

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

**Section (A): (25 Marks)**

Answer all the following questions:

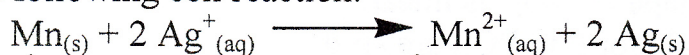
**First question:** Answer **Only Three** from the following: (15 Marks)

- (a) State Graham's law and derive it from kinetic gas equation.
- (b) Compare between physisorption and chemisorption.
- (c) i- How would you prepare the colloidal sol of gold and sulphur?  
ii- What is meant by **only three** from the following:  
Electrophoresis, Standard emf of a cell,  
Isotropy, Adsorption.
- (d) Give reason (or reasons) for **only four** from the following:  
i- Solids are rigid and have a definite volume and shape.  
ii- Deviation of the real gases from the ideal behaviour.  
iii- The vapor pressure of ethyl alcohol is higher than that of water.  
iv- Zinc will displace hydrogen from dilute acid solutions.  
v- The charge on the colloidal particles.

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

- (a) A quantity of 18 gm of water vapor (molar mass = 18) occupies 20 liters at 27 °C. Calculate its pressure using ideal gas and Van der Waals's equations ( $a = 5.464 \text{ atm. L}^2 \text{ mol}^{-2}$ ,  $b = 0.0305 \text{ L mol}^{-1}$ ,  $R = 0.0821 \text{ atm. L deg}^{-1} \text{ mol}^{-1}$ ).

- (b) Assuming the following cell reaction:



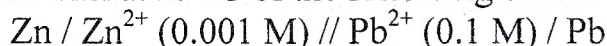
knowing that  $E^\circ_{\text{Ag}/\text{Ag}^+} = +0.80 \text{ volt}$  and  $E^\circ_{\text{Mn}/\text{Mn}^{2+}} = -1.18 \text{ volt}$ .

Write the i- Anode and cathode reactions.

ii- Cell representation (diagram).

iii- Predict whether the reaction is feasible or not.

- (c) i- What will be the emf at 25 °C of the following cell:



given that  $E^\circ_{\text{Pb}/\text{Pb}^{2+}} = -0.13 \text{ volt}$  and  $E^\circ_{\text{Zn}/\text{Zn}^{2+}} = -0.76 \text{ volt}$ .

- ii- 30 liters of a gas has a pressure of 2 atm. and a temp. 27 °C. What will be the volume if the pressure is changed to 5 atm. and the temp. to 127 °C?

*Prof. M. A. Hamed, Prof. Z. A. Ahmed and Prof. M. H. Wahdan*

Please turn over for Section (B) 

### Section (B): (25 Marks)

Answer the following questions:

**First question:**

(12 Marks)

(a) Choose the correct answer:

(5 Marks)

i- The correct set of quantum numbers for the outermost electron of boron atom is .....

1)  $n = 2, \ell = 1, m_\ell = +2, m_s = +1/2$

2)  $n = 2, \ell = 2, m_\ell = -1, m_s = -1/2$

3)  $n = 2, \ell = 1, m_\ell = +1, m_s = +1/2$

4)  $n = 2, \ell = 1, m_\ell = -2, m_s = -1/2$

ii-  $n_2$  value for the third line in Paschen series for hydrogen atom is.....

1) 5

2) 6

3) 7

4) 8

iii- The hybrid orbitals for B in  $\text{BH}_3$  are .....

1)  $\text{sp}^2$

2)  $\text{sp}$

3)  $\text{sp}^3\text{d}$

4)  $\text{sp}^3$

iv- The molecular shape of  $\text{ClF}_3$  is .....

1) Trigonal planar

2) T-shaped

3) Trigonal pyramidal

4) Octahedral

v- "It is not possible to determine with accuracy both the position and velocity of an electron at the same time", this is the statement of .....

