

Final Examination of General Chemistry (2) (C-105) for 1<sup>st</sup> level students

Section (A): Organic Chemistry

(25Marks)

Answer the following questions:

First question

Mark (✓) for the right statement and (X) for the wrong one:

(10 Marks)

- a) Alkanes and cycloalkanes have the same molecular formula. ( )
- b) Butane is produced by free radical polymerization of ethene. ( )
- c) Nucleophiles are electron rich; they form bonds by accepting electrons from electrophiles. ( )
- d) The number of structural isomers of hydrocarbon has molecular formula  $C_4H_8$  is 5. ( )
- e) Addition of hydrogen bromide to propene is regiospecific reaction. ( )
- f) In electrophilic addition reactions the  $\pi$  electrons of the carbon-carbon double bond is electrophile. ( )
- g) On hybridization of one s and one p orbitals of carbon atom we get two  $sp^2$  orbitals and the angle between them  $180^\circ$ . ( )
- h) The carbonate ion has three identical carbon-oxygen bonds. ( )
- i) Monobromination of cyclohexane gave one product only. ( )
- j) Addition of chlorine to unsymmetric alkenes obeys the Markovnikov rule. ( )

Second question

Show by equations how can you prepare three only of the followings: (9 Marks)

- a) 1- propanol from propene.  
b) Ethanal from 2-butene.  
c) 2-propanol from propene.  
d) Propanone from propyne.

Third question

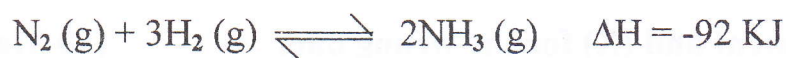
Propose a mechanism and sketch the reaction energy diagram of the electrophilic addition of hydrogen bromide to propene. (6 Marks)

## Section (B) (Nonorganic Chemistry)

Answer Only Five of the following:

(25 Marks)

1. For the following gaseous reaction:



What is the effect of:

- i) Addition of more nitrogen.
- ii) Lowering the temperature.
- iii) Reducing the volume of the mixture to one-half of its original value.
- iv) Removal of ammonia.

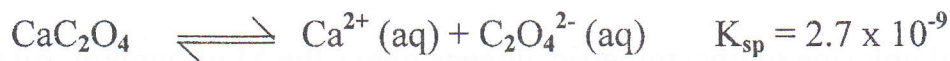
2. A buffer solution contains 0.24 M ammonia and 0.2 M ammonium chloride.

(a) What is the pH of this buffer? (b) If 0.005 mole NaOH is added to 0.50 L of this buffer, what will be the pH-change? ( $K_b = 1.8 \times 10^{-5}$ ).

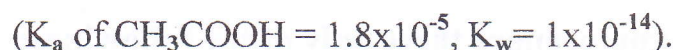
3. Calculate the solubility of AgCl (in g/L) in a solution containing  $6.5 \times 10^{-3}$  M AgNO<sub>3</sub>.  $K_{sp}$  of AgCl =  $1.6 \times 10^{-10}$ , (Atomic weights of Ag= 107.9 and Cl= 35.5).

4. An aqueous solution containing 1.00 g of sorbitol in 100.0 g of water is found to have a freezing point of  $-0.102$  °C. What is the molecular weight of sorbitol ( $K_f = 1.86$  °C/mol).

5. A solution containing 0.005 M Ca(II), If sufficient solid (NH<sub>4</sub>)<sub>2</sub>C<sub>2</sub>O<sub>4</sub> was added to get the conc. of [C<sub>2</sub>O<sub>4</sub><sup>2-</sup>] = 0.00051 M. Will the precipitation of Ca<sup>2+</sup> as CaC<sub>2</sub>O<sub>4</sub> (s) be complete?



6. What is the pH of 0.15 M sodium acetate, CH<sub>3</sub>COONa ?



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Good luck

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Second Semester Final Examination  
Subject: General Chemistry I (C-100)  
Students: First Level "Credit Hours System"

Section (A) (25 Marks)

Answer the Following Questions:

First Question: Answer only three from the following: (15 Marks)

- a) State Charle's law and drive it from kinetic gas equation.
- b) Compare between lyophobic and lyophilic colloids.
- c) i. What is meant by (three only):  
Critical temperature - Boiling point - Emulsion - Amorphous solid .
- ii. How would you prepare the colloidal sol of gold and sulpher.
- d) Give a reason for only four from the following:
1. At high temperature the viscosity is low.
  2. Crystalline solids are anisotropic.
  3. The amount of adsorbed gas decrease as temperature increase.
  4. A gas can be liquefied by lowering temperature and increasing pressure
  5. Zinc will displace hydrogen from dilute acid solution.

