Specific Heats

Name_____ ID_____ TA_____

Partners_____

Date_____ Section_____

Caution

Use extreme caution when you handle the hot water, otherwise it may result in serious personal injuries. If you are not sure how to handle the containers with hot water, ask me to pour the water for you.

ⓘ Please use the units, g, °C, and Cal. through this lab. 🌡

1. Specific heat of solid materials

Hints:

1. Please take a sufficient time to make a material warmed completely.
2. Use the right amount of cold water (maybe just enough to cover the whole material). If you use too much cold water and, the temperature rise of the cold water will be only a degree or two.
3. When reading temperatures, estimate to 1/10 of a degree from the data in Science Workshop.
4. Heat easily radiates. So the transferring process should be done quickly, and also safely.
5. After each trial, calculate the specific heat. Then for next one, try to fix your experiment in order to obtain the better result.

The Formula of Specific Heat of Materials

$$C_m = \frac{M_W C_W (T0 - T_W)}{M_m (T_m - T0)}.$$ where C_W =1.0 Cal / g ·°C (Specific Heat of Water).

Mass of the calorimeter: M_{cal} _____

- **Material 1** _____

Mass of the material Mm	Total mass of calorimeter and cold water	Net mass of cold water Mw	Initial temperature of material Tm	Initial temperature of cold water Tw	Final temperature T0	Specific heat of the material Cm (Cal/g.°C)	% difference $\frac{\text{\|ex. value-ref.\|}}{\text{ref. value}} \times 100$

- **Material 2** _____

Mass of the material Mm	Total mass of calorimeter and cold water	Net mass of cold water Mw	Initial temperature of material Tm	Initial temperature of cold water Tw	Final temperature T0	Specific heat of the material Cm (Cal/g.°C)	% difference $\frac{\lvert \text{ex. value-ref.} \rvert}{\text{ref. value}} \times 100$

- **Material 3** _____

Mass of the material Mm	Total mass of calorimeter and cold water	Net mass of cold water Mw	Initial temperature of material Tm	Initial temperature of cold water Tw	Final temperature T0	Specific heat of the material Cm (Cal/g.°C)	% difference $\frac{\lvert \text{ex. value-ref.} \rvert}{\text{ref. value}} \times 100$

- **Material 4** _____a sinker (lead?)_____

Mass of the material Mm	Total mass of calorimeter and cold water	Net mass of cold water Mw	Initial temperature of material Tm	Initial temperature of cold water Tw	Final temperature T0	Specific heat of the material Cm (Cal/g.°C)

✔ From the average of the trials, can it be determined as lead in accordance with the reference value?

Specific heat reference values

Material	Lead	Iron	Copper	Aluminum
Cm (Cal / g·°C)	0.030	0.11	0.093	0.22

Lab Procedure for Specific Heats

Specific Heat of Solid Materials

1. **Weigh the solid materials provided.**
   This is the procedure to get Mm on the data sheet.
2. **Take an appropriate amount of hot water, and put a material into there to make it warm.**
   This is a procedure to get Tm on the data sheet. The water should be half of the small cup. You should wait several minutes for this even if it is stabilized.
3. **Take cold water with the large mug cup, weigh the total mass, and measure the temperature.**
   The water should be 1/3 of the large cup. If you subtract M_{large} from this, you will obtain Mw. And this temperature will be Tw.
4. **Measure the temperature of hot water containing a material.**
   After you wait for several minutes to make a material completely warmed, you will take a data for Tm.
5. **Pick up the material from the hot water, and put it into the cold; then stir it properly.**
   Heat radiates easily. Therefore, you should conduct this process as quickly as possible.
6. **Measure the cold water temperature containing the warmed material.**
   After stabilized, pick out the temperature for T0.
7. **Calculate the specific heat of material.**
   You can use the formula, $C_m = \frac{M_W C_W (T0 - T_W)}{M_m (T_m - T0)}$, for this.
   However, C_W = 1.0 Cal / g ·°C (Specific Heat of Water)
8. **Calculate also the percent difference for each trial.**
9. **Repeat the process for three more materials.**

- **Lab Report**

Answer the question on the data sheet. Discuss the experimental results from the percent difference. Make sure if you obtained the good value for specific heat of a material compared with the reference values. If not, please discuss why. If you have any insights about this based on your studies and jobs, please write them down in the discussion.