

Assiut University
Faculty of Science
Chemistry Department

June: 2017
Time: 2 hrs
Total Degree: 50

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 three only from the following: (12.5 Marks)

- State Avogadro's law and derive it from kinetic gas equation.
- Compare between lyophobic and lyophilic colloids.
- i) What is meant by (three only):
Critical temperature - Density - Oxidizing agent - Crystalline solid.
ii) Explain briefly reduction method for preparing a colloidal solution.
- d) Give reason for three only from the following:
 - Viscosity is low at high temperature.
 - A gas can be liquefied by lowering temperature and increasing pressure.
 - Copper metal will not displace hydrogen from dilute acid solution.
 - The adsorption can increase by activation.

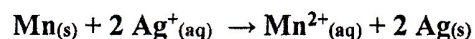
Second Question: Answer two only from the following: (12.5 Marks)

- i) Calculate the emf at 25°C for the following cell:



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

- ii) 600 ml of air at 760 mm Hg pressure were compressed to 200 ml. What will be the new pressure if the temperature remains constant?
- Assuming the following cell reaction:



where $E^0_{\text{Ag/Ag}^+} = +0.8 \text{ V}$ and $E^0_{\text{Mn/Mn}^{2+}} = -1.18 \text{ V}$

Write the i) Anode and cathode reactions.

- Cell diagram.
 - Predict whether the reaction is feasible or not.
- Two moles of NH_3 are enclosed in five liters flask at 25°C. Calculate pressure exerted by using ideal gas equation and Vander Waal's equation.

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

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 : (5 marks)

i. The emission of electrons from the surface of a metal when struck by light is the:
a) photoelectric effect, b) electromagnetic radiation, c) spectrum.

ii. The idea that it is impossible to know both the exact position and momentum of an object at the same time is the uncertainty principle proposed by:
a) Schrodinger, b) Louise de Broglie, c) Heisenberg,

iii. Which of the following are permissible sets of quantum numbers?

- a) $n = 4, l = 4, m_l = 0, m_s = \frac{1}{2}$ b) $n = 3, l = 2, m_l = 1, m_s = -\frac{1}{2}$
c) $n = 2, l = 0, m_l = 0, m_s = \frac{3}{2}$

iv. Which molecule has a Lewis structure that does not obey the octet rule?
a) CO_2 b) PCl_3 c) SF_6

v. The electron-pair geometry and molecular geometry of boron trichloride are respectively
a) tetrahedral, tetrahedral b) tetrahedral, trigonal planar c) trigonal planar, trigonal planar

b) Answer two only from the following: (8 marks)

i. Calculate the wavelength (in nm) of light with energy 7.83×10^{-19} J per photon. In what region of the electromagnetic radiation does this light fall?

ii. Identify the following molecules or ions as stable or unstable. Explain why? Compare the stability.
 He_2 , He_2^+ , O_2 , O_2^-

iii. Draw the Lewis structures for each of the following SiF_6 and CO_2 , then calculate the formal charge for each atom in both of them.

Second Question: Answer three only from the following: (12 Marks)

a) Indicate whether the statement is true or false:

- i. For Paschen series $n_1 = 2, n_2 = 3, 4, 5, \dots$
ii. The bond angle of H_2O molecules is less than the bond angle of CH_4 .
iii. The concept of formal charges is useful in determining the most acceptable Lewis structures.
iv. The resonance structures are introduced because more than one Lewis structures have to be used to describe the bonding of molecules.

b) What is the maximum number of electrons that can be present in the principal level for which $n=3$?

c) Given N_2 and F_2 , using molecular orbital and valence bond theory;

- i. Write molecular orbital configurations ii. Determine bond order and indicate stability
iii. Identify the magnetic properties (paramagnetic or diamagnetic)

d) Draw Lewis dot (electron) structure for PCl_5 , NH_3 and determine:

- i. Electron geometry ii. Molecular geometry iii. Hybridization iv. Bond angle

(Atomic no. $\text{H}=1, \text{He}=2, \text{Li}=3, \text{Be}=4, \text{B}=5, \text{C}=6, \text{N}=7, \text{O}=8, \text{F}=9, \text{Si}=14, \text{P}=15, \text{S}=16, \text{Cl}=17$)
 $c = 3 \times 10^8$ m/s (speed of light), $h = \text{Planck's constant} = 6.6262 \times 10^{-34}$ J.S

Good Luck
Dr. M.I. Abdel Hamid



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

Section (A): Organic Chemistry

(25Marks)

Answer the following questions:

Question 1:- Mark (✓) for the right statement and (X) for the wrong one for Ten Only of the following: (10 Points)

