

Name: _____
Exam #4

Chem. 115 Practice

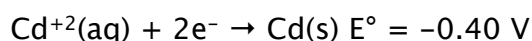
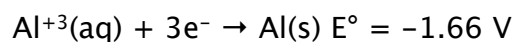
Part 1: Multiple Choice

1. Calculate the solubility product constant for lead(II) iodide if 0.0024 mole of I⁻ ion is present in 2.0 L of a saturated lead(II) iodide solution
 - a. 1.4×10^{-5}
 - b. 8.6×10^{-10}
 - c. 5.2×10^{-8}
 - d. 3.5×10^{-6}
 - e. 4.6×10^{-9}

2. Calculate the number of moles of Ag⁺ ion present in 2.0 L of a saturated solution of silver chromate. For silver chromate, $K_{sp} = 1.1 \times 10^{-12}$.
 - a. 2.6×10^{-4}
 - b. 1.3×10^{-4}
 - c. 2.1×10^{-4}
 - d. 1.1×10^{-4}
 - e. 4.1×10^{-4}

3. Calculate the molar solubility of silver carbonate in 1.0 M sodium carbonate solution. For silver carbonate, $K_{sp} = 8.1 \times 10^{-12}$.
 - a. 8.1×10^{-12}
 - b. 2.8×10^{-6}
 - c. 1.4×10^{-6}
 - d. 1.4×10^{-8}
 - e. 2.0×10^{-4}

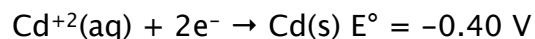
4. Calculate the pH of a solution necessary to just begin the precipitation of magnesium hydroxide when the concentration of magnesium ion = 0.001 M. For magnesium hydroxide $K_{sp} = 1.2 \times 10^{-11}$.
- 11
 - 10
 - 9
 - 8
 - 4
5. The line notation, $\text{Mg(s)} \mid \text{Mg}^{2+}(\text{aq}) \parallel \text{Fe}^{2+}(\text{aq}) \mid \text{Fe(s)}$, indicates that:
- iron metal is the reducing agent
 - magnesium metal is the cathode
 - Fe^{2+} ions are oxidized
 - magnesium metal is the reducing agent
 - Mg^{2+} ion is the reducing agent
6. Consider the following two electrode reactions and their standard electrode potentials:



Write the cell reaction for a voltaic cell based on these two electrodes, and calculate the standard cell potential

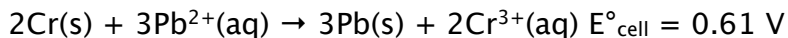
- $2\text{Al}^{3+}(\text{aq}) + 3\text{Cd}^{2+}(\text{aq}) \rightarrow 2\text{Al(s)} + 3\text{Cd(s)} \quad E^{\circ}_{\text{cell}} = 2.10 \text{ V}$
- $2\text{Al(s)} + 3\text{Cd}^{2+}(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 3\text{Cd(s)} \quad E^{\circ}_{\text{cell}} = 1.26 \text{ V}$
- $2\text{Al(s)} + 3\text{Cd}^{2+}(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 3\text{Cd(s)} \quad E^{\circ}_{\text{cell}} = 3.78 \text{ V}$
- $2\text{Al}^{3+}(\text{aq}) + 3\text{Cd(s)} \rightarrow 2\text{Al(s)} + 3\text{Cd}^{2+}(\text{aq}) \quad E^{\circ}_{\text{cell}} = 1.26 \text{ V}$
- $2\text{Al}^{3+}(\text{aq}) + 3\text{Cd(s)} \rightarrow 2\text{Al(s)} + 3\text{Cd}^{2+}(\text{aq}) \quad E^{\circ}_{\text{cell}} = 2.10 \text{ V}$

7. A voltaic cell consists of Mn/Mn²⁺ and Cd/Cd²⁺ half-cells with concentrations [Mn²⁺] = 0.75 M and [Cd²⁺] = 0.15 M. Calculate the cell potential at 25° C.

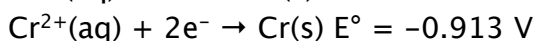


- 1.60 V
 - 1.56 V
 - 1.54 V
 - 0.80 V
 - 0.76 V
8. The standard reference electrode that is used to measure all other standard electrode potentials is called the "standard _____ electrode."
- sulfur
 - oxygen
 - hydrogen
 - iron
 - platinum
9. A constant current was passed through a solution of KAuCl₄ between gold electrodes. Over a period of 20.00 min, the cathode increased in mass by 2.664 g. What was the current in amperes?
(F = 96500 C/mol) Cathode half-reaction: AuCl₄⁻(aq) + 3e⁻ → Au(s) + 4Cl⁻(aq)
- 1.08 A
 - 3.26 A
 - 2.17 A
 - 6.52 A
 - 3.48 A

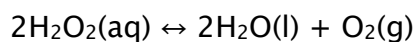
10. Calculate the equilibrium constant K_c for this reaction at 25°C:



- a. 6.7×10^{61}
 - b. 8.1×10^{30}
 - c. 9.2×10^{45}
 - d. 3.2×10^{51}
 - e. 4.6×10^{22}
11. Consider the following half-reactions and select the strongest oxidizing agent present:



