

科目：分析化學

適用：應化系

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
 共 6 頁
 第 1 頁

編號：482

一 選擇題 (72%, 每題 3%)

1. Which of the following is a kind of quantitative observation?

- (A) Solution A is much darker than solution B.
- (B) The silver chloride is a white precipitate in water.
- (C) The solution has a concentration of 10% salt.
- (D) The Cl_3CCOOH has a molecular mass of 163.4 g.

2. Which of the following is not a conjugate acid/base pair?

- (A) H_2PO_4^- and HPO_4^{2-} .
- (B) H_2CO_3 and HCO_3^- .
- (C) HClO and ClO^- .
- (D) NH_4^+ and NH_2^- .

3. The following reactions are spontaneous and proceed to the right. Indicate the correct order of oxidizing strength.



- (A) $\text{Cu}^{2+} > \text{H}^+ > \text{Cd}^{2+} > \text{Zn}^{2+}$.
- (B) $\text{H}^+ > \text{Cu}^{2+} > \text{Cd}^{2+} > \text{Zn}^{2+}$.
- (C) $\text{Zn}^{2+} > \text{H}^+ > \text{Cu}^{2+} > \text{Cd}^{2+}$.
- (D) $\text{Cu}^{2+} > \text{Cd}^{2+} > \text{Zn}^{2+} > \text{H}^+$.

4. The pH of a solution at 25 °C in which $[\text{OH}^-] = 3.0 \times 10^{-5} \text{ M}$ is.

- (A) 5.477
- (B) 9.477
- (C) 9.523
- (D) 10.477

Hint: $\log 3.0 = 0.477$

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本試題
共 6 頁
第 2 頁

5. Which of the following statement is incorrect?
- (A) Potassium hydrogen phthalate is used as a primary standard for standardizing bases.
- (B) Phenolphthalein is an indicator with an acidic range.
- (C) Kjeldahl method is used to determine organic nitrogen in wheat flour.
- (D) Organic chemicals containing sulfonic acid group can be titrated and determined directly with standard base.
6. Which would be the major species when sodium dihydrogen phosphate is dissolved in pH 9.0 buffer solution? The three acid dissociation constants for phosphoric acid are 7.11×10^{-3} , 6.32×10^{-8} , 4.5×10^{-13} .
- (A) H_3PO_4 .
- (B) H_2PO_4^- .
- (C) HPO_4^{2-} .
- (D) PO_4^{3-} .
7. Which of the following metric relationships is incorrect for calcium oxalate in a pH 4.0 buffer solution?
- (A) $[\text{Ca}^{2+}][\text{C}_2\text{O}_4^{2-}] = K_{sp} = 1.7 \times 10^{-9}$
- (B) $[\text{H}^+][\text{OH}^-] = K_w = 1.0 \times 10^{-14}$
- (C) Solubility = $[\text{Ca}^{2+}]$
- (D) $[\text{Ca}^{2+}] = [\text{C}_2\text{O}_4^{2-}]$
8. Which of the following statement is incorrect for a solution that is 0.05 M in KNO_3 and 0.1 M in Na_2SO_4 ?
- (A) The ionic strength of the solution is 0.35 M.
- (B) The sodium concentration is 0.2 M.
- (C) The concentration of negative charge is 0.15 M.
- (D) The solution has the ability to conduct electricity.
9. Which of the following is a kind of systematic errors in chemical analysis?
- (A) The temperature fluctuations affect the viscosity of the liquid.
- (B) Heating a sample causes the loss of a volatile analyte.
- (C) Environmental vibration causes variations in the balance reading.
- (D) Variation in the angle of the pipet as it drains causes variations in volume measurement.
10. Dimethylglyoxime is a specific organic precipitating agent for

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 本試題
 共 6 頁
 第 3 頁

編號：482

- (A) Ni^{2+} .
- (B) Cu^{2+} .
- (C) Pt^{2+} .
- (D) Mg^{2+} .
11. Which of the following statement is incorrect for gravimetric method?
- (A) Colloidal particles are very small, and they are not easily retained by filters.
- (B) Precipitates of sulfides and hydrous oxides generally form as colloids.
- (C) A colloidal silver chloride particles suspend in a solution of silver nitrate have negatively charged primary adsorption layer.
- (D) Peptization is the process by which a coagulated colloid reverts to its original dispersed state.
12. A quality is used to evaluate the linear model predicted by a least-square analysis. The quality is called
- (A) residual (s_{resid}).
- (B) standard deviation for result (s_c).
- (C) standard deviation about regression (s_r).
- (D) coefficient of determination (R^2).
13. Ethylenediaminetetraacetic acid (EDTA) can form complex with Al^{3+} in aqueous solution. The stoichiometric ratio between EDTA and Al^{3+} is
- (A) 1:1
- (B) 1:2
- (C) 2:1
- (D) 3:4
14. Select an incorrect statement for the following reaction.
- $$\text{U}^{4+} + 2\text{Ce}^{4+} + 2\text{H}_2\text{O} \rightleftharpoons \text{UO}_2^{2+} + 2\text{Ce}^{3+} + 4\text{H}^+$$
- (A) It is a redox reaction.
- (B) The net charge on the left side is +12.
- (C) Ce^{4+} is reduced and the product is Ce^{3+} .
- (D) U^{4+} is an oxidant.
15. Silver nitrate (0.1 M) is used to titrate a 50.0 mL solution containing 0.08 M Cl^- and 0.05 M I^- . Which statement is not true? The K_{sp} values for chloride salt and iodide salt are 1.82×10^{-10} and 8.3×10^{-17} ,

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 本試題
 共 6 頁
 第 4 頁

編號：482

respectively.

