

NERNST EQUATION

NAME _____

SECTION _____

1. During the reaction between zinc metal and copper (II) nitrate the measured cell potential changes. In the table below the measured cell potential, E_{cell} is shown as the concentration of $\text{Zn}^{2+}(\text{aq})$ and $\text{Cu}^{2+}(\text{aq})$ change.

Experiment	E_{cell}	E°	$[\text{Zn}^{2+}]$	$[\text{Cu}^{2+}]$
1	0.760	0.76	1	1
2	0.757	0.76	1.1	0.9
3	0.755	0.76	1.2	0.8
4	0.752	0.76	1.3	0.7
5	0.749	0.76	1.4	0.6
6	0.746	0.76	1.5	0.5
7	0.742	0.76	1.6	0.4
8	0.738	0.76	1.7	0.3
9	0.732	0.76	1.8	0.2
10	0.722	0.76	1.9	0.1
11	0.692	0.76	1.99	0.01

- a. How does the cell potential change during the reaction?

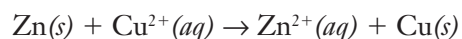
- b. When the data is plotted E_{cell} versus $\log\left(\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}\right)$ a straight line with a negative slope is obtained (try it yourself). Careful consideration of this reaction and other reactions yields the following relationship between the cell potential and concentration of reactants and products.

$$E_{\text{cell}} = E^\circ - \frac{0.0591}{n} \log\left(\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}\right)$$

where n is the number of electrons transferred in the balanced oxidation–reduction reaction and the concentration of products divided by reactants. You should recognize the ratio of concentration as Q for the reaction. Try one of the Experiments to see that you can calculate the E_{cell} for the reaction.

2. Complete the following problems:

a. Calculate E° for the reaction



i. Calculate E_{cell} when the ratio of these concentrations is small, that is, if $[\text{Zn}^{2+}] = 1 \times 10^{-4} \text{ M}$ and $[\text{Cu}^{2+}] = 1.0 \text{ M}$.

ii. Calculate E_{cell} when the ratio of these concentrations is large, that is, if $[\text{Cu}^{2+}] = 1 \times 10^{-4} \text{ M}$ and $[\text{Zn}^{2+}] = 1.0 \text{ M}$.

b. Which of the following oxidizing agents become stronger as the $[\text{H}^+]$ is increased? Which are unchanged? Which become weaker?

i. Br_2

ii. Fe^{3+}

iii. MnO_4^-

iv. H^+

v. $\text{Cr}_2\text{O}_7^{2-}$

c. Calculate E_{cell} for:

