

Bago University
Department of Chemistry
Second Semester Examination, September 2019

Second Year BSc
(Chemistry Specialization)
Answer any six Questions

Chem 2107
Physical Chemistry II
Time Allowed: (3) hours

1. (a) Fill in the blanks with the correct word(s), unit(s), and etc., as necessary.
- (i) A reaction in which one of the reactants is present in a large excess shows an order _____ from the actual order.
 - (ii) The molecularity of an elementary reaction is defined as the number of _____ molecules involved in a reaction.
 - (iii) At constant temperature, the rate at which a substance react is directly proportional to its _____.
 - (iv) The equilibrium constant varies only with the _____ of the reaction.
 - (v) A system with $F=2$ is known as _____ or having two degrees of freedom.
 - (vi) The reduced phase rule equation is _____.
- (b) Select the correct statement(s), word(s), unit(s) and etc., given in the followings.
- (i) A reaction whose concentration does not affect the reaction rate is called (first, second, zero) order reaction.
 - (ii) Half-life for a first order reaction is (dependent, independent, twice) of the initial concentration.
 - (iii) Forward reaction predominates until equilibrium ($Q < K$, $Q = K$, $Q > K$) is established.
 - (iv) For exothermic reaction, heat is (absorbed, given out, equally).
 - (v) The phase diagram or (P-V, P-T, V-T) graph of the system water, ice and vapour.
 - (vi) A solution of common salt system expressed in (two, one, three) components.
2. (a) Describe the differences between order and molecularity of a reaction.
- (b) (i) What is meant by order of a reaction?
- (ii) The time for half change (t) of a gaseous substance undergoing thermal decomposition was determined for various initial pressure (P) with the following results:
- | | | | |
|---------|-----|-----|-----|
| P (mm) | 750 | 500 | 250 |
| t (min) | 105 | 235 | 950 |
- Find the order of the reaction.
3. (a) (i) Define chemical equilibrium. Give an example.
- (ii) We place some nitrogen and hydrogen in an empty 5.0 L vessel at 500°C. When equilibrium is established, 3.01 mol of N_2 , 2.01 mol of H_2 and 0.565 mol of NH_3 are present. Evaluate K_c for the following reaction at 500°C.
- (b) Give the thermodynamic derivation of the equilibrium constant.

P.T.O

4. (a) Derive mathematical expression for the rate constant of a second order reaction;

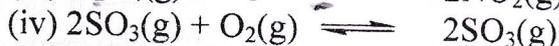
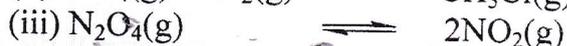
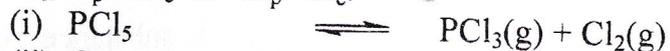


- (b) The thermal dissociation of acetaldehyde was studied by Hinshelwood at 518°C with the following results:

t (s)	42	73	105	190	242
x = (P - P _i) in mm	34	54	74	114	134

Show that the reaction is of the second order if the initial pressure is 363 mmHg.

5. (a) Define the Le-Chatelier-Braun Principle and mention which of the reactions are $K_p = K_c$, $K_p > K_c$ or $K_p < K_c$.



- (b) In a mixture of 1 part of N_2 to 3 parts of H_2 , the mole percent of NH_3 at equilibrium was found to be 1.2 at 500°C and a total pressure of 10 atm. Calculate the K_p and the pressure at the equilibrium mixture at this temperature for 10.4 mole percent of NH_3 .

6. (a) Determine C, P and F for each of the following:

(i) A closed flask containing ice, distill water and water vapour.

(ii) Sulphur_(l) \rightleftharpoons sulphur_(vap)

(iii) Water in a beaker at room temperature

(iv) An aqueous solution of NaCl in equilibrium with ice and water vapour.

- (b) (i) Define the terms phases and components.

(ii) Draw the phase diagram of the water system.

7. (a) Derive the Phase Rule.

- (b) (i) Draw the phase diagram of sulphur system.

(ii) Calculate the number of phases (P), components (C) and degree of freedom (F) for the system in which ammonium chloride is in equilibrium with ammonia and hydrochloric acid certain amount of hydrochloric acid initially present in the system.
