

Specific Heat of Solids

1 Objective

- Find the specific heat of different materials and estimate the heat lost to the calorimeter.

2 Prelab Questions

1. When using water to get the specific heat of an unknown material, define the system where the energy will be conserved.
2. Within your system what are the processes that are taking place?
3. What is the expected difference when calorimeters of identical dimensions are used but are of different materials, eg. copper and aluminium?
4. What is the effect of the stirrer and how does it relate to energy?
5. Given a cylinder made from an unknown material, describe a method for finding what the cylinder is made of.

3 Principles

- The specific heat of different pellets is found.
- Steam is used to heat the pellets, then they are allowed to drop into a calorimeter.

- The temperature of water is recorded before and after the pellets are added.
- Since the specific heat capacities of water and calorimeter are known, that of the pellets could be found.

4 Apparatus

- Calorimeters.
- Various solid pellets.
- Container for heating pellets.
- Hot plate.
- Silicone tubes.
- Metal clamps.
- Stand, clamps and a steam generator.

5 Precautions

1. Do not allow the steam to leak out.
2. Allow the pellets to heat evenly.
3. Minimise heat losses and make sure that you record the temperatures at equilibrium.

6 Experimental Steps

1. Weigh the inside vessel and the stirrer of the calorimeter m_{cal} .
2. Fill the calorimeter with 100 g of tap water and find the mass of the water m_{water} .
3. Fill the steam generator with water.

4. Adjust the pellet heater on the the stand in such a way to allow the pellets to fall directly into the calorimeter once they have been heated.
5. Place the pellets inside the container connected to the steam genetrator via the silicone tube. **Note that the steam outlet should drain in the sink.**
6. Switch on the heater to generate steam. Allow steam to flow for ten minutes or so to make sure that the pellets have been sufficiently heated.
7. Place the calorimeter under the pellet heater and allow the pellets to fall in.
8. Allow some time for the system to reach equilibrium then record the final temperature T_f .
9. Weigh the vessel again to get the mass of the pellets m_p .
10. Repeat the same steps using different pellets.

7 Evaluation

1. Find which material the calorimeter is made of by finding its density.
2. Find the specific heat capacity of the calorimeter from literature.
3. Find the specific heat capacity of the pellets.
4. Compare your results for specific heat with values from the literature.

8 Postlab Questions

1. Describe the calorimeter and state which physical properties it depends on.
2. Calculate how much heat is absorbed by the calorimeter only.
3. What are the sources of error in your experiment.
4. How would the specific heat of pellets compare if a steel calorimeter was used instead of the one in the lab?

9 Helpful Sites (clickable links)

- Determining the specific heat of solids.