Answer on Question #66527-Physics-Molecular Physics-Thermodynamics

Derive an expression for the work done by a gaseous system for an isothermal expansion of an ideal gas.

Solution

The equation of state for ideal gas:

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

Thus,

$$W = \int\limits_{V_1}^{V_2} p\,dV = \int\limits_{V_1}^{V_2} \frac{vRT}{V}\,dV = vRT \int\limits_{V_1}^{V_2} \frac{1}{V}\,dV = vRT \ln\frac{V_2}{V_1}$$

An expression for the work done by a gaseous system for an isothermal expansion of an ideal gas is

$$W = vRT \ln\frac{V_2}{V_1} = p_1 V_1 \ln\frac{V_2}{V_1}$$