D 31785 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION NOVEMBER 2022

Chemistry, Industrial Chemistry, Polymer Chemistry

CHE 3B 03—PHYSICAL CHEMISTRY—I

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answers)

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

1. Calculate the temperature at which RMS velocity of O_2 equals that of H_2 at 27 K.
2. The molecular diameter of He is 0.22 nm. Calculate mean free path of it at 10^{-6} torr and 298K. (k = 1.38 × 10^{-23}. $JK^{-1}molecule^{-1}$).
3. State first law of thermodynamics. Give its mathematical formulation.
4. State and illustrate Hess's law.
5. State Le chateleirs principle with example.
6. What are the characteristics of chemical equillibrium.
7. Write Vant-Hoff s equation.
8. Explain K_c in terms of K_p explain terms.
9. Define symmetry elements and symmetry operation.
10. What is meant by point group ?
11. Give a single operation equivalent to combined operation σ_{xz} and σ_{yz}.
12. Define principal axis.

(Ceiling of marks : 20)

Turn over

Section B (Paragraph)

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

13. Write notes on critical phenomena.

14. Calculate T_c, P_c and V_c for a gas whose a = 6.49 atm $L^2 mol^{-2}$ and b = 0.0562L mol^{-1}.

15. Define enthalpy of formation. Calculate the enthalpy of formation of N_2O5 from following data. $2NO_g + O_{2g} \rightarrow 2NO_{2g}$ $\Delta H° = -114.0$ KJ, $4NO_{2g} + O_{2g} \rightarrow 2N_2O_{5g}$ $\Delta H° = -102.6$ KJ, $N_{2g} + O_{2g} \rightarrow 2NO_g$ $\Delta H° = +180.4$ KJ.

16. Derive the relation between Cp and Cv.

17. State Nernst heat theorem. How is third law of thermodynamics used to find out absolute entropies ?

18. Derive the relation $\Delta G° = -RTlnKp$.

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

(Ceiling of marks : 30)

Section C (Essay)

Answer any **one** *questions.*
Each question carries 10 *marks.*

20. (a) Calculate enthalpy of combustion of H_2S from following data $°\Delta H_{f\,(H_2S,g)} = -20.1$ KJ mol^{-1} $°\Delta H_{f\,(SO_2,\,g)} = -296.9$ KJ mol^{-1} and $°\Delta H_{f\,(H_2O,\,l)} = -285.84$ KJmol^{-1}.

    (b) Calculate the entropy change in evaporation of 1 mole of water at 100°C. Heat of vapourisation of water at 100°C is 2259.4 Jg^{-1}.

21. (a) What is chemical potential ? Derive Gibbs-Duhem equation.

    (b) Explain the concept of residual entropy.

(1 × 10 = 10 marks)