\[ E = 10.2 \text{ eV} = U. \] First excited state of H is really four states because of the degeneracy of the \(3, \text{p}\) states and the \(5\) state.

\[ F = U - TS, \quad \text{look for boundary at } F = 0 \]

\[ \Rightarrow U = TS \quad \Rightarrow \quad T = \frac{U}{S} \]

\[ T = \frac{10.2 \text{ eV}}{8.617 \times 10^{-5} \text{ eV/K}} = 1.2 \times 10^5 \text{ K}. \]

So the excited state is favored for

\[ T > 1.2 \times 10^5 \text{ K} \quad \text{(pretty damn hot)}. \]