THE SCIENCE OF FRINGE

EXPLORING: ENERGY CONVERSION

A SCIENCE OLYMPIAD THEMED LESSON PLAN
SEASON 2 - EPISODE 22: **OVER THERE (PART 1)**

Overview:
Students will learn about how the various forms of energy can be converted into other forms of energy and how these conversions can be used to either disperse or concentrate energy.

Grade Level: 9–12

Episode Summary:
Peter has gone over to the alternate universe with the alternate Walter. Walter and Olivia discover a warning from the Observers that Peter's presence there could cause the destruction of both universes due to his built up energy field. They decide to follow Peter to the alternate universe and try to persuade him to return. In the alternate universe the corresponding Fringe team detects the transfer into their universe and works to investigate and detain the 'intruders'.

Related Science Olympiad Event:
Egg-O-Naut - Teams will design, construct and launch rockets to stay aloft and carry a raw egg without breaking.

Learning Objectives:
Students will understand the following:
- Energy comes in many forms, including potential, kinetic, and thermal.
- The conversion of energy from one form to another results in work, which is how things can function.
- With proper engineering, energy conversion can be managed such that it doesn't significantly impact an object.

Episode Scenes of Relevance:
- Walter and Olivia discussing the message from the Observers.
- Brandon showing the team the energy imbalance in a coffee cup sent between the universes.
- View the above scenes: http://www.fox.com/fringe/fringe-science

Online Resources:
- Fringe "Over There (Part 1)" full episode: http://www.fox.com/watch/fringe
- Science Olympiad Egg-O-Naut event: http://soinc.org/eggonaut_c
- Work: The Transfer of Mechanical Energy e-text: http://www.lightandmatter.com/html_books/2cl/ch03/ch03.html
- Conservation of Energy e-text: http://www.lightandmatter.com/html_books/2cl/ch01/ch01.html
- Winston-Salem Annual Egg Drop competition: http://www.wsfceggdrop.com/

Procedures:

1. Tell your students that they are going to learn about the forms of energy and how they can be converted from one to another in order to perform work.
2. Have your students research energy and work in resources such as physics textbooks and websites and discuss what they have learned.
3. Tell your class they are going to try to create a device to control the conversion of kinetic energy into other forms. The kinetic energy will be in the form of an egg dropped from the top of a stairwell.
4. Divide your class into groups. Have each group build a device as follows:
    a. Materials: eggs, tape, sheets of paper, drinking straws
    b. The device can use a maximum of 10 sheets of paper, 10 drinking straws, and 2 feet of tape.
    c. It must be able to hold the egg and prevent it from breaking when it hits the ground, by dispersing the kinetic energy away from the egg.
5. Once the teams build their devices, test them out by dropping them from a window or stairwell. Be sure to have plenty of cleanup supplies available to handle any broken eggs.
6. Discuss with the class the features they built into their devices and whether or not they worked as planned. Be sure to address:
    a. What form the kinetic energy was converted into.
    b. What other common household items could have been used to help build the device.
    c. Did the orientation of the egg relative to the ground affect the results?
    d. Why are egg cartons designed the way they are?

Additional Discussion Suggestions:

- Have the class discuss everyday activities that involve energy conversion, such as cooking, walking, turning on a TV, and the light coming from the sun.
- Explain the concepts behind Einstein's famous equation $E=mc^2$, which is a very special form of energy conversion.

Extension to Other Subjects:

History: Major advances in our civilization have revolved around discovering new ways to convert energy from one form to another, such as the steam engine and the light bulb. Research some of these advances and discuss the role energy related technology played in them.

Language Arts: The terms energy and work have lots of definitions and meanings. Outline the various meanings and discuss how they are all related.

Social Studies: Energy related stories are frequently in the news, ranging from oil spills to offshore wind farms to electric cars to nuclear power plants. Review recent articles and discuss how effectively they present the science behind the energy concepts.

National Science Standards Alignment:

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

H.E.1 Abilities of technological design

b. Propose designs and choose between alternative solutions.
c. Implement a proposed solution.
d. Evaluate the solution and its consequences.