- (a) The C—Cl bond is a polar ionic bond. ()
- (b) A double headed curved arrow between two structures indicates that they are in resonance. ()
- (c) Free radical substitution reactions involve formation of a carbocation as an intermediate. ()
- (d) Addition of HBr to an unsymmetrical alkene is regiospecific reaction. ()
- (e) 2,2-Dimethylpropane has lower boiling point than pentane. ()
- (f) In a resonance, the electrons which can be moved are π -electrons or nonbonded electrons. ()
- (g) conformational isomers are compounds with the same structural formula but the atoms located in different positions in space. ()
- (h) The angle between hybrid orbitals increase with increasing the s character. ()
- (i) the $\equiv\text{C}-\text{H}$ bond in ethyne is more shorter, stronger and acidic than that in ethylene. ()
- (j) Propylene reacted by addition reaction while propyne reacted by both substitution and addition reactions. ()
- (k) Homolytic bond fission of a covalent bonds gave carbocations and carbanions. ()

Question 2: Write the free radical addition mechanism of ethylene polymerization

(three molecules)

(5 Marks)

Question 3: Complete Five Only of the following equations: (10 Marks)

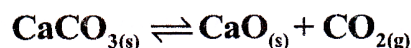
- (a) $\text{H}_3\text{C}-\text{C}\equiv\text{C}-\text{CH}_3 \xrightarrow{\text{Lindlar's catalyst}} \dots\dots\dots$
- (b) $\text{H}_2\text{C}=\underset{\text{H}}{\text{C}}-\underset{\text{H}}{\text{C}}=\text{CH}_2 \xrightarrow{\text{HBr}} \dots\dots\dots$
- (c) $\text{H}_3\text{C}-\text{C}\equiv\text{CH} \xrightarrow{\text{NaNH}_2} \dots\dots\dots$
- (d) $(\text{CH}_3)_3\text{CH} + \text{Cl}_2 \xrightarrow{h\nu} \dots\dots\dots$
- (e) $(\text{CH}_3)_2\text{C}=\underset{\text{H}}{\text{C}}-\text{CH}_3 + \text{O}_3 \xrightarrow{\text{Zn/H}_2\text{O}} \dots\dots\dots$
- (f) $\text{H}_3\text{C}-\underset{\text{H}}{\text{C}}=\text{CH}_2 + \text{H}_2\text{O} \xrightarrow{\text{H}_2\text{SO}_4} \dots\dots\dots$

Section (B): Inorganic**(25 Marks)****First question: Answer only two of the following: (9 Marks)**

- a) A mixture of 0.5 mol H_2 and 0.5 mol I_2 was placed in a 1.0 L stainless steel flask at 430 °C. Calculate the concentrations of H_2 , I_2 and HI at equilibrium. The equilibrium constant (K_c) is 54.3 at this temperature for the reaction $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$
- b) Calculate the solubility of silver chloride (in g/L) in 6.5×10^{-3} M silver nitrate solution. K_{sp} of $AgCl = 1.6 \times 10^{-10}$, (Atomic weights of $Ag = 107.9$ and $Cl = 35.5$).
- c) Calculate the pH value of a 0.15 M solution of sodium acetate, CH_3COONa . (K_b of $CH_3COO^- = 5.6 \times 10^{-10}$, K_a of $CH_3COOH = 1.75 \times 10^{-5}$ and $K_w = 1 \times 10^{-14}$)

Second question: Answer only two of the following: (8 Marks)

- a) For the following endothermic reaction:



What is the effect of i) Adding more $CaCO_3$, ii) Lowering the temperature and iii) Removal of CO_2 .

- b) A buffer solution contains 0.24 M NH_3 and 0.20 M NH_4Cl . If 0.005 mol $NaOH$ is added to 0.5 L of this buffer, what will be the pH of the solution after addition of $NaOH$? ($K_b = 1.8 \times 10^{-5}$)
- c) Calculate the molar solubility of $Al(OH)_3$ in a buffer solution that has a pH = 4. (K_{sp} of $Al(OH)_3 = 1.9 \times 10^{-33}$ at 25 °C)

Third question: Answer only two of the following: (8 Marks)

- a) A solution contains 3.75 g of a nonvolatile hydrocarbon in 95 g of acetone. The boiling points of pure acetone and the solution are 55.9 °C and 56.5 °C, respectively. What is the molecular weight of the hydrocarbon? (K_b of acetone = 1.71 °C/m)
- b) What is the pH of a solution prepared by adding 0.75 g of ammonium chloride to 125 ml of water? (K_b of $NH_3 = 1.77 \times 10^{-5}$, $K_w = 1 \times 10^{-14}$)
(Atomic weights of $H = 1$, $N = 14$ and $Cl = 35.5$)
- c) If 1 mg Na_2CrO_4 is added to 225 ml of 0.00015M $AgNO_3$ (aq), will a precipitate form? $Ag_2CrO_4(s) \rightleftharpoons 2Ag^+(aq) + CrO_4^{2-}(aq)$, $K_{sp} = 4.2 \times 10^{-12}$

(Atomic weights of $O = 16$, $Na = 23$ and $Cr = 52$)

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With Our Best Wishes

Examiners:

Prof. Dr. Hassan El-Sherief.

