大同大學104 學年度(寒)轉學入學考試試題

考試科目:化學　　系別:化學工程學系　　

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

1. Explain the following terms : (30%)

(1) What are the three laws of an ideal gas? (何謂理想氣體的三定律?)

(2) Dalton's law of partial pressure of gases? (寫出道爾頓的氣體分壓定律?)

(3) State function? Standard state? (何謂狀態函數? 何謂標準狀態?)

(4) Hydrogen bonding? Give an example. (何謂氫鍵? 試舉例說明)

(5) How are the acid rains produced in the atmosphere? (大氣酸雨形成原因與反應方程式?)

2. Compare the size of the following ions : S^{-2}, Mg^{2+}, K^{+}, Al^{3+}, Ca^{2+}? Which are the isoelectronic ions?
(比較下列各離子的半徑大小 : S^{-2}, Mg^{2+}, K^{+}, Al^{3+}, Ca^{2+}? 那些是等電子離子?) (10%)

3. Order the following species with respect to carbon-oxygen bond length (longest to shortest)? And why?
CO, CO_2, CO_3^{-2}, CH_3OH. (預測所列各分子或離子中的 C－O 鍵長長短順序(由長至短排列)?為什麼?) (10%)

4. Write the electron configuration and give the core electrons and valence electrons of the following atoms: (寫出各原子的電子組態? 並標出電子組態中那些是核心電子? 那些是價電子?)
(1) $_{23}V$ (2) $_{50}Sn$ (3) $_{29}Cu$ (10%)

5. Consider the reaction : (計算下列反應式中 $ClF_3(g)$的標準生成熱焓$\triangle H°_{f,ClF_3}$ = ? kJ/mole)
$2ClF_3(g) + 2NH_3(g) \rightarrow N_2(g) + 6HF(g) + Cl_2(g)$　　$\triangle H° = -1196$ kJ
$\triangle H°_{f,HF} = -271$ kJ/mole; $\triangle H°_{f,NH_3} = -46$ kJ/mole, Calculate $\triangle H°_{f,ClF_3}$ = ? kJ/mole? (10%)

6. For each of the following molecules, write the Lewis structures, predict the geometric structure.
(寫出下列各項的 (a)最穩定路易士構造? (b)幾何形狀?)
(1) SO_3 (2) $POCl_3$ (3) XeO_4 (4) OCl_2 (5) SF_4 (10%)

7. A balloon is being inflated to its full extent by heating the air inside it. In the final stages of this process, the volume of the balloon changes from 3.5×10^6 L to 4.0×10^6 L by the addition of 1.6×10^8 J of energy as heat. Assume that the balloon expands against a constant pressure of 1.0 atm. Calculate w and $\triangle E$ for the process?
(使用 1.6×10^8 J 的熱量加熱一熱氣球，使其體積由 3.5×10^6 L 變成 4.0×10^6 L，設熱氣球外的大氣壓一直保持 1.0 atm 不變，試計算熱氣球在膨脹過程中對外所做的功 w 與其內能變化$\triangle E$ 值各多少?) (10%)

8. Name each of the following compounds in English and Chinese and in chemical formula.
(寫出下列各化合物之 中文名稱 與 英文名稱 及 化學式)
(1) Sodium sulfite, (2) SO_3, (3) 溴化亞鐵, (4) Hydrocyanic acid, (5) 碳酸氫鈉. (10%)