

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86
(For candidates admitted during the academic year 2019–20 & thereafter)

B.Sc. DEGREE EXAMINATION, NOVEMBER 2023
BRANCH IV- CHEMISTRY
FIFTH SEMESTER

COURSE : MAJOR CORE
PAPER : PHYSICAL CHEMISTRY-II
SUBJECT CODE : 19CH/MC/PC54
TIME : 3 HOURS **MAX.MARKS :100**
SECTION – A **(30x1=30)**

Answer all the questions.

I. Choose the Correct Answer:

- Intensive property among the following is
(i) density (ii) mass (iii) volume (iv) energy.
- The difference between the molar heat capacity of a gas at constant pressure and at constant volume is equal to
(i) enthalpy (ii) entropy (iii) gas constant (iv) internal energy.
- Which of the following factors affects the heat of reaction based on with Kirchhoff Equation?
(i) Temperature (ii) Pressure (iii) volume (iv) none.
- Thermodynamic process in which heat is not exchanged with the surroundings is
(i) isothermal (ii) adiabatic (iii) isobaric (iv) isochoric.
- The necessary condition for a reaction to be spontaneous at all temperatures is
(i) $\Delta G = \Delta H$ (ii) $\Delta G < \Delta H$
(iii) ΔG and ΔH should be positive (iv) ΔG and ΔH should be negative.
- Deliquescent substance amongst the following is
(i) Sodium carbonate (ii) sodium chloride
(iii) oxalic acid (iv) potassium dichromate.
- Gibbs phase rule for general system:
(i) $P+F=C-1$ (ii) $P+F=C+1$ (iii) $P+F=C-2$ (iv) $P+F=C+2$
- The maximum number of phases that can be simultaneously in equilibrium for a one component system is
(i) 1 (ii) 2 (iii) 3 (iv) 4.
- A phase transition is always
(i) isothermal and isoentropic (ii) isothermal and isochoric
(iii) isobaric and isochoric (iv) isothermal and isobaric.
- Solution which obeys Raoult's law is
(i) benzene- toluene (ii) water – ethanol
(iii) water -acetic acid (iv) phenol – water.

II. Fill in the blanks:

- All natural processes are thermodynamically -----.
- Work done in isothermal expansion is ----- than the work done in adiabatic expansion.
- Work and heat are ----- functions.
- Mathematical statement of first law of thermodynamics is -----.
- The temperature at which Joule-Thomson coefficient changes sign is called as -----.
- The entropy of a perfect crystalline solid at absolute zero temperature is -----.
- Reduced phase rule equation is -----.
- The incongruent melting point is also known as ----- temperature.
- Nernst distribution law is -----.
- Henry's law is -----.

III. State whether True or False:

21. The Clausius statement deals with the transfer of heat from a lower to a higher temperature.
22. The direction of a natural process is known from second law of thermodynamics.
23. If hot water and cold water are mixed, entropy of system will decrease.
24. Absolute zero of entropy is defined by second law of thermodynamics.
25. The mixture of acetaldehyde and carbon disulphide shows positive deviation from ideal behavior.

IV. Answer in a line or two:

26. State Nernst theorem.
27. What are freezing mixtures? Give an example.
28. Define activity.
29. What is meant by cryoscopic constant?
30. Calculate the molarity of a solution containing 20 grams of sodium hydroxide in 200 mL of water.

SECTION – B**(5X6=30)****Answer any FIVE questions:**

31. Derive expressions for the work done in reversible isothermal expansion and reversible isothermal compression of an ideal gas.
32. Discuss the criteria for reversible and irreversible processes.
33. Draw and explain the phase diagram of water system.
34. Explain the method by which aniline can be purified.
35. Acetic acid associates in benzene to form double molecules. 1.65 g of acetic acid when dissolved in 100 g of benzene raised the boiling point by 0.36°C, Calculate the van't Hoff factor and the degree of dissociation of acetic acid in benzene. ($K_b = 2.5 \text{ K kg mol}^{-1}$)
36. Discuss the applications of Nernst distribution law.
37. Apply the phase rule to the two-component system in which the components form a eutectic mixture.

SECTION - C**Answer any TWO questions:****(2x20=40)**

38. (a) Derive an expression for the Joule – Thomson coefficient of a van der Waal's gas.
(b) Derive the Clapeyron- Clausius equation and give its applications.
39. (a) State Le Chatlier's principle. Apply this to the formation of ammonia from nitrogen and hydrogen and arrive at the conditions which would favour the formation of ammonia. (Formation of ammonia is an exothermic reaction)
(b) Draw and discuss the phase diagram of a compound with congruent melting point.
40. (a) Derive the relation between the boiling point elevation of a solution and the mole fraction of the dissolved solute. How is the expression used for determining the molar mass of a nonvolatile solute?
(b) Explain the phase diagrams of the following systems (i) water – triethylamine
(ii) nitrobenzene-hexane.



