1. What is the increase in entropy if one gram of ice at $0^\circ C$ is melted and heated to $50^\circ C$?

2. Find the change in entropy if 500 g of water at $80^\circ C$ is added to 300 g of water at $20^\circ C$. (None of the heat is lost from the system.)

3. Consider a mole of a gas initially at 1 ≡ ($P_1, V_1$) and finally at 2 ≡ ($P_2, V_2$). Since $S_2 - S_1$ is path independent, choose the simple path shown in Figure (1) by first changing pressure at constant volume and then volume at constant pressure. Let $0 = (P_0, T_0)$ be the intermediate point you go through. Show that

$$S_2 - S_1 = C_P \ln \left( \frac{T_2}{T_1} \right) - R \ln \left( \frac{P_2}{P_1} \right).$$

Show that if 1 and 2 lie on an adiabatic curve, this difference vanishes. Assume $C_p = C_V + R$, but not a particular value to $C_V$.

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**FIG. 1:** To compute entropy difference $S_2 - S_1$ go from 1 to 0 at constant volume and then from 0 to 2 at constant pressure.