

NOTE: i) All the questions are compulsory.

ii) Figures to right indicate full marks.

iii) Use of non-programmable calculator / log table is allowed.

[20]

Q.1. Attempt any four:

A) The values of ΔH and ΔS for two reactions are given below:

Reaction A: $\Delta H = -10.5 \times 10^3 \text{ Jmol}^{-1}$ $\Delta S = 31 \text{ JK}^{-1}$

Reaction B: $\Delta H = -11.7 \times 10^3 \text{ Jmol}^{-1}$ $\Delta S = -105 \text{ JK}^{-1}$

Calculate ΔG and predict whether these processes are spontaneous or not.

B) From thermodynamic principle, derive the Classius-Clapeyron equation.

C) Explain i) Partial molal volume

ii) Chemical potential

D) Derive the Gibbs-Duhem equation.

E) Explain the variation of Gibbs's free energy with temperature and pressure.

F) i) Define Gibbs free energy and Give its mathematical expression.

ii) How Gibbs free energy is used to decide the spontaneity of a reaction?

G) Explain the variation of chemical potential with temperature.

H) Derive the Gibbs-Helmholtz equation.

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Q.2. Attempt any four:

A) Define transport number and derive $t \propto v$.

B) Define 1) Electrolytic conductors 2) Specific conductance 3) Molar conductance
4) Electronic conductors 5) Specific resistance.

C) Explain the variation of molar conductance with concentration.

D) Give a brief account of Debye-Huckel theory of strong electrolytes.

E) State & explain Kohlrausch law of independent migration of ions and give its application for the determination of limiting molar conductance of weak electrolyte.

F) The conductance of 0.05M acetic acid solution was found to be $4.21 \times 10^{-4} \text{ S}$. If the cell constant of conductivity cell is 1 cm^{-1} . Calculate the specific conductance, equivalent conductance and molar conductance of given solution.

G) Describe the moving boundary method for determination of transport number.

H) Explain the relationship between ionic conductance & transport number.

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Q.3. Attempt any four:

A) Application of analytical chemistry in field of environment and organic chemistry.

B) Explain calibration curve method.

C) Write a short note on Photomultiplier tube.

D) State Beer-Lambert's Law? Explain in detail Beer's law.

E) What is Quantitative analysis? Classify it depending upon types of required information.

VCD

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- F) Define 1) Absorbance 2) Transmittance 3) percentage transmittance 4) Radiant power
5) wave length of maximum absorption.
G) Write advantages of instrumental and chemical methods.
H) Write a short note on sample cell.

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Q.4. Attempt any three:

- A) i) Define vapour pressure of liquid and explain the effect of temperature on it.
ii) For a certain process, $\Delta H = 29.8 \text{ KJmol}^{-1}$ and $\Delta S = 66.5 \text{ JK}^{-1}$ respectively.
Calculate the temperature at which free energy change for the reaction will be zero.
B) Derive the Clapeyron equation.
C) i) Define degree of dissociation and give its mathematical expression.
ii) Calculate the molar conductance of acetic acid at infinite dilution if the values of limiting molar conductance for sodium chloride, hydrochloric acid and sodium acetate are 126.45×10^{-4} , 426.16×10^{-4} , $89.81 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$ respectively.
D) Discuss the application of Kohlrausch's law in determination of dissociation constant of weak electrolyte.
E) Explain principle and working of single beam photometer.
F) The molar absorptivity of solute is $1.8 \times 10^4 \text{ dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$. If the solution of the substance has an absorbance of 0.75 in 1 cm path length.
Calculate 1) transmittance 2) concentration of solution.
