**Quiz 8**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. A voltaic cell is set up at 25 °C with the half-cells Al3+(0.0010 M) |Al and Ni2+(0.50 M) |Ni. Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential (8 points). Given:

Al3+ (aq) + 3 e- → Al (s) E° = -1.662 V

Ni2+ (aq) + 2 e- → Ni2+ (aq) E° = -0.257 V

Oxidation: **(**Al (s) → Al3+ (aq) + 3 e-**) × 2** E° = 1.662 V

Reduction: **(**Ni2+ (aq) + 2 e- → Ni2+ (aq)**) × 3** E° = -0.257 V

2 Al (s) 3 Ni2+ (aq) + 6 e- → 2 Al3+ (aq) + 6 e- + 3 Ni (s) E° = 1.405 V

2 Al (s) 3 Ni2+ (aq) → 2 Al3+ (aq) + 3 Ni (s)

$$E\_{cell}=E^{°}-\frac{RT}{nF}lnQ=E^{°}-\frac{RT}{nF}ln\left(\frac{[Al^{3+}]^{2}}{[Ni^{2+}]^{3}}\right)$$

$$E\_{cell}=1.405 V-\frac{\left(8.3145\frac{J}{mol K}\right)\left(298 K\right)}{\left(6 mol e^{-}\right)\left(96485\frac{C}{mol e^{-}}\right)}ln\left(\frac{(0.0010 M)^{2}}{(0.50 M)^{3}}\right)$$

$$E\_{cell}=1.405 V--0.050 V=1.455 V$$

1. The standard cell potential, E°cell, for the reduction of silver ions with copper metal is +0.462 V at 25 °C. Calculate ∆rG° in kJ for this reaction (6 points).

$$∆\_{r}G^{°}=-nFE^{°}$$

$$∆\_{r}G^{°}=-\left(2 mol e^{-}\right)\left(96485 \frac{C}{mol e^{-}}\right)\left(0.462 V\right)=-89152.14 C V=-89.2 kJ$$

1. Answer the following questions about the Ligand Substitution experiment (4 points):
	1. The ligand \_\_\_\_\_\_\_NH3\_\_\_ is replacing the \_\_\_\_H2O\_\_\_\_\_\_ ligand.
	2. What is the identity of the metal? \_\_\_\_\_nickel
	3. What is the coordination number of the metal in the complex? \_\_\_\_6\_\_\_\_