Educator Introduction

Thank you for using the CERT **Heat Transfer** module in your classroom. This module links directly with the science curriculum "Essential Standards and Clarifying Objectives" for 3rd, 5th, and 6th grade. Specifically, it aligns with the Energy: Conservation and Transfer standards, 3.P.3, 5.P.3, and 6.P.3, respectively. Details of the standards addressed in this module are listed at the end of this document.

Module Contents

The module you have received contains the items necessary to teach the Heat Transfer concept. The full module includes the following:

- *CERT Educational Series, Heat Transfer, Educator Introduction.docx*: This document that you are presently reading.
- *CERT Educational Series, Heat Transfer, Educator Preparation.m4v*: 20 min. instructional video for teacher to explain set-up and classroom preparation
- *CERT Educational Series, Heat Transfer, Step-by-Step Set-up.pdf*: notes to guide you during class delivery
- Classroom videos for the CERT Heat Transfer module:
  - *CERT Educational Series, Heat Transfer, Basics.mp4*
  - *CERT Educational Series, Heat Transfer Enrichment I, Basics.mp4*
  - *CERT Educational Series, Heat Transfer Enrichment II, Heat Equation, Weather Impacts.mp4*
  - *CERT Educational Series, Heat Transfer Enrichment III, Calorimeter.mp4*
- *CERT Educational Series, Heat Transfer, Student Lab Sheet.pdf* (and *.docx*)
- *CERT Educational Series, Heat Transfer, Student Lab Sheet Answer Key.pdf*
- *CERT Educational Series, Heat Transfer, Quiz Question Bank.pdf*
- A kit containing the components for 8 individual experimental set-ups for the classroom:
  - 32 insulated cups (8 each labeled A, B, C, D) and 32 cup liners
  - 1 cup for cooling thermometers
  - 16 foam lids
  - 8 Aluminum bars for the experiments
    - 1 extra aluminum bar to be used before experiments
  - 16 digital thermometers
  - One hot water pot
  - A portable mouse

    - A memory stick containing all files listed above
    - A notebook with all documents listed above
- The classroom videos above in .ppt format. These are provided to allow the educator to make variations if desired.
    - *CERT Educational Series, Heat Transfer, Basics.pptx*
    - *CERT Educational Series, Heat Transfer Enrichment I, Basics.pptx*
    - *CERT Educational Series, Heat Transfer Enrichment II, Heat Equation, Weather Impacts.pptx*
    - *CERT Educational Series, Heat Transfer Enrichment III, Calorimeter.pptx*

Classroom Module Delivery

You need to view the "Educator Preparation video" that will introduce you to the Heat Transfer module and the kit contents.

You can then use the "Step-by-Step Set-up instructions" to assist you the first couple of times you use the kit.

When you are ready to begin, you start the classroom video: "*CERT Educational Series, Heat Transfer, Basics.mp4*"

There are places in the video where you will want to pause the video and have discussion. These places are marked with a "sun icon," along with a laser sound. When you see the sun icon, and hear the laser sound, use the mouse to pause the video, and have a discussion with your class (to verify understanding). Then resume the video.

Students will be prompted to complete sections of the Student Lab Sheet throughout the module.

Module Feedback

When you have finished using the module we ask you to provide feedback using this link:

Thank you for using the CERT Educational Series. Visit our CERT website to discover our other energy education module offerings.

If you have questions please contact us at CERT@ncat.edu or 336-256-2406. We appreciate the opportunity to provide you with our energy education content, and we also look forward to working with you to define other modules for your use.

Kindly,

Dr. Gregory Monty, Dr. Vicki Foust, and Elizabeth Keele
Center for Energy Research and Technology (CERT)

Guilford County School Curriculum Standards

3rd Grade and 5th Grade – Science as Inquiry
As students progress through the grade levels, their strategies for finding solutions to questions improve as they gain experience conducting simple investigations and working in small groups. They are capable of asking questions and make predictions that can be tested. Students must be encouraged to make more careful observations and measure things with increasing accuracy. During investigations, students must have opportunity to use more advance tools such as calculators, computers, graduated cylinders, scales and meter sticks to gather data and extend their senses. They must keep accurate records and run enough trials to be confident of their results to test a prediction. They must have experiences that allow them to recognize patterns in data and use data to create reasonable explanations of results of an experiment or investigation. They should be encouraged to employ more sophisticated language, drawings, models, charts, and graphs to communicate results and explanations. Students must always use appropriate safety procedures, including listening skins, when conducting simple investigations.

Essential Standard (3rd Grade):
3.P.3 Recognize how energy can be transferred from one object to another.

Clarifying Objective:
- 3.P.3.2 Recognize that energy can be transferred from a warmer object to a cooler one by contact or at a distance and the cooler object gets warmer.

Essential Standard (5th Grade):
5.P.3 Explain how the properties of some materials change as a result of heating and cooling.

Clarifying Objectives:
- 5.P.3.1 Explain the effects of the transfer of heat (either by direct contact or at a distance) that occurs between objects at different temperatures (conduction, convection, and radiation).
- 5.P.3.2 Explain how heating and cooling affect some materials and how this relates to their purpose and practical applications.

6th Grade – Science as Inquiry
Traditional laboratory experiences provide opportunities to demonstrate how science is constant, historic, probabilistic, and replicable. Although there are no fixed steps that all scientists follow, scientific investigations usually involve collections of relevant evidence, the use of logical reasoning, the application of imagination to devise hypotheses, and explanations to make sense of collected evidence. Student engagement in scientific investigation provides background for understanding the nature of scientific inquiry. In addition, the science process skills necessary for inquiry are acquired through active experience. The process skills support development of reasoning and problem-solving ability and are the core of scientific methodologies.

Essential Standard (6th Grade):
6.P.3 Understand characteristics of energy transfer and interactions of matter and energy.

Clarifying Objective:
- 6.P.3.1 Illustrate the transfer of heat energy from warmer objects to cooler ones using examples of conduction, radiation and convection and the effects that may result.