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(Pages : 2)

Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2020

(CBCSS)

Chemistry

CHE 1C 04—THERMODYNAMICS, KINETICS AND CATALYSIS

(2019 Admissions)

Time : Three Hours

Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

Answer any **eight** *questions.*

Each question carries a weightage of 1.

1. Explain with examples 'residual entropy'.
2. Define 'excess thermodynamic functions'. Explain its significance.
3. Explain terms 'forces and fluxes' with reference to irreversible process.
4. State and explain Glansdorf Pregogine theorem.
5. State and explain steady state approximation.
6. Explain pressure jump method of relaxation spectroscopy.
7. Distinguish between Diffusion Controlled and Activation Controlled reactions.
8. Distinguish between Collision Cross Section and Reaction Cross Section.
9. Define isosteric heat of adsorption. Explain its significance.
10. Unimolecular gas phase reactions follow first order kinetics at low pressures and zero order kinetics at high pressures. Why ?

(8 × 1 = 8 weightage)

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Section B

Answer any **six** *questions.*
Each question carries a weightage of 2.

11. Define Fugacity. How is it determined ? Discuss.

12. Write Duhern Margules equation. Use the equation to show that solvent obeys Raoult's law in limit of solute obeying Henry's law.

13. Define phenomenological co-efficient. Show that direct co-efficient always dominate in co-efficients.

14. An organic decomposition reaction follow the mechanism.

$$M_1 \xrightarrow{k_1} R_1 + M_2\,(E_1)$$
$$R_1 + M_1 \xrightarrow{k_2} M_3 + R_2\,(E_2)$$
$$R_2 \xrightarrow{k_3} R_1 + M_4\,(E_3)$$
$$2R_2 \xrightarrow{k_4} (R_2)_2\,(E_4)$$

Assuming steady state approximation for R_1 and R_2 derive the rate law. E_1, E_2, E_3, E_4 activation energies for the elementary steps. Find the apparent activation energy.

15. Derive an equation to show the effect of dielectric constant of the medium on the rate reaction in solution.

16. Briefly discuss a crossed molecular beam experiment.

17. How would you determine surface acidity of the solid using TPD of ammonia ? Discuss.

18. Discuss Lotka Volterra model of oscillating chemical reactions.

(6 × 2 = 12 we

Section C

Answer any **two** *questions.*
Each question carries a weightage of 5.

19. Rationalise :

(a) Thermal Osmosis. (b) Thermal Diffusion using irreversible thermodynamic.

20. What are the methods of studying fast reaction ? Discuss.

21. Discuss briefly. 'Activated Complex theory' of reaction rates.

22. What are the methods for the determination of surface area of solids ? Discuss.

(2 × 5 = 10

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