

# 淡江大學 108 學年度日間部寒假轉學生招生考試試題

系別：水環系環工組三年級

科目：環境化學

29-1

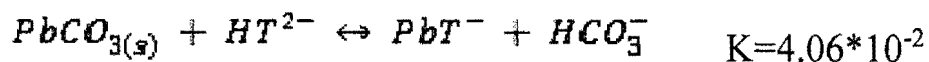
考試日期：1月13日(星期一) 第2節

本試題共 3 大題， 2 頁

本試題雙面印刷

## A. Multiple Choice Questions (8 point/question)

1. What is the equivalent weight (E.W.) of  $\text{H}_2\text{SO}_4$ : (A) 147 (B) 98 (C) 49 (D) 24.5. (Atomic weight: S: 32)
2. Regarding the **alkalinity**, which following statement is **true**?  
(A)  $[\text{Alk}] = [\text{HCO}_3^-] + [\text{CO}_3^{2-}] + [\text{OH}^-] - [\text{H}^+]$   
(B) phenolphthalein alkalinity is determined by titration with acid to the pH at which  $\text{HCO}_3^-$  is the predominant carbonate species  
(C) total alkalinity is determined by titration with acid to the pH at which  $\text{CO}_3^{2-}$  is the predominant carbonate species  
(D) total alkalinity is determined by titration with acid to pH 8.3.
3. What is the pE value in a solution in equilibrium with air (21%  $\text{O}_2$  by volume) at pH 7.00?  
 $\frac{1}{4} \text{O}_2 + \text{H}^+ + e^- \leftrightarrow \frac{1}{2} \text{H}_2\text{O} \quad pE^0 = +20.75$   
(A) 15.58 (B) 14.58 (C) 13.58 (D) 12.58.
4. For the  $\text{CO}_{2(\text{aq})} - \text{HCO}_3^- - \text{CO}_3^{2-}$  system in water, the **incorrect** statement is  
(A) for pH significantly below  $pK_{a1}$ ,  $\alpha_{\text{CO}_{2(\text{aq})}}$  is essentially 1  
(B) when  $\text{pH} = pK_{a1}$ ,  $\alpha_{\text{CO}_{2(\text{aq})}} = \alpha_{\text{HCO}_3^-}$   
(C) when  $\text{pH} = \frac{1}{2}(pK_{a1} + pK_{a2})$ , the predominant species is  $\text{CO}_{2(\text{aq})}$   
(D) when  $\text{pH} = pK_{a2}$ ,  $\alpha_{\text{HCO}_3^-} = \alpha_{\text{CO}_3^{2-}}$
5. What is the fraction of NTA present as  $\text{HT}^{2-}$  after  $\text{HT}^{2-}$  has been brought to equilibrium with solid  $\text{PbCO}_3$  at pH 7.00 in a medium in which  $[\text{HCO}_3^-] = 2.5 \times 10^{-3} \text{ M}$ . (A) 0.174 (B) 0.116 (C) 0.058 (D) 0.029.



## B. Matching Items (10 point/question)

1. Nitrilotriacetic acid (NTA,  $\text{H}_3\text{T}$ ),  $K_{a1} = 2.18 \times 10^{-2}$ ,  $K_{a2} = 1.12 \times 10^{-3}$ ,  $K_{a3} = 5.25 \times 10^{-11}$ , match the following:

- |  |  |
|--|--|
| (A) $pK_{a1}$                                    | 1. $\alpha_{\text{H}_3\text{T}} = \alpha_{\text{H}_2\text{T}^-}$ |
| (B) $\text{pH} = pK_{a1}$                        | 2. $\alpha_{\text{T}^{3-}} = 1$                                  |
| (C) $\text{pH} = \frac{1}{2}(pK_{a1} + pK_{a3})$ | 3. $\alpha_{\text{HT}^{2-}} = 1$                                 |
| (D) pH above 12                                  | 4. 1.66  |

背面尚有試題

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2. Match the pollutant or impurity on the left with a reagent used to treat it from the list on the right, below:

- |                      |                                       |
|----------------------|---------------------------------------|
| (A) $Mn^{2+}$        | 1. Activated carbon                   |
| (B) PCB              | 2. Raise pH by addition of $Na_2CO_3$ |
| (C) Colloidal matter | 3. $Al_2(SO_4)_3 \cdot 18 H_2O$       |
| (D) $Mg^{2+}$        | 4. Oxidation                          |

3. Match each compound or chemical in the left column with its related process in the right column.

- |                     |                       |
|---------------------|-----------------------|
| (A) methane         | 1. Nitrification      |
| (B) ammonium        | 2. Ion exchange       |
| (C) ozone           | 3. Anaerobic digester |
| (D) sodium chloride | 4. Disinfection       |

4. Match the pollutants on the left with effects or other significant aspects on the right, below:

- |                |   |
|----------------|---|
| (A) Salinity   | 1. From soil and mineral strata                       |
| (B) Alkalinity | 2. Can enter water from pyrite or from the atmosphere |
| (C) Acidity    | 3. Osmotic effects on organisms                       |
| (D) Nitrate    | 4. Excessive productivity                             |

## C. Questions (20 point/question)

1. In a  $2.63 \times 10^{-4}$  M standard fluoride solution, a fluoride electrode read -0.100 volts versus a reference electrode, and it read -0.125 volts in an appropriately processed fluoride sample. What was the concentration of fluoride in the sample?

$$\text{At } 25^\circ\text{C}, E \text{ (in volt)} = E^0 + 0.0592 \cdot \log[X] / z$$

z: signed charge (+ for cations, - for anions)