

The Nernst Equation and related constants are given below:

$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0592}{n} \log Q \quad F = \text{Faraday's constant} = 96,485 \text{ C/mol } e$$

$$\Delta G = -nFE^{\circ} \quad 1 \text{ A (amp)} = 1 \text{ C/s}$$

You must show your work for full credit. You will need a periodic table.

Exp 10 Questions

1. The following electrochemical cell is made:

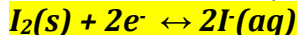


a) Write balanced chemical equations for both the anode and the cathode according to the cell notation given above. (Note: C = carbon – an inert electrode) **(2 pt)**

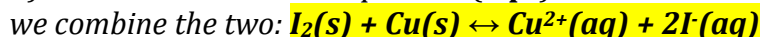
anode: oxidation (left side of cell notation):



cathode: reduction (right side of cell)



b) Write a net balanced equation **(1 pt)**



c) The cell potential was measured and found to be 0.279 V. Calculate E°_{cell} . **(2 pts)**

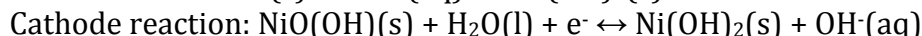
$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - (0.0592/2) \log\{[\text{Cu}^{2+}]/[\text{I}^{-}]^2\}$$

$$\text{or } E^{\circ}_{\text{cell}} = E_{\text{cell}} + (0.0592/2) \log\{[\text{Cu}^{2+}]/[\text{I}^{-}]^2\} = 0.279 \text{ V} + (0.0592/2) \log(0.1)^3$$

$$E^{\circ}_{\text{cell}} = 0.279 \text{ V} - 0.0888 \text{ V} = \mathbf{0.190 \text{ V}}$$

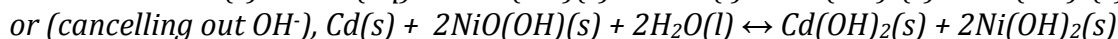
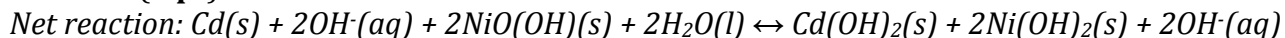
Additional Electrochemistry Problems

2. A NiCad battery works using the following reactions:



For the combined reaction, $E^{\circ}_{\text{cell}} = 1.30 \text{ V}$

a) Does the cell potential depend on $[\text{OH}^{-}]$? Write a net balanced reaction to support your answer. **(1 pt)**



*Since OH⁻ is not in the net reaction the answer is **No**.*

b) If the cell used 10.0 g of NiO(OH)(s) (and a stoichiometric amount of Cd), how many hours could the battery power a motor with a 0.50 A draw? **(2 pts)**

$$FW(\text{NiO(OH)(s)}) = 58.69 + 16.00 \cdot 2 + 1.01 \text{ g/mol} = 91.7 \text{ g/mol}$$

$$\text{moles } e = (10.0 \text{ g NiO(OH)}) (1 \text{ mol}/91.7 \text{ g NiO(OH)}) (1 \text{ mol } e/1 \text{ mol NiO(OH)}) = 0.1091 \text{ mol}$$

$$\text{Charge} = q = nF = (0.1091 \text{ mol } e)(96,485 \text{ C/mol } e) = 10,522 \text{ C} = I \cdot t$$

$$t = (10,522 \text{ C})(1 \text{ s}/0.5 \text{ C})(1 \text{ min}/60 \text{ s})(1 \text{ hr}/60 \text{ min}) = \mathbf{5.8 \text{ hr}}$$

(one more on back)

Chemistry 1B, Fall 2015 Quiz #9A KEY

3. A solution contains Ni^{2+} , Cd^{2+} , and Fe^{2+} that is being reduced in an **electrolytic cell** to the metal form.

a) Given the reduction potentials below, which element will be reduced first? **(1 pt)**

Ni, because it has the greatest reduction potential.

| Ion | Ni^{2+} | Cd^{2+} | Fe^{2+} |
|-----------------------------------|------------------|------------------|------------------|
| E° (for reduction to M(s)) | -0.23 V | -0.40 V | -0.45 V |

b) Give the charge of and name of the electrode where the reduction will occur. **(2 pts)**

Reduction will occur on the **cathode** and it will be **negatively charged**.