



Register Number:

Date:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27

B. Sc. CHEMISTRY – II SEMESTER
SEMESTER EXAMINATION: APRIL- 2022
(Examination conducted in July 2022)

CH 218 : CHEMISTRY - II

Time- 2 ½ hrs

Max Marks-70

Note: This paper contains **3 pages, 3 parts** and **21** questions.

Answer **ALL** the parts.

PART A

Answer any **SIX** questions of the following.

[6 x 2 = 12]

1. Give any two statements of the second law of thermodynamics.
2. 10 moles of an ideal gas expand reversibly from a volume of 5 m³ to 15 m³ at a temperature of 25 °C. Calculate the change in entropy of the gas.
3. Explain Joule-Thomson effect.
4. What is meant by the temperature coefficient of a reaction?
5. Write any two limitations of collision theory.
6. State mutual exclusion rule.
7. Give the gross selection rule for vibrational spectroscopy.
8. Give the mathematical expression of Raoult's law and explain the terms.

PART B

Answer any **EIGHT** questions of the following.

[8 x 6 = 48]

9. Describe the Carnot's reversible cycle for establishing the maximum convertibility of heat into work. Derive an expression for the efficiency of a Carnot's heat engine based on the entropy concept.
10. Derive an expression for the change in entropy of an ideal gas as a function of two variables. i) T and V ii) T and P
11. Explain Andrew's P-V isotherm for CO₂ and mention critical parameters in the P-V isotherm.
12. Derive an expression for rate constant at low pressure for an unimolecular reaction using Lindemann theory.

13. Sketch the fundamental vibrational modes of CO₂ molecule. Indicate the IR activity of these modes.
14. Using electronic transition, explain the Raman effect and discuss the origin of stokes and antistokes lines.
15. Explain the critical solution temperature of a pair of partially miscible binary liquids using phenol-water system as an example.
16. Explain the HSAB concept and discuss any two applications.
17. A protein sample consists of 10 haemoglobin molecules (M=15.5 kg mol⁻¹), 5 ribonuclease molecules (M=13.7 kg mol⁻¹) and 6 myoglobin molecules (M=17.2 kg mol⁻¹). Calculate the number-average and weight-average molecular weights.
18. i) Give any three applications of radioactive isotopes.
 ii) Complete the following reactions:
- a) ${}^{19}_9F + {}^1_1H \rightarrow ? + {}^4_2He$
- b) ${}^7_3Li + {}^4_2He \rightarrow ? + {}^0_0\gamma$
- c) ${}^{238}_{92}U + {}^1_0n \rightarrow {}^{239}_{92}U + ?$ (3 +3)

PART C

Answer any TWO questions of the following. [2 x 5 = 10]

19. Calculate the entropy change accompanying the freezing of one mole of water at 25 °C to ice at -10 °C. Given, the heat of fusion of ice at its fusion point (0 °C) is 6.00 kJ mol⁻¹. The heat capacity of ice is 36.82 JK⁻¹ mol⁻¹ and, the heat capacity of liquid water is 75.31 JK⁻¹ mol⁻¹.
20. a) Arrange the following in increasing order of acid strength and give a reason to justify.
- i) HNO₃, HPO₃, HAsO₃
- ii) CCl₃COOH, CBr₃COOH, F₃CCOOH
- b) Write the conjugate base for the following:
 HClO₄, HNO₃, H₂CO₃, H₂PO₄⁻ (3 +2)
21. a) i) Which of the molecules exhibit microwave spectra?
 N₂, CO₂, OCS, H₂O
- ii) Which of the molecules exhibit IR spectra?
 Cl₂, N₂O, SO₂, HCl
- b) With a suitable explanation, arrange the following in their increasing order of stretching frequency of vibration.
 C≡C, C=C, C—C (3 + 2)
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