Calorimetry

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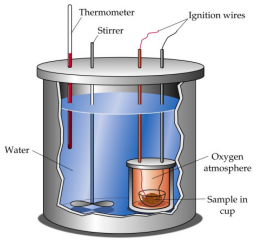
A Calorimeter

- ***Calorimetry*** is the act of measuring the heat of chemical reactions or physical changes, or the science of making such measurements.
- ***Calorimetry*** is performed with a calorimeter.
- ***Calormietry*** is possible because:
  - Heat transfers from hot to cold objects.
  - We can calculate how much heat is transferred, therefore, hot much heat was "created" and "lost."
  - Heat transfer stops at thermal equilibrium.

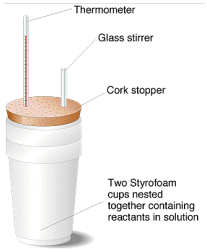
A Calorimeter

- An insulated, sealed container where a reaction takes place.
- Full of a known amount (grams) of a known temperature of water.
- The exothermic reaction releases heat which causes the water's temperature to rise.
- You can find Q=mcΔT for water, therefore also for the reaction.



Our Homemade Calorimeter

- Same basic principle.
- Insulated container.
- Observe the ΔT for the known amount of water.
- Calculate Q=mcΔT for the water.



Calorimetry Practice.

- A chemical reaction takes place in a calorimeter. The calorimeter contains an exothermic reaction in 250 g of 30°C water. The reaction completes and the water is observed to be 52°C. What heat was released by the reaction?

$$Q = m \cdot c_p \cdot \Delta T$$

- The heat released by the reaction -Q is equal to the heat absorbed (Q) by the water. Law of Conservation of Energy.

Calorimetry Practice.

- A scalding hot (289.5°C) piece of metal is placed in the calorimeter. The metal has a mass of 40 grams. The calorimeter has 50.0 g of 23°C water. The reaction completes and the water and metal are observed to at thermal equilibrium at 62°C. What unknown metal was placed in the calorimeter?

$$Q = m \cdot c_p \cdot \Delta T \qquad c_p = \frac{Q}{m \cdot \Delta T}$$

- The heat transferred out of the hot metal (-Q) is equal to the heat absorbed (+Q) by the water. One will have a larger temperature change due to the different specific heat values.

Calorimetry Practice.

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The End

- Summary
- Calorimetry: A way to measure heat transfer.
- −Q is released heat.
- +Q is absorbed heat.

- −Q released = +Q absorbed by water.

$$Q = m \cdot c_p \cdot \Delta T \qquad c_p = \frac{Q}{m \cdot \Delta T}$$