Calculate the entropy change for 2 mole of ice. Freezing point of water is 273 K and molar enthalpy of fusion is 6 kJ/mol.

Solution: We will assume that water was at the STP before the freezing. Then, only the crystallization process occurred. Change of entropy in phase transition process, which occurs at constant temperature T_{ft} is: $\Delta S_{ft} = \frac{\Delta Q_{ft}}{T_{ft}} = n \cdot \frac{\Delta H_{ft}}{T_{ft}}$, where n is the amount of substance, mol, and ΔH_{ft} is the molar latent heat of phase transition, J/mol.

Then, $\Delta S_{cryst} = -n \cdot \frac{\Delta H_{fus}}{T_{cryst}} = -2 \cdot \frac{6000}{273} = -43.96 \ \frac{\text{J}}{\text{K}}$; minus sign occurs because the heat of crystallization is released; it means that in this process entropy decreases. Entropy characterizes the degree of disorder in the system; when the crystallization occurs, water molecules are ordered in the crystalline structure of ice, degree of disorder of the water molecules decreases and entropy decreases too.

Answer: –43.96 J/K.