Chemistry 1105 Lab: Calorimetry

Goals:

1. **Introduction to Calorimetry.**
2. **Determine Heat Capacity of calorimeter(C_{cal}).**
3. **Determine Heat of Neutralization(ΔH_{neut}).**

Calorimetry:

q = amount of heat, measured in joules(J).

$q = m \times sp\_heat \times \Delta t$ where:

m = mass, measured in grams

Δt = temperature change in °C.

sp_heat = the specific heat. J/g×°C
The specific heat is the amount of heat required to raise the temperature of one gram of substance by one degree.

Determine Heat Capacity of Calorimeter:

$$C_{cal} = \text{mass} \times \text{sp\_heat}$$

Thus the heat change for calorimeter is:

$$q_{cal} = C_{cal} \times \Delta t$$

Find C_{cal} by mixing hot and cold water.

$$-q_{hot} = q_{cold} + q_{cal}$$

$$q_{cal} = -q_{hot} - q_{cold}$$

Find C_{cal} cont:

Measure t_{hot}, t_{cold}, t_{final}.

$$q = m \times sp\_heat \times \Delta t$$

$$q_{hot} = 50.0\ g \times 4.184\ J/g \times °C \times (t_{final} - t_{hot})$$

$$q_{cold} = 50.0\ g \times 4.184\ J/g \times °C \times (t_{final} - t_{cold})$$

$$q_{cal} = - q_{hot} - q_{cold}$$

Find C_{cal} cont:

$$q_{cal} = - q_{hot} - q_{cold}$$

$$q_{cal} = C_{cal} \times \Delta t$$

$$C_{cal} = \frac{q_{cal}}{\Delta t} \quad +4.184 J/g \times^{\circ} C \times 100.0 g$$

C_{cal} now includes the 100.0 g of solution.

Determining Heat of Neutralization(ΔH_{neut}):

Find $q_{neutralization}$

Measure final(t_{final}) and initial(t_{inital}) temps.

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l) + heat$

$q_{neutralization}$ = heat liberated

$-q_{neutralization} = +q_{cal}$

Determining Heat of Neutralization cont:

$$q_{cal} = C_{cal} \times (t_{final} - t_{cold})$$

$$-q_{neutralization} = q_{cal}$$

$$\Delta H_{neutral} = \frac{q_{neutralization}}{\text{moles } H^+} = \frac{q_{neutralization}}{\text{moles } OH^-}$$