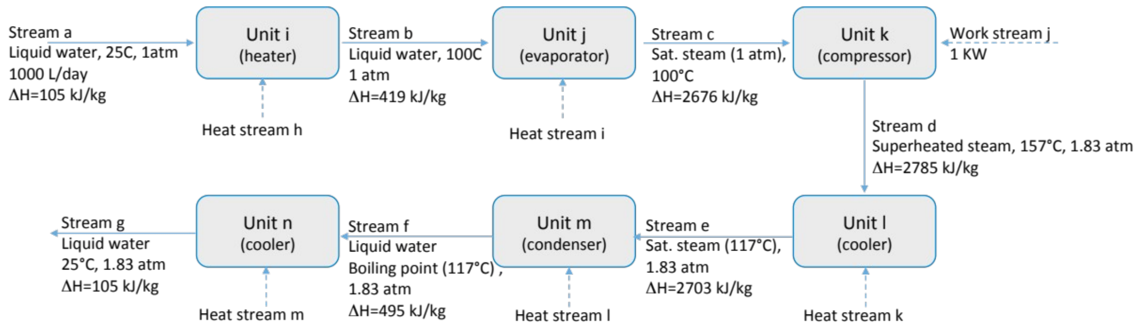
ChE-304 Problem Set 7

Week 8

Problem 1

Below, the flowsheet of the slingshot process is shown with values for enthalpy.



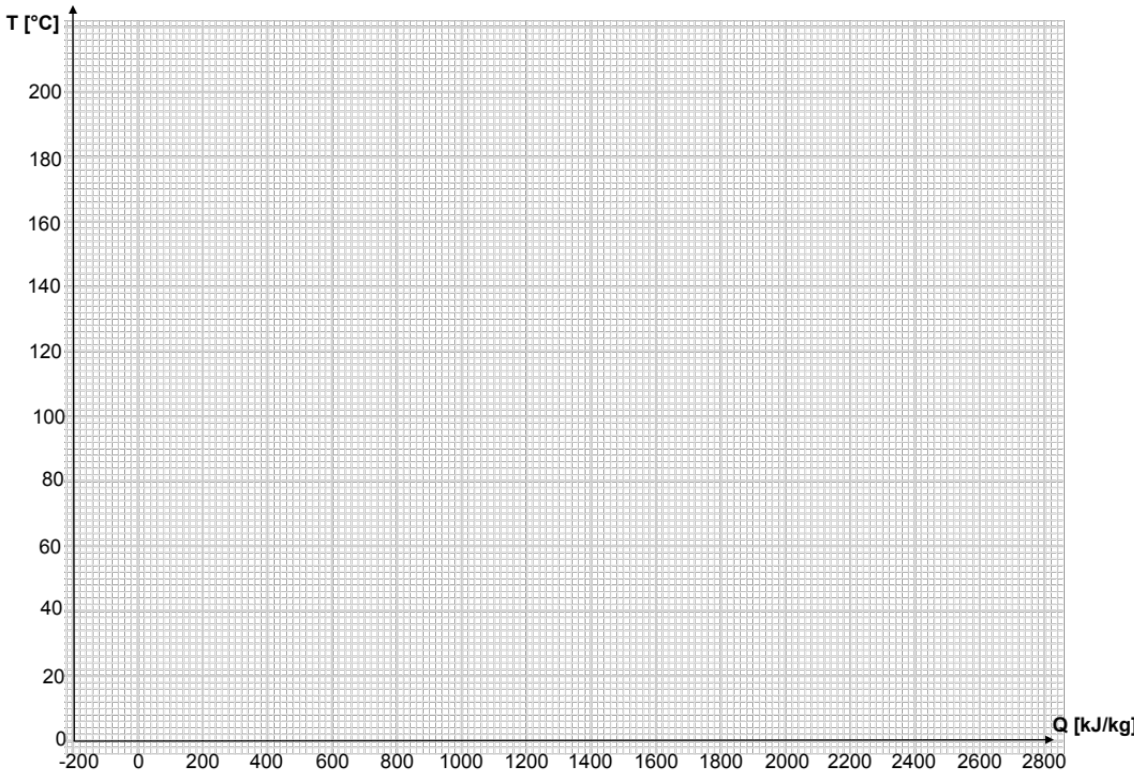
Note: These enthalpies are based on an enthalpy of zero for liquid water at 0°C, which makes the numbers manageable. If you want to use numbers corresponding to last week's problem set, you need to add -15'880 kJ/kg to the numbers above.

Can you draw hot and cold composite curves for this process?

What is the minimum approach temperature (assuming no hot utility is provided)? Is this reasonable?

