

Question 24595

Equation of adiabatic process is $T V^{k-1} = \text{const}$, where k is constant, which depends on type of gas.

By definition $k = \frac{C_p}{C_v}$, where C_p is heat capacity for constant pressure and C_v is heat capacity for constant volume. k might be expressed in terms of number of degrees of freedom s : $k = \frac{s+2}{s}$. For diatomic gas, s is equal to 5, hence $k = 7/5$.

$$\text{Hence, } T_1 V_1^{\frac{2}{5}} = T_2 \cdot 2^{\frac{2}{5}} V_1^{\frac{2}{5}} \Rightarrow T_2 = \frac{T_1}{2^{\frac{2}{5}}} \approx 30.31 \text{ deg}.$$