Textbook Reading 6.3-6.5

HW-25 and HW-26 are based on previous homework problems. You do not need to repeat the analysis from the previous problems and you can use any needed results.

HW – 25(i) (See HW – 11(i))

Carbon dioxide is heated from -40°C (State 1) to -20°C (State 2) in a constant pressure process at 20 bar in a high-pressure cooling system.

Calculate the change in specific entropy, in kJ/kg-K: using compressed liquid tables, using saturated liquid approximation, and using a constant specific heat of 2.082 kJ/kg-K.

HW – 25(ii) (See HW – 11(ii))

Consider three liquids in separate sections of an externally well-insulated, closed rigid tank. Section A contains 5 kg of liquid A at 100°C with a specific heat of 2 kJ/kg-K. Section B contains 2 kg of liquid B at 50°C with a specific heat of 4 kJ/kg-K. Section C contains 1 kg of liquid C at 40°C with a specific heat of 7 kJ/kg-K. There is heat transfer but no mass transfer across the sections until thermal equilibrium is achieved at a final temperature of 67.2°C.

Determine the total entropy change of the system, in kJ/K.

HW – 26 (See HW – 13)

Air (m = 2 kg) contained inside a closed piston-cylinder device undergoes four processes. Use air tables that consider variable specific heats.

Process 1 to 2: A constant temperature process at 600 K from an absolute pressure of 5 bar (State 1) to an absolute pressure of 4 bar (State 2)
Process 2 to 3: A polytropic process $Pv^{1.4}$ = constant to an absolute pressure of 3 bar (State 3)
Process 3 to 4: A constant pressure process
Process 4 to 1: A constant volume process

(a) Calculate the entropy change of air in each process, in kJ/K.
(b) Find the total entropy change of air in the cycle using the values in (a), in kJ/K.
(c) Show the four processes on T-s diagram and the appropriate lines of constant pressure for the four states. Label states and identify process directions with arrows.