

**D 72749**

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Name.....

Reg. No.....

**FIRST SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2019**

(CUCSS)

Chemistry

CH 1C 04—THERMODYNAMICS, KINETICS AND CATALYSIS

(2015 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Section A**

*Answer all questions.*

*Each question carries a weightage of 1.*

1. Explain the significance of Michaelis constant  $K_m$ .
2. Write a short note on crossed molecular beam technique.
3. What are partial molar properties ? Discuss its significance.
4. Explain the influence of pressure on unimolecular gas phase reactions.
5. Explain Goldfinger-Letort-Niclausse rules for organic decomposition reactions
6. Gases spontaneously mixes with each other". Justify the statement using thermodynamic principle of mixing.
7. Explain the Principle of microscopic reversibility.
8. Differentiate activated complex and transition state.
9. Derive the expression for entropy production during a chemical change at thermal equilibrium
10. What is the significance of rate determining step in multistep reactions ?
11. What is meant by heat of adsorption ? Explain its significance
12. How does pH influence the rate constant of specific acid catalyzed reactions ?

(12 × 1 = 12 weightage)

**Section B**

*Answer any eight questions, each question carries a weightage of 2.*

13. Discuss the first and second explosion limits in  $H_2-O_2$  reaction.
14. How Langmuir adsorption isotherm is used for the surface area determination of adsorbents ?

**Turn over**

15. State third law and explain the determination of absolute entropy using third law
16. Calculate the number of collisions per second in  $1 \text{ cm}^3$  of nitrogen at 300K and 101.3kPa pressure. (Given molecular radius of nitrogen is  $1.18 \times 10^{-8} \text{ cm}$ .)
17. Illustrate Eley-Riedel mechanism by taking the example  $2\text{CO} + \text{O}_2$  reaction.
18. Discuss the collision theory.
19. What is meant by Onsager reciprocal relations, explain its significance ?
20. Calculate the fugacity of a gas at 450 atmosphere pressure and 300K with  $\alpha = -7.5 \times 10^{-4} \text{ dm}^3\text{mol}^{-1}$ .
21. How do relaxation method helps in studying fast reactions ?
22. Discuss briefly (a) Thermo-osmosis (b) Thermal diffusion
23. An ESCA electron was found to have a kinetic energy of 1073.5eV, when a  $\text{MgK}\alpha$  source was employed,  $\lambda$  is  $9.8900\text{\AA}$ . The electron spectrometer had a work function of 14.7 eV. Calculate the binding energy of emitted electron.
24. Discuss Brusselator model for oscillating reactions

(8 × 2 = 16 weightage)

### Section C

*Answer any two questions.*

*Each question carries a weightage of 4.*

25. Discuss in detail Lindeman hypothesis for unimolecular reaction. Explain the modifications suggested by Hinshelwood on Lindemann's theory.
26. (a) What do you mean by excess thermodynamic functions ? Give the experimental determination of excess volume and excess enthalpy.  
(b) Discuss Nernst heat theorem.
27. Explain the principle and application of (i) SEM ; and (ii) ESCA.
28. (a) Distinguish between primary and secondary salt effect.  
(b) Explain the influence of solvent on reaction rates.

(2 × 4 = 8 weightage)