

Name _____ Date _____ Heat Transfer by Metals

Problem Statement: How is heat transferred between substances?

URL: https://media.pearsoncmg.com/bc/bc_0media_chem/chem_sim/calorimetry/Calor.php

The simulation will open to an image of the calorimeter setup, but a new screen with an Overview page will appear. You are welcome to read the Overview Page, and by clicking on the Learning Outcomes tab near the top of the display, you may read the Learning Outcomes Page. After reviewing these two pages click on the Experiment tab. When the screen changes the page will show two buttons: Run Demonstration button and Run Experiment button. Click on the *Run Demonstration* button. The instructions below are for the Run Experiment button. The Experimental setup shows a beaker on a hot plate to the left, and a calorimeter on the right. Below the beaker and hot plate are three tabs (Liquids, Solids and Solutions). In this activity you will be using the Solids tab beneath the beaker and hotplate, and the Liquids tab beneath the calorimeter.

- A. Beneath the beaker and hot plate click on the Solids tab and select Silver, Ag. Adjust mass to 20.0 g and adjust the temperature to 200. °C.

Click the Next button in the left frame near the bottom of the screen. Now click on the Liquids tab beneath the calorimeter and add 50.00 g of water and adjust the water temperature to 20.00 °C. Record the initial conditions in the data columns in Table I to the right. In the Run Experiment section click on the “Start” button.	Table I.	
	Ag	water
	Mass	
	Initial Temp	
	Final Temp	
	Change in Temp	
Specific Heat		

What do you observe happening? Record the final temperature of Ag and the water in Table I. Is this a chemical reaction or a physical process? _____

- B. Data Analysis and Interpretation

Which substance, silver or water, loses heat when they are combined? _____

Which substance, silver or water, gains heat when they are combined? _____

Calculate the heat (q) transferred to or from silver. Use the equation $q = m c \Delta t$ (q is heat in units of Joules, m is mass, c is the specific heat, and Δt is the change in temperature).

Calculate the heat (q) transferred to or from water.

Compare the heat exchanged by the silver and water. Is the heat gained or lost by the metal nearly equal to the heat gained or lost by the water? _____ Make a general statement concerning the heat.

C. Data Collection. Repeat the experiment for Al, Cu, and Fe. Choose the same mass and same initial temperature for each metal and same initial temperature for water. Record the data you collect in the following table.

	Al	water	Cu	Water	Fe	water
Mass						
Initial temp						
Final temp						
ΔT						
Specific Heat						
Heat, q						

D. Data Analysis and Interpretation Calculate the heat lost or gained by each metal. Choose one metal and show your work for the calculation. Does the metal release heat or gain heat?

E. Compare the results for all four metals: Ag, Al, Cu, and Fe with respect to the temperature change of the water and the amount of heat transferred from the metal to the water. Rank the metals from high to low in terms of their ability to transfer heat (given the same mass of metal).

F. What is the one factor that was different for each metal? Define this term. Place the metals in order from high to low with respect to their specific heat. Compare this order of metals to the order of metals above. Comment.

G. When *adding* the same amount of energy to two different samples of metal having the same mass, the substance with the _____ (larger or smaller) specific heat will have the greatest temperature change?

H. Choose two metals, one having a mass of 25.0 g the other having a mass of 50.0 g. both have an initial temperature of 20.0°C. Set-up an experiment to produce the same temperature change in the water when the cool metals are placed in separate 50.0 g of 80°C water.

I. If 50.0 g of each of the four metals at 20°C were placed on the same stove burner and an equal amount of heat is added to each metal, which metal would reach 50°C first? Last? Which of these metals would make the best cookware? Define the context. Explain your answer.