- (A) The two anions could form silver precipitates.
- (B) Two end points could be detected.
- (C) The first end point occurs as 40 mL silver nitrate added.
- (D) The first end point occurs at a pAg value of 8.04.
16. Eriochrome Black T is an organic compound that is used to indicate end point in
- (A) precipitate titration.
- (B) complexation titration.
- (C) redox titration.
- (D) neutralization titration.
17. Which of the following photon is most energetic?
- (A) The photon has an energy of 6.6×10^{12} J.
- (B) The photon has a wavenumber of 200 cm^{-1} .
- (C) The photon has a frequency of 3×10^{11} Hz.
- (D) The photon has a wavelength of $0.30 \mu\text{m}$.
18. Every molecule is capable of absorbing of the UV/Vis radiation, and the radiant power of the beam decreases from P_0 to P . Which of the following statement is incorrect?
- (A) The transmittance T is equal to P/P_0 .
- (B) The absorbance A is equal to $-\log(P/P_0)$.
- (C) The absorbance A is proportional to the density of the absorbing medium.
- (D) The absorbance scale has no unit.
19. Which material could transmit in UV region?
- (A) silicate glass
- (B) fused silica.
- (C) KBr salt.
- (D) PVC plastics.
20. Which of the following statement is correct for spectrophotometric instrument?
- (A) Silicon photodiodes are used to monitor all passes wavelength simultaneously.
- (B) Photomultiplier tube is used to generate a beam of radiation.
- (C) A deuterium lamp is used for visible molecular absorption.

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本試題
共 6 頁
第 5 頁

- (D) A narrow slit increases the effective bandwidth.
21. In plasma and flame atomic emission, Li, K and Cs are often added to the sample. Why?
- (A) These elements are used to eliminate phosphate interference.
- (B) These elements are used to cause the analyte shifting to neutral atoms.
- (C) These elements are used to simulate the matrix for the sample.
- (D) These elements are used as internal standard.
22. Cross-linked polystyrene resin with quaternary amine groups possesses the property of
- (A) exchanging anions.
- (B) binding proteins.
- (C) retaining metal sulfides.
- (D) extracting methylcyclohexene.
23. Which of the following statement is incorrect for the enzyme-based electrochemical glucose sensor?
- (A) Glucose oxidases are generally used.
- (B) Hydrogen peroxide is produced and detected.
- (C) Polycarbonate film is impermeable to the proteins in blood sample.
- (D) Glucose is electrochemically active.
24. Which of the following statement is incorrect for the statistical data analysis?
- (A) The probability that a result is outside the confidence interval is called the significance level.
- (B) Student's t statistic is used to estimate the confidence interval of a result from a small set of data.
- (C) The F test is used to decide a suspected result should be retained or rejected.
- (D) The null hypothesis assumes that the numerical quantities being compared are the same.

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編號：482

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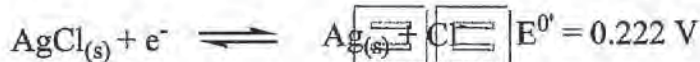
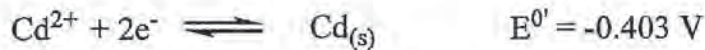
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 本試題
 共 6 頁
 第 6 頁

二 回答問題 (28%, 每題 14%)

 1. An electrochemical cell $\text{Ag}|\text{AgCl}_{(s)}, \text{Cl}^- (0.1 \text{ M}), \text{Cd}^{2+} (0.001 \text{ M})|\text{Cd}$ is constructed. Calculate

- (a) the potential for the Cd electrode. (4%)
- (b) the thermodynamic potential of the cell. (5%)
- (c) the potential that is needed to cause an electrolytic current of 2.00 mA. Assume the internal resistance of the cell is 25.0Ω . (5%)



2. For the following equilibrium system, calculate

- (a) The free zinc ion concentration in a solution of 0.01 M zinc chloride in the presence of 0.1 M ammonium. Assume zinc/ammonium species such as $\text{Zn}(\text{NH}_3)^{2+}$ and $\text{Zn}(\text{NH}_3)_2^{2+}$ are formed, and $K_f = 1.62 \times 10^2, 3.16 \times 10^4$, respectively. (4%)
- (b) the silver ion concentration during the titration of 50.0 mL, 0.05 M NaCl with 20.0 mL, 0.1 M AgNO_3 . For AgCl , $K_{sp} = 1.82 \times 10^{-10}$. (5%)
- (c) the hydronium ion concentration for a solution of 50.0 mL, 0.1 M acetic acid added with 10.0 mL, 0.1 M NaOH. For CH_3COOH , $K_a = 1.75 \times 10^{-5}$. (5%)

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