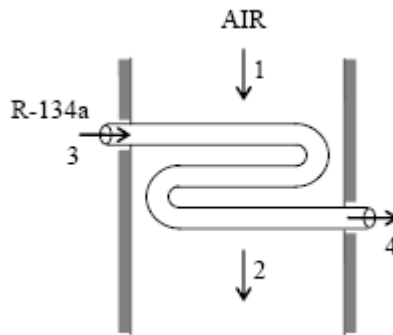


Thermodynamics

Problem 1

Air enters the evaporator section of a window air conditioner at 100kPa and 30°C with a volumetric flow rate of 6 m³/min. Refrigerant 134a at 120kPa and a quality of 0.3 enters the evaporator at a rate of 2.5kg/min and leaves as a saturated vapor at the same pressure. Determine:

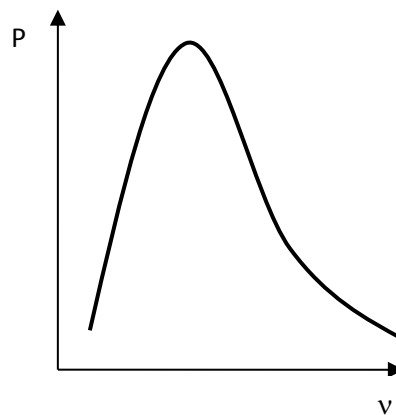
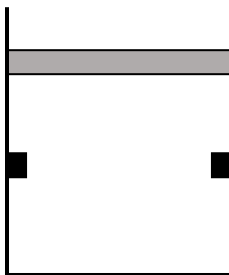
- The mass flow rate of the air [kg/min]
- The temperature of the air leaving the evaporator
- The rate of heat transfer from the air



Problem 2

A piston-cylinder device initially contains 0.3kg steam at 3MPa and 250°C. The steam now loses heat to the surroundings and the piston moves down, hitting a pair of stops at which point the cylinder contains saturated liquid water. Cooling continues until the cylinder is at 200°C. Determine

- The final pressure in the cylinder [kPa]
- The boundary work [kJ]
- The amount of heat transfer when the piston first hits the stops [kJ]
- The total amount of heat transfer [kJ]
- Draw the process on a P-v diagram



Problem 3

Air enters an insulated compressor operating at steady state of 1.05 bars, 22C with a mass flow rate of 1.8kg/s and exits at 2.9bars. Kinetic and potential energy are negligible. If the isentropic efficiency is 80%, Determine:

SOLVE USING VARIABLE SPECIFIC HEAT RELATIONS

- (a) Find the outlet temperature, T_{2A} [K]
- (b) The minimum theoretical Work input, W_s [kW]
- (c) The actual work input, W_A [kW]

Problem 4

A rigid tank has a volume of 0.06m^3 and initially contains water at 1500kPa and a quality of 20%. As the contents of the tank are heated, a pressure regulator keeps the pressure constant in the tank by allowing saturated vapor to escape. Heating continues until the mass of liquid in the tank has decreased to half its initial value. Neglecting PE and KE effects, determine:

- (a) The amount of heat transfer to the tank, [kJ]
- (b) The mass of the vapor that escapes, [kg]
- (c) Draw this process on a P-v diagram

