

Michigan

Correlations to SEPUP's *Investigating Alternative Energy: Hydrogen & Fuel Cells*

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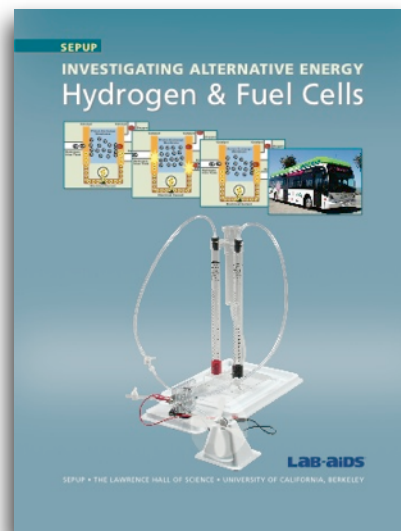
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Chemistry

C1.2 Scientific Reflection and Social Implications

The integrity of the scientific process depends on scientists and citizens understanding and respecting the “Nature of Science.” Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities.

Performance Indicator Descriptor	Location in Module	Where Assessed
C1.2B Identify and critique arguments about personal or societal issues based on scientific evidence.	Activities 1 and 6	Throughout Activities 1 and 6

Performance Indicator Descriptor	Location in Module	Where Assessed
C1.2C Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.	Activity 6	Throughout Activity 6
C1.2D Evaluate scientific explanations in a peer review process or discussion format.	Throughout Module	Throughout Module
C1.2F Critique solutions to problems, given criteria and scientific constraints.	Activities 1 and 6	Throughout Activities 1 and 6
C1.2G Identify scientific tradeoffs in design decisions and choose among alternative solutions.	Activities 1 and 6	Throughout Activities 1 and 6
C1.2K Analyze how science and society interact from a historical, political, economic, or social perspective.	Activities 1 and 6	Throughout Activities 1 and 6

P3.p2 Energy Transfer (prerequisite)

Nuclear reactions take place in the sun. In plants, light from the sun is transferred to oxygen and carbon compounds, which, in combination, have chemical potential energy (photosynthesis). (prerequisite)

Performance Indicator Descriptor	Location in Module	Where Assessed
P3.p2A Trace (or diagram) energy transfers involving various types of energy including nuclear, chemical, electrical, sound, and light. (prerequisite)	Activities 3 and 5	Throughout Activity 5

C5.2 Chemical Changes

Chemical changes can occur when two substances, elements, or compounds interact and produce one or more different substances whose physical and chemical properties are different from the interacting substances. When substances undergo chemical change, the number of atoms in the reactants is the same as the number of atoms in the products. This can be shown through simple balancing of chemical equations. Mass is conserved when substances undergo chemical change. The total mass of the interacting substances (reactants) is the same as the total mass of the substances produced (products).

Performance Indicator Descriptor	Location in Module	Where Assessed
C5.2A Balance simple chemical equations applying the conservation of matter.	Activities 2, 3, and 4	Activity 2, Analysis #1b; Activity 3, Pre-Lab #1a; Activity 4, Procedure Part A

C5.6x Reduction/Oxidation Reactions

Chemical reactions are classified according to the fundamental molecular or submolecular changes that occur. Reactions that involve electron transfer are known as oxidation/reduction (or "redox").

Performance Indicator Descriptor	Location in Module	Where Assessed
C5.6A Balance half-reactions and describe them as oxidations or reductions.	Activity 4	Activity 4, Procedure Parts A and B

Performance Indicator Descriptor	Location in Module	Where Assessed
C5.6E Identify the reactions occurring at the anode and cathode in an electrochemical cell.	Activities 2, 3, 4	Activity 2 Procedure and Analysis #1; Activity 3, Pre-Lab #1a; Activity 4, Procedure Parts A and B

Physics

P4.2 Energy Transformation

Energy is often transformed from one form to another. The amount of energy before a transformation is equal to the amount of energy after the transformation. In most energy transformations, some energy is converted to thermal energy.

Performance Indicator Descriptor	Location in Module	Where Assessed
P4.2A Account for and represent energy transfer and transformation in complex processes (interactions).	Activities 3 and 5	Activity 5, Analysis #3
P4.2B Name devices that transform specific types of energy into other types (e.g., a device that transforms electricity into motion).	Throughout Module	Throughout Module
P4.2C Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).	Activities 3 and 5	Activity 5, Analysis #3
P4.2D Explain why all the stored energy in gasoline does not transform to mechanical energy of a vehicle.	Activity 5	Analysis #4

Performance Indicator Descriptor	Location in Module	Where Assessed
P4.2F Identify and label the energy inputs, transformations, and outputs using qualitative or quantitative representations in simple technological systems (e.g., toaster, motor, hair dryer) to show energy conservation.	Activity 5	Procedure and Student Sheet 5.1

P4.10 Current Electricity — Circuits

Current electricity is described as movement of charges. It is a particularly useful form of energy because it can be easily transferred from place to place and readily transformed by various devices into other forms of energy (e.g., light, heat, sound, and motion). Electrical current (amperage) in a circuit is determined by the potential difference (voltage) of the power source and the resistance of the loads in the circuit.

Performance Indicator Descriptor	Location in Module	Where Assessed
P4.10D Discriminate between voltage, resistance, and current as they apply to an electric circuit.	Activities 3 and 5	Activity 3, Procedures; Activity 5, Procedures and Student Sheet 5.1