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Determine the change in entropy that occurs when 3.1 kg of water freezes at 0°C .

$$\Delta S = \frac{Q}{T}$$

$$Q = mL_f$$

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$$= \frac{3.1 \text{ kg} \left(33.5 \times 10^4 \frac{\text{J}}{\text{kg}} \right)}{273 \text{ K}}$$

$$= \boxed{5.10 \frac{\text{J}}{\text{K}}}$$

66 An 82 kg parachutist descends through a vertical height of 350m with constant speed. Find the increase in entropy if the air temperature is 21°C

$$\Delta S = \frac{Q}{T} \qquad 21^\circ\text{C} = 294\text{K}$$



$$F_{\text{drag}} \, d_{\text{fall}} = E_{\text{dissipated}}$$

$$F_{\text{net}} = 0 = F_{\text{drag}} + F_g$$

$$|F_{\text{drag}}| = |F_g|$$

$$\begin{aligned} E_{\text{diss}} &= mgd = (82\text{kg})(9.81\text{m/s}^2) 350\text{m} \\ &= 2.82 \text{E} 5\text{J} \end{aligned}$$

$$\Delta S = \frac{2.82 \text{E} 5\text{J}}{294\text{K}} = 9.59 \text{E} 2 \frac{\text{J}}{\text{K}} \quad \boxed{960 \frac{\text{J}}{\text{K}}}$$