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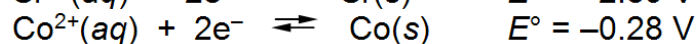高雄醫學大學 **100** 學年度研究所招生考試試卷　　系所: 醫藥暨應用化學系碩士班
　　　　　　　　　　　　　　　　　　　　　科目: 分析化學

可使用電子計算機

單選題(共 30%)

1. Consider the equilibrium reaction: $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$. Which of the following correctly describes the relationship between K_c and K_p for the reaction?
   A. $K_p = K_c$
   B. $K_p = (RT)K_c$
   C. $K_p = (RT)^2 K_c$
   D. $K_p = K_c/RT$

2. Which measurement is expressed to 4 significant figures?
   A. 0.423 kg
   B. 62.40 g
   C. 82,306 m
   D. 1300 K

3. Which of the following has an effect on the magnitude of the equilibrium constant?
   A. removing products as they are formed
   B. adding more of a reactant
   C. change in temperature
   D. adding a catalyst

4. Select the correct relationship among the concentrations of species present in a 1.0 *M* aqueous solution of the weak acid represented by HA.
   A. $[H_2O] > [A^-] \sim [H_3O^+] > [HA] > [OH^-]$
   B. $[H_2O] > [HA] > [A^-] > [H_3O^+] > [OH^-]$
   C. $[HA] > [H_2O] > [A^-] > [H_3O^+] > [OH^-]$
   D. $[H_2O] > [HA] > [A^-] \sim [H_3O^+] > [OH^-]$

5. The hydrated Al^{3+} ion, $Al(H_2O)_6^{3+}$, is a weak acid in water. What are the products of its reaction with H_2O? ($Al(H_2O)_6^{3+}(aq) + H_2O(l) \rightarrow$?)
   A. $Al(H_2O)_5OH^{2+}(aq) + H_3O^+(aq)$
   B. $Al(H_2O)_6H^{4+}(aq) + OH^-(aq)$
   C. $Al(H_2O)_5^{3+}(aq) + 2H_2O(l)$
   D. $Al(H_2O)_6OH^{2+}(aq) + H_3O^+(aq)$

6. When a weak acid is titrated with a strong base, the pH at the equivalence point
   A. is equal to 7.0.
   B. is greater than 7.0.
   C. is less than 7.0.
   D. is equal to the pK_a of the acid.

7. Which of the following aqueous mixtures would be a buffer system?
   A. HCl, NaCl
   B. HNO_3, $NaNO_3$
   C. H_3PO_4, $H_2PO_4^-$
   D. H_2SO_4, CH_3COOH

8. Calculate $E°_{cell}$ for the reaction of nickel(II) ions with cadmium metal at 25°C. $K = 1.17 \times 10^5$. ($Ni^{2+}(aq) + Cd(s) \rightarrow Cd^{2+}(aq) + Ni(s)$)
   A. 0.075 V
   B. 0.10 V

C. 0.12 V
D. 0.15 V

9. Examine the following half-reactions and select the strongest oxidizing agent among the species listed.

$$Cr^{2+}(aq) + 2e^- \rightleftharpoons Cr(s) \qquad E° = -0.913\ V$$
$$Fe^{2+}(aq) + 2e^- \rightleftharpoons Fe(s) \qquad E° = -0.447\ V$$
$$Sr^{2+}(aq) + 2e^- \rightleftharpoons Sr(s) \qquad E° = -2.89\ V$$
$$Co^{2+}(aq) + 2e^- \rightleftharpoons Co(s) \qquad E° = -0.28\ V$$
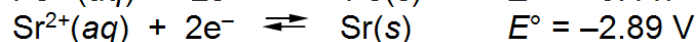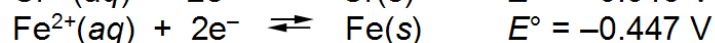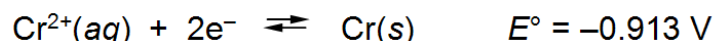
A. $Cr^{2+}(aq)$
B. $Co^{2+}(aq)$
C. $Sr^{2+}(aq)$
D. $Fe(s)$

10. The difference between a student's experimental measurement of the density of sodium chloride and the known density of this compound reflects the _____ of the student's result.
    A. accuracy
    B. precision
    C. random error
    D. systematic error

問答及申論題(共 70%)

Molecular Mass Spectrometry (20%)
1. How do the spectra for electron-impact, field ionization, and chemical ionization sources differ from one another?
2. What mass differences can just be resolved at m values of 100, and 500 if the mass spectrometer has a resolution of (a) 500, and (b) 1000?

Electroanalytical Chemistry (30%)
1. Calculate the electrode potential of the following half-cell at 298 K.
   HCl(1.76 M)|H_2(0.98 atm),Pt   (R=8.314 J· K^{-1}·mol^{-1})
2. Define junction potential. Explain how junction potential occurs and how junction potential influences with a potentiometric measurement.
3. Define faradaic current and nonfaradaic current.

Separation Methods (20%)
1. You are asked to use column chromatography to separate two compounds from their mixtures and both GC and HPLC are available. If only one of the two methods is suitable for the separation, please explain the reason based on the properties of the two compounds. If both methods are suitable for the separation, which one should be chosen and why.
2. Differentiate FID (flame ionization detector) and TCD (thermal ionization detector).