

Mansoura University  
Faculty of Science  
Chemistry Department  
Subject: General Chemistry  
Course code: Chem111



First year education students  
Major: Chemistry  
Time allowed: 3 hours  
Full Mark: 155 Marks  
Date: Jan 11, 2015

**Section A: Inorganic Chemistry [78 Marks]**

**Answer the following questions:**

- I-a) On the basis of VBT, what is the kind of hybridization and geometry of the following: i)  $\text{BeCl}_2$  ii)  $\text{BF}_3$  iii)  $\text{PCl}_5$  iv)  $\text{SF}_6$  (At.No: F=9, B=5, P=15, S=16 and Cl=17) [20 Marks]
- b) Using VESPR theory, determine the geometry of the following: [20 Marks]  
i)  $\text{BrF}_5$  ii)  $\text{SnCl}_5$  iii)  $\text{ICl}_2$  iv)  $\text{NH}_3$   
(H=1, N=7, Br=35, F=9, Cl=17, I=53 and Sn=50)
- c) Write the values of n, l, m and s for each orbital in the  $2p^2$  subshell. [5 Marks]

II- Choose the appropriate answer and give the reason: [33 Marks]

- What is the electronic configuration of  $\text{Mg}^{2+}$  ion ( ${}_{12}\text{Mg}$ )?  
i)  $1s^2 2s^2 2p^6$  ii)  $1s^2 2s^2 2p^6 3s^1$  iii)  $1s^2 2s^2 2p^6 3s^2 3p^6$  iv)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
- Which of the following is most likely to be an ionic compound?  
i)  $\text{NF}_3$  ii)  $\text{Na}_2\text{O}$  iii)  $\text{CO}_2$  iv)  $\text{N}_2$
- Which of the following Lewis structures best represents the bonding in  $\text{POCl}_3$ ?  
i)  $\ddot{\text{O}}=\ddot{\text{P}}-\ddot{\text{Cl}}$  ii)  $\ddot{\text{O}}-\ddot{\text{P}}-\ddot{\text{Cl}}$  iii)  $\ddot{\text{O}}=\text{P}=\ddot{\text{Cl}}$  iv)  $\ddot{\text{O}}-\ddot{\text{P}}-\ddot{\text{Cl}}$
- Which one of the following is a metal?  
i) Ne ii) Cl iii) B iv) Al
- Which atomic orbital is spherical in shape?  
i) 2s ii) 2p iii) 3d iv) 4f
- Which one of the following elements has the largest first ionization energy?  
i) Na ii) Rb iii) Cl iv) Al
- Which of the following has the largest radius?  
i)  $\text{O}^{2-}$  ii)  $\text{F}^-$  iii)  $\text{Na}^+$  iv)  $\text{Mg}^{2+}$
- Calculate the  $\nu$  &  $\lambda$  of the spectral in hydrogen spectrum corresponds to an electron transition (  $n=3$  to  $n=2$  ) {  $A=2.18 \times 10^{-18}$ ,  $c=3 \times 10^8 \text{ m/sec}$ ,  $h=6.62 \times 10^{-34} \text{ J}$  }?  
i)  $4.568 \times 10^{14} / \text{s}$ , 656.3 nm. ii)  $3.95 \times 10^{12} / \text{s}$ , 423.2 nm.  
iii)  $4.568 \times 10^{14} / \text{s}$ ,  $6.563 \times 10^{-7} \text{ m}$ . iv) i or iii.
- How many lone (nonbonding) pairs of electrons are on the central atom of  $\text{XeF}_2$ ?  
i) 1 ii) 2 iii) 3 iv) 4
- Molecules like NO,  $\text{NO}_2$  and  $\text{BF}_3$  .....the octet rule.  
i) do not follow ii) all do not follow iii) only NO follows iv)  $\text{NO}_2$  and  $\text{BF}_3$  follow
- Which of the following molecules contains only one non-bonding pair of valence electrons?  
i)  $\text{NH}_4^+$  ii) HCN iii)  $\text{C}_2\text{H}_4$  iv)  $\text{N}_2$

Please turn over →

**Section B: Physical Chemistry [77 Marks]**

**Answer the following questions:**

1- Write short notes on:

[20 Marks]

- The factors affecting the solubility of a solute in a liquid solvent
- The boiling point elevation in solutions

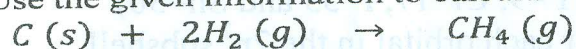
2- Compare between:

[16 Marks]

- Raoult's law and Henry's law
- Bond enthalpy and bond dissociation energy
- Molar heat capacity and specific heat capacity
- Molarity and molality

3- Use the given information to calculate  $\Delta H^\circ$  of the reaction:

[11 Marks]



- The heat of combustion of  $C(s)$  is  $-393.5 \text{ kJ/mol}$
- The heat of combustion of  $H_2(g)$  is  $-285.8 \text{ kJ/mol}$
- The heat of combustion of  $CH_4(g)$  is  $-890.4 \text{ kJ/mol}$

4- Henry's law constant for oxygen dissolved in water is  $4.34 \times 10^{-4} \text{ atm}$  at  $25^\circ\text{C}$ . If the partial pressure of oxygen is  $0.2 \text{ atm}$ , calculate the concentration of dissolved oxygen in moles per litre.

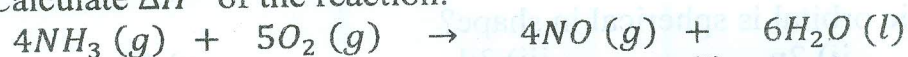
[10 Marks]

5- For a certain hydrocarbon gas,  $20.0 \text{ mg}$  has a pressure of  $24.7 \text{ torr}$  in  $500 \text{ cm}^3$  vessel at  $25^\circ\text{C}$ . Find the molecular weight of the gas.

[10 Marks]

6- Calculate  $\Delta H^\circ$  of the reaction:

[10 Marks]



knowing that  $\Delta H_f^\circ$  of  $NH_3(g)$ ,  $NO(g)$ ,  $H_2O(l)$  are  $-46.11$ ,  $90.25$  and  $-285.83 \text{ kJ/mol}$  respectively.

Best wishes