

18/3/08

Ahsanullah University of Science and Technology  
Department of Computer Science and Engineering  
1<sup>st</sup> Year 1<sup>st</sup> Semester Final Examination ( Fall-2007)  
Course No.: Chem-115. Course Title: Chemistry

Full Marks: 70

Time: 3 hours

There are 8 (eight) questions. Answer any 5 (five) questions. Marks allotted are indicated in the margin.

1. (a) Give the defects of Rutherford atom model. What suggestions were given by Bohr to remove these defects? 5
- (b) Prove that  $mvr = \frac{nh}{2\pi}$  using De-Broglie's concept of wave nature of electron. 4
- (c) State Pauli's Exclusion Principle. Based on this principle show that the maximum number of electrons that can be accommodated in an orbital is 8, when  $n = 2$ . 3
- (d) Define Isotopes and Isobars with examples. 2
2. (a) What are the conditions favorable for the formation of ionic bond? 2
- (b) State VSEPR theory. Discuss the structure of water and ammonia in terms of electron pair repulsion theory. Explain why the bond angles are decreased in different order? 5
- (c) What is hybridization? Explain the formation of bonds in ethylene molecule ( $\text{CH}_2=\text{CH}_2$ ) on the basis of  $\text{SP}^2$  hybridization. 5
- (d) Why ionic compounds are soluble in water? 2
3. (a) Derive a second order rate equation for the reaction  
 $2\text{A} \rightarrow \text{Products}$   
Explain that half life periods of second order reaction depends upon initial concentration of the reactants. 6
- (b) Define activation energy. Draw potential energy diagram for an exothermic and endothermic reaction. 3
- (c) Explain the term "Rate law". 2
- (d) 50% of a first order reaction is complete in 23 minute. Calculate the time required to complete 90% of the reaction. 3
4. (a) What do you mean by chemical equilibrium? Why chemical equilibrium is called a dynamic equilibrium? 4

- (b) The manufacture of ammonia by Haber process is represented by the equation- 6
- $$\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + 22 \text{ kcal}$$
- (i) Discuss the effect of pressure and temperature on the above reaction.
- (ii) Deduce the relation between  $K_p$  and  $K_c$  of the above reaction.
- (c) Some Nitrogen and Hydrogen gases are pumped into an empty five-litre glass bulb at 500 °C. When equilibrium is established, 3.00 moles of  $\text{N}_2$ , 2.40 moles of  $\text{H}_2$  and 0.280 moles of  $\text{NH}_3$  are found to be present. Find the value of  $K_c$  for the reaction. 4
5. (a) Define enthalpy of a reaction. How can you calculate  $\Delta H$  from  $\Delta E$ ? 4
- (b) What is heat of formation? The heat of formation of methane at 298K at constant pressure is -23.98 kcal. Calculate its heat of formation at constant volume. ( $R = 1.987 \text{ cal degree}^{-1} \text{ mol}^{-1}$ ) 4
- (c) State Phase rule and define the terms involved. Draw the phase diagram for the ice-water-water vapor system and explain the areas, lines, triple point and meta-stable equilibrium in this system. 5
6. (a) Describe the electrophilic substitution reaction with reference to the bromination of benzene. 3
- (b) Discuss the mechanism of Markovnikov and anti Markovnikov addition of alkene. 4
- (c) State and derive Raoult's law of vapour pressure. 4
- (d) Calculate the vapour pressure lowering caused by the addition of 120 g of sucrose (mol mass = 342) to 2000 g of water. If the vapour pressure of pure water at 25 °C is 23.8 mmHg. 3
7. (a) Write a note on periodic law. Why group VIII elements may be called bridge element? 4
- (b) What is ionization potential? Show the variation in ionization potential in groups and also in series in periodic table. Explain it. 4
- (c) State and explain the Faraday's laws of electrolysis. 4
- (d) What are electrolytes and non-electrolytes? 2
8. Write short notes on any four of the followings : 3.5×4=14
- (a) Quantum numbers
- (b) Limitation of periodic table
- (c) Metallic bond
- (d) Transition state theory
- (e) Kirchoff's equation
- (f) Determination of order of a reaction by using graphical method
- (g) Osmotic pressure law