Name: ______________________________________ **Date:** ________

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

7.6 Entropy

1. Base your answers to questions a) through c) on the reaction represented by the balanced equation below.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell) + 571.6 \text{ kJ}$$

   a) Identify the information in this equation that indicates the reaction is exothermic.

   b) On the axes give below, draw a potential energy diagram for the reaction represented by this equation.

   c) Explain why the entropy of the system *decreases* as the reaction proceeds.

2. Given the balanced equation:

$$KNO_3(s) + 34.89 \text{ kJ} \xrightarrow{H_2O} K^+(aq) + NO_3^-(aq)$$

Which statement best describes this process?

(1) It is endothermic and entropy increases.
(2) It is endothermic and entropy decreases.
(3) It is exothermic and entropy increases.
(4) It is exothermic and entropy decreases.

3. Systems in nature tend to undergo changes toward

(1) lower energy and lower entropy
(2) lower energy and higher entropy
(3) higher energy and lower entropy
(4) higher energy and higher entropy

4. Explain, in terms of the arrangement of particles, why the entropy of gasoline vapor is greater than the entropy of liquid gasoline.

5. Which list of the phases of H_2O is arranged in order of increasing entropy?
   (1) ice, steam, and liquid water
   (2) ice, liquid water, and steam
   (3) steam, liquid water, and ice
   (4) steam, ice, and liquid water

6. As carbon dioxide sublimes, its entropy
   (1) decreases
   (2) increases
   (3) remains the same

7. Systems in nature tend to undergo changes toward
   (1) lower energy and lower entropy
   (2) lower energy and higher entropy
   (3) higher energy and lower entropy
   (4) higher energy and higher entropy

8. Given the balanced equation representing a reaction:

$$Cl_2(g) \rightarrow Cl(g) + Cl(g)$$

What occurs during this change? (Remember: Ms Hart's relationship phrase)
   (1) Energy is absorbed and a bond is broken.
   (2) Energy is absorbed and a bond is formed.
   (3) Energy is released and a bond is broken.
   (4) Energy is released and a bond is formed.

9. Given the equation for the dissolving of sodium chloride in water:

$$\mathrm{NaCl}(s) \xrightarrow{\mathrm{H_2O}} \mathrm{Na}^+(aq) + \mathrm{Cl}^-(aq)$$

Describe what happens to entropy during this dissolving process.

10. Given the balanced equation representing a phase change:
$C_6H_4Cl_2(s)$ + energy $\rightarrow$ $C_6H_4Cl_2(g)$
Which statement describes this change?
   (1) It is endothermic, and entropy decreases.
   (2) It is endothermic, and entropy increases.
   (3) It is exothermic, and entropy decreases.
   (4) It is exothermic, and entropy increases.

11. Above 0°C, ice changes spontaneously to water according to the following equation:
$H_2O(s)$ + heat $\rightarrow$ $H_2O(l)$.
The changes in $H_2O(s)$ involve
   (1) an absorption of heat and a decrease in entropy
   (2) a release of heat and a decrease in entropy
   (3) an absorption of heat and an increase in entropy
   (4) a release of heat and an increase in entropy

12. Which chemical reaction will always be spontaneous?
   (1) an exothermic reaction in which entropy decreases
   (2) an exothermic reaction in which entropy increases
   (3) an endothermic reaction in which entropy decreases
   (4) an endothermic reaction in which entropy increases

13. What occurs when a sample of $CO_2(s)$ changes to
$CO_2(g)$?
   (1) The gas has greater entropy and less order.
   (2) The gas has greater entropy and more order.
   (3) The gas has less entropy and less order.
   (4) The gas has less entropy and more order.

14. The balanced equation below represents the decomposition of potassium chlorate.

$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

State why the entropy of the reactant is less than the entropy of the products.