

Assiut University
Faculty of Science

Chemistry Department



Jan, 2019

Time: 2 hr.

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

Section A

1- Answer only five of the following: (12.5 Marks)

- a) Illustrate the type of bond on the following: HBr, NaBr, C₂H₆
- b) On which atom is the formal charge in the hydroxyl ion?
- c) Write the structural formula of the following: i) 2-Pentene
(ii) 4-Methylcyclopentene, (iii) 1,3-Cyclohexadiene,
(iv) 2,3- Dichlorobutane, (iv) 3,5,6- Trimethyl-1-heptene
- d) Draw the Newman projection of the most stable conformation of propane.
- e) Complete: Propene + Cl₂ →.....
- f) Cyclopentene + Br₂ →.....

2- Answer the following questions (12.5 Marks)

- a) Ozonolysis of an alkene produces two moles of acetaldehyde. Deduce the alkene structure (3Marks).
- b) Using correct arrow formalism, write the contributors to the resonance hybrid structure of acetate ion (3 marks)
- c) Explain the free radical chain mechanism of the halogenations of methane (4 Marks).
- d) In which compound is carbon more oxidized formic acid or formaldehyde? (2.5 Marks).

(Section B) انظر خلف الورقة من فضلك

Examiner: Prof. Ali Ahmed Abdel-Hafez

Section (B): (25 Marks)

First question: Answer the following: (17 Marks)

- a) Calculate the pH values of the following solutions:
i) 0.0005M H_2SO_4 ii) 0.1M NH_4OH iii) 0.1M CH_3COONa
iv) a mixture of CH_3COOH and CH_3COONa each of them is 0.03M
(K_b of $\text{NH}_4\text{OH}=1.8 \times 10^{-5}$ and K_a of $\text{CH}_3\text{COOH}=1.75 \times 10^{-5}$) (6 Marks)
- b) Calculate the molar solubility of silver sulphate, Ag_2SO_4 , in the following solutions:
i) pure water ii) 1.0M aqueous Na_2SO_4
(K_{SP} of $\text{Ag}_2\text{SO}_4=1.4 \times 10^{-5}$, Atomic weights: $\text{Ag}=107.9$, $\text{S}=32$ and $\text{O}=16$) (6 Marks)
- c) State Le Chatelier's principle. Predict the following changes on the equilibrium of the reaction:
 $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{SO}_{3(g)} , \Delta H^\circ = -198 \text{ KJ}$
i) increasing the temperature ii) removal of SO_3 iii) adding more SO_2
iv) reducing the volume of the mixture. (5 Marks)

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

- a) 40% of NOBr gas decomposes at 450°C according to the following reaction:
$$2\text{NOBr}_{(g)} \rightleftharpoons 2\text{NO}_{(g)} + \text{Br}_{2(g)}$$

calculate the equilibrium constant (K_C) if 5.0 moles of NOBr (in one liter container) are allowed to decompose at 450°C .
- b) Define buffer solution. A buffer solution is prepared that is 0.24M NH_4OH and 0.2M NH_4Cl . What is the pH of this buffer? If 0.005 mole NaOH is added to 0.5L of this buffer, what will be the pH? (K_b of $\text{NH}_4\text{OH}=1.8 \times 10^{-5}$)
- c) Calculate the molar solubility of $\text{Al}(\text{OH})_3$ in a buffer solution that has a pH value of 4.
(K_{sp} of $\text{Al}(\text{OH})_3 = 1.9 \times 10^{-33}$)
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With My Best Wishes

Dr. Soliman Abdel-Fadeel

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

Section (A): (25 Marks)

Answer all the following questions:

Question One: Answer *only three* from the following:

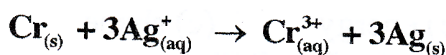
(15 Marks)

- State Graham's law and derive it from the kinetic gas equation.
 - Compare between physisorption and chemisorption.
 - i) What is meant by *only three* from the following:
 - Amorphous solids
 - Critical state of a gas
 - Electrochemical cell
 - Adsorptionii) How would you prepare *only two* of the following lyophobic sols:
Gold, ferric oxide, sulphur.
- d) Give a reason for *only four* from the following:
- Solids are rigid and have a definite volume and shape.
 - Hydrogen gas has a Z/P curve above the ideal behaviour.
 - The vapour pressure of water is lower than that of ethyl alcohol.
 - The charge on colloidal particles.
 - Zinc will displace hydrogen from a dilute acid solution while copper doesn't react.

