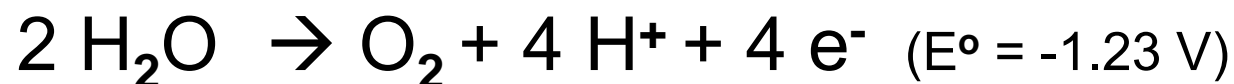
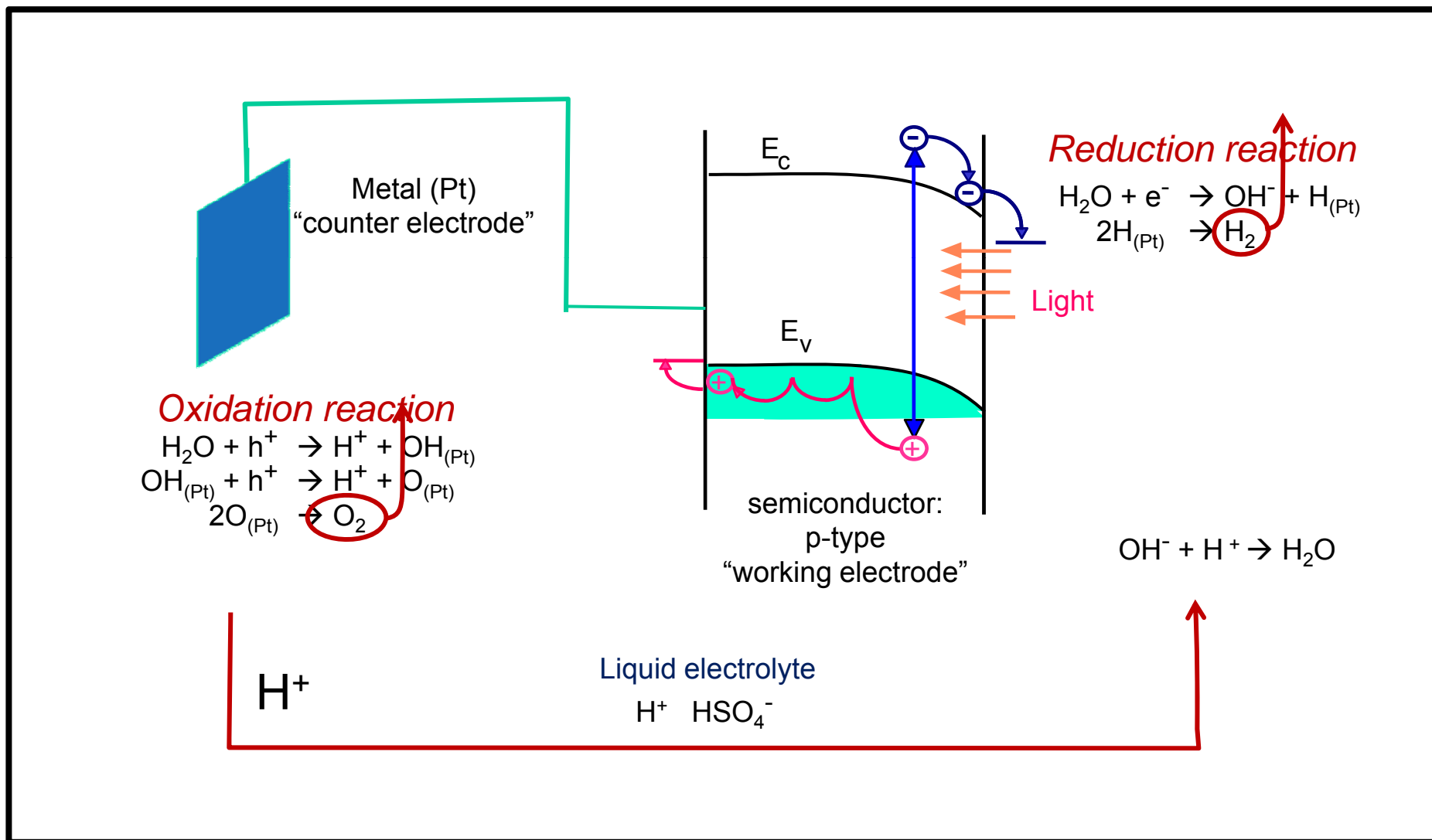
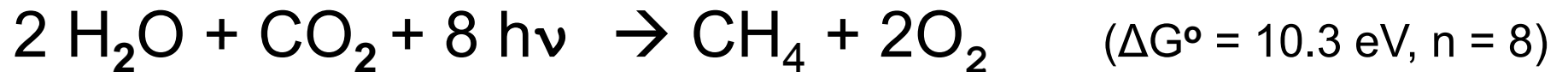
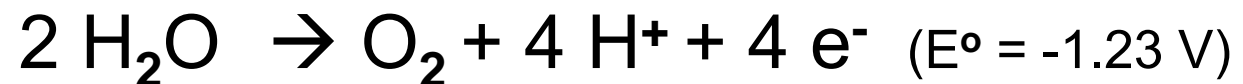


Overall:*Two half-reactions:*1) **Water oxidation:**2) **Water reduction:**

Basis of Semiconductor Photoelectrochemistry



Overall:*Two half-reactions:*1) **Water oxidation:**2) **CO₂ reduction:**

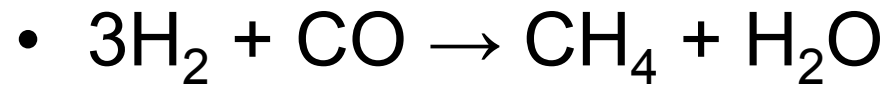
CO₂ Reduction:

Four two-electron transfer reactions:

- 1) $\text{CO}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{HCOOH}$ (Formic Acid)
- 2) $\text{HCOOH} + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{CO} + \text{H}_2\text{O}$ (Formaldehyde)
- 3) $\text{H}_2\text{CO} + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_3\text{COH}$ (Methanol)
- 4) $\text{H}_3\text{COH} + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{CH}_4 + \text{H}_2\text{O}$ (Methane)

- Rates of reaction are slow
- Catalyst is needed to increase rate
- No good catalyst is currently known

Fischer–Tropsch process



Water gas shift reaction:

