



SAIVA BHANU KSHATRIYA COLLEGE
(Aruppukottai Nadargal Uravinmurai Pothu Abi Viruthi Trustuku Pathiyapattathu)
ARUPPUKOTTAI
DEPARTMENT OF CHEMISTRY
QUESTION BANK

Class:	B.Sc., Chemistry		
Semester (UG - III & V; PG - III) :	V	Subject Code :	SCHJC52
Name of the Subject :	PHYSICAL CHEMISTRY II		

Section A (Multiple Choice Questions)

UNIT I: FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS

- Which among the following is not an extensive variable?
a) mass b) volume c) energy d) temperature
- _____ is an extensive property of a system
a) pressure b) viscosity c) mass d) surface tension
- The amount of heat (q) for an adiabatic process is _____
a) infinity b) zero c) positive d) negative
- The Joule-Thomson coefficient for an ideal gas is _____
a) zero b) positive c) negative d) infinity
- Which among the following is path function?
a) internal energy b) enthalpy c) work d) entropy

UNIT II: SECOND LAW OF THERMODYNAMICS AND ITS APPLICATIONS

- The change of internal energy for a cyclic process is _____
a) positive b) negative c) zero d) none of the above
- The maximum efficiency of an engine operating between 110 °C and 25 °C is _____
a) 2.22 b) 0.222 c) 0.0222 d) 22.2
- Entropy unit is _____
a) J b) K c) JK d) JK⁻¹
- Which among the is the correct statement for the spontaneous process?
a) $\Delta S = 0$, $\Delta G = 0$ and $\Delta A = 0$ b) $\Delta S = +ve$, $\Delta G = -ve$ and $\Delta A = -ve$
c) $\Delta S = +ve$, $\Delta G = +ve$ and $\Delta A = -ve$ d) $\Delta S = -ve$, $\Delta G = +ve$ and $\Delta A = +ve$
- For a total of one mole of a pure substance the free energy is equal to _____
a) Chemical potential b) entropy c) internal energy d) enthalpy

UNIT III: THERMODYNAMICS OF EQUILIBRIUM PROCESSES

- The Nernst heat theorem holds good only in the case of _____
a) pure liquids b) pure gases c) pure solids d) none of the above



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12. The Δn for the formation of ammonia is _____
a) zero b) positive c) negative d) infinity
13. Which among the following is not a colligative property?
a) osmotic pressure b) atmospheric pressure
c) lowering of vapour pressure d) elevation of boiling point
14. The mole fraction of solute in dilute solution is _____
a) less than unity b) equal to unity c) greater than unity d) zero
15. The ΔG for an equilibrium reaction is _____
a) + ve b) - ve c) zero d) infinity

UNIT IV: PHASE EQUILIBRIA

16. The Gibbs phase rule is _____
a) $F = C + P - 2$ b) $F = C + P + 2$ c) $F = C - P + 2$ d) $F = C - P - 2$
17. The degree of freedom (F) at triple point is equal to _____
a) one b) two c) three d) zero
18. Which among the following is simple eutectic system?
a) Water system b) Sulphur system
c) Lead - silver system d) Ferric - chloride system
19. The reduced Gibbs phase rule is _____
a) $F = C + P - 1$ b) $F = C + P + 1$ c) $F = C - P + 1$ d) $F = C - P - 1$
20. The number of phases at triple point is _____
a) one b) two c) three d) four

UNIT V: GROUP THEORY

21. Which among the following is not a symmetry element in water molecule?
a) E b) C_2 c) σ_v d) i
22. The point group for the ammonia molecule is _____
a) C_{2v} b) C_{3v} c) C_{2h} d) D_{2h}
23. Ethylene molecule belongs to _____ point group
a) C_{2v} b) C_{3v} c) C_{2h} d) D_{2h}
24. The angle by which an object is rotated by C_3 axis is _____
a) 90° b) 120° c) 180° d) 60°
25. _____ property is absent in non-abelian group
a) Inverse b) Associative c) Commutative d) Closure



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Section B (7 mark Questions)

Unit I: FIRST LAW OF THERMODYNAMICS AND ITS APPLICATION

26. Give an account on
 - a) Zeroth law of thermodynamics
 - b) Joule-Thomson effect
27. Derive work done expression for isothermal and adiabatic process
28. Compare the following properties
 - a) Intensive and extensive properties
 - b) State and path function
29. Derive $C_p - C_v = R$
30. Derive mathematical form for the first law of thermodynamics

Unit II: SECOND LAW OF THERMODYNAMICS AND ITS APPLICATIONS

31. Give various statements for the second law of thermodynamics
32. Derive Gibbs- Helmholtz equation
33. Show that $\Delta S = q_{rev} / T$
34. Derive expression for the entropy change accompanying variation of
 - a) Temperature and volume
 - b) Temperature and pressure
35. What is meant by chemical potential? Derive the Gibbs – Duhem equation

Unit III: THERMODYNAMICS OF EQUILIBRIUM PROCESSES

36. Derive the relation between the equilibrium constant K_p and K_c
37. State the law of mass action. Derive Van't Hoff isotherm
38. State and explain Nernst Heat theorem
39. State and derive Raoul's law for relative lowering of vapour pressure
40. Discuss in details about the abnormal behavior of solution of electrolytes

Unit IV: PHASE EQUILIBRIA

41. State phase rule. Explain the various terms involved
42. Derive the Gibb's Phase rule



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43. Draw schematically the phase diagram for the water system and apply the Gibbs phase rule to it
44. Draw and discuss the phase diagram for the Sulphur system
45. Draw and discuss the phase diagram for the Lead – Silver system

Unit V: GROUP THEORY

46. Discuss the following symmetry operation with suitable examples
 - a) Proper axis of rotation
 - b) Centre of symmetry
47. Construct Group multiplication table for H₂O molecule
48. Show that the symmetry elements of H₂O molecule form an abelian group
49. Explain in details about the properties of a group with suitable example
50. Discuss the point groups with suitable examples
 - a) C_nv
 - b) C_nh

Section C (10 mark Questions)

Unit I: FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS

51. Give an account on
 - a) Kirchoff's equation
 - b) Hess's law of constant heat of summation
52. Derive the Joule-Thomson coefficient. Show that it is zero for an ideal gas and has a positive value for a real gas

Unit II: SECOND LAW OF THERMODYNAMICS AND ITS APPLICATIONS

53. Give the formation of the second law of thermodynamics on the basis of Carnot cycle
54. Derive the followings
 - a) Maxwell relation
 - b) Thermodynamic equation of state

Unit III: THERMODYNAMICS OF EQUILIBRIUM PROCESSES

55. State Le-Chatelier principle and give its application in the formation of ammonia
56. Derive the thermodynamic derivation of relationship between relative lowering of vapour pressure and osmotic pressure

Unit IV: PHASE EQUILIBRIA



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57. Draw and explain the phase diagram for the Ferric Chloride – water system
58. Explain the following with the help of Clapeyron – Clausius equation
- Effect of pressure on the melting point of ice
 - Effect of pressure on the boiling point of water

Unit V: GROUP THEORY

59. Show that the symmetry elements of NH_3 molecule form non abelian group
60. Derive matrix representation for the following symmetry operations
- Proper axis of rotation (C_n)
 - Plane of symmetry (σ)
 - Centre of symmetry (i)