

## Guided Notes: Spontaneity & Gibb's Free Energy

Name: \_\_\_\_\_ Period: \_\_\_\_\_

### Spontaneous Reactions

- A chemical reaction that occurs without a \_\_\_\_\_ supply of energy.
  - $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$
- Two things to consider in determining if a reaction will be spontaneous:
  - Entropy (\_\_\_\_\_)
  - Enthalpy (\_\_\_\_\_)
- **Spontaneity \_\_\_\_\_ determine the \_\_\_\_\_!**

### Determining Spontaneity

- If entropy is \_\_\_\_\_, the reaction is likely to be \_\_\_\_\_
- If the reaction is \_\_\_\_\_, the reaction is likely to be \_\_\_\_\_
  - $C_4H_{10}(l) + 9O_2(g) \rightarrow 4CO_2(g) + 10H_2O(g) + \text{heat}$

Spontaneous?      Why?

### Spontaneous?

- $6CO_2(g) + 6H_2O(l) + \text{Energy} \rightarrow C_6H_{12}O_6(s) + 6O_2(g)$
- $H_2O(s) \rightarrow H_2O(l)$ 
  - Depends on what?

	<b><math>-\Delta H_{\text{system}}</math> (exo)</b>	<b><math>+\Delta H_{\text{system}}</math> (endo)</b>
$+\Delta S_{\text{system}}$ (more disorder)		
$-\Delta S_{\text{system}}$ (less disorder)		

### Gibb's Free Energy

- \_\_\_\_\_ determines spontaneity
  - $\Delta G =$  \_\_\_\_\_
    - $\Delta G =$  \_\_\_\_\_
    - $\Delta H =$  \_\_\_\_\_
    - $T =$  \_\_\_\_\_
    - $\Delta S =$  \_\_\_\_\_
- $-\Delta G =$  \_\_\_\_\_
- $+\Delta G =$  \_\_\_\_\_

### Example:

- Ice melting
  - $\Delta H = 6.03 \text{ kJ/mol}$
  - $\Delta S = 22.1 \text{ J/K}\cdot\text{mol}$
- Calculate  $\Delta G$  at  $-10^\circ\text{C}$  and  $10^\circ\text{C}$

- REMEMBER:  $\Delta G$  &  $\Delta H$  are given in kJ  
 $\Delta S$  given in J  
CONVERT!!!!!!!!!!

### Check For Understanding

- Given the following information, determine if the reaction is spontaneous or non-spontaneous.  
 $\Delta H = 365 \text{ kJ}$ ,  $T = 388\text{K}$ ,  $\Delta S = 55.2 \text{ J/K}$