B.Sc. Engg./ HD CSE 2nd Semester

04 November 2017

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION — **SUMMER SEMESTER, 2016-2017**

DURATION: 3 Hours — **FULL MARKS: 150**

Chem 4241: Chemistry

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

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1. a) Define chemical potential and Gibb's free energy — 6

   b) Derive a mathematical equation relating the free energy change (ΔG) and equilibrium constant (K). Mention the significance of the obtained equation. — 12

   c) Calculate Kp for the reaction $N_2(g) + O_2(g) \leftrightarrow 2NO(g)$ at 25^0C, when the value of standard free energy (ΔG^o) is 173 KJ. Comment on the result. — 7

2. a) Name and define Chemical bonds. Give a comparative picture of Ionic and Covalent Compounds. — 10

   b) Draw the molecular diagram of NO and CN and explain the bond order and magnetic properties of them. — 10

   c) Show the hybridization in Carbon . — 5

3. a) What are the fundamental particles of an atom? Describe them in brief. — 6

   b) Discuss Bohr's theory of hydrogen atom. What modifications were proposed by Sommerfeld and why? — 12

   c) Calculate the wave length of the first line of Balmer series. — 7

   [Rydberg constant = 109700 cm^{-1}]

4. a) State and explain Henry's law. What is the effect of temperature on the solubility of Gases in liquids. — 10

   b) What is critical solution temperature(CST)? Draw and explain the CST diagram for the water – triethyl amine system. — 10

   c) Discuss briefly hydrogen bonds with an example. — 5

5. a) What is energy of activation(Ea)? Derive an equation showing the relationship between temperature and rate constant (k). 10

b) Discuss the isolation and differential methods to find the order of a reaction. 8

c) The value of the half-life for a first order reaction is 1000 seconds. At what time $1/10^{th}$ of the reactant will remain unreacted ? 7

6. a) Define modern periodic table. Classify elements in terms of electronic configuration. 8

b) Discuss the variation of properties of elements within periods and groups with reference to their (i) Ionic radii (ii) Electro negativity. 8

c) What are inert gases? Discuss the uses of helium and argon. How can you prove that helium is a mono atomic gas? 9

7. a) Define heat of solution and heat of combustion with suitable examples. How can you determine the heat of combustion in a laboratory ? 8

b) Derive mathematical equation showing the effect of temperature on the heat of reaction. Name the equation. 10

c) The heat of reaction of $N_2 + 3H_2 \rightarrow 2NH_3$ at 27^0C was found to be -21.976 kcal. What will be the heat of reaction at 50^oC?The heat capacities Cp at 27^oC for N_2, H_2 and NH_3 are 6.8, 6.77 and 8.86 $cal.mol^{-1}.deg^{-1}$ respectively. 7

8. Write short notes: 5×5

a) Isober and Isotope
b) Quantum Number
c) Relationship between "Kp" and "Kc"
d) Le Chatelier Principle
e) Rutherford's Atom Model