CW2HWST-5)

For a monatomic gas, gamma is 5/3. We know that for an adiabatic process (for gases), $PV^{\gamma}=C$.

A)

$$\mathrm{V_f} = \frac{1}{3}\mathrm{V_i} = \frac{1}{3}0.06 = 0.02\ \mathrm{m}^3$$

B)

$$P_f V_f^{\gamma} = P_i V_i^{\gamma} \quad \rightarrow \quad P_f = \frac{P_i V_i^{\gamma}}{V_f^{\gamma}} = P_i\left(\frac{V_i}{V_f}\right)^{\gamma} = 3\left(\frac{0.06}{0.02}\right)^{1.67} = 18.79\ atm$$

C)

We already worked out a formula for this. Since we want an answer in joules, we need to put the pressure in pascals.

$$W = \frac{P_i\, V_i}{\gamma - 1}\left(1 - \left(\frac{V_i}{V_f}\right)^{\gamma-1}\right) = \frac{(3 \times 1.01 \times 10^5)(0.06)}{\frac{5}{3}-1}\left(1 - \left(\frac{0.06}{0.02}\right)^{\frac{5}{3}-1}\right) = -29{,}038\ \mathrm{J}$$

D)

Use the ideal gas law:

$$\frac{P_f V_f}{nT_f} = \frac{P_i V_i}{nT_i} \quad \rightarrow \quad T_f = \frac{P_f V_f}{P_i V_i} T_i = \frac{(18.79)(0.02)}{(3)(0.06)} T_i = 2.08\, T_i$$