

# Non Sibi High School

Andover's Chem 250: Introductory/Basic Chemistry

## Chapter 14, Review Quiz 1

### 1

Predict the sign of  $\Delta S$  for each process:

- Solid naphthalene dissolves in benzene.
- Bromine vapor condenses.
- $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \longrightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
- Neon gas cools from  $250^\circ\text{C}$  to room temperature.
- Solid arsenic sublimates.

### 2

Predict the sign of  $\Delta S^\circ$  and then calculate  $\Delta S^\circ$  for the reaction  $2\text{H}_2\text{S}(\text{g}) + 3\text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 2\text{SO}_2(\text{g})$  using the following information:

Compound	$S^\circ$ (J/mol · K)
$\text{H}_2\text{O}(\text{l})$	70.
$\text{H}_2\text{S}(\text{g})$	206
$\text{O}_2(\text{g})$	205
$\text{SO}_2(\text{g})$	248

### 3

For a certain reaction at  $135^\circ\text{C}$ ,  $\Delta H = -58 \text{ kJ/mol}$  and  $\Delta S = -185 \text{ J/mol}\cdot\text{K}$ . Calculate  $\Delta G$  for the reaction at  $135^\circ\text{C}$  and determine if the reaction is spontaneous at this temperature.

### 4

Determine whether reactions with the following  $\Delta H$  and  $\Delta S$  values will be spontaneous at all temperatures, nonspontaneous at all temperatures, spontaneous

at high temperatures only, or spontaneous at low temperatures only. Also indicate the driving force for each spontaneous reaction:

- a.  $\Delta H = 82 \text{ kJ/mol}$ ,  $\Delta S = 68 \text{ J/mol}\cdot\text{K}$
- b.  $\Delta H = -326 \text{ kJ/mol}$ ,  $\Delta S = 175 \text{ J/mol}\cdot\text{K}$
- c.  $\Delta H = 592 \text{ kJ/mol}$ ,  $\Delta S = -326 \text{ J/mol}\cdot\text{K}$
- d.  $\Delta H = -97 \text{ kJ/mol}$ ,  $\Delta S = -55 \text{ J/mol}\cdot\text{K}$

## 5

For a reaction with  $\Delta H = -52.6 \text{ kJ/mol}$  and  $\Delta S = -125 \text{ J/mol}\cdot\text{K}$ , estimate the cutoff temperature in  $^{\circ}\text{C}$  at which the reaction changes from spontaneous to nonspontaneous and also specify if the reaction is spontaneous above or below this cutoff temperature.

## 6

Calculate  $\Delta G^{\circ}$  for the reaction  $\text{N}_2\text{H}_4(\text{l}) + 2\text{H}_2\text{O}_2(\text{l}) \rightarrow \text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$  at  $25^{\circ}\text{C}$  using the following information:

Compound	$\Delta G_f^{\circ}$ (kJ/mol) at $25^{\circ}\text{C}$
$\text{H}_2\text{O}(\text{g})$	-228.6
$\text{H}_2\text{O}_2(\text{l})$	-120.4
$\text{N}_2\text{H}_4(\text{l})$	149.3



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