**Name: Period: Seat#:**

**Worksheet #4**

**Directions:** Use half-reactions and/or reduction tables to answer the following questions. Remember to use binder paper for more space if needed – there is so much to keep track of when doing redox problems, don’t get questions wrong because you weren’t using enough binder paper! ☺

1. Write the equations for the reaction between iron and a solution of silver nitrate to produce Fe(II) ions and silver metal.

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| * 1. Write the balanced half-cell reactions |
| * 1. Write the overall balanced equation for the reaction |
| * 1. Draw a diagram of the cell and calculate the standard cell potential. *E° = +1.24V* |

1. Balance the following reactions in acidic solutions:

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| * 1. Al(s) + Ag+ (aq) → Al3+ (aq) + Ag(s) | *1, 3, 1, 3* |
| * 1. Fe2+ (aq) + Cr2O72− (aq) → Cr3+ (aq) + Fe3+ (aq) | *6, 1, 14H+, 2, 6, 7H2O* |
| * 1. MnO4− (aq) + H2SO3 (aq) → Mn2+ (aq) + SO42− (aq) | *2, 5, 6H+, 2, 5, 3H2O* |

1. Consider the following pairs of half-reactions, decided which of the two half-reactions will occur at the anode and which will occur at the cathode, draw diagrams for the cells, and calculate the standard cell potentials:

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|  | Co2+ (aq) + 2e− → Co(s)  Ag+ (aq) + e− → Ag(s)  *E°cell = +1.08V* |  |
|  | Ni2+ (aq) + 2e− → Ni(s)  Cu2+ (aq) + 2e− → Cu(s)  *E°cell = +0.59V* |  |
|  | Sn2+ (aq) + 2e− → Sn(s)  Mg2+ (aq) + 2e− → Mg(s)  *E°cell = +2.23V* |  |

1. The reaction of copper metal with silver ions in a solution of silver nitrate is spontaneous *(\*Hint - makes Cu2+)*

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| * 1. Calculate the standard cell potential to show that this is so. |
| * 1. From the cell potential calculate the value of the equilibrium constant for the reaction at 25°C. |
| * 1. From the equilibrium constant, or from the cell constant, calculate the standard free energy change for the reaction. Indicate clearly how these three quantities are related *ΔG°rxn = -88.8 kJ* |

1. A copper-zinc voltaic cell is constructed using 100 mL solutions of 1M solutions of copper sulfate and zinc sulfate with a sodium sulfate salt bridge. After some time, t, has passed at 25°C, the concentration of the Zn2+ ions in the anode half cell had increased to 1.50M and the concentration of the Cu ions in the cathode half-cell had decreased to 0.50M. *(\*Hint - makes Cu2+)*

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| * 1. Calculate the initial cell potential. *E°cell = +1.100V* |
| 1. Calculate the cell potential at time t. *E°cell = +1.086V* |
| 1. Calculate the total charge provided by the cell. *9648.5 C* |
| 1. Calculate (approximately) the energy provided by the cell. *105 kJ* |