

- 一. 答案依題目順序寫於答案卷上
- 二. 計算題務必列出相關公式和計算過程，只寫答案不計分
- 三. 選擇題答錯者倒扣題分的四分之一
- 四. 可使用無儲存功能的計算機
- 五. $R = 8.32 \text{ J/K} \cdot \text{mol}$

一. Write down the English names for the following compounds:
(10%)

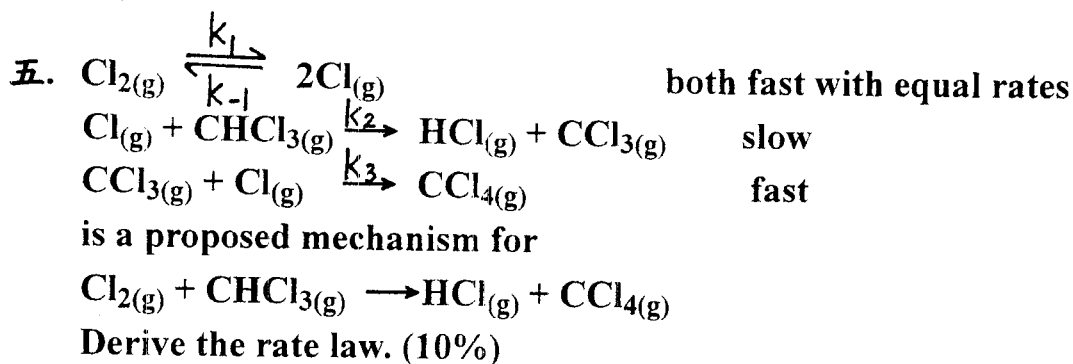
- | | |
|-------------------------------|---|
| (a) C_4H_{10} | (b) $[\text{Co}(\text{NH}_3)_5\text{Cl}] \text{Cl}_2$ |
| (c) $\text{Mn}(\text{OH})_2$ | (d) $(\text{NH}_4)_2\text{SO}_4$ |
| (e) NaHCO_3 | |

二. Gas diffusion plays an important role in the enrichment of uranium for use in nuclear reactor. Natural uranium is mostly $^{238}_{92}\text{U}$, which can not be fissioned to produce energy. It contains only about 0.70% of the fissionable nuclide $^{235}_{92}\text{U}$. In the gas diffusion enrichment process, the natural uranium reacts with fluorine to form a mixture of $^{238}\text{UF}_6$ and $^{235}\text{UF}_6$. Then, UF_6 molecules are allowed to pass into a series of chambers separated by semiporous walls. Calculate the number of chambers required to enrich from 0.70% ^{235}U to 0.72% ^{235}U . (M_w for $^{238}\text{UF}_6 = 352.05 \text{ g/mol}$, M_w for $^{235}\text{UF}_6 = 349.03 \text{ g/mol}$) (10%)

三. Describe all the atomic orbitals and hybrid orbitals in the chemical bonding of ethylene molecule. (5%)

四. The structure of copper is characterized by a face-centered cubic unit cell. Draw the unit cell. (5%)

(背面仍有題目,請繼續作答)



六. (a) Complete the following equation. (5%)



(b) Draw the structure of 4-bromopentanoic acid. (5%)

七. (a) Predict a structure of BeF_2 in the gas phase. (5%)

(b) What structure would you predict for BeF_2 (s). (5%)

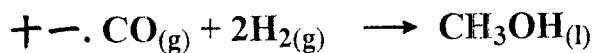
八. The Lewis structure of carbon dioxide is given to be $\ddot{\text{O}}=\text{C}=\ddot{\text{O}}$, but not $\text{:C}\equiv\text{O}-\ddot{\text{O}}\text{:}$, $\ddot{\text{C}}=\text{O}=\ddot{\text{O}}$ and $\ddot{\text{C}}-\text{O}\equiv\text{O}\text{:}$. Why? (hint: formal charge) (10%)

九. What is the PH after a 25 ml, 0.2 M solution of H_3PO_4 is titrated with 50 ml, 0.1 M NaOH solution? ($K_{a1}=7.5\times 10^{-3}$, $K_{a2}=6.2\times 10^{-8}$, $K_{a3}=4.8\times 10^{-13}$)(10%)

(a) 2.4 (b) 3.8 (c) 4.7 (d) 5.2 (e) 6.2

十. At a constant pressure of 1.00 atm, 99 kJ of energy is released as heat when 1.00 mol of $\text{SO}_{2(g)}$ reacts completely with 0.50 mol $\text{O}_{2(g)}$ to form 1.00 mol of $\text{SO}_{3(g)}$ at 25°C . What is the ΔE for this oxidation process? (10%)

(a) 41.8 (b) 97.6 (c) 117.3 (d) 139.4 (e) 150.0 kJ



It is known that the change of free energy (ΔG) at 25°C for the above reaction is -38 kJ/mol , in which $\text{CO}_{(g)}$ is at 5.0 atm and $\text{H}_{2(g)}$ at 3.0 atm . What is the equilibrium constant for this reaction? (10%)

- (a) 9.9×10^4 (b) 1.2×10^5 (c) 2.7×10^5 (d) 4.2×10^5 (e) 5.1×10^5