

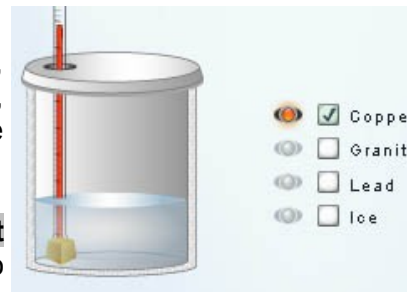
Name: _____ Date: _____

Student Exploration: Calorimetry Lab

Gizmo Warm-up

A calorimeter is an insulated container filled with a liquid, usually water. When a hot object is placed in the calorimeter, heat energy is transferred from the object to the water and the water heats up.

Calorimeters can be used to find a substance's **specific heat capacity**. You will use the *Calorimetry Lab* Gizmo™ to determine the specific heat capacities of various substances.



On the SIMULATION pane, select **Copper**. Use the slider to set its **Mass** to 200 g. Set the **Water mass** to 200 g. Check that the **Water temp** is set to 30.0 °C and the copper's **Temp** is 90 °C. Select the GRAPH tab, and click **Play** (▶).

What was the **Final temperature** of the copper and the water? _____

How much did the temperature of the copper change? _____

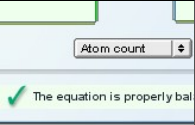
How much did the temperature of the water change? _____

Specific heat capacity can be described as a substance's *resistance* to temperature changes. Which substance has a greater specific heat capacity, copper or water? Explain.

How do you think increasing the water's mass would affect the final temperature?

How do you think increasing the copper's mass would affect the final temperature?

How do you think increasing the copper's initial temperature would affect the final temperature?

Activity A: Specific heat	Get the Gizmo ready:	
	<ul style="list-style-type: none"> • Click Reset. • Deselect Copper, and select Granite. 	

Question: How can you compare the specific heat capacities of various substances?

Use the Gizmo to determine the final temperature for each set-up listed below. Record your results in the table. The first row has been completed for you.

Substance	Substance initial temp. (°C)	Substance mass	Water initial temp. (°C)	Water mass	Final temp. (°C)
Copper	90 °C	200 g	30.0 °C	200 g	34.96 °C
Granite	90 °C	200 g	30.0 °C	200 g	
Lead	90 °C	200 g	30.0 °C	200 g	

Of the three substances, which caused the largest temperature change in the water? _____

Remember that specific heat capacity is a measure of a substance's resistance to temperature change. The more resistant a substance is to temperature change, the higher is its specific heat capacity.

Rank the three substances in order of their specific heat capacities, from highest to lowest.

Challenge: In addition to calculating specific heat capacities, some calorimeters can be used to determine how much energy is in food. The energy in food is usually expressed in calories or kilocalories (Calories).

Suppose a snack bar is burned in a calorimeter and heats 2.0 kg of water by 20 °C. How much heat energy (in Joules) was released? (The specific heat capacity of water $c = 4186 \text{ J/kg}^\circ\text{C}$.)

$$\text{Heat Energy} = mc \Delta T =$$

How many kilocalories (Calories) does the snack bar contain?

$$\text{_____ J} \times \left(\frac{1 \text{ Cal}}{4186 \text{ J}} \right) = \text{_____ Cal}$$