**Heat Packs and Calorimetry**

Materials:

Small hand warmers

Balance

Styrofoam cups

Thermometer

Stopwatch

Water to fill cups

Teacher Notes:

Have students in groups of two and give each group a set of the materials above.

Engage:

Hand out materials and ask students what they think we will be investigating. Have them come up with a method of what they think we should do first, second, third, etc. and have them write this method in their notebooks. Since this is a fairly short activity, the students can use this time at the beginning to practice their skills in coming up with procedures.

Explore:

Tell the students they will be recording the temperature of the water in their Styrofoam cups after the heat pack has been activated and the time at which the temperature is recorded. Hand out the worksheet accompanying the activity. The students should be creating their own data tables in their notebooks and will also create a graph of temperature vs. time in their notebooks.

Explain:

Tell the students that many chemical reactions release energy. They can release this energy in the form of heat, sound, or light. Exothermic reactions release heat to the surroundings (emphasize that the surroundings *gain* heat while the reaction *looses* heat). These reactions often occur spontaneously (no energy has to be put into the system). Endothermic reactions absorb heat (reaction *gains* heat) and do not occur spontaneously. Does T increase or decrease with time in an exothermic/endothermic reaction? What kind of reaction did we see today?

Elaborate:

Ask students (think-pair-share/write in notebooks) how we can use this knowledge we gained today when constructing our energy bars. Do we want food to have an exothermic or endothermic reaction within our bodies? Go over the PowerPoint with students to introduce the heat capacity equation, importance of mass in these measurements, and how we connect this idea of calorimetry to the final artifact. There are several questions throughout the PowerPoint that address the loss of mass of the heat pack, mass of the water, endothermic and exothermic reactions, and the heat capacity equation. Have students perform calculations in their notebooks for how much heat was lost from the heat packs (gained in the surroundings) and discuss findings as a class.

Evaluate:

Write this problem on the board: Describe an exothermic and endothermic reaction and how they are related to the process of creating an energy bar. Ask students to write their answers on a sheet of paper. Collect student answers (exit tickets) before they leave class.