系所組別：環境醫學研究所甲組

考試科目：環境化學 考試日期：0224，節次：3

※ 考生請注意：本試題不可使用計算機

1. Balance the following equations: (25%, 5% for each)
   (1) $Ca_3(PO_4)_2+H_3PO_4 \rightarrow Ca(H_2PO_4)_2$
   (2) $Fe(OH)_2+H_2O+O_2 \rightarrow Fe(OH)_3$
   (3) $FeSO_4 + K_2Cr_2O_7 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + K_2SO_4 + H_2O$
   (4) $H_2C_2O_4 + KMnO_4 + H_2SO_4 \rightarrow CO_2 + MnSO_4 + K_2SO_4 + H_2O$
   (5) $Cl^- + NO_3^- + H^+ \rightarrow Cl_2 + NO + H_2O$

2. 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%)

3. What is "Buffer Index" ? (6%) The wastewater from a petrochemical plant contains 0.15 mol/L acetic acid and 0.1 mol/L acetate, and the wastewater was treated with NaOH to make up the pH to 5.0. If you want to adjust the the pH of wastewater to 6.5, how many mol/L NaOH is needed to add to wastewater ? （10%） The K_A of acetic acid is 1.8×10^{-5}。

4. Please use reactive equation and methane as example to interpret the role of hydrocarbons in the photochemical smog (9%) and the productive mechanism of PAN (Peroxyacetyl nitrate) (9%)

5. Consider the following chemical reaction: (21%, 3% for each).
   $PbI_2(s) + 4OH^-(aq) \rightarrow Pb(OH)_4^{2-}(aq) + 2I^-(aq)$
   Will the concentration of $Pb(OH)_4^{2-}(aq)$ be increased, decreased or unaffected by :
   (1) increasing the concentration of $OH^-(aq)$
   (2) addition of $HNO_3(aq)$
   (3) decreasing the amount of $PbI_2(s)$
   (4) decreasing the temperature ($\Delta H^o<0$)
   (5) increasing the total pressure ($\Delta V^o>0$)
   (6) addition of $NaClO_4(aq)$
   (7) decreasing the $PbI_2(s)$ particle size