SP22a—Due by 4:30 pm EST on Friday 10 March to your division Gradescope site

A heat pump cycle has 20 bar NH\textsubscript{3} saturated vapor enter the condenser and saturated liquid exit. The evaporator operates at 5 bar; two-phase mixtures enter and exit. Compute the coefficient of performance if all the processes are reversible. What is the condenser specific heat transfer[kJ/kg]?

SP-22b- Due by 4:30 pm EST on Friday 10 March to your division Gradescope site

A Carnot vapor power cycle uses water as its working fluid. The boiler pressure is 150 bar; saturated liquid enters and saturated vapor exits. The condenser pressure is 0.1 bar, with 2-phase mixtures entering and exiting. Calculate the thermal efficiency. What is the specific heat transfer for water passing through the boiler[kJ/kg]?
In a real heat pump, the condenser temperature is not constant because a superheated vapor enters. This renders the Carnot expression inaccurate.

Be that as it may, the Carnot expression will still serve as an upper bound on the cycle thermal efficiency, as long as we can find an effective upper T. We’ll do that by choosing that effective T to lie between that of the condenser outlet and condenser inlet. **Choose a value and use it to compute the coefficient of performance using the Carnot expression.** Use NH₃ as the working fluid with an evaporator temperature corresponding to 5 bar. The condenser exit temperature corresponds to 20 bar. The compressor exit temperature is 10°C above the condenser exit temperature.
Return to SP22a. Calculate the entropy for each of the four states. Which component has the largest entropy increase? Are they all positive? If not, does this concern you? Why or why not?