Answer on Question #66525-Physics-Molecular Physics-Thermodynamics

One mole of an ideal gas expands isothermally to five times its initial volume.

Calculate the entropy change in terms of R, the gas constant.

Solution

The entropy change is

$$\Delta S = S_2 - S_1 = \int_{V_1}^{V_2} \frac{\delta Q}{T}$$

$$\delta Q = pdV + dU.$$

For one mole of an ideal gas:

$$p = \frac{RT}{V}.$$

$dU = 0$ for isotheral process.

Thus,

$$\Delta S = \frac{1}{T} \int_{V_1}^{V_2} pdV = \frac{1}{T} \int_{V_1}^{V_2} \frac{RT}{V} dV = R \int_{V_1}^{V_2} \frac{1}{V} dV = R \ln \frac{V_2}{V_1}$$

The entropy change in terms of R is

$$\Delta S = R \ln 5$$

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