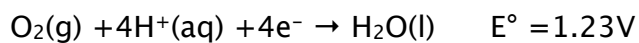
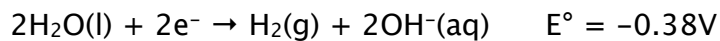
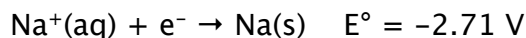
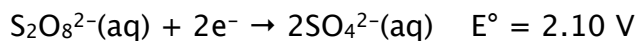
- a. $\text{Cr}^{2+}(\text{aq})$
 - b. $\text{Sr}^{2+}(\text{aq})$
 - c. $\text{Co}^{2+}(\text{aq})$
 - d. $\text{Sr}(s)$
 - e. $\text{Co}(s)$
12. The standard free energy change for the following reaction is -210 kJ. What is the cell potential?



- a. +0.640 V
- b. +1.09 V
- c. +0.420 V
- d. +0.547 V

e. +0.752 V

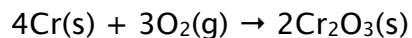
13. In the electrolysis of aqueous sodium sulfate, which one of the following species is oxidized?



- a. sodium ion
- b. oxygen
- c. sulfate ion
- d. water
- e. hydronium ion

14. Calculate ΔS° for the following reaction:

Standard molar entropies, S° (J/mol · K): Cr(s), 23.8; O₂(g), 205.1; Cr₂O₃(s), 81.2



- a. 548.1 J/K
- b. 147.7 J/K
- c. -147.7 J/K
- d. -548.1 J/K
- e. -66.5 J/K

15. When crystalline solid barium hydroxide octahydrate and crystalline solid ammonium nitrate are mixed in a beaker at room temperature, a spontaneous reaction occurs. The temperature of the beaker contents rapidly falls to below 0°C . Use this information to decide whether the reaction is exothermic or endothermic and what the signs of ΔH and ΔS are.
- endothermic; $\Delta H > 0; \Delta S > 0$
 - exothermic; $\Delta H < 0; \Delta S > 0$
 - endothermic; $\Delta H < 0; \Delta S < 0$
 - endothermic; $\Delta H < 0; \Delta S > 0$
 - exothermic; $\Delta H > 0; \Delta S < 0$
16. A certain reaction has $\Delta H^{\circ} = -14.2 \text{ kJ}$ and $\Delta S^{\circ} = +87.9 \text{ J/K}$. What is the value of ΔG° for this reaction? (Temperature is 25°C)
- +40.4 kJ
 - 16.4 kJ
 - 26200 kJ
 - 40.4 kJ
 - 7820 kJ
17. A reaction has an equilibrium constant $K_c = 7.0$ at 35°C . Calculate the value of ΔG° for the reaction
- 4.98 kJ
 - 2.46 kJ
 - 5.66 kJ
 - 2.16 kJ
 - none of the above

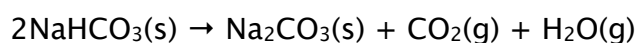
18. The compound 1-pentanol has an enthalpy of vaporization of 55.5 kJ/mol and an entropy of vaporization of 148 J/K·mol. Calculate its approximate boiling point.

- a. 45°C
- b. 102°C
- c. 93°C
- d. 210°C
- e. 375°C

19. Which of the following statements about entropy and enthalpy of a system is correct?

- a. The absolute entropy of pure oxygen at 25°C and 1 atm is zero.
- b. When ice melts, ΔS is positive and ΔH is negative.
- c. When a candle burns, ΔS is positive and ΔH is negative.
- d. The entropy of a system must increase for the reaction to be spontaneous.
- e. None of the above statements are correct.

20. Sodium carbonate can be made by heating sodium bicarbonate carbonate:



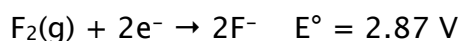
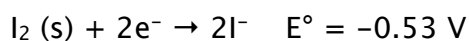
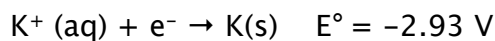
For this reaction, $\Delta H^\circ = 128.9 \text{ kJ}$ and $\Delta S^\circ = 321 \text{ J/K}$. At approximately what temperature will $K = 1$?

- a. 401.6° C
- b. 401.6 K
- c. 33.1° C
- d. 33.1 K
- e. None of the above

Part 2: Free Response. Please show all work.

1. Will a precipitate form when 125 ml of 0.0250 M aluminum nitrate and 25.0 ml of 0.000100 M calcium hydroxide are mixed together? Why? K_{sp} of aluminum hydroxide = 3.7×10^{-15}

2. In the electrolysis of a molten mixture of potassium iodide and magnesium fluoride, identify which product forms at the positive electrode, and what product forms at the negative electrode.



3. In a $Cd^{2+}/Cd(s)$ and $Au^{3+}/Au(s)$ voltaic cell the electronic voltmeter measures to be 1.92-Volts. What concentration of cadmium (II) ion must be present in the cell if the gold (III) ion concentration is known to be 0.10 M.

