

## Hydrogen K-W-L

### Student Objective

The student:

- (intro activity) will know their level of knowledge of hydrogen technology
- (follow-up activity) will assess what they have learned about hydrogen

### Materials

- Science Journal
- extra copy of Science Journal pages (1 per group)
- flip chart paper (2 - 4 sheets)

### Key Words:

(These words will be covered in the High-energy Hydrogen unit)

atom  
electrolysis  
electron  
fuel cell  
Hindenburg  
H<sub>2</sub>O  
hydrogen  
oxygen  
pollution  
proton

### Time:

1 class period

### Procedure (Introductory Activity)

1. Explain to students that they will be answering a few questions in their Science Journal about hydrogen. Tell the students that their answers today will not be graded and that there will probably be many questions that they don't know the answers to yet. Explain to them that these are the questions that they will be researching during this unit.
2. Give the students time to answer the questions in their journals
3. Divide the students into lab groups of 3 - 5 students.
4. Pass out a blank copy of the of the Science Journal questions to each group.
5. Explain to the groups that they are to discuss the questions among themselves and decide on a group answer to each.
6. Give the groups time to decide on their answers.
7. For each question, ask the groups which answer they thought was the best. You may wish to chart these group answers on the board. Tell the students that during the unit they will be investigating these questions and finding out which answers are correct.
8. Label one piece of flip chart paper with a 'K' and one with a 'W'.
9. Ask the students to list off the things they know about hydrogen and list their responses on the K paper. Don't worry if some of the answers at this time are incorrect.
10. On the W sheet list all the things that the students want to know. Don't answer any questions at this time, just list them.
11. Save these sheets for the follow-up activity.

**Procedure (Follow-up Activity, to be done at the end of the unit)**

1. Bring out the K and W sheets.
2. Read through the K items and ask the students for clarification on any items that are incorrect. Correct these statements as needed.
3. Read through the W items and have the students answer each one. If an item on the W list hasn't been answered yet, you may wish to ask if a student would like to research the answer for the class (this could be extra credit).

**Answer Key**

1. B. Water is made of two hydrogen atoms to every oxygen atom
2. A. Water and heat
3. D. Hydrogen and oxygen
4. C. Electrons
5. B. Electricity
6. A. Electrolysis
7. C. Hydrogen will be used to provide our electricity and power our cars
8. B. Hydrogen can be used to create electricity cleanly—with only water and heat as by-products
9. T
10. F
11. T
12. F

# High-energy Hydrogen I

## Florida Sunshine Standards Benchmarks/Grade Level Expectations

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### Hydrogen K-W-L

|                   |            |           | .1 | .2 | .3 | .4 | .5 | .6 |
|-------------------|------------|-----------|----|----|----|----|----|----|
| Nature of Matter  | Standard 1 | SC.A.1.2- |    |    |    |    | X  |    |
|                   | Standard 2 | SC.A.2.2- |    |    |    |    |    |    |
| Energy            | Standard 1 | SC.B.1.2- | X  | X  |    | X  |    |    |
|                   | Standard 2 | SC.B.2.2- |    | X  | X  |    |    |    |
| Force and Motion  | Standard 1 | SC.C.1.2- |    |    |    |    |    |    |
|                   | Standard 2 | SC.C.2.2- | X  |    |    |    |    |    |
| Nature of Science | Standard 1 | SC.H.1.2- |    |    | X  |    |    |    |
|                   | Standard 2 | SC.H.2.2- |    |    |    |    |    |    |
|                   | Standard 3 | SC.H.3.2- | X  |    |    | X  |    |    |

**Benchmark SC.A.1.2.5** - The student knows that materials made by chemically combining two or more substances may have properties that differ from the original materials.

#### Grade Level Expectations

The student:

*Fifth*

- knows that materials made by chemically combining two or more substances have properties that differ from the original materials
- knows the difference between physical and chemical changes.

**Benchmark SC.B.1.2.1** - The student knows how to trace the flow of energy in a system.

#### Grade Level Expectations

The student:

*Fourth*

- knows how to trace the flow of energy in a system

*Fifth*

- knows how to trace the flow of energy in a system.

**Benchmark SC.B.1.2.2** - The student recognizes various forms of energy.

#### Grade Level Expectations

The student:

*Third*

- knows different forms of energy

*Fourth*

- knows that there are a variety of sources for electricity.

**Benchmark SC.B.1.2.4** - The student knows the many ways in which energy can be transformed from one type to another.

**Grade Level Expectations**

The student:

*Fourth*

- knows ways that energy can be transformed.

**Benchmark SC.B.2.2.2** - The student recognizes the costs and risks to society and the environment posed by the use of nonrenewable energy.

**Grade Level Expectations**

The student:

*Third*

- classifies resources as renewable or nonrenewable

*Fourth*

- knows the risk factors associated with the use of nonrenewable energy sources.

**Benchmark SC.B.2.2.3** - The student know that the limited supply of usable energy sources places great significance on the development of renewable energy sources.

