Problem 3.34: a) Water at 1 bar, 20 °C is heated at const P to produce steam with quality 95%. What is the amount of heat?
b) Steam at 1 bar 400 °C is cooled by removing 300 kJ/kg of heat at constant pressure. What is the final temperature? If the state is a vapor-liquid mixture, report the mass fraction in each phase.

Problem 3.35: Water at 20 °C 30 bar is heated in a closed system under constant pressure.
a) If the quality in the final state is 75%, what is the amount of heat?
b) If the amount of heat is 2000 kJ/kg, what is the final temperature?
c) If the amount of heat is 3000 kJ/kg, what is the final temperature?

Problem 3.36: An insulated tank is divided into two equal parts. Both halves contain the same ideal gas but one is at 300 K and 2 bar while the other one is at 400 K and 1 bar. The partition is suddenly removed and the system is allowed to reach equilibrium. What is the temperature and pressure when equilibrium has been established?
Additional data: The heat capacities of this ideal gas may be assumed to be constant in the temperature range of this problem.

Problem 3.37: At 120 °C the saturation pressure of ethanol that is 4.3 bar.
a) What is the state of ethanol at 120 °C and 10 bar (i.e., compressed liquid, saturated liquid/vapor, superheated vapor)? At 140 °C and 1 bar?
b) Can we assume that ethanol vapor at 1800 °C and 20 bar behaves as an ideal gas?
c) A rigid vessel contains 1 mol of ethanol at 1800 °C and 20 bar. How much heat must be removed in order for the pressure to drop to 10 bar?
Additional data: ~~At 450 °C,~~ the C_P of ethanol is ~~123~~ 173 J/mol/K.

Problem 3.38: Oxygen in a closed system is compressed adiabatically from 25 °C and 1 bar to a final temperature of 450 °C. Then it is cooled under constant pressure until the temperature falls to 5 °C. Assuming oxygen to be an ideal-gas:
a) Draw a quantitative PV graph and show the process.
b) Calculate the final pressure.
c) Calculate ΔU, ΔH, Q, and W for the entire process.
d) Is it correct to assume that oxygen is an ideal gas under the conditions of this problem? You may use $C_P^{\text{ig}} = 29.4$ J/molK.

Problem 3.39: Saturated steam at 1 bar is heated at constant pressure to a final temperature of 500 °C in a closed system. Treating steam as an ideal gas, determine the amount of heat and work, and the change in enthalpy and internal energy.