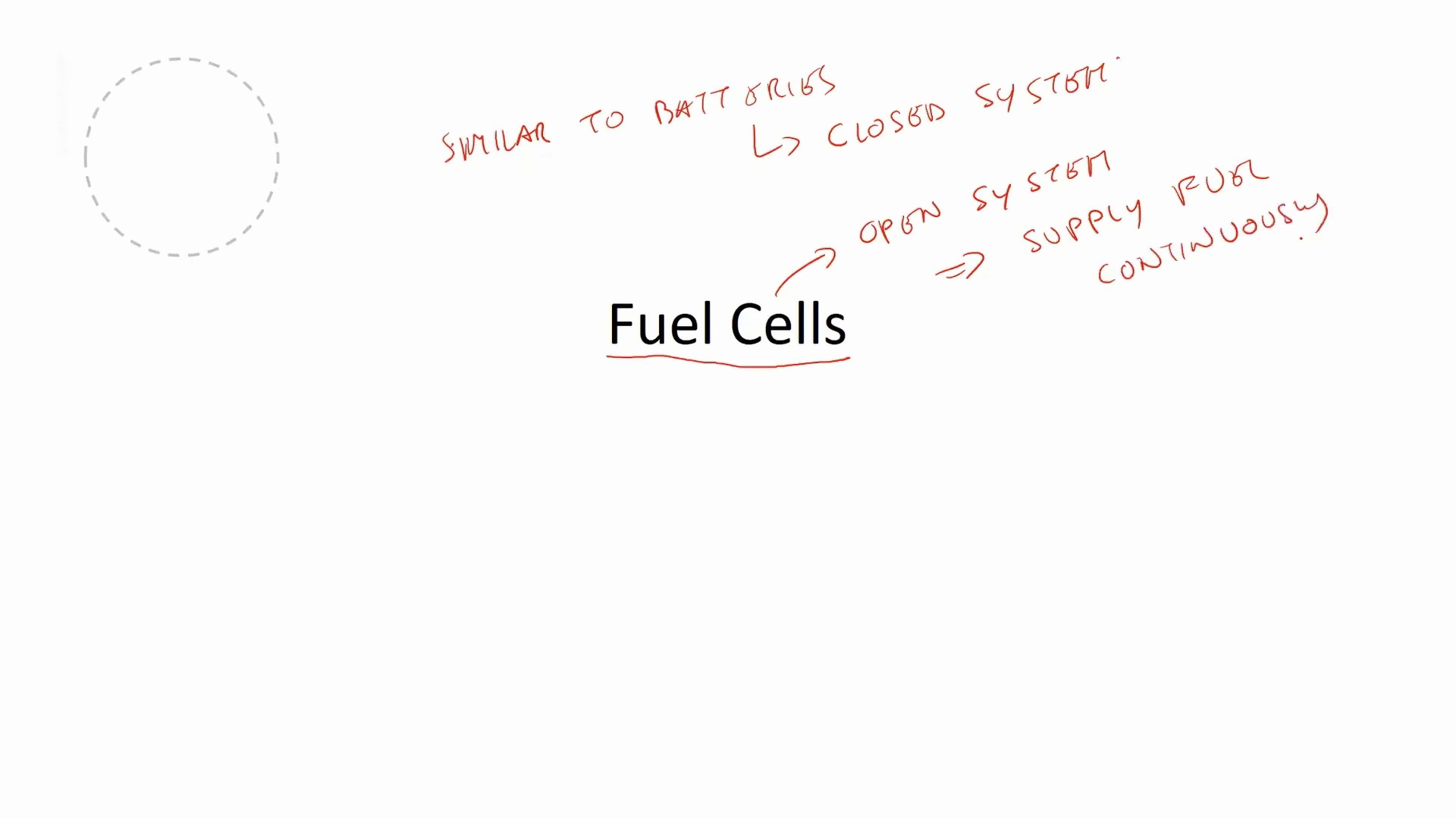
