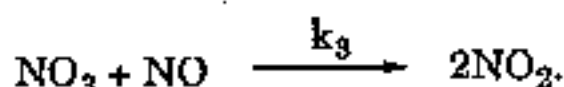
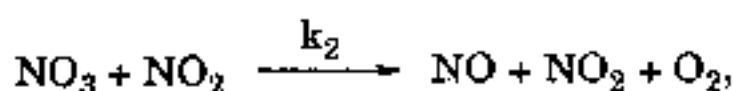
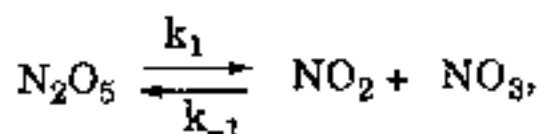


八十四學年度 生物醫學研究所 組碩士班研究生入學考試

科目 普通化學 科號 1106 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

- (1) Calculate the molecular weight of a crystal in which the unit cell is triclinic with cell parameters, $a=3.00 \text{ \AA}$, $b=2.00 \text{ \AA}$, $c=4.00 \text{ \AA}$, $\alpha=90^\circ$, $\beta=60^\circ$, $\gamma=30^\circ$; each unit cell contains 3 molecules and the density is 1.60 g/mL . (10%)
- (2) If the reaction of $2 \text{ N}_2\text{O}_5 \rightleftharpoons 4 \text{ NO}_2 + \text{ O}_2$ follows the mechanism. Please derive the rate law based on $-\text{d}[\text{N}_2\text{O}_5]/\text{dt}$. No credit will be given if you derive the rate law either from $\text{d}[\text{NO}_2]/\text{dt}$ or from $\text{d}[\text{O}_2]/\text{dt}$. (15 %)



- (3) One mole of an ideal expands reversibly from a volume of 2 to 20 liters, and the initial and final temperature is kept at 0°C . Calculate the changes of entropy, heat and internal energy of the system. (10 %).
- (4) Show clearly the radial probability $4\pi r^2 R^2(r)$ versus $r(\text{A})$ for the following orbitals in the hydrogen atom. (a) 5p (b) 5f (c) 6s. (5 %). [Here $R(r)$ is the radial function and r is the displacement(A) from the nuclei.]
- (5) Show the number of unpaired electrons and the splitting of orbital energy of valence electrons for the following compounds (a) C_2 (b) CoCl_4^{2-} (c) $\text{Ni}(\text{CN})_4^{2-}$. The atomic numbers of Co and Ni are 27 and 28 respectively. (12 %).

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科目 普通化學 科號 1106 共 2 頁第 2 頁 *請在試卷【答案卷】內作答

- (6) Derive the electron energy of a hydrogen-like atom based on Bohr theory. (13 %).
- (7) Calculate ΔE° and the equilibrium constant for $2\text{Fe}^{3+} + 3\text{I}^- = 2\text{Fe}^{2+} + \text{I}_3^-$. Now $\text{Fe}^{3+} + e = \text{Fe}^{2+}$ $\Delta E^\circ = 0.771$ eV, and $2e + \text{I}_3^- = 3\text{I}^-$, $\Delta E^\circ = 0.536$ eV. (10 %) (Since no calculator is available, express the equilibrium constant in terms of the value of ΔE°).
- (8) If a reaction has a rate constant $k = 5.03 \times 10^{-2} \text{ M}^{-1} \text{ sec}^{-1}$ at 289° and $k = 6.71 \text{ M}^{-1} \text{ sec}^{-1}$ at 333° . Find the activation energy of this reaction. (10 %)
- (9) For most solids, the heat capacity C_V is approximately $3R = 6 \text{ cal/mol-deg}$ at high temperatures. Derive this value based on the vibration energy of a solid. (15 %).