Second Question: Answer only two from the following: (10 Marks)

- a) Consider the reaction:



- i. Write the reaction occur ling at anode and cathode.
- ii. Write cell diagram.
- iii. Predict whether the reaction is feasible or not.

$$\text{Where } E^0_{\text{Cu}/\text{Cu}^{2+}} = +0.34 \text{ V} \quad \text{and} \quad E^0_{\text{Al}/\text{Al}^{3+}} = -0.44 \text{ V}$$

- b) Two moles of  $\text{NH}_3$  are enclosed in five liters flask at  $27^\circ\text{C}$ . Calculate pressure exerted by using both ideal gas equation and Vander Waal's equation.

$$(a = 4.18 \text{ L}^2 \text{ atm.mol}^{-2}, \quad b = 0.037 \text{ L mol}^{-1}, \quad R = 0.0821 \text{ L. atm. Mol}^{-1} \text{ K}^{-1})$$

- c) i. Calculate the emf at  $25^\circ\text{C}$  for the following cell:



$$\text{Where } E^0_{\text{Zn}/\text{Zn}^{2+}} = -0.76 \text{ V} \quad \text{and} \quad E^0_{\text{Pb}/\text{Pb}^{2+}} = -0.13 \text{ V}$$

- ii. How many mole of gas present when the gas is occupying a volume of 5.0 L at a pressure of 10.0 atm. and temp. 310 K ( $R = 0.0821 \text{ L. atm. Mol}^{-1} \text{ K}^{-1}$ )

Good Luck  
Prof. Dr. Zahra Abdel Aziz

Please turn over for section B →

Section (B) (25 Marks)

Answer the Following Questions:

First Question: ..... (13 Marks)

a) Choose the correct answer: (9 Marks)

1. Which molecule exhibits resonance?

- a)  $O_3$                       b)  $BeCl_2$                       c)  $CO_2$                       d)  $NF_3$

2. What is the total number of valence electrons in the chlorate ion,  $ClO_3^-$  ?

- a) 24                      b) 26                      c) 28                      d) 32

3. Which one of the following types of radiation has the longest wavelength?

- a) X-rays              b) ultraviolet rays              c) red colored visible light rays              d) gamma rays

4. Octet rule is not followed in the formation of:

- a)  $CH_4$                       b)  $NF_3$                       c)  $BCl_3$                       d)  $H_2O$

5. The emission of electrons from the surface of a metal when struck by light is the:

- a) photoelectric effect              b) electromagnetic radiation              c) spectrum.

6. The electron configuration for  $Fe^{2+}$  is  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$ . Therefore  $Fe^{2+}$  is:

- a) paramagnetic with three unpaired electrons              b) diamagnetic.  
c) paramagnetic with two unpaired electrons              d) paramagnetic with four unpaired electrons

7. In which of these compounds is the bond between the atoms NOT a nonpolar covalent bond?

- a)  $Cl_2$                       b)  $H_2$                       c)  $HCl$                       d)  $O_2$

8. Which one of the following is an allowable set of quantum numbers for an electron?

- a)  $n = 3, l = 2, m_l = -1, m_s = 0$                       b)  $n = 2, l = 1, m_l = -1, m_s = -1/2$   
c)  $n = 1, l = 1, m_l = 1, m_s = +1/2$

9. What is the formal charge on the nitrogen atom in the Lewis Structure?



- a) -1                      b) 0                      c) +1                      d) +2

b) Indicate whether the statement is true or false: (4 Marks)

- LiCl contains an ionic bond.
- For Lyman series  $n_1 = 2, n_2 = 3, 4, 5, 6...$
- In drawing a Lewis structure, the central atom is the atom with the highest atomic number atom.
- The Aufbau principle states that electrons occupy the lowest energy orbital available in the ground state.

Second Question: ..... (12 Marks)

a) Draw Lewis dot (electron) structure for  $(NH_3)$  and determine:

- Molecular geometry                      2. Bond angle
- Hybridization. (Use partial orbital diagram to describe how the mixing of atomic orbitals on the central atoms leads to hybrid orbitals). (6 Marks)

b) Answer two only from the following: (6 Marks)

1. Given  $O_2$ , using molecular orbital and valence bond theory:

- a. Write molecular orbital configuration.              b. Determine bond order.

2. Use a polar arrow to indicate the polarity of each bond: N - H, F - N, I - Cl.

(E.N. of N = 3.0, H = 2.1, F = 4.0, I = 2.5, Cl = 3.0)

3. What is the energy of a photon corresponding to radio waves of frequency  $1.255 \times 10^6 \text{ s}^{-1}$  ?

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(Atomic no. H = 1, He = 2, Be = 4, B = 5, C = 6, N = 7, O = 8, F = 9, Cl = 17)

(Planck's constant =  $6.626 \times 10^{-34} \text{ J.s}$ )