

Specific Heat Laboratory Activity

Background:

Transfer of heat or heat flow always occurs in one direction – from region of higher temperature to a region of lower temperature – until some final equilibrium temperature is reached. The transfer of heat energy can be detected by measuring the resulting temperature change, ΔT , calculated by subtracting the initial temperature from the final temperature.

In this experiment, heat is transferred from a hot metal sample to a colder water sample. Each metal causes the temperature of water to increase to a different extent. This means that each metal must have a differing ability to absorb energy and release the energy to the water causing the temperature to rise. The ability of any material to contain heat energy is called the material's *heat capacity*. The measure of heat capacity, or the quantity of heat needed to raise the temperature of one gram of a substance by one degree Celsius at a constant pressure is termed *specific heat*, and is represented by the symbol c .

Substance	Specific Heat (in J/g °C)
Aluminum	0.899
Copper	0.385
Lead	0.129
Tin	0.222
Zinc	0.385
Iron	0.448
Nickel	0.444
Water	4.186

Procedure:

1. Fill a beaker $\frac{3}{4}$ full of tap water. Place on hot plate at high heat until a rolling boil is achieved.
2. Weigh a metal sample on the electronic balance. Record in grams.
3. Place the metal sample in a boiling water bath for approximately 5-10 minutes to be sure the sample is 100°C.
4. Fill a Styrofoam calorimeter with cool tap water. Pour the water from the calorimeter into a beaker. Use the electronic balance to find the mass in grams of the water. Record in grams.
5. Transfer tap water back into calorimeter. Use the temperature probe to find the initial temperature of the water in Celsius.
6. Using tongs, lift the heated metal sample from the water bath and carefully place it inside the calorimeter. Quickly place the lid on top.
7. In one of the lid's holes insert a glass stir rod. Stir the mixture slowly and constantly. In the other hole, insert the temperature probe. Make sure the probe is not touching the metal.
8. Record the highest temperature the water reaches.

Data:

mass of water in calorimeter: _____ (g)

initial temperature of water: _____ (°C)

highest temperature reached by water: _____ (°C)

mass of unknown metal: _____ (g)

initial temperature of metal: _____ (°C)

final temperature of metal: _____ (°C)

Calculations:

1. Calculate the specific heat of the sample. Identify the metal.

2. Calculate the amount of heat gained by the water.

3. Calculate the amount of heat lost by the sample.