**SCSU CRISP CCSA Kit Pages 2017**

**Title of Module:** Why Do I Spin?

**Subject or Unit of Study: STEM**

**GRADE LEVEL** 9-12 **LENGTH OF MODULE: 1 Day (Extension Activities 1-2 Days)**

**STUDENT OBJECTIVES**

*Students will…*

Design an experiment using a simple machine to demonstrate knowledge of heat transfer and mechanics.

Develop skills in scientific inquiry

**NEXT GENERATION SCIENCE STANDARDS**

**NATIONAL STANDARDS & COMMON CORE**

**CONNECTICUT STATE STANDARDS**

**MATERIALS FOR MODULE**

3 Stirling Engine

Ice

Candle

Matches

Heat Plate

Heat Safety Mits

Room Temp Water
3 Identical Cups

Thermometer

Timer

Marker (Dry Erase Marker)

Paper

Hair Dryer

**SAFETY FOR MODULE**

PPE = Safety Goggles

**LEARNER BACKGROUND**

Students need to know: how to read a thermometer, know basic chemistry, states of matter, states of matter.

**LEARNING ACTIVITY**

This activity involves the use of a Stirling Engine that teaches students about different components of thermodynamics and mechanical drive. Through hands-on problem-based learning, students will develop methods to test different variables and identify their impact on the overall machine.

Provide students with a demonstration of a working Stirling Engine that is placed on top of a cup/beaker of ice or hot water. Have students observe and record their observations, and then discuss amongst themselves what may be causing the machine to run. Have student design an experiment changing the variable that they deemed responsible for the movement of the machine to see how that affects the movement of the machine. Provide students with a variety of measurement tools (including those listed above) to accurately collect data during their experiments.

Questions to ask students:

1. What is causing the machine to move?
2. Is the speed of the machine constant?
3. How might you measure the speed of the machine?
4. Design an experiment to vary the speed.
5. Was your experiment successful?

**ASSESSMENT**

Students will provide a written review of their findings, as well as a demonstration and explanation of their experimental design. Students will be able to test out their hypothesis/engineering design with the Stirling Engine. Students can evaluate one another's experiments as they are presented.

**EXTENSION ACTIVITIES**

Have students design and test a way to change the direction of motion without altering the mechanics of the machine.

Suggest practical applications for this machine. What would you have to alter to make it work for that application? (Add materials, change fundamental mechanical design, etc?)

**ADDITIONAL RESOURCES**

Youtube

Search for Stirling Engine in Jay Leno’s Garage (youtube.com)

**TEACHER NOTES**
Since there are limited Stirling Engine resources, plan on having students work in small cooperative groups and design experiments first before testing on a class device.

Note: remind students of safety concerns when using heat elements.

**STEM CAREERS**

Mathematics

Science

Engineering

Material Science

**Collaborators: Rachelle Pedersen, Jack Walsh, Simone Minichino, George Baldwin**