(6 pages) **Reg. No. :**

Code No. : 6886 Sub. Code : PCHM 43

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Fourth Semester

Chemistry-Core

PHYSICAL CHEMISTRY – IV

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — $(10 \times 1 = 10 \text{ marks})$

Answer ALL questions.

Choose the correct answer :

- 1. Which of the following transitions between rotational energy levels is not allowed?
 - (a) $J = 1 \rightarrow J = 0$
 - (b) $J = 1 \rightarrow J = 0$
 - (c) $J = 1 \leftarrow J = 3$
 - (d) $J = 1 \leftarrow J = 2$

- 2. A simple harmonic oscillator may absorb energy
 - (a) Anytime
 - (b) When the frequencies match exactly
 - (c) At no time
 - (d) When he amplitudes are the same
- 3. The transition zone for Raman spectra is ———.
 - (a) Between vibrational and rotational levels
 - (b) Between electronic levels
 - (c) Between magnetic levels of nuclei
 - (d) Between magnetic levels of unpaired electrons
- 4. Raman Effect supports ———.
 - (a) Corpuscular theory
 - (b) Wave theory
 - (c) Quantum theory
 - (d) Electromagnetic theory
- 5. The minimum energy necessary to permit a reaction to take place is ———.
 - (a) Activation energy
 - (b) Threshold energy
 - (c) Free energy
 - (d) Kinetic energy

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- 6. Collision theory satisfactorily explains ———.
 - (a) First order reaction
 - (b) Zero order reaction
 - (c) Third order reaction
 - (d) Bimolecular energy
- 7. Activated complex is formed due to ———.
 - (a) Decreasing activation energy
 - (b) Decreasing internal energy
 - (c) Increasing activation energy
 - (d) Decreasing enthalpy
- 8. A catalyst increases the rate of reaction by
 - (a) Pressure
 - (b) Effective collision
 - (c) Ineffective collision
 - (d) Temperature
- 9. Anything which increases rate of reaction without being involved in the reaction ————.
 - (a) Promotor
 - (b) Inhibitor
 - (c) Catalyst
 - (d) All of the above

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- 10. A substance which increases the reactivity of enzyme is called ———.
 - (a) Promoters (b) Inhibitors
 - (c) Stimulators (d) Non-activators

PART B — $(5 \times 5 = 25 \text{ marks})$

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Write a note on an anharmonic oscillator.

Or

- (b) What do you mean by the number of fundamental vibrations?
- 12. (a) How does Raman Spectroscopy differs from IR spectroscopy in a few fundamental ways?

 \mathbf{Or}

- (b) Write a comprehensive note on rule of Mutual Exclusion.
- 13. (a) Write a comprehensive note on pulse radiolysis.

Or

(b) Describe the collision theory of bimolecular reactions.

Page 4 Code No. : 6886 [P.T.O.] 14. (a) Explain the Rice-Herzfeld mechanism.

Or

- (b) Outline the influence of pressure on the rate of reaction in solutions.
- 15. (a) How will you compare the physisorption and chemisorptions?

Or

(b) Write a comprehensive note on micelles.

PART C — $(5 \times 8 = 40 \text{ marks})$

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain the energy of diatomic molecules as simple harmonic oscillator.

Or

- (b) Give a brief account on vibration-rotation spectra of polyatomic molecules.
- 17. (a) Discuss the classical and quantum theories of Raman Effect.

Or

(b) Give a comprehensive description on techniques and instrumentation of Raman spectroscopy.

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18. (a) Explain the Lindemann's theory of unimolecular reactions.

Or

- (b) Discuss the NMR and ESR methods of studying fast reactions.
- 19. (a) Give a brief account of influence of solvent on the rate of ionic reactions in solution.

Or

- (b) Explain the following :
 - (i) Formation of phosgene
 - (ii) Decomposition of nitrogen pentoxide (N_2O_5) .
- 20. (a) Derive an expression for BET adsorption isotherm.

Or

(b) How do you calculate the rate of an enzyme catalyzed reaction?

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