**Grade Level Expectations**

The student:

*Third*

- knows that alternate energy sources are being explored using natural and mechanical processes

*Fifth*

- knows that the limited supply of usable energy sources places great significance on the development of renewable energy sources.

**Benchmark SC.D.2.2.1** - The student knows that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life.

**Grade Level Expectations**

The student:

*Fourth*

- knows ways misuse of natural resources affects the quality of life for all species

**Benchmark SC.H.1.2.3** - The student knows that to work collaboratively, all team members should be free to reach, explain, and justify their own individual conclusions.

**Grade Level Expectations**

The student:

*Third*

- knows that to work collaboratively, all team members should be free to reach, explain, and justify their own individual conclusions

*Fourth*

- works collaboratively to collect, share, and record information for a scientific investigation.

**Benchmark SC.H.3.2.1** - The student understands that people, alone or in groups, invent new tools to solve problems and do work that affects aspects of life outside of science.

**Grade Level Expectations**

The student:

*Fourth*

- researches and reports on a science topic

*Fifth*

- knows areas in which technology has improved human lives
- knows that new inventions often lead to other new inventions and ways of doing things.

**Benchmark SC.H.3.2.4** - The student know that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas.

**Grade Level Expectations**

The student:

*Third*

- knows that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas

*Fourth*

- knows ways that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas

*Fifth*

- extends and refines knowledge of ways that, through the use of science processes and knowledge, people can solve problems, make decisions, and form new ideas.

## Hydrogen K-W-L

**atom** - the smallest unit of an element, having all the characteristics of that element and consisting of a dense, central, positively charged nucleus surrounded by a system of electrons

**electrolysis** - chemical change, especially decomposition, produced in an electrolyte by an electric current

**electron** - an elementary particle with negative charge

**fuel cell** - an electrochemical cell in which the energy of a reaction between a fuel, such as hydrogen, and an oxidant, such as oxygen, is converted directly and continuously into electrical energy

**H<sub>2</sub>O** - the chemical formula for water—2 atoms of hydrogen and one atom of oxygen

**Hindenburg** - the largest aircraft to ever fly, the Hindenburg was a gas-filled dirigible (blimp, zeppelin), that crashed upon landing at Lakehurst, New Jersey on May 6, 1937

**hydrogen** - a colorless, highly flammable gaseous element, the lightest of all gases and the most abundant element in the universe

**oxygen** - an element that at standard temperature and pressure is colorless, tasteless, and odorless. Oxygen is required for nearly all combustion and in the cellular functioning of animals

**pollution** - the contamination of soil, water, or the atmosphere by the discharge of harmful substances.

**proton** - a stable, positively charged subatomic particle

## Hydrogen K-W-L (Introductory Activity)

Multiple Choice. Circle the best answer.

1. What is meant by  $H_2O$ ?
  - A. Hydrogen is made with oxygen
  - B. Water is made of two hydrogen atoms to every oxygen atom
  - C. Water is made of two oxygen atoms to every hydrogen atom
  - D. Water is made of helium and oxygen
2. What are the by-products of hydrogen fuel cells?
  - A. Water and heat
  - B. Carbon and oxygen
  - C. Dirty exhaust
  - D. Hydrogen flames
3. What two elements do hydrogen fuel cells combine?
  - A. Oxygen and silicon
  - B. Hydrogen and carbon
  - C. Water and vapor
  - D. Hydrogen and oxygen
4. Which particles pass through the fuel cell's membrane?
  - A. Neutrons
  - B. Protons
  - C. Electrons
  - D. Molecules
5. The flow of electrons on a wire is called
  1. Nuclear power
  2. Electricity
  3. Photovoltaics
  4. Hydrogen fuel cell

6. What process uses electricity to separate water molecules into hydrogen and oxygen?
- A. Electrolysis
  - B. Fissure
  - C. Evaporation
  - D. Fission
7. What is meant by the 'hydrogen future'?
- A. We will all be drinking hydrogen in the future
  - B. The government will require us to pay a hydrogen tax
  - C. Hydrogen will be used to provide our electricity and power our cars
  - D. Shares of hydrogen will be traded on the stock market
8. What are the benefits of using hydrogen as a form of energy? (Circle all that are true)
- A. Hydrogen can be extracted from mines in the U.S.
  - B. Hydrogen can be used to create electricity cleanly—with only water and heat as by-products
  - C. Hydrogen is much more dangerous than gasoline to use in cars
  - D. Hydrogen is currently cheaper to produce than gasoline

Mark the following True (T) or False (F)

9. \_\_\_\_\_ Fuel cells have been used by NASA to provide power aboard the Space Shuttle.
10. \_\_\_\_\_ Gasoline cars are safer than hydrogen fueled cars.
11. \_\_\_\_\_ Hydrogen can be used to launch a rocket.
12. \_\_\_\_\_ Using hydrogen as a fuel source can make the air polluted.



## Hydrogen K-W-L (Follow-up Activity)

Multiple Choice. Circle the best answer.

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