

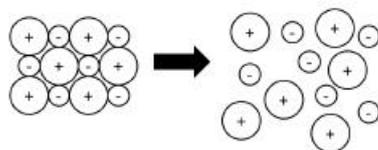
Applications of Thermodynamics
 9.1 Introduction to Entropy
 9.2 Absolute Entropy and Entropy Change
 Worksheet

- 1) Do the following processes produce an increase or a decrease in entropy? Explain.

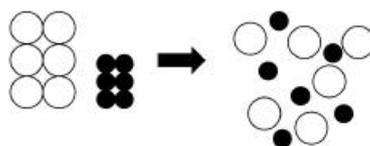
- a. $\text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{O}(g)$
- b. $\text{N}(g) + \text{O}(g) \rightarrow \text{NO}(g)$
- c. $\text{N}_2(g) + 3 \text{H}_2(g) \rightarrow 2 \text{NH}_3(g)$
- d. $\text{C}_8\text{H}_{18}(g) + 25 \text{O}_2(g) \rightarrow 16 \text{CO}_2(g) + 18 \text{H}_2\text{O}(g)$
- e. $\text{CaO}(s) + \text{CO}_2(g) \rightarrow \text{CaCO}_3(s)$
- f. $\text{MgCl}_2(s) + \text{H}_2\text{O}(l) \rightarrow \text{MgO}(s) + 2 \text{HCl}(g)$

- 2) Is the sign for the entropy change associated with the following reactions or physical processes positive or negative?

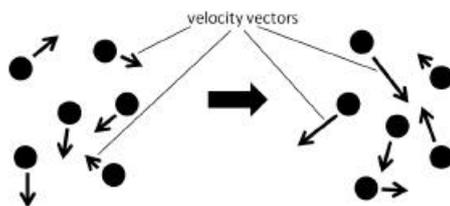
a.



b.



c.



d.



- 3) Which of the representations below depicts the most negative change in entropy? Justify your answer.

I.



II.



- 4) Find the entropy change, ΔS° , for the following reactions using the S° values in the appendix of your textbook.
- $2 \text{H}_2\text{O}(l) \rightarrow 2 \text{H}_2(g) + \text{O}_2(g)$
 - $8 \text{Fe}(s) + 6 \text{O}_2(g) \rightarrow 4 \text{Fe}_2\text{O}_3(s)$
 - $2 \text{CH}_3\text{OH}(g) + 3 \text{O}_2(g) \rightarrow 2 \text{CO}_2(g) + 4 \text{H}_2\text{O}(g)$
 - $2 \text{NiS}(s) + 3 \text{O}_2(g) \rightarrow 2 \text{SO}_2(g) + 2 \text{NiO}(s)$
 - $\text{Al}_2\text{O}_3(s) + 3 \text{H}_2(g) \rightarrow 2 \text{Al}(s) + 3 \text{H}_2\text{O}(g)$
 - $2 \text{CH}_3\text{OH}(g) + 3 \text{O}_2(g) \rightarrow 2 \text{CO}_2(g) + 4 \text{H}_2\text{O}(l)$
 - $2 \text{CO}(g) + 2 \text{NO}(g) \rightarrow 2 \text{CO}_2(g) + \text{N}_2(g)$
- 5) Explain why the reaction in question (4.d.) has a negative ΔS° value whereas the reaction in (4.c.) has a positive ΔS° value.
- 6) The following questions pertain to the dissolving of solid NaCl in water.
- Is the ΔS value for the dissolving of NaCl positive, negative, or zero?
 - Does the entropy increase or decrease during the dissolving process? Justify your answer by describing the changes in entropy that occur during the dissolving process.