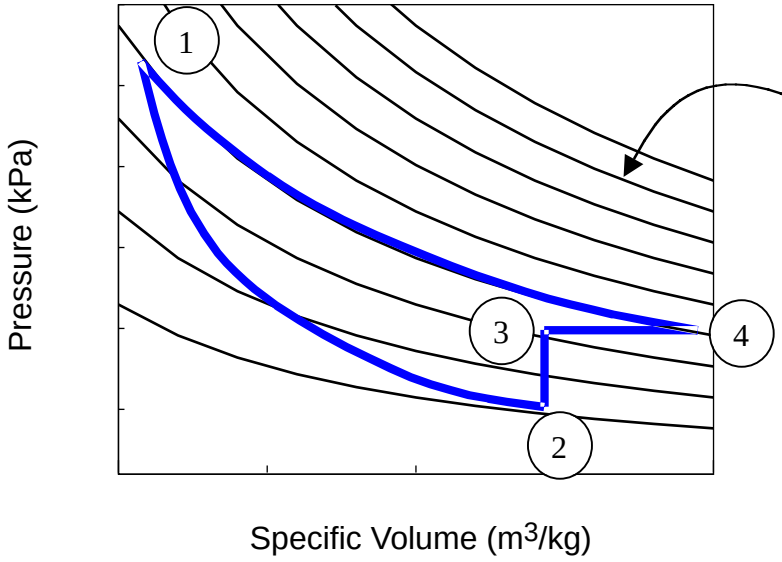
T5 SOLUTIONS (Waitz)

a) Draw a thermodynamic cycle on p-v and T- v diagrams consisting of

Leg 1-2: adiabatic expansion
Leg 2-3: constant volume heat addition
Leg 3-4: constant pressure expansion
Leg 4-1: isothermal compression

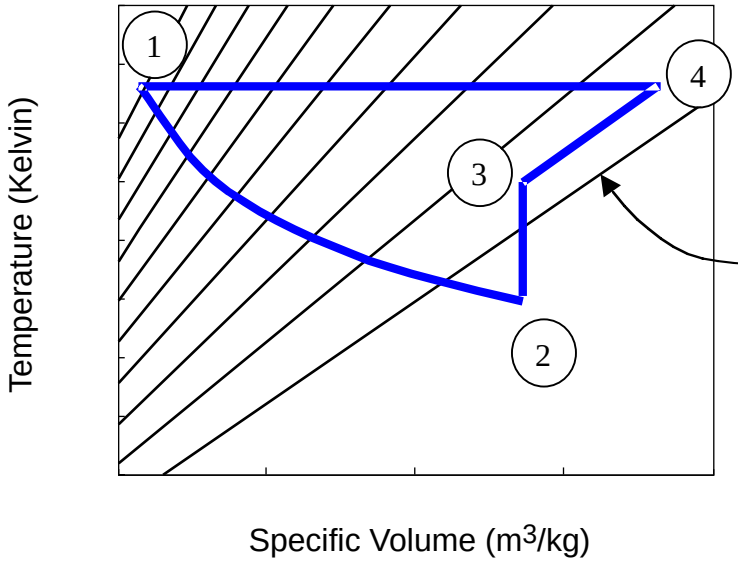
Assume that all processes are quasi-static and involve an ideal gas.



lines of constant temperature

For 1-2, pv^{γ}=constant

adiabat is steeper than pv=constant (an isotherm)



lines of constant pressure

For 1-2, $Tv^{\gamma-1}$=constant

a curved line much like the adiabat on a p-v diagram but it would be shallower

b) For each leg determine if the heat and work transfers are (+), (-), or zero.

	Q (+, -, or zero)	W (+, -, or zero)
Leg 1-2	0	+
Leg 2-3	+	0
Leg 3-4	+	+
Leg 4-1	-	-

c) Is the net work for this cycle positive or negative?

The net work for this cycle is negative The area under the expansion process is less than the area under the compression processes.

d) What common purpose might you use a cycle like this for and why?

This cycle could serve as a cooler or refrigerator. Overall it takes in energy in the form of heat from cold temperatures and expels energy in the form of heat from high temperatures. The net work for the cycle as a whole is negative, meaning that energy is put into the system to enable these transfers of heat to take place.