

(4041) **SARDAR PATEL UNIVERSITY**  
**M.Sc. First Semester Examination**

Course No: PS01CCHE03, PHYSICAL CHEMISTRY-I

Wednesday, 5th December, 2012

Time: 10.30 am to 1.30 pm

Total marks: 70

- N.B 1. Figure to the right of each question indicates full marks.  
 2. Answer of all the questions (including multiple choice questions) should be written in the provided answer book only.

Q 1. Answer the following questions.

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- (i) Fugacity integration constant depends on  
 (a) Nature of gas and temperature (b) Nature of gas and pressure  
 (c) Temperature and pressure (d) None of these
- (ii) Freezing point and melting point, both depend on  
 (a) Molar volume (b) External pressure  
 (c) Latent heat constant (d) Temperature
- (iii) Which of the following aqueous solutions has the highest boiling point?  
 (a) Urea (b) NaCl  
 (c) Glucose (d)  $ZnSO_4$
- (iv) The ratio of fugacity to pressure approaches unity as  
 (a)  $p \rightarrow 0$  (b)  $f \rightarrow 0$   
 (c)  $T \rightarrow 0$  (d) None of these
- (v) For any chemical reaction to be spontaneous  
 (a)  $\Delta G$  is positive (b)  $\Delta G$  is negative  
 (c) Reaction should be in equilibrium (d) Reaction should not take place
- (vi) When the liquid components of an ideal solution are mixed then there is no change in  
 (a) Volume (b) Density  
 (c) Heat and volume (d) Volume and density
- (vii) With increasing dilution of a solution, which one of the following is correct?  
 (a) Solute  $\rightarrow 0$ , Solvent  $\rightarrow 0$  (b) Solute  $\rightarrow 0$ , Solvent  $\rightarrow 1$   
 (c) Solute  $\rightarrow 1$ , Solvent  $\rightarrow 1$  (d) None of these
- (viii) Which one of the following is not an intensive property  
 (a) Temperature (b) Density  
 (c) Partial pressure (d) Mass

**Q 2. Answer the following (Any Seven)**

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- (i) Derive the equation  $dF=RT \ln f$ .
- (ii) What is Van der waal's equation? Also state the terms used in the equation.
- (iii) Derive equation for relative fugacity of an infinitesimal isothermal process.
- (iv) What is the thermodynamic significance of partial molar properties?
- (v) Define (i) Partial molar property (ii) Apparent molar property.
- (vi) State ideal form of Henry's Law.
- (vii) Give the criteria for a reaction to occur spontaneously.
- (viii) Derive an expression for mean ionic activity coefficient.
- (ix) Justify: Nature of the standard state is of no thermodynamic significance for activity and activity coefficient.

**Q 3. (a)** Define fugacity. Also discuss equation of state method for determining fugacity of a real gas. **6**

**(b)** Discuss the Lewis Randall rule for determination of fugacity of a gas in gaseous mixture.

**OR**

**(b)** From the following data, calculate the fugacities of Nitrogen gas at various pressure at 0°C. **6**

P (atm)	50	100	200	400	800	1000
PV/RT	0.9846	0.9846	1.0365	1.2557	1.7959	2.0641

**Q 4. (a)** Define metathetic reaction. Derive the statistical expression for value of equilibrium constant for such reaction. **6**

**(b)** Derive the equation for the partition function for a chemical reaction. **6**

**OR**

**(b)** Write Vant Hoff equation and integrate this equation without limits of integration. **6**

Q 5. (a) Explain the relationship between apparent molar property and partial molar property for infinite dilute solution. 6

(b) What is non ideal solution? Discuss about the solutions exhibiting positive and negative deviations from ideal behavior. 6

OR

(b) The freezing point of the benzene is  $5.4^{\circ}\text{C}$  and its latent heat of fusion is  $30.2 \text{ Cal/gm}$ . A solution containing  $6.054 \text{ gm}$  of Triphenyl methane in  $1000 \text{ gm}$  of benzene has a freezing point which is  $0.1263^{\circ}\text{C}$  below that of pure solvent. Calculate the molecular weight of the solute. 6

Q 6. (a) Discuss analytical procedure for calculating activities of a solution. 6

(b) (i) How to find activity of one component from that of other component in a mixture? 3

(ii) Derive the expression for activity coefficient from e.m.f. measurements. 3

OR

(b) Give osmotic pressure method for determining activity of solvent in a solution. 6

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