3. Immediately place the NaOH pellets in the calorimeter cup, and gently stir the solution with a stirring rod. **Do not stir with a thermometer.** Place the lid on the calorimeter. Watch the thermometer, and record the highest temperature in your data table.

4. Be sure to clean all equipment and rinse it with distilled water before continuing.

Reaction 2: NaOH and HCl in Solution

5. Pour 50 mL of 1.0 M HCl into your calorimeter. Record the temperature of the HCl solution to the nearest 0.1°C.

6. Pour 50 mL of 1.0 M NaOH into a graduated cylinder. **For this step only, rinse the thermometer, and measure the temperature of the NaOH solution in the graduated cylinder to the nearest 0.1°C. Record the temperature, and then replace the thermometer in the calorimeter.**

7. Pour the NaOH solution into the calorimeter cup, and stir gently. Place the lid on the calorimeter. Watch the thermometer and record the highest temperature.

8. Pour the solution in the container designated by your teacher. Clean and rinse all equipment before continuing with the procedure.

Reaction 3: Solid NaOH and HCl in Solution

9. Pour 100 mL of 0.50 M HCl into your calorimeter. Record the temperature of the HCl solution to the nearest 0.1°C.

10. Measure the mass of a clean and dry watch glass, and record the mass. Wear gloves, and using forceps, obtain approximately 2 g of NaOH pellets. Place them on the watch glass, and record the total mass. **As in step 2, it is important that this step be done quickly.**

11. Immediately place the NaOH pellets in the calorimeter, and gently stir the solution. Place the lid on the calorimeter. Watch the thermometer, and record the highest temperature. When finished with this reaction, pour the solution into the container designated by your teacher for disposal of basic solutions.

CLEANUP AND DISPOSAL

12. Check with your teacher for the proper disposal procedures. Always wash your hands thoroughly after cleaning up the lab area and equipment.

ANALYSIS AND INTERPRETATION

1. **Organizing Ideas:** Write a balanced chemical equation for each of the three reactions that you performed. (Hint: Be sure to include the physical states of matter for all substances.)

2. **Organizing Ideas:** Write the equation for the total reaction by adding two of the equations from item 1 and then canceling out substances that appear in the same form on both sides of the new equation.

3. **Organizing Data:** Calculate the change in temperature for each of the reactions.

4. **Organizing Data:** Assuming that the density of the water and the solutions is 1.00 g/mL, calculate the mass of liquid present for each of the reactions.

5. **Analyzing Results:** Using the calorimeter equation, calculate the energy as heat released by each reaction. (Hint: Use the specific heat of water in your calculations.)

$$c_{p,\,H_2O} = 4.184 \text{ J/g} \cdot {}^\circ\text{C}$$

$$\text{heat} = m \times \Delta t \times c_{p,\,H_2O}$$

6. **Organizing Data:** Calculate the moles of NaOH used in each of the reactions.

7. **Analyzing Results:** Calculate the ΔH value in kJ/mol of NaOH for each of the three reactions.

8. **Organizing Ideas:** Using your answer to Analysis and Interpretation item 2 and your knowledge of Hess's law, explain how the enthalpies for the three reactions should be mathematically related.