# 淡江大學 106 學年度日間部轉學生招生考試試題

系別：水資源及環境工程學系
環境工程組三年級

科目：環境化學

考試日期：7 月 21 日(星期五) 第 2 節　　本試題共 2 大題， 1 頁

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

1. What is the equivalent weight (E.W.) of $Ca(OH)_2$: (A) 111 (B) 74 (C) 37 (D) 18.5. (Atomic weight: Ca: 40)

2. How many grams of $AgNO_3$ are required to prepare 1 L of a 0.1 N solution to be used in a precipitation reaction? (A) 170 (B) 17 (C) 8.5 (D) 108. (Atomic weight: Ag: 108, N: 14)

3. For the $CO_{2(aq)}$ - $HCO_3^-$ - $CO_3^{2-}$ system in water, the **incorrect** statement is (A) for pH significantly below $pK_{a1}$, $\alpha_{CO2(aq)}$ is essentially 1 (B) when pH= $pK_{a1}$, $\alpha_{CO2(aq)} = \alpha_{HCO3^-}$ (C) when pH= 1/2 ($pK_{a1}$ + $pK_{a2}$), the predominant species is $CO_{2(aq)}$ (D) when pH= $pK_{a2}$, $\alpha_{HCO3^-} = \alpha_{CO3^{2-}}$

4. Of the following, the **least likely** mode of transport of iron(III) (Fe) in a normal stream is: (A) bound to suspended humic material, (B) bound to clay particles by cation exchange processes, (C) as suspended $Fe_2O_3$, (D) as soluble $Fe^{3+}$ ion, (E) bound to colloidal clay humic substance complexes.

5. Regarding secondary wastewater treatment, the **true** statement of the following is (A) the activated sludge process is predominantly a physical/chemical process, (B) the activated sludge process gets rid of all of the sludge as soon as it is made, (C) trickling filters make use of a mass of biological sludge that is continuously pumped over the filter, (D) the trickling filter is an aerobic treatment process, (E) excess sludge from activated sludge treatment is likely to undergo the process represented by $2\{CH_2O\} + O_2 \rightarrow CH_4 + CO_2$.

**B. Questions**

1. Triprotic acid ($H_3A$)

$$H_3A \leftrightarrow H_2A^- + H^+ \qquad K_{a1}$$
$$H_2A^- \leftrightarrow HA^{2-} + H^+ \qquad K_{a2}$$
$$HA^{2-} \leftrightarrow A^{3-} + H^+ \qquad K_{a3}$$

Determine the ionization fraction (α) of each species (including $H_3A$, $H_2A^-$, $HA^{2-}$, and $A^{3-}$) as a function of acid dissociation constants ($K_a$) and hydrogen ion concentration ($[H^+]$). (30 point)

2. Assuming levels of atmospheric $CO_2$ are 390 ppm $CO_2$ (which means 0.039% by volume of normal dry air) at 25℃, please answer following questions: (30 point)

(a) What is the concentration of $CO_{2(aq)}$?

(b) What is the pH of rainwater due to the presence of 390 ppm carbon dioxide?

Henry's Law $[X_{(aq)}]=K_x*P_x$ At 25℃ the partial pressure of water is 0.0313 atm

$K_{co2}=3.38*10^{-2}$ mol/L/atm $CO_{2(aq)} + H_2O \leftrightharpoons H^+ + HCO_3^-$ $Ka_1=4.45*10^{-7}$