Chemistry 202: Quiz #4

1. The enthalpy of formation of $AB_2(l)$ from $A_2(g)$ and $B_2(g)$ at 298K is –301.4 kJ/mol. Determine ΔE for this process at 298K in units of kJ/mol.

   a) –294.0 b) –297.7 c) –298.9 d) –303.9 e) –305.1

2. In a coffee-cup calorimeter, a 3.000-g sample of a salt (molar mass = 65.12 g/mol) is mixed with 100.0 g of water at an initial temperature of 25.0°C. After the salt dissolves, the temperature of the solution is 27.5°C. Assume the specific heat capacity of the solution is constant at 4.18 J/g°C that there is no heat transfer to or out of the calorimeter. Determine the enthalpy change for the dissolving of the salt kJ/mol.

   a) 1.076 b) 22.68 c) –22.68 d) 23.36 e) –23.36

3. You carry out an acid-base reaction in a Styrofoam cup calorimeter by mixing aqueous solutions of baking soda and vinegar, measuring the temperature (which decreases), and determining ΔH for the reaction in kJ/mol. Your lab partner carries out the same reaction in a bomb calorimeter, measures the temperature (also decreases), and determines ΔE for the reaction in kJ/mol. Which of the following best describes the relationship between ΔH and ΔE? The reaction in question is:

   $$NaHCO_3(aq) + HC_2H_3O_2(aq) \rightarrow NaC_2H_3O_2(aq) + H_2O(l) + CO_2(g)$$

   a) The values for ΔH and ΔE are both negative and the magnitude of the value for ΔH is greater than the value for ΔE.
   b) The values for ΔH and ΔE are both positive and the magnitude of the value for ΔH is greater than the value for ΔE.
   c) The values for ΔH and ΔE are both positive and the magnitude of the value for ΔE is greater than the value for ΔH.
   d) The values for ΔH and ΔE are both negative and the magnitude of the value for ΔE is greater than the value for ΔH.
   e) The values for ΔH and ΔE are both negative and the magnitudes of the values for ΔH and ΔE do not differ significantly.

4. The reaction represented by the chemical equation $H_2(g) + F_2(g) \rightarrow 2HF(g)$ is exothermic. What does this tell us?

   a) The bond energy of HF is higher than the average bond energies of H_2 and F_2.
   b) The average bond energies of H_2 and F_2 are higher than the bond energy of HF.
   c) Nothing about average bond energies.
   d) All bond energies are endothermic.
   e) All bond energies are exothermic.

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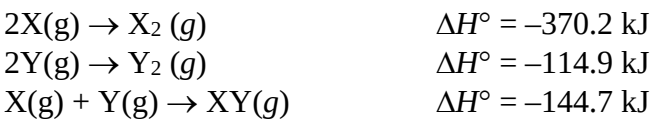
5. Using the following data, calculate the standard enthalpy of formation of the compound XY(*g*) at 25°C in kJ/mol. The standard states of elements X and Y are $X_2(g)$ and $Y_2(g)$, respectively.



$2X(g) \rightarrow X_2(g)$ $\quad \Delta H° = -370.2$ kJ

$2Y(g) \rightarrow Y_2(g)$ $\quad \Delta H° = -114.9$ kJ

$X(g) + Y(g) \rightarrow XY(g)$ $\quad \Delta H° = -144.7$ kJ

a) 48.93 b) 97.85 c) 170.2 d) 195.7 e) 340.4

6. The heat of combustion of acetylene, $C_2H_2(g)$ at 25°C, is –1304 kJ/mol. The products of this reaction are $CO_2(g)$ and $H_2O(l)$. At this temperature, the $\Delta H_f°$ values for $CO_2(g)$ and $H_2O(l)$ are –393 kJ/mol and –286 kJ/mol, respectively. Determine $\Delta H_f°$ for acetylene.

a) 232 kJ/mol b) –232 kJ/mol c) 420. kJ/mol d) –420. kJ/mol e) 464 kJ/mol

7. You add 50.0 g of ice at –10.0°C to 75.0 g of water at 75.0°C in a perfectly insulated Styrofoam cup calorimeter. Given the following information, determine the final temperature of the water.

- Specific heat capacity of $H_2O(s)$ = 2.03 J/g°C
- Specific heat capacity of $H_2O(l)$ = 4.18 J/g°C
- ΔH_{fusion} = 6.01 kJ/mol

a) Not all of the ice melts. b) 11.1°C c) 14.0°C d) 15.1°C e) 43.0°C

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KEY:

1. b, 2. e, 3. b, 4. a, 5. b, 6. a, 7.b