

Hydrogen Energy Storage Lab

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/hydrogen/>

Name: _____ Date: _____

Learning objectives

- Describe storing energy as hydrogen.
- Explain electrolysis and fuel cells.
- Discuss round-trip efficiency.

Variables to change

- Electrolysis power
- Stored hydrogen
- Fuel-cell load

Procedure

1. Use electricity to split water into hydrogen and oxygen (electrolysis) and store the hydrogen.
2. Run the hydrogen through a fuel cell to regenerate electricity.
3. Compare the electricity in with the electricity recovered.

Observations

Record energy in during electrolysis vs energy out from the fuel cell.

Questions

1. How is energy stored as hydrogen?
2. How is the energy recovered?

3. What is the round-trip efficiency like?
4. What is the byproduct of a hydrogen fuel cell?
5. Why use hydrogen despite lower efficiency?

Answer key (instructors)

- **1.** Electricity splits water into hydrogen and oxygen (electrolysis); the hydrogen holds chemical energy.
- **2.** A fuel cell recombines hydrogen with oxygen to produce electricity (and water).
- **3.** Relatively low — often ~30–40% — because both electrolysis and the fuel cell lose energy.
- **4.** Water (plus heat).
- **5.** It stores large amounts of energy for long durations and can decarbonize hard-to-electrify uses.

Hydrogen storage uses surplus electricity to electrolyze water, stores the hydrogen, then runs it through a fuel cell to regenerate electricity, emitting only water. Round-trip efficiency is modest (~30–40%) but it enables long-duration, large-scale storage.