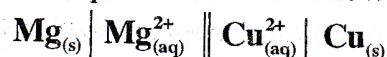
Question Two: Answer *only two* from the following:

(10 Marks)

- Calculate the pressure exerted by 32.0 g of methane (molecular mass=16) in a 500 ml container at 27°C using both ideal gas and van der Waals equations.
($R = 0.0821 \text{ atm.L.K}^{-1}.\text{mol}^{-1}$, $a = 2.253 \text{ atm.L}^2.\text{mol}^{-2}$, $b = 0.0428 \text{ L.mol}^{-1}$)
- Consider the following cell reaction:



- Write anode and cathode reactions.
 - Write cell representation.
 - Predict whether the reaction is feasible or not.
 - Calculate the value of cell potential (emf) at 25°C when $[\text{Cr}^{3+}] = 0.01\text{M}$ and $[\text{Ag}^{+}] = 0.1\text{M}$.
- c) i) A gas occupies 60 litres at 27°C and 5 atm. What pressure is required to compress this quantity of gas into 20 litres at 127°C?
- ii) Write the cell reaction and emf equation for the following cell:



The standard reduction potentials are: $E^{\circ}_{\text{Cu}/\text{Cu}^{2+}} = +0.34 \text{ V}$, $E^{\circ}_{\text{Zn}/\text{Zn}^{2+}} = -0.76 \text{ V}$,
 $E^{\circ}_{\text{Ag}/\text{Ag}^{+}} = +0.80 \text{ V}$, $E^{\circ}_{\text{Cr}/\text{Cr}^{3+}} = -0.74 \text{ V}$, and $E^{\circ}_{\text{Mg}/\text{Mg}^{2+}} = -2.37 \text{ V}$.

Prof. Maher M. A. Hamed, Prof. Zahra A. Ahmed, Dr. Mohamed N. Abd El-Hameed, and Dr. Ahmed A. K. Mohammed

Please turn over for section (B) →

Section (B): (25 Marks)

Answer the following questions:

First question: Answer the following:

(5 Marks for each)

- (a) Using the molecular orbital theory, draw the energy level diagrams for O_2^+ and C_2 , calculate the bond order and predict the magnetic properties for each of them.
- (b) Based on VSEPR theory, predict the electron domain geometries and the molecular shapes for ClF_3 and CCl_4 .
- (c) Write down Lewis structures for only two of the following: NO_3^- , BrF_5 or SF_4 , assign the formal charge for each atom in both of them.

Second question: Answer Only Two of the following: (10 Marks)

- (a) Put true ($\checkmark$) or false (X) for each of the following: (5 Marks)
 - i- de Broglie states that no two electrons in the same atom can have the same set of four quantum numbers.
 - ii- The geometrical shape of CO_2 molecule is bent.
 - iii- The Balmer series of hydrogen spectrum appears in the ultraviolet region.
 - iv- The bond angle in NH_3 is smaller than that in CH_4 molecule.
 - v- A bonding molecular orbital has no nodal plane between the two atoms forming the bond.
- (b) Choose the correct answer: (5 Marks)
 - i- The bond order in O_2^- species is
(a) 1.0 b) 1.5 (c) 2.0 (d) 2.5
 - ii- The geometrical shape of BrF_5 molecule is
(a) octahedral (b) trigonal bipyramidal (c) square pyramidal (d) seesaw
 - iii- Magnetic quantum number (m_l) describes the orbital
(a) size (b) energy (c) shape (d) orientation in the space
 - iv- The hybrid orbitals for P in PCl_5 is
(a) sp^3d^2 (b) sp^3d (c) sp^3 (d) sp^2
 - v- suggested the presence of elliptical orbits in atoms in addition to the spherical orbits
(a) Sommerfield (b) Planck (c) Bohr (d) Pauli
- (c) Give reasons for each of the following: (5 Marks)
 - i- The bond angles in H_2O molecule is smaller than that in CH_4 .
 - ii- B_2 molecule has paramagnetic properties while F_2 molecule has diamagnetic properties.

(Atomic numbers: H=1, Be=4, B=5, C=6, N=7, O=8, F=9, P=15, S=16, Cl=17, Br=35)

Good Luck

Dr. S.A. Soliman, Dr. A.M. Kamal and Dr. M. Farrag and Dr. A. Abo Markeb