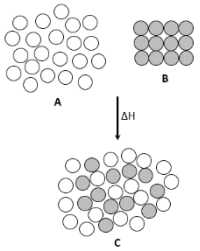
Dougherty Valley HS Chemistry - AP
Solutions – Heat of Solution

Worksheet #4

Name: **Period:** **Seat#:**

Conceptual Questions

1) The diagram below is an atomic level representation of a small amount of solid powder being dissolved in a large amount of liquid. Complete the statement below the diagram using the words *solute, solvent, solution.*



A is the _____ B is the _____

and C is the _____

2) Which of the following is NOT a step in the dissolving process? Draw a diagram of how things dissolve.

a. *Separating the solute into its individual components*
b. *Breaking solvent molecules into smaller pieces*
c. *Overcoming intermolecular forces in the solvent to make room for the solute*
d. *Allowing the solute and solvent to interact to form the solution*

3) Explain the conditions that would result in the formation of a solution being endothermic.

4) Explain the conditions that would result in the formation of a solution being exothermic.

5) What lab technique is often used to calculate the heat of solution? Hint – think back to thermochem!

6) Describe some common lab errors with the lab technique mentioned in Q #5.

7) Instant ice packs, and instant hot packs work by having a small packet of water inside a bigger packet filled with different ionic compounds. When you pop the small packet of water inside the bigger packet, the water reacts with the compounds and results in either an endothermic or exothermic reaction. Based on the rxns and molar heat of sol'ns given below, which rxn is appropriate for the instant ice pack, and which is for the instant hot pack? Explain.

$CaCl_2(s) \rightarrow Ca^{2+}(aq) + 2Cl^-(aq)$ $\Delta H_{soln} = -82.8\ ^{kJ}/_{mol}$

$NH_4NO_3(s) \rightarrow NH_4^+(aq) + NO_3^-(aq)$ $\Delta H_{soln} = +25.7\ ^{kJ}/_{mol}$

Calculations – show your work with dimensional analysis, units, etc.

Note *- Assume the solutions have the same specific heat as water.*

8) A 10 gram sample of NH_4Cl is dissolved in 206.5 mL of water. The temperature of the water changes from 22.7° C to 19.6°C. Calculate the molar heat of solution. Was this an endothermic or exothermic process?

9) A 10 gram sample of LiCl dissolves in a 60 mL sample of water at 20.0 °C. The final temperature of the water is 22.3 °C. What is the molar heat of solution? Was this an endothermic or exothermic process?

10) The molar heat of solution for KOH is -57.61 kJ/mol. A 15.6 g sample of KOH is dissolved in 150 g of water in a foam cup calorimeter. What is the final temperature of the system? The initial temperature of the water was 25 °C.

11) When a 50. mL sample of C_2H_5OH is mixed with a 50. mL sample of H_2O, the resulting mixture has a volume of 95 mL, and the container is warm to the touch. Which of the following best describes these observations? Explain what is wrong with all the wrong choices, and what is correct for the correct choice.

A. A chemical reaction occurs. As evidenced by the volume of the resultant mixture being less than the total volume of the initial components.
B. A chemical change occurs, as evidenced by the formation of new covalent bonds releasing more energy than is absorbed by the breaking of the existing covalent bonds.
C. A physical change occurs, and the solvation process is exothermic.
D. A physical change occurs, and the solvation process is endothermic.

12) We talk a lot about the Enthalpy of solution/solvation but do not forget that we can bring it back to thermodynamics as well! Watch the following video and jot down some notes so I know you watched it.

Professor Dave Free Energy of Dissolution
http://tinyurl.com/4bsz85dz