism has been suggested : (05)
- Step-1. $O_3 \xrightleftharpoons[k_{-1}]{k_1} O_2 + O$
- Step-2. $O_3 + O \xrightarrow{k_2} 2O_2$
- Use steady state approximation and other suitable approximation to account for the observed rate law, viz., $r = -k [O_3]^2 / [O_2]$.
- (b) Discuss the effect of catalyst on the rate of a reaction. (03)
- OR
- Q-2 (a) What is meant by mechanism of a reaction? Explain the equilibrium and steady state approximations for the complex reaction. (05)
- (b) Consider the following Lindemann mechanism for the unimolecular decomposition of a molecule A in the presence of an inert gas molecule M : (03)
- $A + A \xrightleftharpoons[k_{-1}]{k_1} A^* + A$
- $A + M \xrightleftharpoons[k_{-2}]{k_2} A^* + M$
- $A^* \xrightarrow{k_3} P$
- Applying the steady state approximation to A*, derive the rate law for the formation of the product.
- Q-3 (a) Derive an expression for rotational partition function of diatomic molecule. (04)
- (b) The vibrational band of HCl is centered at 2885 cm⁻¹. This represents the vibrational transition $v = 0 \rightarrow v = 1$. Calculate the force constant of HCl bond. (04)
- (at.wt. Cl = 35.46, H = 1 gm /mol and speed of light = 3×10^8 m/s).
- OR
- Q-3 (a) Derive an expression for vibrational thermal energy of diatomic molecule. (05)
- (b) Calculate the partition function for translational motion of O₂ molecule free to move along one dimension of a one litre cubic container. Molar mass of oxygen is 32 g/mol and $k = 1.38066 \times 10^{-23}$ JK⁻¹. (03)
- Q-4 What are the important advantages of HPLC? Also discuss about the refractive index detector. (08)
- OR
- Q-4 Describe various types of pumps used in HPLC, also discuss the effect of temperature on HPLC. (08)