1) De Broglie's hypothesis

2) Hund's rule

3) Pauli's exclusion principle

4) Heisenberg's uncertainty principle

(b) Give reasons for **only two** from the following:

(3 Marks)

i-  $\text{O}_2$  molecule has paramagnetic properties.

ii- The bond angle in  $\text{NH}_3$  molecule is less than that in  $\text{CH}_4$  molecule.

iii- The bond energy in  $\text{H}_2^+$  ion is lower than that in  $\text{H}_2$  molecule.

(c) Write down Lewis structures for  $\text{NO}_3^-$  and  $\text{SF}_4$ . Assign the formal charge for each atom in both of them.

(4 Marks)

**Second question:**

(13 Marks)

(a) Put Yes (✓) or No (x) for each of the following:

(4 Marks)

i- The molecular shape of  $\text{NO}_2^-$  is linear.

ii- The hybrid orbitals for P in  $\text{PCl}_5$  are  $\text{sp}^3\text{d}^2$ .

iii- The bond order in  $\text{O}_2^{2-}$  is 1.5

iv- The energy of an electron in Bohr's atom decreases as we move away from the nucleus.

(b) Draw the energy level diagrams for  $\text{N}_2$  and  $\text{F}_2$  molecules. Calculate the bond order and predict the magnetic properties for each one.

(5 Marks)

(c) Using VSEPR theory, predict the electron domain geometries and molecular shapes for **only two** from the following molecules:  $\text{H}_2\text{O}$ ,  $\text{BrF}_5$ ,  $\text{HCN}$ . (4 Marks)

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

**Good Luck**

**Dr. A. A. Dahy, Dr. S. A. Soliman and Dr. H. S. Ibrahim**





Assiut University  
Faculty of Science

January, 2015

Chemistry Department

Time: 2 hr.

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

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Section A

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

- Explain by equation the addition reaction of bromine to ethyne.
- On which atom is the formal charge in the hydronium ion?
- Write the resonance hybrid of the carbonate ion.
- Illustrate the Newman projection of the most stable conformation of propane.
- Complete: Propyne + HBr → .....
- Write a structural formula that shows all bonds of the following:  
i)  $\text{CH}_3\text{CCl}_2\text{CH}_3$     ii)  $(\text{CH}_3)_2\text{C}(\text{C}_2\text{H}_5)_2$   
iii)  $\text{C}_4\text{H}_6$     iv)  $\text{C}_2\text{H}_2$     v)  $\text{C}_4\text{H}_{10}$

2- Answer the following questions ( 12.5 Marks)

- Ozonolysis of an alkene produces equal amount of acetone and propanaldehyde, respectively. Deduce the alkene structure (3Marks).
- Sketch the reaction energy diagram of the polar addition of HBr to ethylene (3Marks).
- Explain the free radical polymerization of ethylene to give polyethylene (4 Marks).
- In which compound is carbon more oxidized acetaldehyde or acetic acid (2.5 Marks).

(Section B) انظر خلف الورقة من فضلك

Examiner: Prof. Ali Ahmed Abdel-Hafez

**Section ( B ) : ( 25 Marks )**

**Answer the following questions :**

**( 25 Marks )**

**First Question :**

**( 9 Marks )**

a) Calculate the pH of a solution containing 0.2 M  $\text{CH}_3\text{COOH}$  and 0.3 M  $\text{CH}_3\text{COONa}$ . And What would be the pH of a 0.2 M  $\text{CH}_3\text{COOH}$  solution if no salt was present ?  
(  $K_a$  of  $\text{CH}_3\text{COOH} = 1.8 \times 10^{-5}$  ).

**( 5 Marks )**

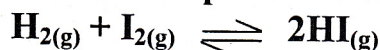
b) Calculate the solubility of silver chloride ( in g/L ) in  $6.5 \times 10^{-3}$  M silver nitrate solution. ( Atomic weights : Ag = 107.9 , Cl = 35.45 ) and (  $K_{sp}$  of AgCl =  $1.6 \times 10^{-10}$  ).

