D 92584 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, NOVEMBER 2015

(UG–CCSS)

Core Course—Chemistry

CH 3B 05—PHYSICAL CHEMISTRY-I

Time : Three Hours Maximum : 30 Weightage

I. Answer all the *twelve* questions. Each question carries a weightage ¼. This section contains multiple choice, fill in the blanks and *one word* answer questions :

1 At a particular temperature, the RMS velocity of CO_2 is comparable with :

(a) N_2O. (b) C_3H_8.

(c) CO. (d) Both N_2O and C_3H_8.

2 The deviation of a gas from ideal behaviour is maximum at :

(a) High pressure and high temperature.

(b) Low pressure and low temperature.

(c) High pressure and low temperature.

(d) Low pressure and high temperature.

3 The SI unit of surface tension is :

(a) Nm^{-}. (b) Jm^{-}.

(c) $Nm^{\wedge}$. (d) Nm.

4 The value of ΔH at any temperature is equal to the value of ΔE, for the reaction :

(a) $2C(s) + O_2(g) \longrightarrow 2CO(g)$.

(b) $11_2(g) + 1_2(g) \longrightarrow 2HI(g)$.

(c) $PCI_5 \longrightarrow PC1_3(g) + C1_2(g)$.

(d) $\mathbf{N_2}(g) + 3\,\mathbf{11_2}(g) \longrightarrow 2NH_3(g)$.

5 The value of equilibrium constant of a reaction is independent of :

(a) The initial amount of reactants.

(b) The pressence of a catalyst.

(c) The direction from which the equilibrium is attained.

(d) All these.

Turn over

6 A positive value for Joule Thomson coefficient of a gas shows _____ effect on adiabatic expansion.

7 The condition for reversibility coincides with the condition for _____

8 The ratio of the fugacity of a gas in any state to that in a reference state is called _____

9 Fermions are particles that obey _____

10 A chemical equilibrium in which, the substances are in different physical state is called _____

11 The degree of degeneracy of a particular energy level is expressed in terms of _____

12 Give the relation between Kp and Kx of a reaction.

(12 x ¼ = 3 weightage)

II. Answer all the *nine* questions. Each question carries a weightage of 1 :

13 Write the Maxwell-Boltzmann equation for the distribution of molecular velocities and explain the terms.

14 Calculate the most probable velocity of 0_2 molecule at 300 K.

15 What is optical exaltation ?

16 Define parachor.

17 Distinguish between extensive and intensive properties.

18 Write any *two* limitations of the first law of thermodynamics.

19 'Decrease in Gibb's free energy is a measure of the work other than that due to expansion' : Illustrate.

20 What is meant by residual entropy ?

21 The equilibrium constant for the reaction $CO(g) + H_2O(g)$ $CO_2(g) + H_2(g)$ is 1×10^5 at 298 K. Calculate the value of $\Delta G°$.

(9 x 1 = 9 weightage)

III. Answer any *five* questions. Each question carries a weightage of 2 :

22 Deduce the Virial equation of state from van der Waals' equation.

23 Calculate the molar refraction of C_2H_5OH for which the refractive index is 1.3611 and density is 0.789 g cm ^.

24 Derive any *two* of the Maxwell's relations.

25 Calculate the entropy of mixing of one mole of oxygen and two moles of hydrogen, assuming no chemical change.

26 Derive the relation between entropy and probability.

27 Calculate the translational partition function of a molecule of 0_2 gas at 1 atm and 298 K, moving in a vessel of volume 24.4 dm^3. Given the value of 'm' as 5.3×10^{-26} kg.

28 Explain the effect of temperature and pressure in the following equilibria, using Le-Chatelier's principle.

(i) $A(g) \rightleftharpoons B(g) + C(g)$: ΔH = xKJ and

(ii) $N_2(g) + 3H_2(g) \rightarrow 2NH_3$ (g) : $\Delta H = -92$ KJ.

(5 x -2 = 10 weightage)

IV. Answer any *two* questions. Each question carries a weightage of 4 :

29 (i) What is mean free path of a gas ? How is it related to the coefficient of viscosity of the gas ?

(ii) Explain the limiting density method for the determination of molecular mass of a gas

30 (i) Discuss the different steps involved in the working of Carnot cycle and derive an equation for the efficiency of a Carnot engine.

(ii) The vapour pressure of a liquid increased from 630 mm to 760 mm, when the temperature increased from 368 K to 373 K. Calculate the molar enthalpy of vapourisation of the liquid in this temperature range.

31 (i) Write briefly on :

(a) Partition function and

(b) Statistical weight factor.

(ii) Derive an equation to show the dependence of equilibrium constant on temperature.

(2 x 4 = 8 weightage)