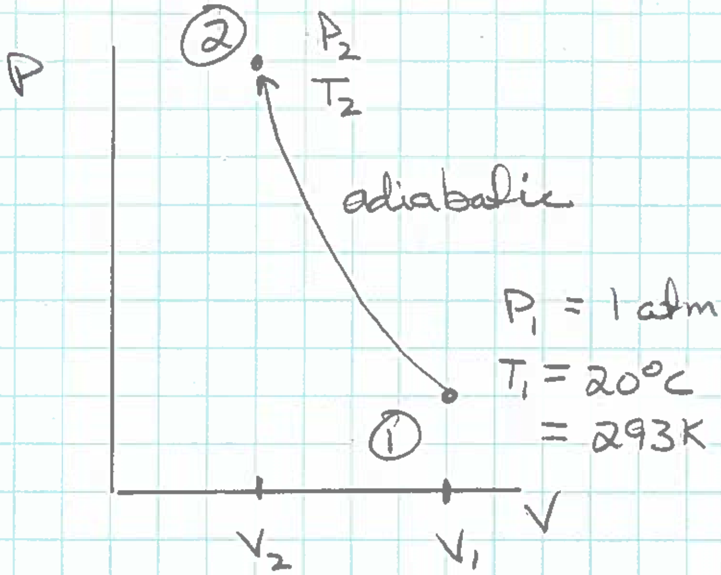
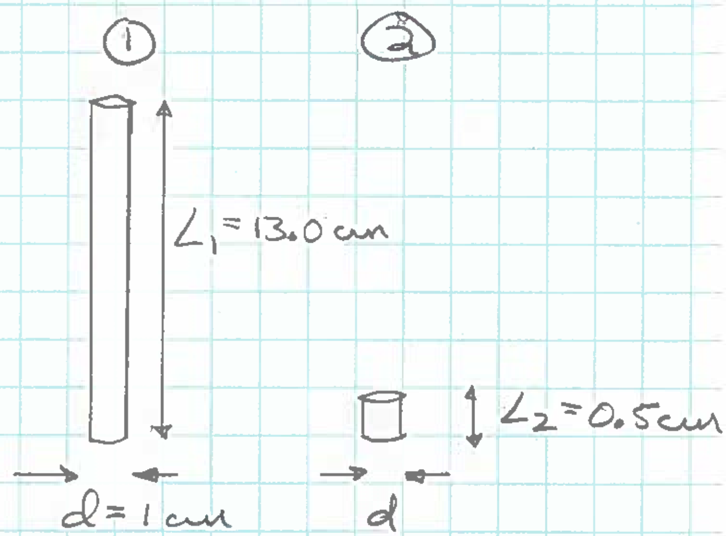


Gas Cylinder



for air $\gamma = 1.4$

NOTE: $V_1 = \pi\left(\frac{d}{2}\right)^2 L_1$ & $V_2 = \pi\left(\frac{d}{2}\right)^2 L_2$

a.) find P_2: PV^γ = constant

So: $P_1 V_1^\gamma = P_2 V_2^\gamma$

$$P_2 = P_1\left(\frac{V_1}{V_2}\right)^\gamma = P_1\left(\frac{L_1}{L_2}\right)^\gamma = 95.7 \text{ atm}$$

b.) find T_2: Three ways to do this:

#1) Calculate all known quantities in MKS units. Use T_1, P_1 and V_1 to find n. Then use IGL at ② to find T_2.

— lots of busy calculations!

#2) Work with ratios:

$$PV = nRT \Rightarrow \frac{PV}{T} = nR = \text{constant}$$

So:

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \Rightarrow T_2 = T_1\left(\frac{P_2}{P_1}\right)\left(\frac{V_2}{V_1}\right)$$

$$= T_1\left(\frac{95.7\,atm}{1\,atm}\right)\left(\frac{L_2}{L_1}\right)$$

$$= 1078\,K$$

#3) The best way:

Adiabitic $\Rightarrow$ PV^{γ} = constant

and IGL $\Rightarrow$ $PV = nRT \Rightarrow P = \frac{nRT}{V}$

So, adiabitic condition is:

$$PV^{\gamma} = \left(\frac{nRT}{V}\right)V^{\gamma} = \text{const}$$

or, $TV^{\gamma-1}$ = constant

- an alternate statement of the adiabatic condition.

So: $T_1V_1^{\gamma-1} = T_2V_2^{\gamma-1}$

$$T_2 = T_1\left(\frac{V_1}{V_2}\right)^{\gamma-1} = T_1\left(\frac{L_1}{L_2}\right)^{\gamma-1}$$

$$T_2 = 1078\,K = 806\,°C$$