HUMAN BODY
SECTION 3: MEASURING CALORIES
From *Hands on Science by Linda Poore, 2003.*

STANDARDS:
Students know plant and animal cells break down sugar to obtain energy, a process resulting in, carbon dioxide (CO_2) and water (respiration).

Students will select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.

Students will draw conclusions based on scientific evidence and indicate whether further information is needed to support a specific conclusion.

KEY WORDS:
CALORIES: The units used to measure the amount of energy a food supplies.
PHYSICAL CALORIE (c): The amount of heat necessary to raise the temperature of 1 gram (1ml) of water 1°C.
DIETARY CALORIE (C): Equal to 1000 physical calories.
ENERGY: Usable power or heat.

MATERIALS:
For the Teacher:
1 can with 5 oz. water (150 ml)
1 peanut (without shell)
Centigrade thermometer
32 oz. Pyrex cup
clamp to hold can
matches
pencil with eraser
paper clip
timer

DISCUSS:
1. **WHAT ARE CALORIES GOOD FOR US?**
   Calories give us energy that we need to move and grow.

2. **WHY ARE MOST JUNK FOODS HARMFUL TO OUR BODIES?**
   'Junk' foods contain a high number of calories due to fats or sugars, but almost no other nutrients. Our bodies fill up, without acquiring enough nutrients to stay healthy. The extra fats are stored in our bodies, causing us to gain wait.

DEMONSTRATE:

WHAT IS A CALORIE? HOW MANY CALORIES ARE IN A PEANUT?
HOW DO SCIENTISTS MEASURE CALORIES?

1. **MEASURING THE CALORIES IN A PEANUT:**
   - Remove the peanut's brown seed coat.
   - Straighten a paper clip, stick one end into the peanut and the other end into a pencil eraser.
   - Measure 150 ml (5 oz) of water into the can.
   - Record the temperature of water accurately in Celsius.
   - Light the peanut with a match (it takes several tries) and burn the peanut, holding it under the can so the flame heats the water.
   - Hold the can with a clamp. Continue until the flame burns out.
   - Measure the water temperature immediately in Celsius, without touching the thermometer to the hot bottom of the can.

2. **FINDING THE TEMPERATURE DIFFERENCE:**
   How man degrees hotter is the water now? (Subtract beginning temperature form ending temperature for the temperature difference.) This heat is a measure of energy available from foods for use by our bodies.

3. **HOW MANY CALORIES ARE IN ONE PEANUT?**

Take the temperature of the water first in Celsius.
Subtract this beginning temperature form the ending water temperature (after burning the peanut). Complete the equation:
150 ml x _____ = _____ c.   *(# of degrees it went up)*   =   *physical calories*
_____ ÷ 1000 =_____C   *physical calories*   *dietary calories (C)*

[example: If the temperature difference is 10°C, then 150 x 10 = 1500 scientific or physical calories. 1500 ÷1000=1.5 dietary calories in 1 peanut. You multiply by 150 because you used 150 ml of water, not 1 ml. (see definition of dietary calorie)]

MATH:

MEASURING CALORIES FROM OUR BODY

1. Your body uses calories to keep you warm. This experiment measures the amount of calories of heat energy that transfers from your hand to 500 mL of water in 5 minutes.

2. Put 500 ml (16 oz) of water in the Pyrex measuring cup.
   Measure the temperature °C.
   Put one hand in the cup for 5 minutes.

3. **MATH:**

Take the temperature of the water first in Celsius.
Put 1 hand in 500 ml of water for minutes.
After 5 minutes, take the temperature of water in °C. Subtract this temperature from the beginning temperature. Complete the equation.
500 ml x _____ = _____ c. *(# of degrees it went up)*   =   *physical calories*
_____ ÷ 1000 = _____ C *physical calories*   *dietary calories (C)*

You multiply the <u>difference</u> in temperature by 500 because you use 500 ml, not 1ml. (see definition of a physical calorie)
You divide by 1000 to figure the amount of <u>dietary</u> Calories lost because 1 dietary Calorie is equal to 1000 physical calories. [e.g., If the temperature difference after 5 minutes is 4°C, then 4 x 500 = 2000 ÷ 1000 = 2 Calories (dietary lost by one hand.]

DISCUSS:
CALORIES ARE HEAT ENERGY
- Would the temperature of the room make the results different? (yes)
- Does your body use more calories on a cold day when you do not wear a jacket? (yes, to keep you warm)
- Would the temperature of your hand before the experiment change the experiment results? (Yes, do not pick a student with cold hands.)

ASSESSMENT:
List the 6 nutrients, foods that contain each and how they help the body grow and stay healthy. Make a chart:

Nutrient	Foods it is found in	Used by the body for: