THE SCIENCE OF FRINGE

EXPLORING: TIME

A SCIENCE OLYMPIAD THEMED LESSON PLAN

SEASON 2 EPISODE 18 : **WHITE TULIP**

Overview:
Students will learn about scientific concepts related to time such as astronomy and physics, with a focus on timekeeping.

Grade Level: 9 12

Episode Summary:
A group of dead victims is found on a train, and Olivia is able to identify a suspect, Alistair Peck, who is an astrophysics professor at MIT. When Alistair's house is raided, the team discovers very complex notes and calculations related to the fundamental nature of time. Alistair returns home during their investigation, and promptly activates a time travel device to jump back in time, starting the sequence of events again. Over the course of several time jumps, Walter is eventually able to understand what is occurring and directly confronts Alistair in an attempt to dissuade him from his ultimate goal of traveling back several months to the day his fiancé died.

Related Science Olympiad Event:
It's About Time - Using a pre-constructed non-electronic device, students will measure time in intervals and be tested on their knowledge of time related concepts.

Learning Objectives:
Students will understand the following:

- Keeping accurate track of time is vital to many aspects of modern society.
- Time-keeping devices can range from very complex to incredibly simple, yet still be quite accurate.
- There are many ways and scales used to indicate time.

Episode Scenes of Relevance:

- Walter examining the complex astrophysics notes on the walls in Alistair's house.
- Walter summarizing Alistair's manuscript about time travel to Peter and Olivia.
- View the above scenes: http://www.fox.com/fringe/fringe-science

Online Resources:

- Fringe "White Tulip" full episode: http://www.fox.com/watch/fringe
- Science Olympiad It's About Time event: http://soinc.org/its_about_time_c
- National Institute of Standards and Technology: http://physics.nist.gov/GenInt/Time/time.html
- Official US Time:: http://www.time.gov/
- National Cancer Institute melanoma page: http://www.nawcc.org/

Procedures:

1. Tell your students that they are going to learn about time and time-keeping devices.
2. Have your students research time-related topics in resources such as astronomy and physics textbooks and discuss what they have learned.
3. Divide your class into groups. Have each group complete the following activity:

a. Materials: several feet of thin string or fishing line, tape, a ruler, stopwatch, large washers or nuts
b. Tape the ruler to the top of a table so that half of it is sticking over the edge.
c. Tie several of the washers or nuts together at the end of the string to serve as a weight.
d. Create a pendulum by taping the end of the string to the ruler such that the washers or nuts can swing freely 2-3 feet below.
e. Use the stopwatch to count how many times the pendulum swings in 15 seconds.
f. Allow the pendulum to continue to swing for 15 seconds and then count how many times it swings in the following 15 seconds.
g. Repeat the process several times, starting the pendulum at varying angles each time.
h. Shorten and/or lengthen the string and note the effect on the period of the pendulum.
i. Add and/or remove weight from the end of the pendulum and note the effect on the period.
j. Try to adjust the pendulum such that its period is exactly one second.

4. Lead the class in a discussion comparing their results. Discuss how only the length of the pendulum impacts its period. Relate this experiment back to the design of time-keeping devices such as grandfather clocks.
5. Discuss different situations the students regularly encounter where it is important to keep accurate track of time, such as attending class, cooking, sporting events, and traveling.

Additional Discussion Suggestions:

- There are several other basic time-keeping device designs, such as sand or water clocks, torsional pendulums, and piezoelectric crystals. What are the pros and cons of each type?
- Why is astronomy so closely linked to time keeping? How do astronomers keep track of time?
- What are time zones and why are they used?
- Time periods can be represented in a variety of scales, ranging from nanoseconds to eons. What are some applications where these extremes are regularly used?

Extension to Other Subjects:

History: Research how the development of more accurate clocks has facilitated major breakthroughs in explorations, such as navigation of the oceans and the launch of spacecraft beyond Earth's orbit.

Mathematics: Record the current time on each of the time-keeping devices (e.g. watches, cell phones, clocks) currently in the classroom. Calculate the mean, min, max and standard deviation of the group.

Art: Examine various digital and analog clock face designs for inspiration and create a personalized design that is easy to read yet illustrates a specific personality trait.

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.