Name: ________________________________ **Date:** ________

Chemistry *~ Ms. Hart* **Class:** Anions or Cations

THE URBAN ASSEMBLY SCHOOL FOR CRIMINAL JUSTICE

7.5 Enthalpy

1. Which compound is formed from its elements by an exothermic reaction at 298 K and 101.3 kPa?
   (1) $C_2H_4(g)$
   (2) $HI(g)$
   (3) $H_2O(g)$
   (4) $NO_2(g)$
2. For which compound is the process of dissolving in water exothermic?
   (1) NaCl
   (2) NaOH
   (3) NH_4Cl
   (4) NH_4NO_3
3. Given the balanced equation representing a reaction:
   Cu + S CuS + energy

Which statement explains why the energy term is written to the right of the arrow?
   (1) The compound CuS is composed of two metals.
   (2) The compound CuS is composed of two nonmetals.
   (3) Energy is absorbed as the bonds in CuS form.
   (4) Energy is released as the bonds in CuS form.
4. A thermometer is in a beaker of water. Which statement best explains why the thermometer reading initially increases when LiBr(s) is dissolved in the water?
   (1) The entropy of the LiBr(aq) is greater than the entropy of the water.
   (2) The entropy of the LiBr(aq) is less than the entropy of the water.
   (3) The dissolving of the LiBr(s) in water is an endothermic process.
   (4) The dissolving of the LiBr(s) in water is an exothermic process.
5. For a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is equal to the
   (1) heat of fusion
   (2) heat of reaction
   (3) activation energy of the forward reaction
   (4) activation energy of the reverse reaction
6. For a chemical reaction, the heat of reaction is equal to the
   (1) potential energy of the reactants, only
   (2) potential energy of the products, only
   (3) potential energy of the products plus the potential energy of the reactants
   (4) potential energy of the products minus the potential energy of the reactants

Back to NOTES:

__**Example #1:**__ Several steps are involved in the industrial production of sulfuric acid. One step involves the oxidation of sulfur dioxide gas to form sulfur trioxide gas. A catalyst is used to increase the rate of production of sulfur trioxide gas. In a rigid cylinder with a movable piston, this reaction reaches equilibrium, as represented by the equation below.

$$2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g) + 392\text{ kJ}$$

Determine the amount of heat released by the production of 1.0 mole of $SO_3(g)$.

Step 1. *Write the given (include units!).* Given= ___________________

Step 2. *What are we looking for (include units!)* Want to know: ___________________

Step 3. *What is the mole-to-energy ratio between the given and what we are looking for?*

Step 4: *List the given first and then multiply it by the ratio we found in step 3 so that the unit for what we want to know is the only factor left over.*

Example #2: Given the equation: $2H_2(g) + O_2(g) \leftrightarrow 2H_2O(l) + 571.6\ kJ$
Determine the amount of heat released by the production of 1 mole of H_2O.

Step 1. *Write the given (include units!).* Given= ___________________

Step 2. *What are we looking for (include units!)* Want to know: ___________________

Step 3. *What is the mole-to-energy ratio between the given and what we are looking for?*

Step 4: *List the given first and then multiply it by the ratio we found in step 3 so that the unit for what we want to know is the only factor left over.*

Your turn

Propane is a fuel that is sold in rigid, pressurized cylinders. Most of the propane in a cylinder is liquid, with gas in the space above the liquid level. When propane is released from the cylinder, the propane leaves the cylinder as a gas. Propane gas is

$C_3H_8(g) + 5O_2(g) \leftrightarrow 2CO_2(g) + 4H_2O(l) + 2219.2kJ$

7. Determine the total amount of energy released by the production of 1 mole of H_2O.

8. Determine the total amount of energy released when 2.50 moles of propane is completely reacted with oxygen.

9. Determine the total amount of energy released by the production of 4 moles of CO_2.

Ethanol, C_2H_5OH, is a volatile and flammable liquid with a distinct odor at room temperature. Ethanol is soluble in water. The boiling point of ethanol is 78.2°C at 1 atmosphere. Ethanol can be used as a fuel to produce heat energy, as shown by the balanced equation below.

$$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l) + 1367\ kJ$$

10. Determine the total amount of heat produced by the complete combustion of 2.00 moles of ethanol.

11. Determine the total amount of energy released by the production of 1 mole of H_2O.