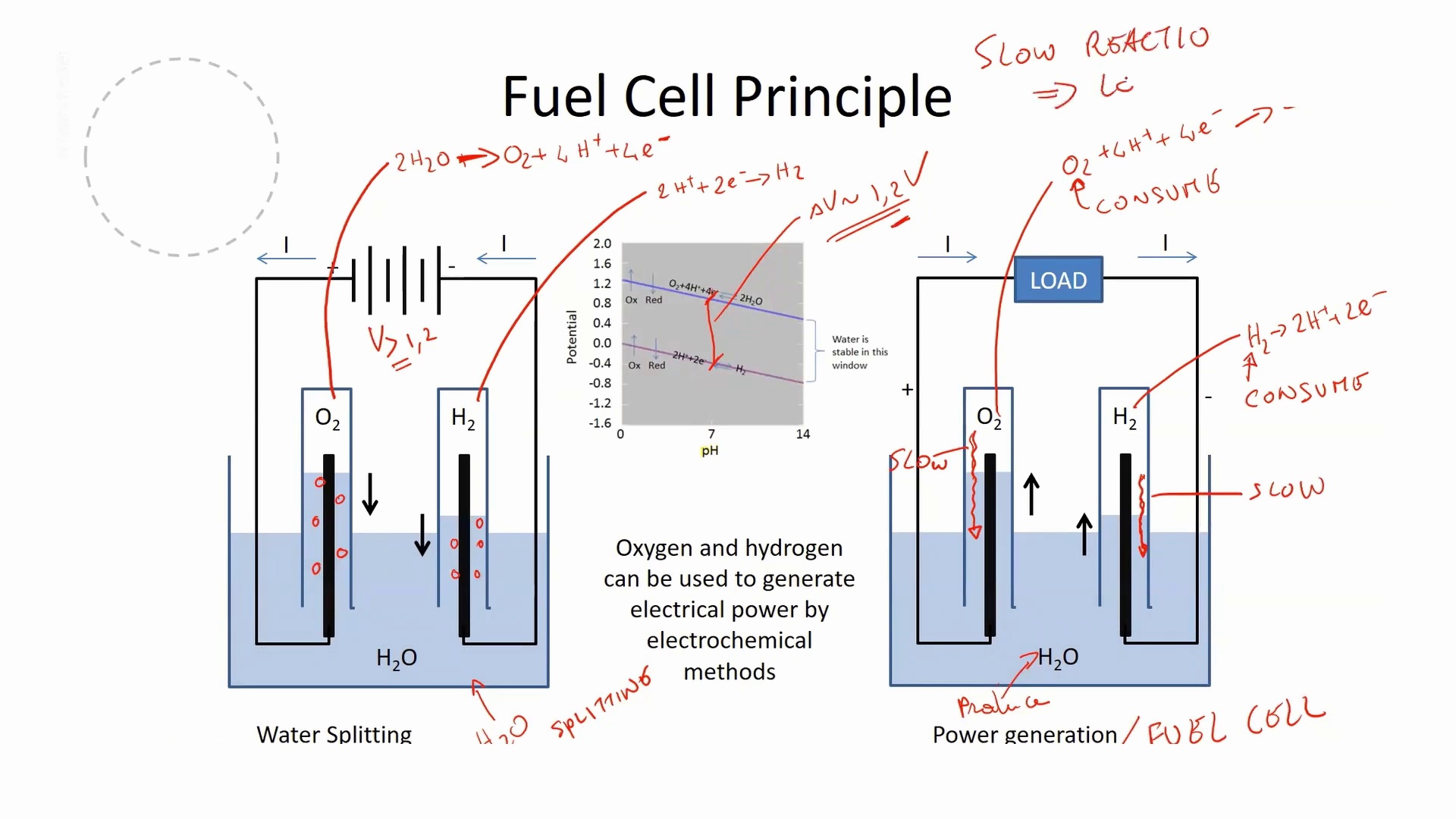
# Slide-by-Slide Revision Summaries

