

Answer Question #67519 – Physics – Mechanics

An ideal gas ($\gamma = 1.40$) expands slowly and adiabatically. If the final temperature is one third the initial temperature, by what factor does the volume change?

Solution. To describe the adiabatic process we use equation $TV^{\gamma-1} = \text{const}$. Let T_0, V_0 – the initial temperature and volume of an ideal gas and T_f, V_f – the final temperature and volume of an ideal gas. Therefore $T_0V_0^{\gamma-1} = T_fV_f^{\gamma-1}$.

According to the condition of the problem $\frac{T_0}{T_f} = 3$. Hence $\left(\frac{V_f}{V_0}\right)^{\gamma-1} = \frac{T_0}{T_f} = 3 \rightarrow \frac{V_f}{V_0} = 3^{\frac{1}{\gamma-1}} \approx 15.6$

Answer. 15.6

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