

# Chemistry 1105 Lab: Calorimetry

## Goals:

1. Introduction to Calorimetry.
2. Determine Heat Capacity of calorimeter( $C_{\text{cal}}$ ).
3. Determine Heat of Neutralization( $\Delta H_{\text{neut}}$ ).

# **Calorimetry:**

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

**q = m×sp\_heat×Δt    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:

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

Thus the heat change for calorimeter is:

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

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

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

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

**Find  $C_{\text{cal}}$  cont:**

**Measure  $t_{\text{hot}}$ ,  $t_{\text{cold}}$ ,  $t_{\text{final}}$ .**

$$q = m \times \text{sp\_heat} \times \Delta t$$

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

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

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

**Find  $C_{\text{cal}}$  cont:**

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

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

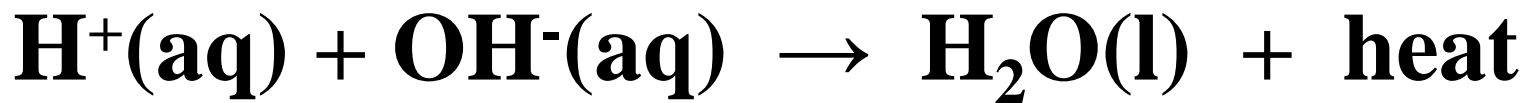
$$C_{\text{cal}} = \frac{q_{\text{cal}}}{\Delta t} + 4.184 \text{ J / g } \times ^\circ \text{ C } \times 100.0 \text{ g}$$

**$C_{\text{cal}}$  now includes the 100.0 g of solution.**

# Determining Heat of Neutralization( $\Delta H_{\text{neut}}$ ):

Find  $q_{\text{neutralization}}$

Measure final( $t_{\text{final}}$ ) and initial( $t_{\text{initial}}$ ) temps.



$q_{\text{neutralization}} = \text{heat liberated}$

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

# Determining Heat of Neutralization cont:

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

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

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