KNT/KW/16/5083

Bachelor of Science (B.Sc.) Semester II (C.B.S.) Examination

CHEMISTRY (Physical Chemistry)

Compulsory Paper—2

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) All **FIVE** questions are compulsory and carry equal marks.

(2) Draw diagrams and give chemical equations whenever necessary.

1. (A) Derive an expression for w, q, ΔE and ΔH for expansion of gases under isothermal reversible process. 5

(B) Explain :

(i) Average bond energy, and

(ii) Bond dissociation energy.

Calculate the enthalpy change of the following reaction :

$$H_{2(g)} + Cl_{2(g)} \rightarrow 2\ HCl_{(g)}$$

Given that the bond dissociation energies of H – H, Cl – Cl and H – Cl are 437.0 KJ mol^{-1}, 244.0 KJ mol^{-1} and 433.0 KJ mol^{-1} respectively. 5

OR

(C) Distinguish between reversible and irreversible processes. $2^1/_2$

(D) Explain with examples :

(i) Intensive, and

(ii) Extensive properties. $2^1/_2$

(E) Show that in Joule-Thomson experiment the enthalpy remains constant under adiabatic expansion of a real gases. $2^1/_2$

(F) Calculate the enthalpy of combustion of ethylene (g) to form $CO_{2(g)}$ and $H_2O_{(g)}$ at 298 K and 1 atmospheric pressure. The enthalpies of formation of CO_2, H_2O and C_2H_4 are –393.7, –241.8 and +52.3 KJ mol^{-1} respectively. $2^1/_2$

2. (A) Draw and discuss the phase diagram of Lead-Silver system. 5

(B) What is critical solution temperature ? Discuss Phenol-water and Triethylamine - water systems. 5

OR

(C) Explain why KCl – NaCl – H_2O system should be regarded as a 3-component system whereas KCl – NaBr – H_2O system should be regarded as a 4-component system. $2^1/_2$

(D) Draw well-labelled diagram of water system. $2^1/_2$

(E) State and explain the Raoult's law of ideal solutions. $2^1/_2$

(F) In the distribution of benzoic acid between water and benzene, the following results were obtained :

C_1 (in water)	1.50	1.95	2.97
C_2 (in benzene)	24.20	41.20	97.00

Assuming that benzoic acid exists as single molecule in water, show that it exists as double molecule in benzene. $2^1/_2$

3. (A) Explain the terms :

(i) Specific conductance

(ii) Equivalent conductance

(iii) Molar conductance

The resistance of 0.01N NaCl solution at 25°C is 200 ohms. Cell constant of the conductivity cell is 1 cm^{-1}, calculate the equivalent conductance of the solution. 5

(B) State and explain Kohlrausch's law of independence migration of ions. How can it be used to determine equivalent conductance at infinite dilution for weak electrolytes ? 5

OR

(C) What are the postulates of Arrhenius theory of Electrolytic Dissociation ? $2^1/_2$

(D) Write a note on Relaxation effect. $2^1/_2$

(E) The equivalent conductance of a very dilute solution $NaNO_3$ at 18°C is 105.2 mhos cm^2 g eq^{-1}. If the ionic conductance of NO_3 ion in the solution is 61.7 mhos cm^2 g eq^{-1}, calculate the transport number of Na^+ ion in the solution. $2^1/_2$

(F) Discuss conductometric titration of weak acid with strong base. $2^1/_2$

4. (A) Describe half-life period for the determination of order of reaction. The half-life of a chemical reaction at a particular concentration is 50 minutes. When the concentration is doubled, the half-life becomes 100 minutes. Find out the order of reaction. 5

(B) Discuss Transition State theory. Derive an expression for the rate constant based on equilibrium constant. 5

OR

(C) Describe the various factors affecting the rate of reaction. $2^1/_2$

(D) Derive an expression for rate constant for the reactions of first order. $2^1/_2$

(E) For a reaction A→ B, the rate constant doubled when temperature was raised from 25°C to 35°C. Calculate the activation energy of the reaction. $2^1/_2$

(F) Discuss the Lindemann's theory as applied to the unimolecular reaction. $2^1/_2$

5. Attempt any **TEN** questions out of the following :

(i) Define isolated system.

(ii) Give two statements of first law of thermodynamics.

(iii) Define inversion temperature.

(iv) Write Gibbs phase rule equation.

(v) State Henry's law.

(vi) Give any two Limitations of Nernst distribution law.

(vii) Write Debye-Huckel Onsagar equation.

(viii) What do you mean by transport number ?

(ix) Write an equation for solubility product of AB_2 type electrolyte.

(x) Define order of reaction.

(xi) What is Pseudo unimolecular reaction ?

(xii) Define activation energy of a reaction. 1×10=10