# Activities

**Student Activities *continued***

**Total heat transfer divided by temperature loss of iron; then the results divided by the weight of iron = the specific heat of iron, or:**

**(q)/ (m) x delta t = cp**

Record these calculations in #2 on data sheet.

10 Next, the group can repeat the process, but this time with their own calorimeter.

11 While waiting the 30 minutes, students can hypothesize about whether the temperature will be found to be the same, and what variables could cause a difference.

12 Repeat the process of that same item in homemade calorimeter. Notate which hypotheses were right. If the temperatures varied, what variables do they think are the cause?

13 Next, put class into two groups, with one group repeating the steps for aluminum, and one for copper (using the manufactured calorimeter).
While waiting to measure, they should share their individual group findings and hypotheses. Discuss how they could improve their homemade calorimeter.

14 Notate the temperatures for each material.

15 Have students discuss and note on data sheet the following question:

How might this knowledge have assisted us in cooking methods, common to most households? (You can use foil to cook, but it won't burn you if you touch it…)

# Assessment

Data Sheet and Group Calorimeter



# TEACHERS GUIDE

## CALORIMETER
**ITEM # 3235-00**

## ENERGY - HEAT

Calorimeter contains heat in one place until it can be measured. The 200 mL inner vessel holds water and heated items at a constant temperature as Styrofoam and outer, 750 mL vessel insulates it from outside fluctuations. A stirrer allows for heat to be distributed evenly for accurate reading. Also comes with rubber stopper and molded cover.

# Materials

- 4-6Calorimeters
- 4-6 thermometers if not included in your particular calorimeter
- several copper shavings
- several aluminum foil shavings
- a few iron nails

***4-6 of each of the following:***

- small tin can and a coffee can with lid
- a rubber gasket that fits the coffee can (could cut from rubber coaster material)
- a stirring stick and a thermometer
- a small burner and saucepan
- water
- data sheets

# Goals & Objectives

**Students will:**

- learn how to use a calorimeter
- compare the heating capacity of various metals (copper, aluminum foil, iron)
- build their own calorimeter

**! This lesson could take 3-4 days, depending on length of class time.**

# Discussion

**Optional Study and Discussion**

1. What's a practical way to discover what materials can hold heat better than others?
2. How might this information assist in inventions?







# Activities

1. Ask students which material would be hottest to the touch after being in the fire, iron, copper, or foil.
2. Tell students that sometimes in inventions, inventors need to know this so that heat can be transferred, or blocked as needed. A tool can be used to discover what materials are fitting to each need.
3. Show students the calorimeter.
4. Demonstrate how the parts go together. Divide class into groups of 4-6. Distribute the data sheets.
5. Each group should bring water to a boil (100 C). This should take about 30 minutes. When done, record answer in #1 on data sheet.
6. While waiting, groups should gather one each of the tin cans, lid, stick, and thermometer. They should consider how the manufactured calorimeter is made, and use thematerials to create one of their own.
7. Then they can fill the tube half way with nails, weigh and record the weight of the nails, and place the test tube into the water in the inner vessel. Heat for 10 minutes. Now they can quickly remove the test tube and pour the nails into the boiling water of the inner vessel. Students should stir with the stirring stick and take three readings of the water with the heated nails. Keep the highest reading to use for calculations. Subtract initial temperature of boiling water from the highest temperature, to achieve the heat gained.

**Note**

It is always best to DO an experiment ahead of time to be able to best present it to the class.

8. Now students can calculate to see how much heat the nails were able to generate, (calories) by using that highest reading in the following formula:

**Heat gained x 125 ml (mass of water) x specific heat = total heat transfer in calories, or:**

**(delta T) x (m) x (cp) = (q)**

Record these calculations in #2 on data sheet.

9. The heat gained in the water is also the heat lost by the metal. They could also do this calculation:

*continued on page 4*

# STUDENT HANDOUT

Student Name: _____

**1** **Iron nails**
**Temperature reading from manufactured calorimeter:**

**2** **Hypothesize about whether the temperature from the first calorimeter and your own will be found to be the same, and what variables could cause a difference.**

**3** **Calculations from homemade calorimeter and nails:**

**4** **Which hypotheses were correct? Were there differences? If so, why?**

**5** **Calculations for foil shavings:**

**6** **How might this knowledge have assisted us in cooking methods, common to most households?**