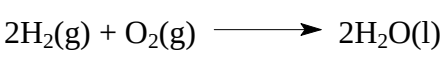
Extra thought thermodynamics question:

1) The reaction



$$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$$

has ε° = 1.22868539 V at 25°C, and ε° = 1.207524137 V at 50°C. Using *only* this information, answer the following questions:

a) Calculate ΔH° and ΔS° for the reaction. **[ΔH° = -571.6 kJ; ΔS° = -326.68 J/K]**
b) If the equilibrium pressure of O_2 at 25°C is found to be 2.0 atm, what will be the equilibrium pressure of H_2 at 25°C in a battery constructed from these chemicals? **[2.048 x 10^{-42} atm]**

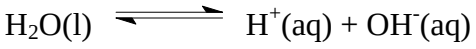
c) Will the cell potential ever drop to zero volts if the hydrogen and oxygen pressure are each 5.0 atm? If so, at what temperature will this occur? **[1994.87 K or 1721.72°C]**

d) Calculate K_c for the cell at 50°C.**[3.98 x 10^{79}]**

e) Calculate $\Delta H°_f(H_2O(l))$. **[-285.8 kJ]**

f) Given that S° for H_2 is 130.7 J/K and S° for O_2 is 205.1 J/K, calculate S° for $H_2O(l)$. **[69.91 J/K]**

g) Finally, given that $K_w = 1.0 \times 10^{-14}$ at 25°C for the reaction



$$H_2O(l) \rightleftharpoons H^+(aq) + OH^-(aq)$$

and that ΔH° for the reaction immediately above is +55.8 kJ, calculate S° and $\Delta H°_f$ for the $OH^-(aq)$ anion. Use any data necessary from the previous questions.

[$\Delta H°_f$ = -230.0 kJ; S° = -10.96 J/K]