

Answer on Question #45070, Physics, Molecular Physics — Thermodynamics

one litre of nitrogen at 15 degree celsius and 10^6 Pa expands isothermally until its volume is doubled and then adiabatically until it is redoubled. find the final pressure of gas.

Solution

Pressure after the isothermal expansion

$$p_0 V_0 = p_1 V_1$$

$$p_1 = \frac{V_0}{V_1} p_0 = \frac{1}{2} p_0$$

Pressure after adiabatic expansion

$$p_2 V_2^\gamma = p_1 V_1^\gamma$$

$$p_2 = p_1 \frac{V_1^\gamma}{V_2^\gamma}, \quad \gamma = 7/3$$

$$p_2 = p_1 \frac{1}{2^{7/3}} = p_0 \cdot \frac{1}{2} \cdot \frac{1}{2^{7/3}} \approx 0.1 p_0 = 10^5 \text{ Pa}$$