Answer on Question 59904, Physics, Molecular Physics, Thermodynamics

Question:

904.5 g of ice is melted at a temperature of 29°F. Find the change in entropy. Answer in units of J/K.

Solution:

First of all, let's convert Fahrenheit to Kelvin:

$$T_{(K)} = \left(T_{(°F)} + 459.67\right) \cdot \frac{5}{9} = (29°\text{F} + 459.67) \cdot \frac{5}{9} = 271.5\ K.$$

We can find the change in entropy from the formula:

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

here, Q is the amount of heat needed to melt the ice, T is the temperature.

Let's find the amount of heat needed to melt the ice:

$$Q = m_{ice} L_f,$$

here, m_{ice} is the mass of ice, $L_f = 3.33 \cdot 10^5\ J/kg$ is the latent heat of fusion of ice.

Finally, we can calculate the change in entropy:

$$\Delta S = \frac{Q}{T} = \frac{m_{ice} L_f}{T} = \frac{0.9045\ kg \cdot 3.33 \cdot 10^5\ \frac{J}{kg}}{271.5\ K} = 1109.4\ \frac{J}{K}.$$

Answer:

$\Delta S = 1109.4\ \frac{J}{K}$.