Calorimetry

<u>CALORIMETRY</u> - is the technological process of measuring energy changes using an **isolated system** called a calorimeter.

In the calorimeter the system being studied is surrounded by a known quantity of water. Energy is then transferred between the chemical system and the water. The heat gained by the water can be determined and thus equals the heat lost by the system.

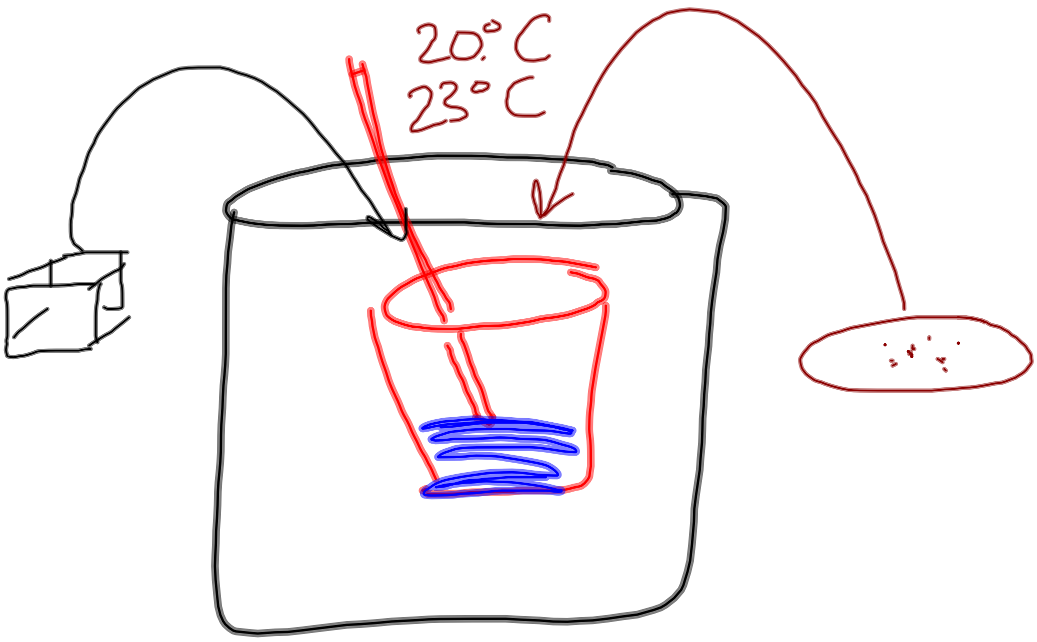
ASSUMPTIONS IN CALORIMETRY
1. no heat is transferred between the calorimeter and the outside environment.
2. any heat absorbed or released by the calorimeter materials is negligible.
3. a dilute aqueous solution has the same density and specific heat capacity as pure water.

Assumption #2 implies

$$\Delta H_{system} = - q_{calorimeter}$$

If the water is gaining heat, this means the system (LiCl) is losing heat. When a system loses heat to
the surroundings it is an **exothermic change.**
$\Rightarrow$therefore ΔH and H are negative

so $H_s = - 37$ kJ/mol
** the last step in any problem is to check whether H and
ΔH is positive or negative.



$$\Delta H = -q$$

$$q = -q$$

Example

4.24 g of lithium chloride is dissolved in 100. mL of water at an initial temperature of 16.3°C. The final temperature of the solution is 25.1°C. Calculate the molar enthalpy of solution, H_s, for lithium chloride.

LiCl H_2O

LiCl

$m = 4.24 g$

$H_s = ?$

H_2O

$V = 100. mL$

$T_i = 16.3°C$

$T_f = 25.1°C$

$$\Delta H_s = -q$$

$$nH_s = -vC\Delta T$$

$$\left(\frac{4.24 g}{42.39 g/mol}\right)H_s = -(0.100 \cancel{L})\left(4.19 \frac{kJ}{\cancel{L}\cdot\cancel{°C}}\right)(8.8 \cancel{°C})$$

$$(0.100 mol)H_s = -3.6872 kJ$$

$$\boxed{H_s = -36.9 \frac{kJ}{mol}}$$

Homework

Worksheet