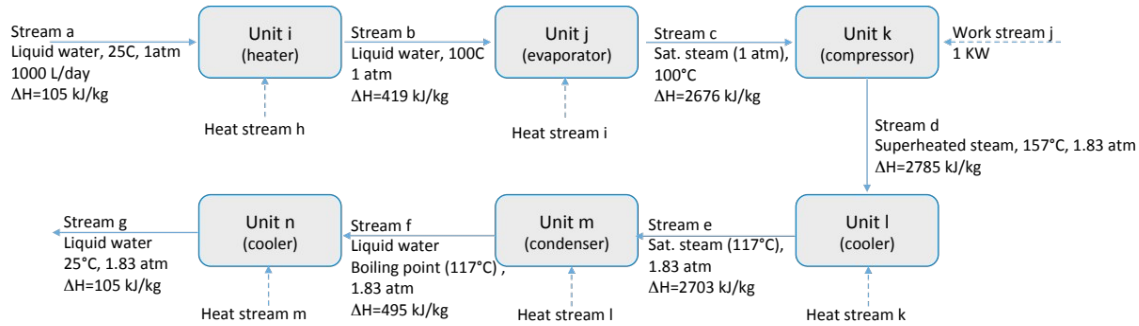
At what temperature would the liquid exit the process (temperature of stream g) if the slingshot was to be completely autonomous (no hot or cold utility)?

A grid is included to help you draw the composite curves.


T [°C]
200
180
160
140
120
100
80
60
40
20
0
Q [kJ/kg]
-200
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800

Problem 2

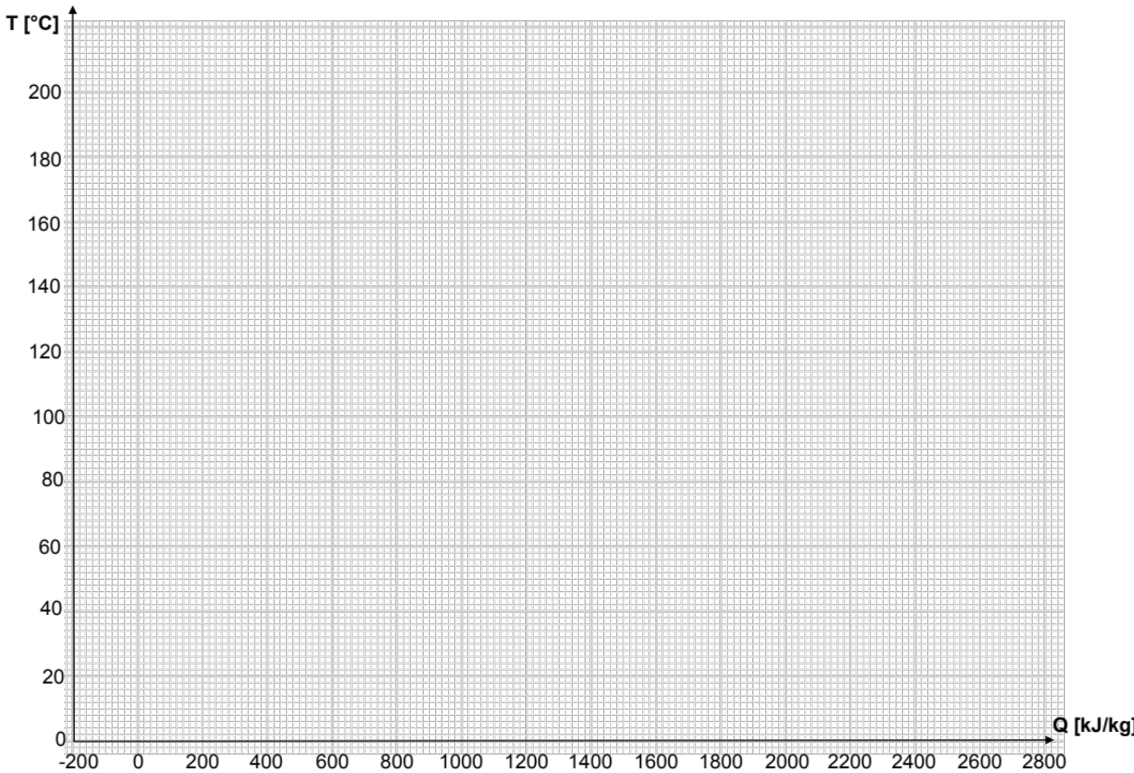
Again, we begin with our process.



Note: These enthalpies are based on an enthalpy of zero for liquid water at 0°C, which makes the numbers manageable. If you want to use numbers corresponding to last week's problem set, you need to add -15'880 kJ/kg to the numbers above.

Perform a heat cascade calculation. Specifically, calculate the Ts, Ts', $T_{\int ¿¿}$ and GCC matrices (see pages 31 and 32 in the notes). From the GCC matrix can you sketch the grand composite curve?

Note: Because there is excess heat in this process, the initially constructed grand composite curve will be above zero and will not require the usual translation to set the pinch point at zero.


T [°C]
200
180
160
140
120
100
80
60
40
20
0
Q [kJ/kg]
-200
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800

Problem 3

Can you use your calculations for the grand composite curve in problem 3 to calculate the exact temperature at which the water should exit in order to have no cooling requirement (in a more exact way than the graphical method employed in Problem 1).