

科目：分析化學 適用：應化所

編號：442

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本試題

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第 1 頁

請依照題目順序作答，考試中不可使用計算機

第一大題 是非題，對的請打(O)，錯誤的請打(X) (每題 3 分，共 30 分)

1. Phosphorescence is the emission of a photon during a transition between states with the same spin quantum number. ☐
2. Spectrophotometric analyses employing visible radiation are called colorimetric analyses. ☐
3. Isocratic elution means that HPLC separation is performed with a single solvent or constant solvent mixture. ☐
4. Affinity chromatography employs specific interactions between one kind of solute molecule and a second molecule that is immobilized to the stationary phase. ☐
5. A Clark electrode is designed for the measurement of  $\text{CO}_2$  in solution. ☐
6. Ferrocene can act as a mediator that transports electrons between analyte and the working electrode in an electroanalytical system. ☐
7. The dissociation of a mercury salt ( $\text{Hg}_2(\text{IO}_3)_2$ ) in water is not affected by the addition of  $\text{KNO}_3$  electrolyte. ☐
8. Hydrochloric acid solution is a primary standard and is used directly in titration. ☐
9. The activity coefficients of ions decrease as the ionic strength of solutions increase. ☐
10. Least square method is a widely used technique for finding a straight line through a set of data points. ☐

第二大題 選擇題，請選出最正確的答案 (每題 3 分，共 30 分)

1. The p-value of solubility products ( $\text{pK}_{\text{sp}}$ ) of some salts are listed.  
 $\text{BaSO}_4 = 8.82$ ;  $\text{CoS} = 21.3$ ;  $\text{PbSO}_4 = 7.89$ ;  $\text{AgBr} = 12.3$ ;  $\text{BaCO}_3 = 8.30$   
 Which one is the most soluble in moles/liter?  
 (A)  $\text{BaSO}_4$  (B)  $\text{CoS}$  (C)  $\text{PbSO}_4$  (D)  $\text{AgBr}$  (E)  $\text{BaCO}_3$
2. Which of the following is a conjugate acid/base pair?  
 (A)  $\text{HCl}/\text{OCl}^-$  (B)  $\text{NH}_4^+/\text{NH}_3$  (C)  $\text{H}_3\text{PO}_4/\text{PO}_4^{3-}$  (D)  $\text{H}_3\text{O}^+/\text{OH}^-$  (E)  $\text{NO}_2/\text{NO}_2^-$
3. Using the following  $\text{K}_a$  values, indicate which one is the strongest base.  
 $\text{HOCl} = 3.0 \times 10^{-8}$ ;  $\text{HF} = 6.8 \times 10^{-4}$ ;  $\text{HCN} = 6.2 \times 10^{-10}$ ;

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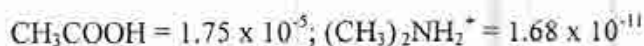
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(A)  $\text{OCl}^-$  (B)  $\text{F}^-$  (C)  $\text{CN}^-$  (D)  $\text{CH}_3\text{COO}^-$  (E)  $(\text{CH}_3)_2\text{NH}$ 

4. The pH in a solution of 0.1 M  $\text{H}_2\text{A}$  ( $K_{a1} = 1.0 \times 10^{-7}$ ;  $K_{a2} = 1.0 \times 10^{-14}$ ) is

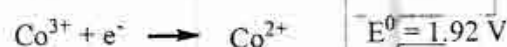
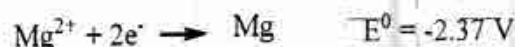
(A) 3.0 (B) 3.5 (C) 4.0 (D) 4.5 (E) 5.0

5. How many electrons are transferred in the following reaction?



(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

6. Which of the following is the strongest reducing agent?

(A)  $\text{Cl}_2$  (B)  $\text{Mg}^{2+}$  (C)  $\text{Co}^{2+}$  (D)  $\text{Mg}$  (E)  $\text{Cl}^-$ 

7. EDTA is an abbreviation for ethylenediaminetetraacetic acid, a compound that form strong (A) 1:1 (B) 1:2 (C) 2:1 (D) 1:3 (E) 3:1 complexes with most metal ions.

8. The usual excitation source in an atomic absorption experiment is (A) hollow-cathode lamp (B) mercury lamp (C) deuterium lamp (D) halogen lamp (E) laser

9. The common stationary phases in the partition HPLC columns are made of (A) polystyrene resin (B) polyacrylamide (C) starch (D) silica (E) zeolite

10. We usually use a pH-electrode to determine the acidity of a solution. The detection is based on the measurement of (A) electrode resistance (B) electrode potential (C) reaction current (D) solution conductivity (E) electrode impedance

第三大題 10 分

由以下之實驗數據，請畫出一次微分圖形 (以  $\Delta p\text{Ag}/\Delta \text{NaCl}$  為 Y 座標，NaCl 體積為 X 座標)

NaCl ( $\mu\text{L}$ )	80.0	81.0	82.0	83.0	84.0	85.0	86.0	88.0
pAg	4.245	4.400	4.626	4.933	5.273	5.530	5.719	5.980

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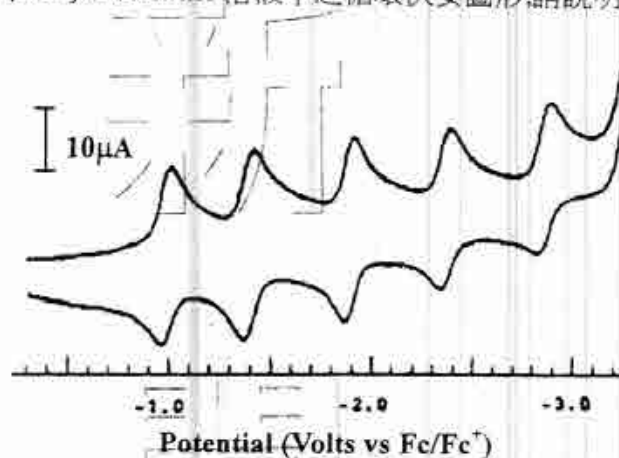
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## 第四大題 10 分

下列圖形為  $C_{60}$  在室溫下於  $CH_3CN/toluene$  溶液中之循環伏安圖形，請說明該圖形之意義



## 第五大題 10 分

請畫圖並以文字說明單光束吸收光譜儀(single beam spectrophotometer)的設計原理及如何應用於分析樣品。

## 第六大題 10 分

從層析圖(chromatogram)中，可以獲知兩個重要的參數 capacity factor (也稱為 retention factor)  $k'$  及 resolution  $R$ ，請說明這兩個參數的意義。