D 51727 **(Pages : 2)** **Name.....**

Reg. No.....

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2023

Chemistry/Industrial Chemistry/Polymer Chemistry

CHE 3B 03—PHYSICAL CHEMISTRY—I

(2019—2022 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answers)

Answer questions up to 20 *marks.*
Each question carries 2 *marks.*

1. Define RMS velocity and give its mathematical expression.
2. Calculate the mean free path of O_2 molecule at 25°C and 1 atm pressure. The collision diameter of O_2 molecule is 273 pm.
3. What are extensive properties ? Give an example.
4. State and explain Nernst heat theorem.
5. Define heat capacity. Write down the relation between heat capacity at constant volume and at constant pressure.
6. Calculate the maximum work done when five moles of an ideal gas expand isothermally and reversibly from a volume of 1 litre to 10 litre at 27°C.
7. Write down the Gibbs Helmholtz equation and explain the terms.
8. Write down the relation between entropy and probability.
9. What is meant by heterogeneous equilibria ? Give an example.
10. State and explain the law of mass action.
11. Identify the point group and write down the symmetry elements present in H_2O.
12. What is meant by centre of symmetry ? Explain with an example.

(Ceiling of marks : 20)

Turn over

Section B (Paragraph)

Answer questions up to 30 *marks.*
Each question carries 5 *marks.*

13. Explain why real gases deviate from ideal behaviour and derive the van der waals equation of state.

14. Define bond dissociation energy. How will you determine the resonance energy of benzene from thermochemical data.

15. Derive the maxwell relations.

16. What is chemical potential ? Briefly describe the variation of chemical potential with temperature and pressure.

17. State and explain Le Chatelier principle taking any *one* reaction as an example.

18. Write and explain the rules for a set of elements to form a mathematical group.

19. What are point groups ? Depict the group multiplication table of C_2v point group.

(Ceiling of marks : 30)

Section C (Essay)

Answer any **one** *question.*
The question carries 10 *marks.*

20. Explain Carnot cycle and derive an expression for efficiency of heat engine.

21. What are critical constants ? Derive the expression for critical constants of a van der Waals gas.

(1 × 10 = 10 marks)