Chemistry 201

The standard hydrogen electrode

NC State University

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Just like we have an arbitrary definition for the zero of enthalpy (enthalpies of elements in their reference states), we define the zero of potential using a reference. Here the reference is the standard hydrogen electrode. The reaction is:

$$2H^+ + 2e^- \rightarrow H_2 \qquad E^o = +0.0 V$$

This is an important reaction in its own right! You may have heard talk of the "hydrogen economy" This reaction is one important way to generate hydrogen fuel. In essence, it converts electrical energy into chemical energy. SHE

standard hydrogen electrode

- 1. platinum electrode
- 2. hydrogen blow
- 3. solution of the acid with activity of H⁺ = 1 M
- 4. hydroseal for prevention of oxygen interference
- 5. Salt bridge



The standard state in redox chemistry

When we write E^o (with the naught), we refer to the standard state precisely in the same as have done for free energy. This means that concentration of reactants is 1 molar and the pressure of the product is 1 bar. When we consider the reaction:

$$2H^+ + 2e^- \rightarrow H_2 \qquad E^o = +0.0 V$$

We must understand that this refers to a solution with a pH = 0! Recall the when $[H^+] = 1$ M, then pH = $-\log_{10}(1) = 0$. Now, let's do a thought experiment. What is the potential of this reaction at pH 7?