MAKE UP DATA

Part II (Lab): Finding ΔH$_{solution}$ of NH$_4$NO$_3$. **Name:**__________________________**p.**____ **Seat** _____

Write a balanced net ionic equation, with phase subscripts, showing solid ammonium nitrate dissolving into water.

$NH_4NO_{3(s)} \rightarrow NH_4^+ + NO_3^{-1}$ ΔH$_{solution}$ = ______________

*Mass of solid ammonium nitrate used: 3.09 g (Weigh out between 2.90 and 3.10 grams, on weighing paper.)

*Volume of water in the calorimeter: 52.0 mL (use between 45 and 55 mL. Measure volume in grad cylinder.)

Mass of water in the calorimeter: 52.0 g

*Initial Temperature of water in calorimeter 19.0°C

*Final Temperature of water in calorimeter 14.9°C

ΔT of water in calorimeter -4.1°C

Calculations:

1a. Based on the sign of ΔT, did the water gain or lose energy when the solid dissolved?______________

b. Therefore, did the ammonium nitrate absorb or release energy when it dissolved into water?__________________

c. Based on your answer to (b), is this process (of dissolving) exothermic or endothermic?__________________

2a. Calculate the amount of heat energy absorbed or released by the water, in calories. (Use the absolute value of ΔT)

b. Convert your answer to (a) to kiloJoules.

3. Calculate the number of moles of ammonium nitrate that dissolved during the experiment.

4. Calculate the value for |ΔH$_{solution}$| in kJ/mole. (kiloJoules per mole of ammonium nitrate)

5. Keeping in mind your answer to 1c, write the value for ΔH$_{solution}$, including the sign, on the equation you wrote, above.

Data Analysis:

1a. The "calorimeters" we used were made up styrofoam, which is a good insulator, but is not perfect. Besides losing or gaining heat to/from the from the room through the walls of the calorimeter, how else could we have lost/gained heat to/from the room?

[redacted] If heat is lost/gained due to imperfect insulation, how will this affect the value of |ΔT|?________________

[redacted] How will this affect the value of |ΔH|?___________________

[redacted] Suppose that not all of the solid actually dissolved during this experiment.

How would this affect your result for |ΔH| ?___________________

2. The book value for |ΔH$_{solution}$| is 26.4 kJ for ammonium nitrate. Based on how your result compares to the book value, do you think any discrepancy between your value and the book value could be accounted for by the errors mentioned in #1? Explain.

% error =

Demo and Mini-lab: Using a calorimeter to find ΔH!

Part 1 (Demo): Finding $\Delta H_{solution}$ of NaOH.

$\Delta H_{solution}$ is the energy change when a substance dissolves into water (or some other solvent).
Write a balanced net ionic equation, with phase subscripts, showing solid sodium hydroxide dissolving into water.
(Note: dissolving is more of a physical change than a chemical change, but we can still write it as a chemical equation)

$NaOH_{(s)} \rightarrow Na^{+} + OH^{-}$ $\Delta H_{solution}$ = -27.9 kJ

true: -44 kJ

*Mass of solid sodium hydroxide used: 3.00 g NaOH

*Volume of water in the calorimeter: 50.0 mL

Mass of water in the calorimeter: 50.0 g

*Initial Temperature of water in calorimeter 21.8°C

*Final Temperature of water in calorimeter 31.8°C

ΔT of water in calorimeter +10.0°C

Calculations:

1a. Based on the sign of ΔT, did the water gain or lose energy when the sodium hydroxide dissolved? gain

b. Therefore, did the sodium hydroxide absorb or release energy when it dissolved into water? released

c. Based on your answer to (b), is this process (of dissolving) exothermic or endothermic? exo

2a. Calculate the amount of heat energy absorbed or released by the water, in calories. (Use the absolute value of ΔT)

$$Q = 50.0g\left(\frac{1\ cal}{g\ °C}\right)(10.0°C)$$

$$Q = 500.\ cal$$

b. Convert your answer to (a) to kiloJoules.

$$500.\ cal\left(\frac{4.184\ J}{1\ cal}\right)\left(\frac{1\ kJ}{1000\ J}\right) = 2.09\ kJ$$

3. Calculate the number of moles of sodium hydroxide that dissolved during the experiment.

$$3.00g\ NaOH\left(\frac{1\ mol}{40.00\ g}\right) = 0.0750\ mol\ NaOH$$

4. Calculate the value for $|\Delta H_{solution}|$ in kJ/mole. (kiloJoules per mole of sodium hydroxide)

$$\frac{2.09\ kJ}{0.0750\ mol} = \frac{x\ kJ}{1\ mol}$$

27.9 kJ/mol NaOH

5. Keeping in mind your answer to 1c, write the value for $\Delta H_{solution}$, including the sign, on the equation you wrote, above.