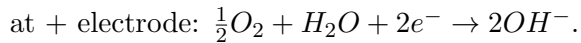
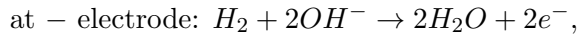


HW5, PHYS 3113

P1 (5.4) In a hydrogen fuel cell, the steps of the chemical reaction are



Calculate the voltage of the cell. What is the minimum voltage required for electrolysis of water? Explain briefly.

P2 (3.23) Show that the entropy of a two-state paramagnet, expressed as a function of temperature, is

$$S = Nk [\ln(2 \cosh x) - x \tanh x] ,$$

where $x = \mu B/kT$. Check that this formula has the expected behavior at $T \rightarrow 0$ and $T \rightarrow \infty$.

P3 (3.20) In an experiment, an ideal two-state electronic paramagnet such as DPPH, with $\mu = \mu_B$, is placed in a magnetic field of strength 2.06 T at a temperature of 2.2 K. Calculate the energy, magnetization, and entropy of this system, expressing each quantity as a function of its maximum possible value. What would the experimenters have had to do to attain 99% of the maximum possible magnetization?