Gold Seal Lesson:

Copernicus Education Gateway

Author(s): ***Michael Lucky Voiselle***			***Lesson Title:*** ***BURNING FOOD***			
Grade Span			***ICLE Application Model***			
K-4	***5-8*** ***X***	***9-12***	***A***	***B***	***C*** ***X***	***D***

Instructional Focus:

Algebraic Concepts and Relationships
Students use algebraic methods to investigate, model, and interpret patterns and functions involving numbers, shapes, data, and graphs in a problem-solving situation. Students evaluate and communicate the reasoning used in solving these problems.

Science as Inquiry
Students demonstrate knowledge and skills necessary to perform scientific inquiry.

Science in Personal and Social Perspectives
Students apply scientific principles to personal and social issues.

Performance Task

Your task involves the measuring of the amount of calories, (heat energy), contained in certain foods. Use a pecan, or a cashew nut for the first trial. Nuts deliver great results because of the fatty oils they contain.
Organize into groups of 2 or 3 and consult the accompanying diagram. You are to construct a cook stove out of a 16-ounce soup or juice can with holes punched entirely around the top and bottom cylindrical surfaces. Turn the can upside down and you have a mini-stove. You will need a large cork and a jumbo paper clip to construct a cradle to hold your pecan. You will also need a 250ml beaker with 100ml of water to place on the cook stove, and a centigrade thermometer to measure the temperature of the water before, during, and after the food burns.
Select a pecan, mass it in grams using a triple beam balance, and place it on the paper clip cradle. Ignite the nut making sure it is lit well before placing the cook stove over it. Quickly place the beaker on top of the stove. Be sure you have measured the temperature of the water before starting. Place all data in a neatly organized data table. Place the thermometer midway in the water taking care to not let it come in contact with the glass container. Let the nut burn completely and record the highest temperature the water reaches. (Caution: The nut will stop burning, however the temperature will continue to rise for a while. Keep a constant watch until the temperature begins to drop.

Your next task involves computing the caloric content of the pecan and converting to calories. See diagram for formulas needed.

Next, examine the label on the pecan container for its actual energy value per gram. You may have to divide the total energy (calorie) value of the package by the mass of the package to get an energy value per gram. Compare your experimental value with the package value and compute a relative error. What can you modify in this experiment to acquire better results?

Repeat this experiment using one other snack food easily ignited. (potato chips, or other nuts work well) Record all information in your neatly organized data chart. All calculations must be neatly organized and all work shown.

You are to trace the energy transference from the heat of the pecan to the thermometer using words like conduction, convection and radiation. This will be included in a well-written, neatly organized conclusion write-up free from spelling and grammatical errors.

Your write-up must also include the experiments of Count Rumford, the cannon borer, James Prescott Joule, who stated that heat energy can do work, and the difference between the physics definition of a calorie and the calorie labeled on the food packages. You may use any resources available to do your research including other people, encyclopedias, textbooks, and the Internet.

ICLE Essential Skills

Apply in writing the rules and conventions of grammar, usage, punctuation, paragraphing and spelling. (ela1)
Gather information from a variety of sources, including electronic sources, and summarize, analyze, and evaluate its use for a report. (ela3)
Identify, collect and/or select pertinent information while reading. (ela5)
Understand ***basic algebraic properties*** (i.e., commutative: ab = ba; associative: ab(c) = a(bc); and distributive: a(b+c) = (ab)+(ac)). (m3)
Plan and apply real or hypothetical models and constructions to facilitate investigation and learning and the solution to practical problems. *(Not Rank s115*
Understand nutrition - the need for food and a good diet, ingestion, digestion, egestion and related disorders such as ulcers, appendicitis, etc. (s3)
Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way. (s5)

Scoring Guide:

RATE CRITERIA: 3=Excellent, 2=Satisfactory, 1=Unsatisfactory, 0=Does not attempt or does not understand

CRITERIA	**SCORE**
Experimental procedure and group work	_____
Data table neatly organized	_____
All work shown on calculations with correct cancellation of units	_____
Experiment repeated on another snack food	_____
Experimental modifications included in write-up	_____
Student addressed the experiments of Rumford and Joule in write-up	_____
Definition of calorie addressed in write-up	_____
Write-up is free from spelling and grammatical errors	_____

Keywords

English Language Arts	Mathematics	Science
Reading **Independent Reading**	**Algebra** **Algebraic operations**	**Earth Science**
Writing **Grammar** **Spelling**	**Geometry**	**Life Science** **Health** **Nutrition**
Communications	**Statistics**	**Chemistry**
Literature	**Calculus**	**Physics** **Energy Transference** **Thermodynamics**
Other	**Trigonometry**	**Other**
	Other	

Picture, Chart, or Graph file name(s):

Formulas Needed:

Calorie = $\Delta T(T_f - T_i)$

$\frac{\text{Calorie}}{\text{Gram}} = \frac{\text{Calorie of Food}}{\text{mass of food}}$

$\text{Percent Error} = \frac{\text{PKg claim - Your Value}}{\text{PKg claim}}$