

Mid-West University

Examinations Management Office

Final Examinations -2081

Level: Bachelors/B.Sc. Environmental Science /Semester: II F. M: 60

Time: 3hrs. P. M: 30

Subject: Thermodynamics and Kinetics (ENV425)

*Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks*

### Group-A

**Very Short Answer Questions (ANY TEN) [10×2 = 20]**

1. What is the instantaneous rate of reaction?
2. Write an example of Second-order kinetics.
3. How does Ozone decompose? Write its kinetics.
4. Write differences between unimolecular and bimolecular reactions.
5. What are heat capacities? Write the heat capacity equation in terms of constant volume.
6. Write two factors that affect rate of reaction.
7. What is Gibbs-Helmholtz equation? Write criteria of the spontaneity of a reaction.
8. State the third law of thermodynamics. How can you evaluate it?
9. A Carnot engine whose low-temperature reservoir at 7°C has an efficiency of 50%. It is desired to increase the efficiency by 70% by how many degrees should the temperature of the high reservoir be increased?

10. Calculate the work done for reversible adiabatic contraction of 2 mols of an ideal gas on cooling from 270°C to 0°C. Given  $\gamma = 5/3$ ,  $R = 0.08247 \text{ atm mole}^{-1}$ .
11. What are the practical limitations of applying thermodynamic and kinetic model.
12. Define Pseudo Order Reaction? Give example.

### Group-B

**Short Answer Questions (ANY FIVE) [5×4=20]**

13. Prove that  $C_p - C_v = R$ . 8 gm of Oxygen at 27°C and under a pressure of 10 atm. are permitted to expand adiabatically and reversibly until the final pressure is 1atm. Find the final temperature and work done in the process. (For Oxygen  $C_p = 7/2R$ ). [3+2]
14. State the Joule-Thomson effect. Explain the interpretation of the Joule-Thomson effect. [1+4]
15. Explain the Carnot cycle with an indicator diagram. [5]
16. Prove  $W_{rev} = \frac{nR}{\gamma-1}(T_1 - T_2)$ , Where symbols have their usual meaning. [1+4]
17. Differentiate between Order and Molecularity. Derive an integrated rate law equation for first-order kinetics. [1+4]
18. Explain the fundamental assumptions of Collision theory. [5]

**Group-C**

**Long Answer Questions (ANY TWO)**

**[2×10 =20]**

19. Explain the mathematical formulation of Entropy from the Carnot cycle.

Write the criteria of spontaneous reaction.

20. Derive an expression for second-order kinetics. How does temperature affect the rate of reaction? Explain on the basis of Arrhenius equation.

21. The increasing temperature of the Earth by  $0.1^{\circ}\text{C}$  per decade, caused by the accumulation of toxic gases in the atmosphere leading to thermal warming, acid rain, flooding, and ecosystem disruption, how can the principles of chemical kinetics and thermodynamics be applied to identify, strategize, and solve these environmental issues effectively? Explain.

**THE- END**

