1. Write =, <, >, or X (for cannot be determined). Formaldehyde is CH_2O

Compound	Melting Point	Boiling Point
Formaldehyde	181 K	254 K
Boron tribromide	227 K	364 K

   (a) ΔS_{CH_2O} heating 0 K→150 K ____________ ΔS_{BBr_3} heating 0 K→ 150 K

   (b) ΔS_{BBr_3} heating 350 K→375 K ____________ ΔS_{BBr_3} heating 375 K→ 400 K

   (c) $\Delta S_{CH_2O,\,melt}$ ____________ $\Delta S_{CH_2O,\,vap}$

   (d) ΔS_{CH_2O} heating 375 K→ 400 K ____________ ΔS_{BBr_3} heating 400 K→ 425 K

2. Two ideal gases, gas A (n_A, V_A) and gas B (n_B, V_B), are mixed in a isolated container. Initially, gas A is confined to the left half of the container, and gas B occupies the right half. The two gases are at the same temperature and pressure.

   (a) Calculate the total entropy change ΔS_{mix} for the process of mixing the two ideal gases.

   (b) Rewrite the entropy using mol fractions $X_A = \frac{n_A}{n_A+n_B}$ and $X_B = \frac{n_B}{n_A+n_B}$.

   (c) Draw a conclusion about the sign of ΔS.

3. Consider a system of 6 distinguishable particles with total energy 12. The accessible single particle energy levels are: $E = 1, 3, 5, 7$

   (a) List all possible macrostates for this system.

   (b) For each macrostate, determine the number of microstates W

   (c) Determine the residual entropy for this system, no longer subject to the energy constraint.

   (d) Now suppose each energy level is 2-fold degenerate. How would your answers change?

Homework Problem 18

1. Consider a system of 8 distinguishable particles with total energy 12. The accessible single particle energy levels are: $E = 0, 1, 4, 9$
   (a) List all possible macrostates.

   (b) For each macrostate, determine the number of microstates W, then determine the most probable microstate and its associated probability.