**D 12003**         (Pages : 2)        Name...........................................

                                                   Reg. No.....................................

## THIRD SEMESTER (CBCSS–UG) DEGREE EXAMINATION NOVEMBER 2021

Chemistry/Industrial Chemistry/Polymer Chemistry

CHE 3B 03—PHYSICAL CHEMISTRY—I

(2019—2020 Admissions)

Time : Two Hours                                                  Maximum : 60 Marks

### Section A

*Answer atleast* **eight** *questions.*
*Each question carries* 3 *marks.*
*All questions can be attended.*
*Overall ceiling* 24.

1. Calculate RMS velocity of $O_2$ at : (a) STP ; and (b) at 288 K.

2. Calculate number of collisions per second per molecule of $O_2$ at 25ºC and at 1 atm pressure. Collision diameter of oxygen is 361 pm.

3. Distinguish extensive and intensive properties with example.

4. State Carnot's theorem and second law of thermodynamics.

5. What is meant by chemical potential ? What is its significance ?

6. What is entropy ? Give its unit.

7. Why chemical equilibrium is termed dynamic ?

8. What is reaction quotient ?

9. Define order of a group. Give example.

10. Define principal axis.

11. Name point group to which water belongs. Write down its symmetry elements.

12. What is meant by plane of symmetry ? Illustrate with an example.

                                                       $(8 \times 3 = 24 \text{ marks})$

## Section B

*Answer atleast* **five** *questions.*
*Each question carries 5 marks.*
*All questions can be attended.*
*Overall ceiling* 25.

13. Derive expressions for critical constants in terms of Vander Waals constant.

14. Derive RMS and average velocity from Maxwell Boltzmann equation.

15. Six moles of an ideal gas expands isothermally and reversibly from a volume of 1dm3 to volume of 10dm3 at 27ºC. What is the maximum work done ?

16. Derive an expression for relation between entropy and probability.

17. Explain Nernst heat theorem. How does it lead to third law of thermodynamics ?

18. Derive Gibbs-Helmholtz equation. What is its significance ?

19. Give group multiplication table of symmetry operations of $H_2O$ molecule.

(5 × 5 = 25 marks)

## Section C

*Answer any* **one** *question.*
*Each question carries 11 marks.*

20. (a) What is meant by efficiency of heat engine ? Derive an expression.

    (b) What do you understand by heat capacity of a system ? Show from thermodynamic consideration that $C_p - C_v = R$.

21. Derive relation between $K_p$ and $K_c$.

(1 × 11 = 11 marks)