

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Chlorination is the major disinfection method of tap water, please use figure and reactive equation to interpret what are (1) Breakpoint Chlorination ? (2) Free and Combined Chlorine Residuals ? (10%) In addition, please present two analytical methods to measure the Free and Combined Chlorine Residuals in water samples.(10%)
2. Balance the following equations: (25%, 5% for each)
 - (1) $\text{Ca}_3(\text{PO}_4)_2 + \text{H}_3\text{PO}_4 \rightarrow \text{Ca}(\text{H}_2\text{PO}_4)_2$
 - (2) $\text{Fe}(\text{OH})_2 + \text{H}_2\text{O} + \text{O}_2 \rightarrow \text{Fe}(\text{OH})_3$
 - (3) $\text{FeSO}_4 + \text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + \text{Cr}_2(\text{SO}_4)_3 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$
 - (4) $\text{H}_2\text{C}_2\text{O}_4 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{MnSO}_4 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$
 - (5) $\text{Cl}^- + \text{NO}_3^- + \text{H}^+ \rightarrow \text{Cl}_2 + \text{NO} + \text{H}_2\text{O}$
3. Please describe the nitrogen cycle in the ecosystem and describe the role of organism in the nitrogen cycle. (20%)
4. The incineration becomes a principal method for treatment of municipal solid waste in Taiwan. Please use reactive equation to describe the formation mechanisms of dioxins during the combustion of municipal solid waste. (15%)
5. What evidences had been stemmed to confirm that iron and manganese gain entrance to water supplies through changes produced in environmental conditions as results of biological reactions? (20%)