Determine the Specific Heat of a Solid in a Calorimeter

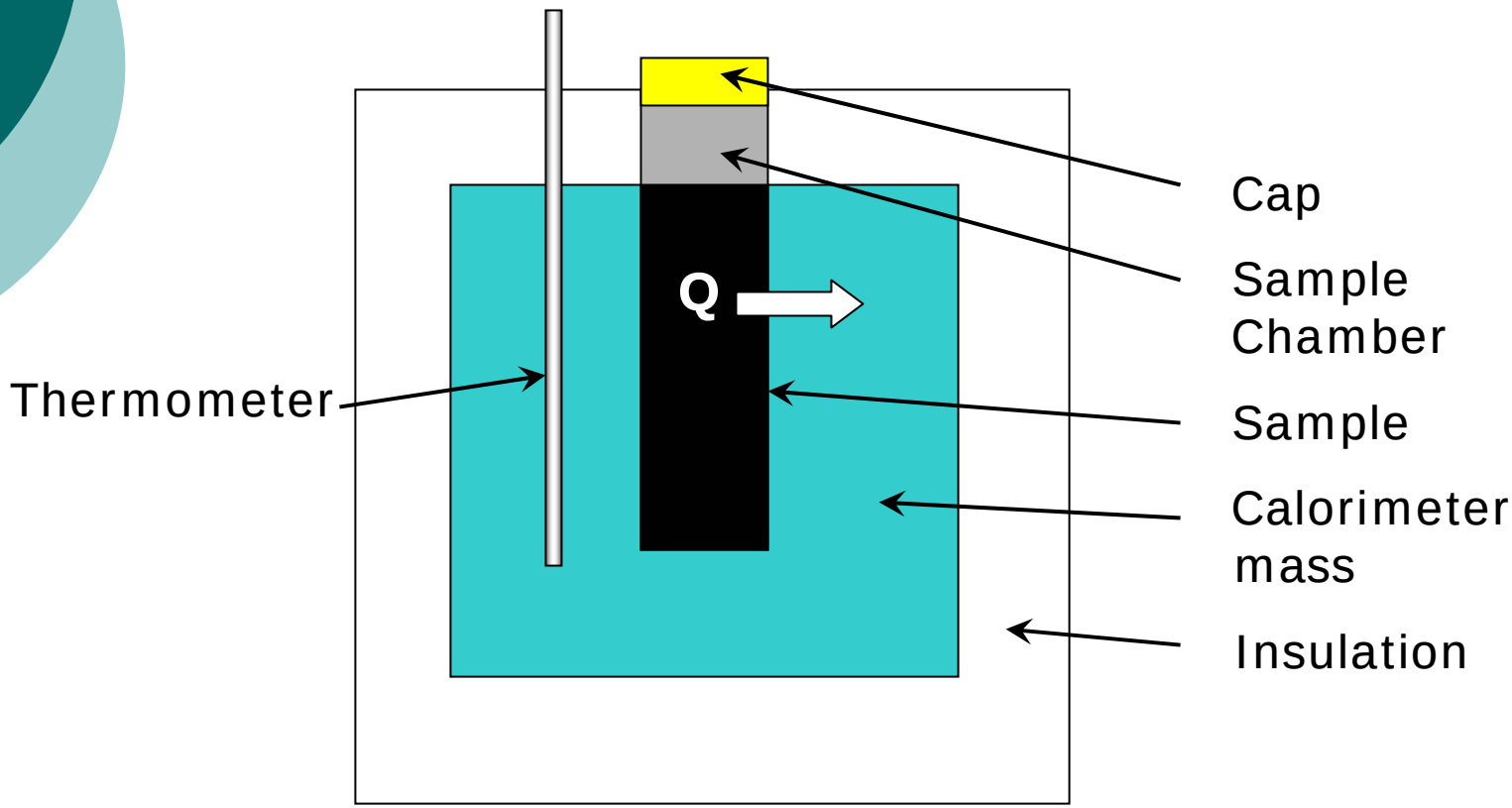
AREN 2110

ITL Lab Assignment

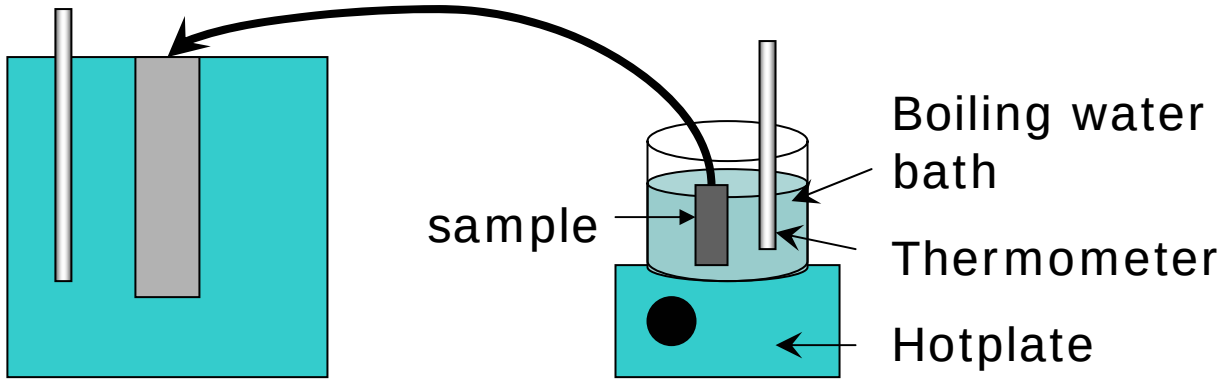
Calorimeter is a multicomponent, adiabatic process

- 1st Law Statement: $\Sigma \Delta U_i = 0$
- Where components are the calorimeter mass and the sample mass.
- Assumptions: rapid heat transfer between sample and calorimater mass, no heat transfer to surroundings
- You will be using an **aneroid** calorimeter, one that uses a metal mass with high thermal conductivity (e.g., aluminum) for the calorimeter mass.
- Characteristics of calorimeter, relatively **rapid heat transfer by conduction** so equilibrium is reached quickly; **relatively low specific heat** so measurable temperature change occurs; **relatively high mass** (compared with sample mass) so temperature change is not so large that it is hard to maintain adiabatic conditions.

Aneroid Calorimeter



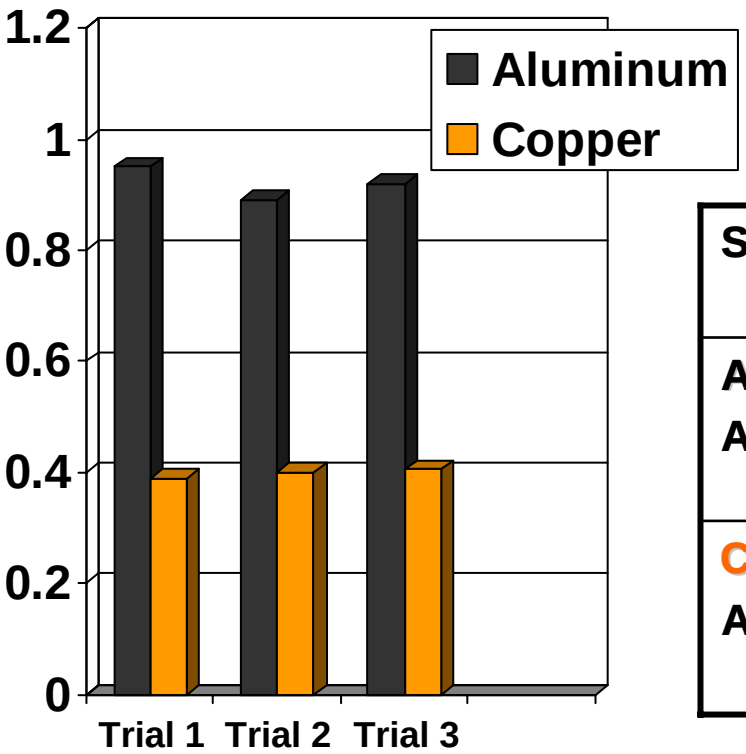
Tips for Procedure



Key Points

- **<u>Submerge</u> sample in boiling water bath long enough so T_{sample} reaches T_{sat}**
- **Record calorimeter and water bath temperature <u>before</u> moving sample from bath to calorimeter**
- **Move sample to calorimeter as quickly as possible using tongs**
- **Watch calorimeter thermometer reading carefully to make sure you record the equilibrium temperature of the calorimeter (and sample)**

Tips for Data Display



Sample	C_p Lab	C_p Table	% diff.
Aluminum Avg ± std. dev.	0.88 ± 0.11	0.929	5
Copper Avg ± std. dev.	0.43 ± 0.13	0.39	10

Tips for Discussion of Results

- General comments on accuracy of results, performance of calorimeter, suggestions for improved measurement

ERRORS

- Do not just cite “measurement error”
- Use the 1st law calorimeter formula to show how a temperature measurement would result in over- or under-estimate
- If the variability between runs is large, discuss why
- If you think the adiabatic assumption (or any other assumption) is not correct, give specific reason(s)