

AP Chemistry – Spontaneous Entropy – 32

Name _____ Per _____

1. Which of the following processes are spontaneous:
 - (a) Spreading of the fragrance of perfume through a room.
 - (b) Separating a mixture of N_2 and O_2 into two separate samples, pure N_2 and pure O_2 .
 - (c) The bursting of an inflated balloon.
 - (d) The reaction of sodium metal with chlorine gas to form sodium chloride.
 - (e) The dissolution of HCl in water to form concentrated hydrochloric acid
2. The *normal* (at 1 atm) freezing point of 1-propanol, C_3H_8O is $-127^\circ C$.
 - (a) Is the freezing of 1-propanol an endothermic or exothermic process?
 - (b) In what temperature range is the freezing of 1-propanol a spontaneous process?
 - (c) In what temperature range is the freezing of 1-propanol not spontaneous?
 - (d) Is there any temperature at which liquid and solid 1-propanol are in equilibrium?
3. A sample of TNT is detonated.
 - (a) Is the explosion of the sample a spontaneous process?
 - (b) What is the sign of q for this process?
 - (c) What is the sign of w for this process?
 - (d) What is the sign of ΔE for this process?
4. A liquid freezes.
 - (a) What has happened to the entropy of the system?
 - (b) What is the sign of ΔS for this process?
 - (c) Is entropy a state function? Explain.
5. For which of the processes in question 1 does the entropy of the system increase?
6. In a chemical reaction, two gases combine to form a solid. What is the sign of ΔS ?

7. Why is the increase in entropy of the system greater for the vaporization of a substance than for its melting?

8. The element Cs freezes at 28.4°C and its molar enthalpy of fusion is $\Delta H_{\text{fus}} = 2.09 \text{ kJ/mole}$.

(a) When molten cesium solidifies at its normal melting point, is ΔS positive or negative?

(b) Calculate the value of ΔS when 15.0 g of Cs solidifies at 28.4°C .

9. For each of the following pairs, circle the substance that possesses the larger standard entropy. Explain for each case.

(a) 1 mole of $\text{P}_{4(\text{g})}$ at 300°C , 0.01 atm or 1 mole of $\text{As}_{4(\text{g})}$ at 300°C , 0.01 atm

(b) 1 mole of $\text{H}_2\text{O}_{(\text{g})}$ at 100°C , 1 atm or 1 mole of $\text{H}_2\text{O}_{(\text{l})}$ at 100°C , 1 atm

(c) 0.5 moles of $\text{N}_{2(\text{g})}$ at 298 K, 20 L or 0.5 moles $\text{CH}_{4(\text{g})}$ at 298 K, 20 L

(d) 100g $\text{Na}_2\text{SO}_{4(\text{s})}$ at 30°C or 100 g $\text{Na}_2\text{SO}_{4(\text{aq})}$ at 30°C

10. Predict the sign of ΔS_{sys} for each of the following processes:

(a) molten Fe solidifies

(b) $\text{LiCl}_{(\text{s})}$ is formed from $\text{Li}_{(\text{s})}$ and $\text{Cl}_{2(\text{g})}$

(c) zinc metal dissolves in hydrochloric acid

(d) silver bromide precipitates upon mixing $\text{AgNO}_{3(\text{aq})}$ and $\text{KBr}_{(\text{aq})}$