

Iona Physics Experiment

Experiment: To determine the Specific Heat of a Metal Sample

Apparatus: Metal Sample, thermometer, balance, calorimeter, boiling water

Procedure:

1. Place the metal sample in the water and let it heat up until it has been in boiling water for about 10 minutes.
2. Determine the mass of the empty calorimeter cup. NOTE: you need the mass of the calorimeter cup and stirrer. DO NOT include the outer insulating jacket, the ring, or the top. Record this as M_c . The calorimeter cup is made of aluminum. Look up the value of the specific heat of aluminum and record that as the specific heat of the calorimeter cup. (C_c)
3. Fill the calorimeter cup approximately half way with cool water. Obtain the mass of the calorimeter, stirrer, and water combined. By subtraction determine the mass of the water used in the experiment (M_w). Place the cup and stirrer inside the insulating jacket and cover it with the top. Insert a thermometer through the large hole in the center of the top.
4. Just before you transfer the metal sample into the calorimeter cup, stir it gently and record the temperature to the nearest 0.1 degree. Record this as T_{iw} .
5. Before you transfer the metal from the boiling water use a different thermometer to measure the temperature of the boiling water. Assume the metal is at that temperature and record it as the initial temperature of the metal (T_{im}).
6. QUICKLY transfer the metal from the boiling water into the calorimeter. Replace the top and stir gently. Watch the thermometer which is in the calorimeter. The temperature of the water and calorimeter should rise slightly. When the temperature stops rising, record the final temperature as T_f .
7. Remove the metal sample. Dry it off and record its number. (Sample number)
8. Determine the mass of the metal sample. (M_m)

Mathematics:

Using the method of mixtures you can see that

(Heat lost metal cooling down) = (Heat gained by water and calorimeter heating up)

$$(M_m)(C_m)(T_{im} - T_f) = (M_w)(C_w)(T_f - T_{iw}) + (M_c)(C_c)(T_f - T_{iw})$$

Solve this equation for C_m (which is what you are looking for.) Use MKS units everywhere.

DATA:

Mass of Calorimeter with stirrer (M_c) _____

Mass of Calorimeter and stirrer with water _____

Mass of water used (M_w) _____

Specific Heat of Calorimeter (C_c) [Aluminum] _____

Initial Temp of metal (T_{im}) _____

Initial Temp of water and calorimeter (T_{iw}) _____

Final Temp of mixture (T_f) _____

Mass of metal (M_m) _____

Number of Metal sample _____

Conclusion: The specific heat of sample # _____ was found to be _____.