

Al-Azhar University  
Faculty of Pharmacy

Department of Pharmacognosy and Pharmaceutical chemistry

General chemistry

Final exam.

Student name:.....  
Time: 120 minutes.

Q1	/18
Q2	/7
Q3	/15
Q4	/10
Q5	/10
Final Mark	
/60	

First semester  
2019-2020

**Question 1:**

A- For each of the following molecules, draw Lewis structures that have no formal charges, and then use VSEPR model to predict the geometric shape of the molecule and type of hybridization of the central atom.

The molecule	Lewis structure	Geometric shape (name + drawing)	Type of hybridization of the central atom
$\text{AsF}_5$ As is the central atom			
$\text{HCN}$ C is the central atom			
$\text{OSbCl}$ Sb is the central atom			
$\text{OPCl}_3$ P is the central atom			
$\text{H}_2\text{CO}$ C is the central atom			

C- Which of the following two compounds has a higher solubility in water: CH<sub>3</sub>OH or LiCl? Justify your answer.

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Question 3:

A- You have a bottle containing concentrated HCl solution that is 37% HCl by mass. The density of the solution is 1.18 g/ml.

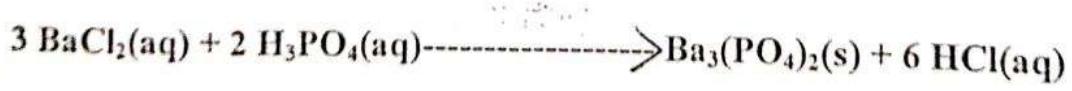
1- What volume of this bottle should be used to prepare 250 ml of 2 M HCl solution?

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2- Calculate the molality of the concentrated solution?

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B- When H<sub>3</sub>PO<sub>4</sub>(aq) is added to 125 ml of a solution of BaCl<sub>2</sub>, 3.26g of Ba<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>(s) precipitates. What is the molarity of the BaCl<sub>2</sub> solution. The equation for the reaction is:



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B- Which of the following two molecules has a higher polarity:  $\text{PF}_3$  or  $\text{BF}_3$ ? Justify your answer using Lewis structures.

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C- Write Lewis structures for these ions: (a)  $\text{C}_2^{2-}$ , (b)  $\text{NO}^+$ . Show formal charges.

(a) $\text{C}_2^{2-}$	
(b) $\text{NO}^+$	

D- Draw the most acceptable resonance structures for: (a)  $\text{ClO}_3^-$  ion, (b) FNNN molecule. Show formal charges.

(a) $\text{ClO}_3^-$ ion	
(b) FNNN molecule	

Question 2:

A- List the types of intermolecular forces that exist in each of these species:

- (a) Benzene ( $\text{C}_6\text{H}_6$ ).....  
(b)  $\text{CH}_3\text{Cl}$ .....  
(c)  $\text{NH}_3$ .....

B- Which of the following two compounds has a higher boiling point:  $\text{CH}_3\text{OH}$  or  $\text{CH}_3\text{Br}$ ? Justify your answer.

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B- Which of the following two molecules has a higher polarity:  $\text{PF}_3$  or  $\text{BF}_3$ ? Justify your answer using Lewis structures.

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(a) $\text{ClO}_3^-$ ion	
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- (b)  $\text{CH}_3\text{Cl}$ .....
- (c)  $\text{NH}_3$ .....

B- Which of the following two compounds has a higher boiling point:  $\text{CH}_3\text{OH}$  or  $\text{CH}_3\text{Br}$ ? Justify your answer.

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**Question 4:**

**A- Consider the following equilibrium at 395 K:**



Write the equation of  $K_c$  and  $K_p$  (if found) for the reaction.

**B- Consider the equilibrium between molecular oxygen and ozone:**



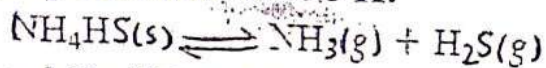
What would be the effect of the following changes on the position of equilibrium:

- (a) increasing the pressure on the system .....
- (b) adding  $\text{O}_2$  to the system.....
- (c) decreasing the temperature.....
- (d) adding a catalyst.....

**C- A sample of 20 mL of 0.10 M  $\text{Ba}(\text{NO}_3)_2$  is added to 50 mL of 0.10 M  $\text{Na}_2\text{CO}_3$ . Given that:  $K_{sp}$  for Barium carbonate ( $\text{BaCO}_3$ ) is  $8.1 \times 10^{-9}$ . Will  $\text{BaCO}_3$  precipitate? Justify your answer by calculations.**

**Question 4:**

**A- Consider the following equilibrium at 395 K:**



Write the equation of  $K_c$  and  $K_p$  (if found) for the reaction.

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**B- Consider the equilibrium between molecular oxygen and ozone:**



What would be the effect of the following changes on the position of equilibrium:

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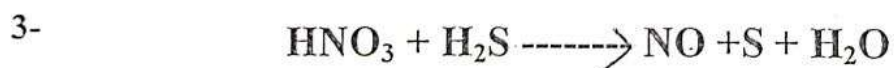
C- Balance the following equations:



Final equation	
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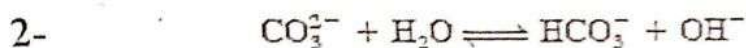
Final equation	
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Final equation	
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A- Identify the acid-base conjugate pairs in each of these reactions:



B- Compare the strengths of the following pairs of acids:

1-  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{SeO}_4$ .

2-  $\text{HNO}_3$  and  $\text{HNO}_2$ .

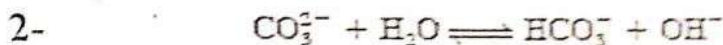
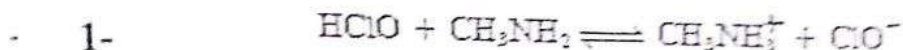
3-  $\text{H}_2\text{O}$  and  $\text{H}_2\text{S}$ .

C- Complete the following sentences:

1. In 2s subshell, 2 denotes the value of .....number, and s denote the symbol of .....number.
2. The ground state electron configuration of Cs represented by noble gas core is.....
3. The elements in which the differentiating electron is filled in the f subshells are called.....
4. Group ..... have the highest electron affinity values, while groups .....and.....have the lowest electron affinity.
5. ....is defined as the energy required to completely separate one mole of a solid ionic compound into gaseous ions.
6. The name of  $\text{P}_4\text{O}_6$  is....., while the molecular formula of boron trichloride is.....
7. When the overall enthalpy change in the formation of the solution ( $\Delta H_{\text{soln}}$ ) is negative, this means that overall process of solution formation is.....

Question 5:

A- Identify the acid-base conjugate pairs in each of these reactions:



B- Compare the strengths of the following pairs of acids:

1-  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{SeO}_4$ .

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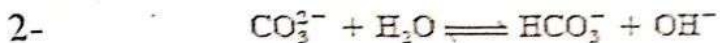
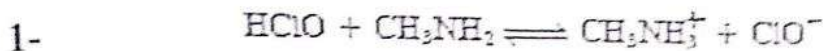
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