

Thermochemistry: Entropy Worksheet

1. Are the following processes spontaneous?

_____ (a) the melting of ice cubes at -5°C and 1 atm of pressure

_____ (b) dissolving of sugar in a cup of hot coffee

_____ (c) formation of CH_4 and O_2 molecules from CO_2 and H_2O at 298 K and 1 atm

2. How does the entropy of the system change (increase or decrease) when each of the following occurs?

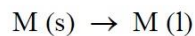
_____ (a) a liquid vaporizes

_____ (c) a gas liquefies

_____ (b) a solid melts

_____ (d) a solid dissolves in water

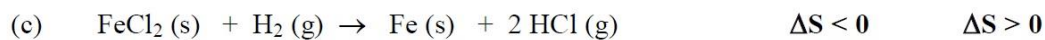
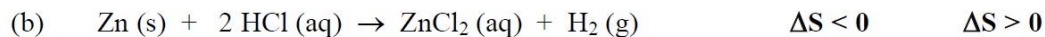
3. Which process (melting or vaporization) shown below would be expected to show the larger increase in entropy? Explain.



4. What do you expect for the sign of ΔS if two moles of gaseous reactants are converted into three moles of gaseous products?

5. In a certain chemical reaction, two gases combine to form a solid product. What is the sign of ΔS ?

6. **Without** using a reference sheet of thermochemical values, predict the sign of the entropy change of the system for each of the following reactions.



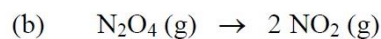
Key Formula: $\Delta S^{\circ}_{\text{rxn}} = \Sigma S^{\circ}(\text{Products}) - \Sigma S^{\circ}(\text{Reactants})$

7. Use the chart of S° values to calculate ΔS° values for the following reactions.



$\Delta S^{\circ} =$

Does the sign make sense? Why?



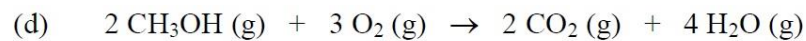
$\Delta S^{\circ} =$

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Does the sign makes sense? Why?



$\Delta S^{\circ} =$

Does the sign makes sense? Why?

| S values | Joules/Kelvin-mole |
|-----------------------------------|--------------------|
| Al (s) | 28.32 |
| AlCl ₃ (s) | 109.29 |
| Be(OH) ₂ (s) | 47 |
| C ₂ H ₄ (g) | 185 |
| C ₂ H ₆ (g) | 229.5 |
| CH ₃ OH (g) | 240 |
| CO ₂ (g) | 214 |
| Cl ₂ (g) | 222.957 |
| H ₂ (g) | 131 |
| H ₂ O (g) | 189 |
| N ₂ O ₄ (g) | 304 |
| NO ₂ (g) | 240 |
| O ₂ (g) | 205 |