D 51245 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Core Course

CHE 3B 03—PHYSICAL CHEMISTRY-I

Time : Three Hours Maximum : 80 Marks

Section A (One Word)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. The critical pressure Pc is related to Vander Waals constants by the relation ————.
2. The value of mean free path of a gas ———— with increasing pressure.
3. Give one example for an extensive property.
4. For Joule- Thomson expansion of a real gas, ΔH will be ————.
5. Adiabatic expansion is accompanied by ———— in entropy.
6. In N! = ————.
7. Give one example for a State function.
8. With decrease in temperature, viscosity of a liquid will ————.
9. For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, Kc and Kp are related as ————.
10. The equilibrium constant is related to the standard free energy change of a reaction as ————

(10 × 1 = 10 marks)

Section B (Short Answers)

Answer any **ten** *questions.*
Each question carries 2 *marks.*

11. Calculate the most probable velocity of H_2 molecule at 27°C.
12. Sketch the PV isotherms of CH_4 gas and He gas.
13. Write Vander Waals equation for *n* moles of real gas.
14. Define critical temperature.
15. State zeroth law of thermodynamics.
16. Distinguish between a thermodynamic open and isolated system.

17. What is meant by chemical potential ?

18. What is the effect of temperature on the surface tension of a liquid.

19. What is meant by heterogenous equilibria ? Give one example.

20. Enthalpy of neutralization of strong acid by a strong base is always constant. Explain.

21. One mole of an ideal gas expands isothermally and reversibly at 300 K from a volume of 10 dm^3 to 20 dm^3. Calculate the work done by the system.

22. The equilibrium constant of a reaction is 1.5×10^{-5} at 300 K. Calcualte the value of ΔG°.

(10 × 2 = 20 marks)

Section C (Paragraphs)

Answer any **five** *questions.*
Each question carries 6 *marks.*

23. State Le Chateliers principle. What is the effect of pressure and temperature in the reaction N_2O_4 (g) → $2NO_2$ (g) ΔH = + 59.0 kJ. Explain.

24 Derive Vander Waals equation for *n* moles of a gas.

25. Derive the expression for Joule-Thomson coefficient and also show that its value is zero for an ideal gas.

26. Derive Clausius-Clapeyron equation and discuss its application in liquid-vapour equilibria.

27. Define critical constants. Explain the determination of critical temperature and critical pressure of a gas.

28. Calculate the enthalpy of formation of methane. Give that the standard enthalpy of formation of liquid water, carbondioxide gas are – 285.9 KJ/mol, – 393.5 kJ/mol respectively. Enthalpy of combustion of methane is – 890.3 kJ/mol.

29. What is meant by Parachor ? How is it helpful in the elucidation of molecular structure ?

30. Derive the relation between equilibrium constants Kp and Kc.

(5 × 6 = 30 marks)

Section D (Essays)

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

31. (a) Explain Maxwell's distribution of molecular velocities. Illustrate the effect of temperature on this distribution.

(7 marks)

(b) Calculate the temperature at which root mean square velocity of Hydrogen gas becomes equal to that Oxygen gas.

(3 marks)

32. (a) Derive Gibbs Helmholtz equation. (7 marks)

(b) The enthalpy of formation of ethane at 298 K and at constant pressure is - 89.90 kJ. Calculate the enthalpy of formation at constant volume at this temperature ?

(3 marks)

33. (a) Derive Kirchhoff equation. (7 marks)

(b) For the reaction NH_4Cl (s) $\rightarrow$ NH_3 (g) + HCl (g) ΔH = 170.85 KJ and ΔS = 0.15 $KJ.K^{-1}$ at 300 K. Predict whether the reaction is spontaneous or not at 300 K. Explain.

(3 marks)

34. (a) Derive Van't Hoff equation. (7 marks)

(b) The equilibrium constant of a reaction doubles on raising the temperature from 298 K to 308 K. Calculate the standard enthalpy of the reaction.

(3 marks)

(2 × 10 = 20 marks)