

Name
Delta S

- Entropy (second law of thermodynamics)
 - Students will be able to recognize if entropy is increasing or decreasing as a matter of movement.
 - Students will understand how entropy relates to energy.
 - Students will calculate the actual value of entropy of a chemical process using thermodynamic tables.
 - Students will be able to relate the sign of ΔS and spontaneity.

1. (Brady804) Predict the algebraic sign of ΔS for the reactions:

- a) $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$ —
- b) $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$ +
- c) $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$ +
- d) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{g})$ +
- e) $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$ —
- f) $4\text{Fe}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{Fe}_2\text{O}_3(\text{s})$ —

2. There are multiple ways to calculate ΔS . Using the absolute entropy calculate the net entropy?

$\text{C}_3\text{H}_8 = 269\text{J/molK}$
 $\text{O}_2 = 205\text{J/molK}$
 $\text{CO}_2 = 213\text{J/molK}$
 $\text{H}_2\text{O} = 188\text{J/molK}$

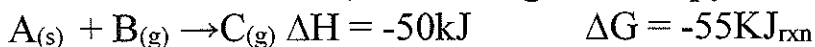
$$\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$$

269	205(5)	213(3)	188(4)
269 + 1025		639	752
1294		1391	

$P-R=\Delta$

$$1391 - 1294 = +97$$

3. Alternate method, for solving for entropy.



a. Using the equation, estimate the sign of entropy change.

all gases +

b. Calculate Entropy using the values above. @25°C

$$\Delta G = \Delta H - T\Delta S$$

$$-55 = -50 - 298(\Delta S)$$

$$x = +0.016 \text{ kJ/molK}$$

c. How does temperature have to change to make this reaction non-spontaneous?

-ΔG at all temps

$$\Delta G = \Delta H - T\Delta S$$

- - +