2-9. Construct the potential-pH diagram for zinc using the following
reactions and assuming the activity of all dissolved substances is
$10^{-6}$. Assume any other reactions necessary to complete the
diagram using the diagram for aluminum, Figure 2.11a, as a
guide.

[1] $\text{Zn}^{+2} + 2e^- = \text{Zn}$ \hspace{1cm} $E^o = -0.763v$
[2] $\text{ZnO} + 2\text{H}^+ + 2e^- = \text{Zn} + \text{H}_2\text{O}$ \hspace{1cm} $E^o = -0.439v$
[3] $\text{ZnO}_2^- + 4\text{H}^+ + 2e^- = \text{Zn} + 2\text{H}_2\text{O}$ \hspace{1cm} $E^o = 0.441v$

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\[ E(1) = -0.763 + 0.0296\log[10^{-6}] \]
\[ E(2) = -0.439 - 0.0592\text{pH} \]
\[ E(3) = 0.441 + 0.0296\log[10^{-6}] - 0.1182\text{pH} \]
2-12. A buried stainless steel nuclear waste storage tank contain of dissolved radioactive Cr$^{3+}$, Al$^{3+}$, Fe$^{3+}$ and Ni$^{2+}$ at pH 2. It is proposed to neutralize this acid tank solution to pH 7 in the tank with concentrated NaOH. The neutralized solution will then be pumped out of the tank for further processing. Explain the advantages and disadvantages of the neutralization step using the appropriate Pourbaix diagrams. On the basis of your evaluation, would you recommend neutralization?

Kind of a silly question [not nearly as good as the kind I would ask, you understand], but let’s have at it. In all cases, from the Pourbaix diagrams for Cr, Al, Fe and Ni, the component metal cations would precipitate as the respective hydoxides at pH 7, leaving a sludge at the bottom of the tank. If neutralization would not be effected, the issue now becomes whether these reducible metal cations can contribute to the corrosion of the stainless steel tank, even whether this stainless steel can remain passive at this pH - more about this later.....