Answer on Question #67518- Physics / Mechanics / Relativity

9/ A 2.0 mol sample of an ideal monatomic gas undergoes a reversible process at constant volume, increasing its temperature from 400 K to 600 K. What is the entropy change of the gas?

Solution:

Entropy of ideal gas

$$S(T_1V) = \nu(C_v \ln T + R \ln V + S_0)$$

Thus, change of entropy

$$\Delta S = \nu C_v \ln\frac{T_1}{T_2} = 2\times\frac{3}{2}\times 8.3\times\ln\frac{600}{400} = 4.38\ \frac{\text{J}}{\text{K}}.$$

Answer: $\Delta S = 4.38\ \frac{\text{J}}{\text{K}}$.

10/ Calculate the change in entropy of gases in the following cases:
a) A 3.0 mol sample of an ideal gas expands reversibly and isothermally at 350 K until its volume doubled.
b) The temperature of 1.0 mol of an ideal monatomic gas is raised reversibly from 200 K to 300 K, with its volume kept constant.

Solution:

Entropy of ideal gas

$$S(T_1V) = \nu(C_v \ln T + R \ln V + S_0)$$

A)

$$\Delta S = \nu R \ln\frac{V_1}{V_2} = 3\times 8.3\times\ln 2 = 3.74\ \frac{\text{J}}{\text{K}}.$$

B)

$$\Delta S = \nu C_v \ln\frac{T_1}{T_2} = 1\times\frac{3}{2}\times 8.3\times\ln\frac{300}{200} = 2.19\frac{\text{J}}{\text{K}}.$$

Answer: $\Delta S = 3.74\ \frac{\text{J}}{\text{K}}, \Delta S = 2.19\frac{\text{J}}{\text{K}}$.