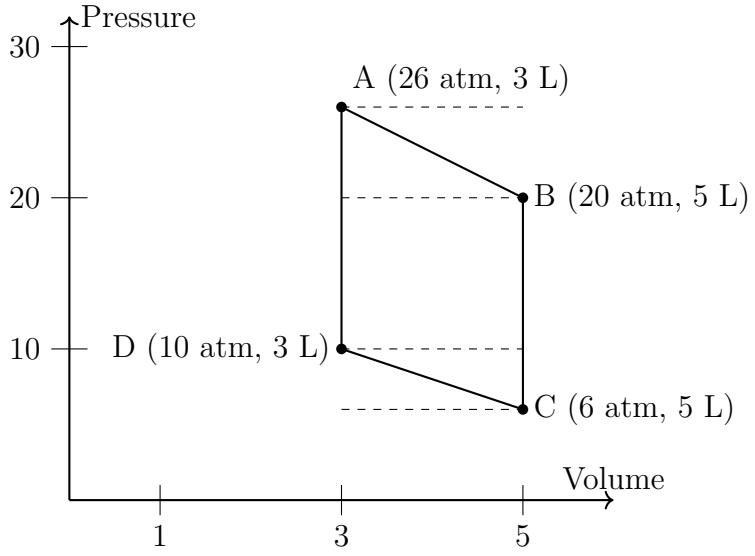
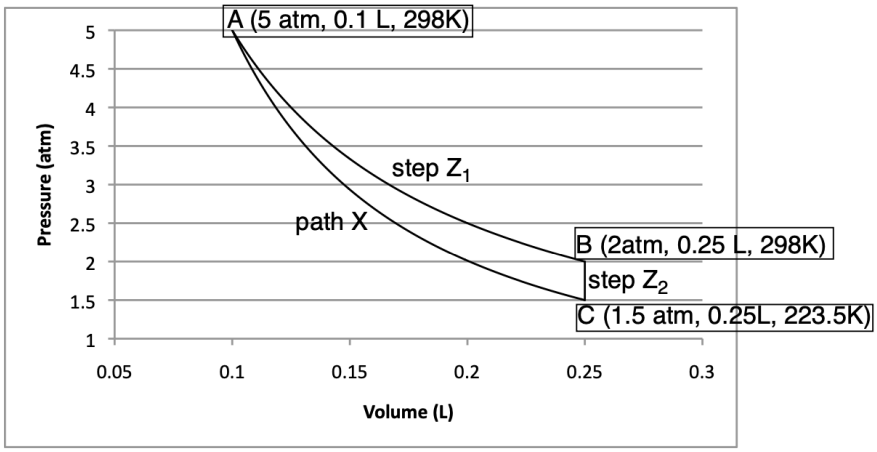
1. Find the work and heat associated with the closed cycle $D \to C \to B \to A \to D$.

   Hint: Use the dashed lines to help think about this problem.



2. The graph below shows 0.02 moles of a linear diatomic gas undergoing expansion from point $A(5\,\text{atm}, 0.1\,\text{L}, 298\,\text{K})$ to point $C(1.5\,\text{atm}, 0.25\,\text{L}, 223.5\,\text{K})$ via two different pathways.



(a) The first pathway consists of two steps: Step 1 (Z_1) is a reversible isothermal expansion from A to B, followed by Step 2 (Z_2), in which the gas is cooled from B to C.

(b) The second pathway (X) is a direct adiabatic expansion from A to C.

What are the values of $\Delta U, w, q$ for Step Z_1, Step Z_2, and Path X? Express your answer in Joules.

Homework Problem 13

1. One mole of a monoatomic ideal gas is stored in a 5 L container at $P = 10$ bar and $T = 601$ K. Find $\Delta U, q, w$ for each of the following steps. Express your answer in Joules.
   (a) Reversible Isothermal Expansion to 25 L

   (b) Reversible Adiabatic Compression to 5 L, 29.2 bar

   (c) Reversible Isochoric Cooling to initial conditions