Lesson Plan Design
Title: Transfer of Thermal Energy

Problem to be Studied:
How is the quantity of thermal energy transferred from one object to another calculated from the temperature change and heat capacity of one of the materials?

The place of this lesson in the curriculum:

This lesson is at:
the beginning of the study of heat and physical and chemical changes

This lesson follows:
the study of the classification of matter,
the discussion of physical and chemical changes,
the discussion of phase changes,
learning about ionic compounds, covalent compounds, chemical equations, and stoichiometry, and
the use of an electronic recording device interfaced to a temperature sensor.

This lesson precedes:
the study of thermochemical equations,
Hess' law, and
the discussion of the causes of chemical processes.

The purpose of the lesson is:
for students to work on becoming more proficient and practiced at meeting the Pennsylvania standards listed below.

Science and Technology Process Standards:
3.2.11.D Analyze and use the technological design process to solve problems.

Science and Technology Content Standards:
3.4.11.D Apply and analyze energy sources and conversions and their relationship to heat and temperature.

Writing Standards:
1.5.11.A Write with a sharp, distinct focus.
1.5.11.B Write using well-developed content appropriate for the topic.
1.5.11.C Write with controlled and/or subtle organization.
1.5.11.D Write with a command of the stylistic aspects of composition.
1.5.11.F Take writing using the conventions of language.

Content Objectives(Learning Goals based on Bloom's Levels of Thinking):
Students should be able to:

- Operationally define temperature and heat.
- Distinguish between temperature and heat flow.
- Calculate the amount of heat energy released or absorbed in a chemical process.
- Design a procedure to gather and evaluate data to achieve a desired end.
- Decide how the overall activity could be adapted, in such a way that the progress of the reaction can be continually graphically monitored by

Suggested Level:
Students in Grades 10-12
Chemistry courses
Preparatory Chemistry

Science and Technology Standards Categories:
3.2. Inquiry & Design
3.4. Physical Sciences

Writing Standards:
1.1.F, 1.5.A,B,C,D,F

Instructional Strategies:
- Solve the problem
- Lecture/Discussion in the classroom
- Examples
- Examples
- Examples
- Examples
- Examples
- Examples
- Lab Activity: Lab Data Collection
- Demonstration
- Whole Classroom Discussion
- Teacher Assistance
- Use of Technology Software
- Science Laboratory Report

Related Concepts for Upcoming Study:
- Enthalpy
- Enthalpy change
- Heat of reaction
- Hess' law

Materials for: The Sweet Substance Challenge: Heat data by
- Laboratory Agenda
- Safety Protocols
- Introductory notes
- Lesson aid
- Hot or Cold? Student
- Graph recording/drawing
- Conversion factors, lab results
- Tap water
- Signage

Materials for: The Great Cold Treat Day:
- Laboratory Agenda
- Safety Protocols
- Introductory Chemical activity
- PLA lab on dissolved salts
- Calorimetry design or measuring standard glycol
- Water standardization
- Ice cube factors
- Data set of dissolved salt mixtures and hence of the T vs. dissolved
- Reflection
- CBL, graphing calculator and software
- Computer-data collection, graphing, and comparison
- Signage