**( 4 Marks )**

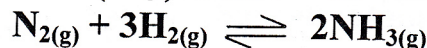
**Second Question :**

**( 8 Marks )**

a) A mixture of 0.500 mol  $\text{H}_2$  and 0.500 mol  $\text{I}_2$  was placed in a 1.00 L stainless steel flask at  $430^\circ\text{C}$ . Calculate the concentrations of  $\text{H}_2$  ,  $\text{I}_2$  and  $\text{HI}$  at equilibrium. The equilibrium constant ( $K_c$ ) is 54.3 at this temperature for the reaction :



b) At  $350^\circ\text{C}$ , the equilibrium constant (  $K_c$  ) is  $2.37 \times 10^{-3}$  for the reaction : ( 4 Marks )



In a certain experiment, the equilibrium concentrations are  $[\text{N}_2]=0.683$  M,  $[\text{H}_2]=8.80$  M and  $[\text{NH}_3]=1.05$  M. Suppose some of the  $\text{NH}_3$  is added to the mixture, so that its concentration is increased to 3.65 M.

- Use Le Chatelier's principle to predict the direction that the reaction will proceed.
- Confirm your prediction by calculating the reaction quotient  $Q_c$  and comparing its value with  $K_c$ .

**Third Question :**

**( 8 Marks )**

**Answer Only Two of the following :**

a) An aqueous solution is prepared by dissolving 1.50 g of hemocyanin , a protein obtained from crabs , in 0.25 L of water. The solution has an osmotic pressure of 0.00342 atm at  $277^\circ\text{K}$ . What is the molar mass of hemocyanin ?

(  $R = 0.082$  L. atm.  $\text{mol}^{-1}.\text{K}^{-1}$  ).

**( 4 Marks )**

b) What is the pH value of a buffer solution containing 0.24 M  $\text{NH}_3$  and 0.20 M  $\text{NH}_4\text{Cl}$  (  $K_b$  for  $\text{NH}_3 = 1.8 \times 10^{-5}$  ).

**( 4 Marks )**

c) Define each of the following terms :

**( 4 Marks )**

Henry's Law - Crystallization – The Molality

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" Good Luck "

Examiner : Dr. Ahmed Mohamed Kamal



First Semester Examination  
Subject: General Chemistry (C-100)  
Students: First level "Credit Hours System"  
Group number 8

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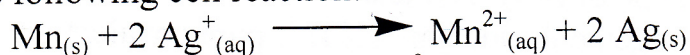
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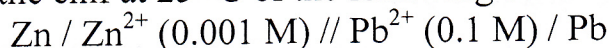
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- 

*Prof. M. A. Hamed*

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## Section (B): (25 Marks)

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(12 Marks)

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(5 Marks)

- i- The correct set of quantum numbers for the outermost electron of boron atom is .....
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- ii-  $n_2$  value for the third line in Paschen series for hydrogen atom is.....
- 1) 5      2) 6      3) 7      4) 8
- iii- The bond order in  $H_2^+$  is .....
- 1) 0      2)  $1/2$       3) 1      4) 1.5
- iv- The molecular shape of  $ClF_3$  is .....
- 1) Trigonal planar    2) T-shaped    3) Trigonal pyramidal    4) Octahedral
- v- "It is not possible to determine with accuracy both the position and velocity of an electron at the same time", this is the statement of .....
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(4 Marks)

**Second question:**

(13 Marks)

(a) Put Yes (✓) or No (x) for each of the following:

(4 Marks)

- i- The molecular shape of  $NO_2^-$  is linear.  
ii- The bond in hydrogen chloride gas ( $HCl$ ) is pure covalent.  
iii- The bond order in  $O_2^{2-}$  is 1.5  
iv- The energy of an electron in Bohr's atom decreases as we move away from the nucleus.

(b) Draw the energy level diagrams for  $N_2$  and  $F_2$  molecules. Calculate the bond order and predict the magnetic properties for each one.

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**Dr. S. A. Soliman**