Prof. Dr. Ali Abdelhafez

Prof. Dr. Ragaa Abolwafa

Dr. Ahmed Mohamed Kamal

Dr. Mohamed Abdel megeed



Assiut University
Faculty of Science
Chemistry Department

May 2017
Time: 2 hr.

Final Examination For 1st year Students (General Chemistry II,
105C, Industrial Chemistry Group).

Section A (Organic Chemistry)

- 1- Choose the correct answer (answer five only) (5 Marks)
- a) What could be the name of a compound that has the general formula RSH?
i) Acid, ii) Ester, Ketone, iii) thioalcohol.
- b) Which formula represents a saturated hydrocarbon?
i) C_3H_6 , ii) C_3H_8
- c) Which compound is an isomer of ethanol?
i) Dimethylthioether, ii) dimethyl ether.
- d) In a molecule of cyclobutane, the total number of covalent bonds is:
i) 6, ii) 10, iii) 12, iv) none.
- e) Which compound is an ester? i) CH_3OH , ii) CH_3CO_2H , iii) $CH_3CO_2CH_3$
- f) A molecule of propene is similar to a molecule of propane in that they both have the same: i) Structural formula, ii) Molecular formula, iii) Number of carbon atoms.
- 2- Proene reacts with hydrogen bromide to produce 2- bromopropane as a major product and not propanol.
- i) Outline the mechanism of the reaction (3 Marks)
- ii) Explain why 2- bromopropane is the major product (2 Marks)
- 3- Complete the following equations: (4 Marks)
- i) Ethylene + HBr \rightarrow
- ii) Cyclohexene + H_2 (Pd/C catalyst) \rightarrow
- 4- a) Ozonolysis of an alkene produces equal amount of formaldehyde. Deduce the alkene structure. (3 Marks)
- b) In which compound is carbon more oxidized: sodium carbonate or sodium acetate (3 Marks)
- c) Explain by using a mechanism the synthesis of polyethylene from ethylene. (5 Marks)

انظر خلفه

Examiner: Prof. Ali Ahmed Abdel-Hafez

General Chemistry (2) (C-105) (Nonorganic Chemistry Part)

Answer the following questions: (25 Marks)

First question: Answer Only Three from the following: (12 Marks)

- (a) What is the pH of a solution containing 0.30 M HCOOH and 0.52 M HCOOK?
($K_a = 1.8 \times 10^{-4}$)
- (b) Calculate the solubility of silver chloride (in g/L) in 6.5×10^{-3} M silver nitrate solution. (K_{sp} of AgCl = 1.6×10^{-10})
- (c) A solution of unknown substance in water at 27 °C gives rise to an osmotic pressure of 3.85 atm. What is the molarity of the solution?
($R = 0.082 \text{ atm.L.mol}^{-1}.\text{K}^{-1}$)
- (d) What molarity of NH_4NO_3 solution has a pH = 5.2?
(K_b for $\text{NH}_4\text{OH} = 1.8 \times 10^{-5}$, $K_w = 10^{-14}$)

Second question: Answer Only Three from the following: (13 Marks)

- (a) Use Le-Chatelier's principle to predict how each of the changes would affect this equilibrium. $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g}) \quad \Delta H^\circ = -198 \text{ kJ}$
- (i) adding $\text{O}_2(\text{g})$ to the system (ii) adding $\text{SO}_3(\text{g})$ to the system
- (iii) lowering the temperature (iv) decreasing the pressure
- (b) For the reaction $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$, $K = 33.3$ at 760 K. One gram of PCl_5 is injected into a 500 mL flask and allowed to come to equilibrium. What will be the concentration of PCl_5 at equilibrium?
- (c) What is the pH value of a solution prepared by dissolving 0.0155 mole $\text{Ca}(\text{OH})_2$ in water to give 735 ml aqueous solution?
- (d) A solution of 0.45 g of urea ($\text{CH}_4\text{N}_2\text{O}$) in 22.5 g of water gave a boiling point elevation of 0.17°C. Calculate the molal elevation constant of water.

(Atomic weights: H = 1, C = 12, N = 14, O = 16, P = 31, S = 32, Cl = 35.5, Ag = 107.87)

----- Good Luck -----

Examiner: Dr. Hossieny Ibrahim