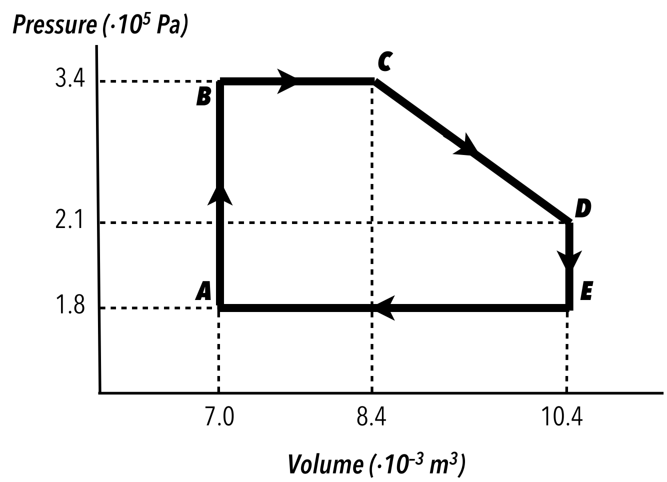
Name_____________________________Pd________

From PV Diagrams—With Love…

You create a soup-can piston steam engine (with 3 moles of ideal gas inside) that goes through the following processes shown on the following PV diagram:



Point	Temp (K)
A	50.5
B	95.4
C	114.5
D	87.6
E	75

Compute the temperatures (in Kelvins) for each labeled endpoint of the processes shown.

Fill out the following chart with the heat input, the work output, and the change in internal energy for each process and for the complete cycle:

Process	Heat IN (J)	Work OUT (J)	Δ Internal Energy (J)
A → B	1680	0	1680
B → C	1190.6	476	714.6
C → D	−456.4	550	−1006.4
D → E	−471.4	0	−471.4
E → A	−1528.6	−612	−916.6
Net for Cycle	≈414 (414.2)	414	≈0 (-0.2)

What is true about the ΔU for the entire cycle?

ΔU = 0 for a cycle; the gas starts and ends at the same point with the same temperature, so ΔT is 0.

What is the maximum theoretical efficiency of the engine?

Carnot efficiency = $1-T_L/T_H$ = 1−(50.5/114.5), so ε = 55.9%

What's the true efficiency for process C → D?

True efficiency = W_{out}/Q_{in} = 550/-456.4, so ε = −121% (Which goes to show why we only talk about true efficiencies for whole cycles.)

What's the Carnot efficiency for process C → D?

Carnot efficiency = $1-T_L/T_H$ = 1−(87.6/114.5), so ε = 23.5% (How does this show that Carnot efficiencies only work well for cycles?)