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

SEMESTER FINAL EXAMINATION   SUMMER SEMESTER. 2017-2018
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) State and explain Le Chatelier's principle with suitable examples. **6**
   b) Derive the expression of Kp and Kc for the reaction $N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g)$ in terms of "a", "b" and "x" where "a" and "b" are the initial number of moles of the reactants and "x" is the number of moles going into reaction at equilibrium. Let "P" and "V" are the total pressure and volume of the system. Mention the significance of the obtained expressions. **11**
   c) For the reaction $PCl_5(g) \leftrightarrow PCl_3(g) + Cl_2(g)$, 35% $PCl_5(g)$ is dissociated at 373K. If the total pressure of the system at equilibrium is 1.5atm., calculate the value of Kp and K. **8**

2. a) Define and classify conductance. What is an electrochemical cell? **5**
   b) Draw and explain Galvanic cell. What is the composition and function of salt bridge? **8**
   c) Derive a mathematical equation showing the relationship between equilibrium constant and temperature. Give the graphical representation as well. **12**

3. a) What is an ideal solution? Give the characteristic of an ideal solution and colligative properties. **6**
   b) Derive a mathematical expression relating the molecular weight of a non-electrolyte solute with the lowering of vapor pressure of its solution. **12**
   c) 9.1gm of an unknown non-electrolyte solute is dissolved in 100gm water at 50°C. The lowering of vapor pressure is 25mm of Hg. Calculate the molecular weight(MW) of the solute when the vapor pressure of water at 50°C is 92mm of Hg. **7**

4. a) State the postulates of Bohr's atom model. Derive an equation for calculating the radius of orbits in a hydrogen atom. **12**
   b) Define Isotopes and Isobars. Choose isotopes and isobars from the following list: **6**
   $^{12}_{6}C$; $^{12}_{5}B$; $^{14}_{7}N$; $^{16}_{8}O$; $^{14}_{8}O$; $^{13}_{6}C$; $^{13}_{7}N$
   c) Explain the dual nature of electron and deive De Broglie's equation. **7**

5. a) Define the terms "diamagnetism", "paramagnetism" and "bond order". **6**
   b) Show through the molecular energy diagram the magnetic property and bond order of O_2 and N_2 molecules. What types of bonds are present in them? **14**
   c) Define and explain hydrogen bond with suitable examples. **5**

6. a) Define quantum numbers? What do they signify? Show the relationship between the quantum numbers. **8**
   b) What do you understand by hybridization in Chemistry? Show the different hybridized form of carbon atom with diagram. **8**
   c) Explain with diagram what you understand by osmosis, osmotic pressure and reverse osmosis. What is the importance of reverse osmosis in modern time? **9**

7. a) State and explain Hess's law of constant heat summation with example. What are the application and limitations of this law? 8

   b) What is thermo-chemical equation? What are factors required for writing such an equation? Define and show the importance of heat of neutralization and heat of combustion. 9

   c) Compare any four properties of ionic and covalent compounds. Give reasons for your answers. 8

   5×5

8. Write short notes on the following:
   a) Kinetics of reaction at equilibrium
   b) Kp and Kc relationship
   c) AUFBAU and Pauli exclusion principle
   d) Importance periodic table
   e) Bomb calorimeter