#### Register Number:

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# 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

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

Answer ALL the parts.

## PART A

## Answer any SIX questions of the following.

- 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 m<sup>3</sup> to 15 m<sup>3</sup> 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.

- 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 CO<sub>2</sub> 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.

Max Marks-70

 $[6 \times 2 = 12]$ 



[8 x 6 = 48]

- 13. Sketch the fundamental vibrational modes of CO<sub>2</sub> 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<sup>-1</sup>), 5 ribonuclease molecules (M=13.7 kg mol<sup>-1</sup>) and 6 myoglobin molecules (M=17.2 kg mol<sup>-1</sup>). Calculate the number-average and weight-average molecular weights.
- 18. i) Give any three applications of radioactive isotopes.
  - ii) Complete the following reactions:
  - a)  ${}^{19}_{9}F + {}^{1}_{1}H \rightarrow ? + {}^{4}_{2}He$
  - b)  ${}^{7}_{3}Li + {}^{4}_{2}He \rightarrow ? + {}^{0}_{0}\gamma$
  - c)  ${}^{238}_{92}U + {}^{1}_{0}n \rightarrow {}^{239}_{92}U + ?$

#### PART C

#### Answer any TWO questions of the following.

- 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<sup>-1</sup>. The heat capacity of ice is 36.82 JK<sup>-1</sup> mol<sup>-1</sup> and, the heat capacity of liquid water is 75.31 JK<sup>-1</sup> mol<sup>-1</sup>.
- 20. a) Arrange the following in increasing order of acid strength and give a reason to justify.
  - i) HNO3, HPO3, HAsO3
  - ii) CCI<sub>3</sub>COOH, CBr<sub>3</sub>COOH, F<sub>3</sub>CCOOH
  - b) Write the conjugate base for the following:

HCIO<sub>4</sub>, HNO<sub>3</sub>, H<sub>2</sub>CO<sub>3</sub>, H<sub>2</sub>PO<sub>4</sub> (3 +2)

21. a) i) Which of the molecules exhibit microwave spectra?

N2, CO2, OCS, H2O

ii) Which of the molecules exhibit IR spectra?

#### $CI_2,\,N_2O,\,SO_2,\,HCI$

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)

CH218\_A\_22

[2 x 5 = 10]

(3+3)

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