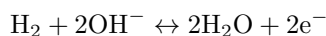
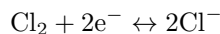
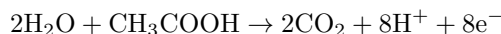


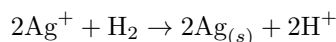
1. Calculate the standard potential, U° from ΔG° for the following cells:
 - Chlor-alkali process to produce hydrogen and chlorine from a brine of NaCl (aqueous salt solution). Use the hydrogen reaction for an alkaline solution.



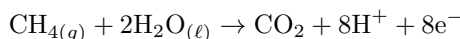
- Acetic acid/oxygen fuel cell with acidic electrolyte, where the acetic acid reacts to form liquid water and carbon dioxide. The reaction at the negative electrode is:



2. Does the redox reaction as written below proceed spontaneously at 25 °C and standard conditions?

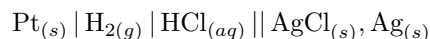


3. What is the standard half-cell potential for the oxidation of methane under acidic conditions? The reaction for methane is as follows:

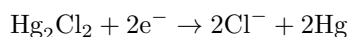
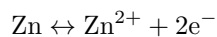


Which element is oxidized and how does its oxidation state change?

4. Determine the equilibrium potential of the cell shown below:



5. Consider the electrochemical reactions shown below. Mercury(I) chloride, also known as calomel, is a solid used in reference electrodes. The two reactions are:



- (a) What is the overall chemical reaction?
- (b) Develop an expression for U , the equilibrium potential of the cell.
- (c) Write down an expression for the standard potential of the cell in terms of the standard Gibbs energies of formation.
- (d) Use standard half-cell potentials from the table to determine the standard Gibbs energy of formation for aqueous ZnCl_2 . Why is this value different than the value for solid ZnCl_2 ?

Reference Text:

Electrochemical Engineering 1st Edition by Thomas F. Fuller (Author), John N. Harb (Author), John Wiley and Sons, 2018.