

Chemistry Lab: Specific Heat of a Solid

Introduction:

The quantity of heat needed to change the temperature of one gram of a substance by 1°C is known as the *specific heat capacity* or *specific heat* of the substance. The higher the specific heat, the more calories or joules are needed to raise the temperature. The higher the specific heat, the more calories or joules are stored and given back off when it cools. In general, the higher the specific heat the higher the melting and boiling point.

The units for specific heat are cal/g x °C or J/g x °C. You will notice in your textbook that the specific heat is given in either calories or joules. The specific heat of water for calories is 1cal/g x °C, since it takes on calorie to raise 1 g of water 1°C. The specific heat of water for joules is 4.18J/g x °C. You need to be able to calculate the specific heat in both calories and joules.

- As you know, the formulas for calculating heat (q) are: C is the symbol for specific heat.

$$\text{cal} = \text{g} \times \Delta t \times C \text{ (cal/g} \times \text{°C)} \quad \text{or} \quad \text{Joules} = \text{g} \times \Delta t \times C \text{ (J/g} \times \text{°C)}$$

- If we want do calculate the specific heat of an object we can rearrange the formulas:

$$C \text{ (cal/g} \times \text{°C)} = \frac{\text{cal}}{\text{g} \times \Delta t} \quad \text{or} \quad C \text{ (J/g} \times \text{°C)} = \frac{\text{joules}}{\text{g} \times \Delta t}$$

- Heat (q) always goes from the heat source into the object or substance. The value for the heat lost by the source is numerically equal to the heat gained by the object. We can use the heat gained by the water to calculate the missing specific heat for the solid.
- It will be the same for joules.

In this lab you will calculate the specific heat of different metal objects. This is done by determining how much heat is gained from them by water.

Purpose:

The purpose of this lab is to calculate the specific heat of two different metals.

Procedure:

- Mass a metal cylinder to the nearest .001 g.
- Place it in the can that you have been given and heat to boiling.
- While it is heating, accurately measure 70.0 ml of water and place in the calorimeter.
- Place the cap and thermometer on the calorimeter and accurately measure its temperature to the .1 °C.
- Carefully and quickly lift the cylinder out of the hot water and place into the calorimeter.
- Mix the water and object and accurately record the temperature to the .1 °C.
- Repeat for second metal cylinder.
- Fill in table.
- Calculate specific heat for both metals.
- Identify the metals.

TABLE 1. Specific Heat of a Solid

	Metal A	Metal B
TEMPERATURE OF COLD WATER		
TEMPERATURE OF METAL (hot)		
TEMPERATURE OF MIXTURE		
TEMPERATURE CHANGE OF COLD WATER		
TEMPERATURE CHANGE OF HOT METAL		
HEAT GAINED BY THE COLD WATER (cal)		
HEAT GAINED BY THE COLD WATER (joules)		
SPECIFIC HEAT OF METALS		
IDENTITY OF METALS		