**Laboratory Investigation** Name _____

Chemistry: Form L6.1A Date _____ Period _____

# Measuring Specific Heat

## PROBLEM

What is the specific heat of zinc?

## INTRODUCTION

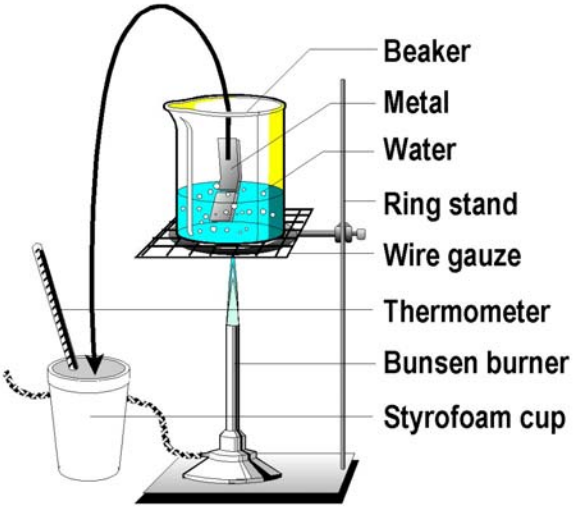
The sun beat down on the beach, reflecting off the smooth surface of the lake and the bright white sand. A beach-goer stepped eagerly off the blanket anticipating the relief of the cool water. Yipes!!! The sand was hot! How could the sand be so hot and the water so cool with the same sun beating down on them? Simple. Water has a higher specific heat than sand. Water is resistant to temperature change. In this laboratory investigation, you will measure the specific heat of zinc and compare zinc's resistance to temperature change to water's.

## MATERIALS (*per group*)

Balance; beaker; Bunsen burner; graduated cylinder; ring stand and ring; safety goggles; styrofoam cup; thermometer; tongs; zinc

## PROCEDURE

1. Put on safety goggles. Fill a 250 mL beaker partway with water. Set up a hot water bath as shown to the right with a ring, ring stand, wire gauze, Bunsen burner, and the beaker of water. Light the Bunsen burner.




2. Obtain about 50 g of zinc metal. Take several strips of zinc metal and measure the total mass. Record the result in the data table on the next page.

3. Using tongs, place the zinc strips into the hot water bath and allow the water to come to a rapid boil.

4. Using a graduated cylinder, measure 100 mL of water and pour it into a styrofoam cup. Measure the initial temperature of the water in the styrofoam cup with a thermometer. Record the result in the data table on the next page.

5. Measure the temperature of the boiling water. This is the initial temperature of the metal. Record the result in the data table on the next page.

6. Using tongs, remove the zinc metal strips from the boiling water and place them in the styrofoam cup. Stir the water gently with the thermometer. When the temperature stops rising, measure the final temperature. This is both the final temperature of the water and the final temperature of the metal. Record the result in the data table on the next page.

7. Calculate the temperature changes of both the water and the zinc by finding the absolute value of the difference between the final and initial temperatures. Record the results in the data table on the next page.

8. Calculate the number of joules gained by the water using the equation below.

$$Q = m \times \Delta T \times c_p$$

**Q** = heat energy  **ΔT** = change in temperature
**m** = mass of water  $\mathbf{c_p}$ = specific heat capacity

NOTE: The specific heat of water is 4.2 J/g°C. The density of water is 1 g/mL. The mass of 100 mL of water is, therefore, 100 g.

Record the result in the data table below.

9. Calculate the specific heat of the zinc metal. The number of joules gained by the water must be equal to the number of joules lost by the metal. the specific heat is therefore,

$$c_p = \frac{Q}{m \times \Delta T}$$

where "Q" is the number of joules absorbed by the water, "m" is the mass of the zinc, and "ΔT" is the change in temperature of the zinc. Record the result in the data table below.

## OBSERVATIONS

[a] mass of zinc metal . . . . . _____

[b] initial temperature of water . . . . . _____

[c] initial temperature of zinc . . . . . _____

[d] final temperature . . . . . _____

[e] change in the temperature of water . . . . . _____

[f] change in the temperature of zinc . . . . . _____

[g] joules gained by water . . . . . _____

[h] specific heat of zinc . . . . . _____

## CONCLUSIONS

1. How do we know that the heat gained by the water must be equal to the heat lost by the zinc? _____

2. Why should the final temperature of both the water and the zinc be the same? _____

3. Which had the larger temperature change, water or zinc? Why? _____