LAB 19, SPECIFIC HEAT

Name _____ Period_____

The method of mixtures is used to determine the specific heat of a metal. Water in a calorimeter (styrofoam cup) is warmed by a solid as the solid cools.
The heat gained or lost by a substance when it undergoes a change in temperature is calculated as **$Q = mc\Delta t$**, where Q = calories of heat, m = mass of metal in grams, c = the specific heat in cal/g•C^o, and Δt is the change in temperature. According to the law of heat exchange, the total amount of heat lost by a hot object equals the total amount of heat gained by the cold object with which it comes in contact. Consequently, in this experiment the total heat lost by the solid on cooling equals the heat gained by the water and calorimeter as they are warmed.

OBJECTIVE:

After completing this experiment, you should be able to determine the specific heat of a metal.

PROCEDURE:

1. Take **one** sample at a time, then trade it in for another sample.

2. Measure the mass of the metal sample in grams and record it in the data table below.

3. Use a copper hook about 20 cm long to lower the sample into a 250 ml beaker half-full of boiling water. Leave the sample in the boiling water for 5 minutes.

4. While the sample is heating to boiling, determine the mass of the styrofoam cup and record it.

5. Fill the cup **HALF FULL** with tap water.

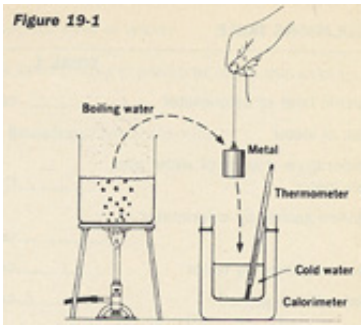
6. Mass the cup **HALF FULL** of water.

WARNING: Thermometers break very easily! Keep them away from the edges of the table! Do not leave them unattended in a beaker or cup!

7. Take and record the temperature of the boiling water with the thermometer. Since the solid is being heated in the boiling water, its original temperature is the temperature of the boiling water.

8. Take the temperature of the water in the cup and record it.

9. Remove the sample from the boiling water and place it in the cup as shown in Figure 19-1.



10. **Gently** stir with the thermometer and record its highest reading.

11. Repeat the above for three other samples.

Data Table

Sample	Mass Sample (g}	Mass Cup (g)	Mass Cup + water (g)	Temp boiling water ^{o}C	Init. Temp Cup ^{o}C	Final Temp Cup ^{o}C
Cu	.	.	.	.	.	.
Sn	.	.	.	.	.	.
Al	.	.	.	.	.	.
Zn	.	.	.	.	.	.

CALCULATIONS:

Record each calculation in the calculations table below.

1. For each sample, calculate the mass of the water in the cup by subtracting the mass of the cup from the total mass.

.

2. For each sample, calculate the temperature change, **Δt**, of the **water** in the cup calorimeter.

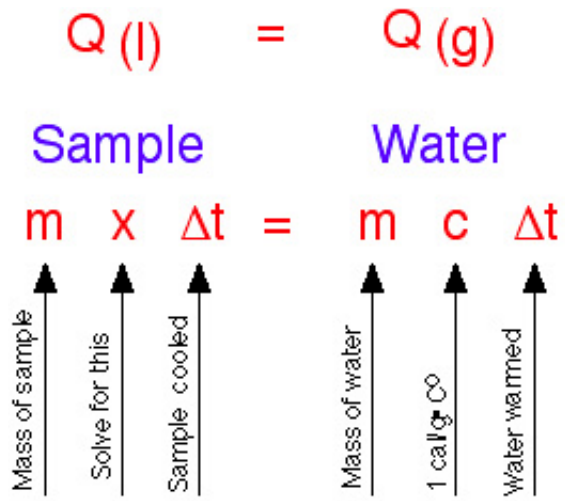
.

3. For each sample, calculate the temperature change, **Δt**, of the **metal**.

.

4. Using the relationship that **Heat Lost** $_{\text{(by sample)}}$ **= Heat Gained** $_{\text{(by water)}}$ solve for **x**, the specific heat of each sample.

.



5. The accepted values of the specific heats have been entered for you. Calculate your error and the percentage error. **HINT: Percent error = your error/accepted value X 100%.**

Calculations Table

Sample	Mass H_2O in Cup (g)	Δt H_2O in Cup C^o	Δt of Sample C^o	Calculated Sp. Ht in cal/g•C^o	Accepted Value cal/g•C^o	Your Error	% Error
Cu	.	.	.	.	**0.09**	.	.
Sn	.	.	.	.	**0.05**	.	.
Al	.	.	.	.	**0.21**	.	.
Zn	.	.	.	.	**0.09**	.	.

CRITIQUE: