CH302H – Principles of Chemistry II: Honors
Spring 2014, Unique 51880

Bonus Quiz
22 April 2014

Pt is nearly always treated as an inert electrode. Nitric acid is, however considered a strong oxidizing agent. Is Pt "safe" in a nitric acid solution, or will it dissolve away?

- Write the balance reaction for this redox reaction.
- Tell me to what extent a Pt wire would dissolve in a 1 M HNO_3 solution. (i.e., what is $[Pt^{2+}]$ in 1 M HNO_3?)

$NO_3^- + 4H^+ + 3e^- \rightarrow NO_{(g)} + 2H_2O$ $\quad E^\circ = +0.955$ V

$Pt^{2+} + 2e^- \rightarrow Pt_{(s)}$ $\quad E^\circ = 1.18$ V

If you need make any assumptions, clearly state what they are and, if possible, justify your assumption.

$Pt(s) \rightarrow Pt^{2+} + 2e^- \quad]\times 3 \qquad E^\circ = 1.18\,V$

$NO_3^- + 4H^+ + 3e^- \rightarrow NO(g) + 2H_2O \quad]\times 2 \qquad E^\circ = 0.955\,V$

$3Pt(s) + 2NO_3^- + 8H^+ \rightarrow 3Pt^{2+} + 2NO(g) + 4H_2O$

Assuming reaction reaches equillibrium

$$E^\circ_{cell} = \frac{0.059}{n} \log K$$

$$(0.955 - 1.18) = \frac{0.059}{6} \log \left(\frac{[Pt^{2+}]^3}{[NO_3^-]^2 [H^+]^8} \right)$$

$$-0.225 = 0.00983 \log [Pt^{2+}]^3$$

$$[Pt^{+2}]^3 = 1.314 \times 10^{-23}$$

$$[Pt^{+2}] = 2.36 \times 10^{-8}\ M.$$