

Research Experiences for Teachers (RET) – 2014

LESSON PLAN TEMPLATE

MODULE TOPIC: Engineering Design Challenge

Lesson - Energy Efficiency

OBJECTIVE(S): Students will be able to:

- Assemble and test a small electric motor car employing 3 alternative energy sources, a battery pack, a solar panel and a rechargeable Hydrogen cell.
- Document their test data on a the worksheet provided.

STANDARD(S):

NGSS

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy

HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved

MATERIALS: Solar/ Hydrogen cell/ battery kits, volt meters, meter stick, stop watch, user guide with notes to students and teachers.

BACKGROUND INFORMATION:

See Thames and Kosmos user guide: <http://www.thamesandkosmos.com/products/fc/fc10.html>

CLASSROOM ACTIVITY DESCRIPTION (LABORATORY/EXERCISES/PROBLEMS)
including detailed procedures:

- 1 - Teacher introduces the idea of energy from difference sources using the model car as a demo, and discusses the mechanism which generates energy in each case.
- 2 - Teacher demonstrates how to use the volt meter and has students try it.
- 3 - Students form work groups of 3 or 4, and review the procedures, measurements and calculations with the teacher
- 4 - Students build and race the electric car in the 3 modes measuring the energy available and energy delivered in each case in order to determine efficiency.
- 5 - Students record and process experimental data, and evaluate results comparing the results achieved by using the 3 energy sources.

SAMPLE QUESTIONS TO ELICIT CLASS DISCUSSION:

What is meant by electrical efficiency? What are some sources of energy and which the most portable or sustainable? What are the limitations of each source?

HOMEWORK ACTIVITY/EXERCISES/PROBLEMS:

Calculate the speed, kinetic energy, power, and efficiency of the car in each energy mode. Compare and contrast the alternative energy sources by the test results.

Lesson Plan Template rev 6-16-14

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Center for Pre-College Programs & Newark College of Engineering

New Jersey Institute of Technology

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PARAMETERS TO EVALUATE STUDENT WORK PRODUCTS:

Assessment is based on the following criteria

- Do measurements and calculations appear correct based on the data gathered? I.E., do students have realistic values for voltages, speed, and efficiency.
- Did they demonstrate the knowledge of efficiency based on reported results that include:
 - Findings, and
 - Recommendation of which energy source they would use in their own car.

REFERENCES:

<http://www.thamesandkosmos.com/products/fc/fc10.html>

<http://science.howstuffworks.com/environmental/energy/solar-cell.htm>

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