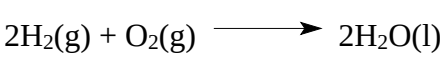
Extra thought thermodynamics question:

(To duplicate the answers here exactly, you'll need to use the values of the Faraday constant and the ideal gas constant I used; they were 96485.3251 coul/mol and 8.3144598 J/mol·K respectively.)

1) The reaction



has ε° = 1.22889318 V at 25°C, and ε° = 1.20773634 V at 50°C. Using *only* this information, answer the following questions:

a) Calculate ΔH° and ΔS° for the reaction. **[ΔH° = -571.66 kJ; ΔS° = -326.612 J/K]**
b) If the equilibrium pressure of O_2 at 25°C is found to be 2.0 bar, what will be the equilibrium pressure of H_2 at 25°C in a battery constructed from these chemicals? **[2.015 x 10^{-42} bar]**

c) Will the cell potential ever drop to zero volts if the hydrogen and oxygen pressure are each 5.0 bar? If so, at what temperature will this occur? **[1995.55 K or 1722.40°C]**

d) Calculate K_c for the cell at 50°C.**[4.27 x 10^{79}]**

e) Calculate $\Delta H°_f(H_2O(l))$. **[-285.83 kJ]**

f) Given that S° for H_2 is 130.68 J/K and S° for O_2 is 205.152 J/K, calculate S° for $H_2O(l)$. **[69.95 J/K]**

g) Finally, given that $K_w = 1.01 \times 10^{-14}$ at 25°C for the reaction

and that ΔH° for the reaction immediately above is +55.815 kJ, calculate S° and $\Delta H°_f$ for the $OH^-(aq)$ anion. Use any data necessary from the previous questions.

[$\Delta H°_f$ = -230.015 kJ; S° = -10.79 J/K]