# Piston cylinder

**A piston cylinder device contains an ideal gas. The gas undergoes two successive cooling processes by rejecting heat to the surroundings. First the gas is cooled at constant pressure until $T_2 = \frac{3}{4}T_1$. Then the piston is held stationary while the gas is further cooled to $T_3 = \frac{1}{2}T_1$,where all temperatures are in K. The ratio of the final volume to the initial volume of the gas is:**

Answer: 0.75.

Explanation: First, it should be noted that there is no change in volume between the $2^{nd}$ and the $3^{rd}$ state since the piston is held stationary. Therefore, $\frac{V_2}{V_1} = \frac{V_3}{V_1}$ holds.
Because process 1-2 has a constant volume, the following equation holds:

$$\frac{V_2}{V_1} = \frac{T_2}{T_1} = \frac{\frac{3}{4}T_1}{T_1}$$

So, the ratio of the final volume to the initial volume is:

$$\frac{V_3}{V_1} = 0.75$$