## Slide 1



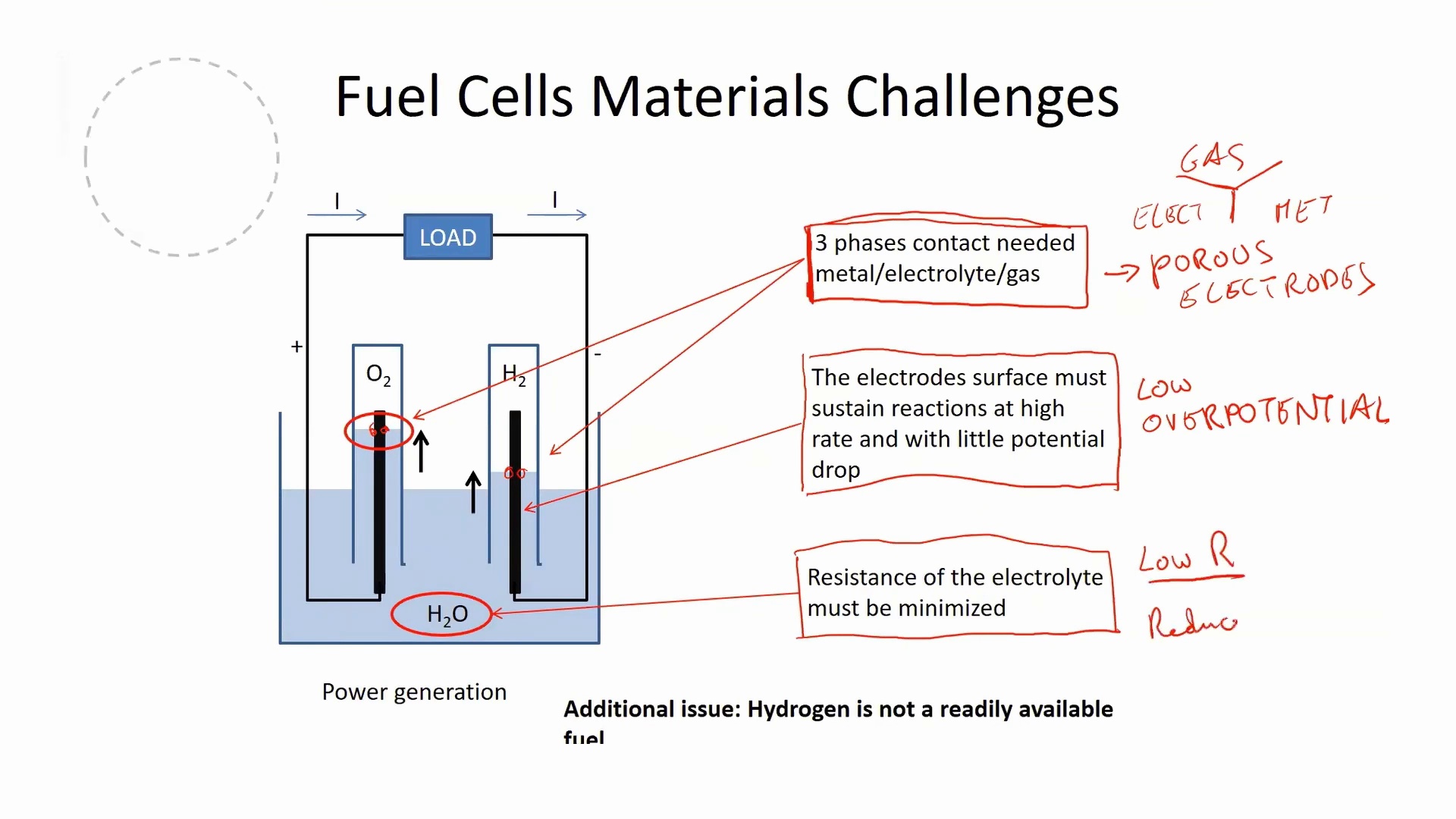
* Fuel cells and batteries both generate electricity, but operate differently.
* Batteries are closed systems with limited internal reactants.
* Fuel cells are open systems, continuously supplied with external reactants (fuels).
* Fuel cells can produce electricity as long as fuel is provided.
* The basic operating principle of fuel cells will be explained further in the presentation.

## Slide 2



* Water splitting in an electrochemical cell requires a minimum voltage slightly above 1.2 V, as indicated by the Pourbaix diagram, to decompose water into hydrogen and oxygen via electrolysis.
* The anode (positive electrode) produces oxygen, while the cathode (negative electrode) generates hydrogen during water electrolysis.
* The process is theoretically reversible: combining hydrogen and oxygen in a similar cell can generate water and produce a voltage of about 1.2 V.
* In practice, the actual current generated is very low due to slow reaction kinetics, primarily limited by the diffusion of oxygen to the electrode surface.
* Effective electrochemical reactions mainly occur at triple-phase boundaries, making this cell design inefficient for practical fuel cell applications.

## Slide 3



* Fuel cell materials must provide extensive three-phase contact sites (gas, electrolyte, metal) to maximize electrochemical reaction efficiency.
* Porous materials are essential to maintain adjacent but separate regions for gas and electrolyte, supporting necessary reaction interfaces.
* Materials must ensure good electrolyte contact to enable efficient ion transport during operation.
* Electrode materials should effectively catalyze hydrogen oxidation and oxygen reduction with minimal overpotential to reduce energy losses.
* Minimizing the electrolyte’s ohmic resistance is crucial to prevent additional voltage drops and maximize fuel cell efficiency.