Examples

1. A piston-cylinder device contains 5 kg of steam at 3 Mpa and 300 °C. It is cooled at constant volume until the temperature reaches 200 °C. This is followed by a constant temperature compression to 2.5 MPa.
   a) Sketch the processes on a Tv and pv diagrams
   b) Determine the quality and pressure at state 2 and volume at state 3

2. A 0.0076 m^3 rigid tank contains 0.05 kg steam at 1.6 MPa. What is the temperature of the steam? If the tank is cooled, what is the temperature for the steam to be in saturated condition?
   Cooling is continued further until the pressure becomes 1.1 MPa. Find the internal energy at each state.'

3. A 2.5 m^3 rigid tank contains 5 kg saturated liquid-vapor mixture of steam at 75 °C. It is heated slowly. Determine the quality and enthalpy of the mixture initially and finf the temperature when all liquid has evaporated. Show the process on a T-v diagram.

4. A piston cylinder device contains 2 kg of water at 0.2 Mpa and 220 °C. It is cooled and the piston moves freely until the quality reaches the value 0.65.
   a) Sketch the process on p-v and T-v diagrams
   b) Find the specific volume and specific enthalpy at the initial and final states
   c) Find the volume of the vapor phase at the final state

Examples (ctd.)

1. A 20 m^3 tank contains N_2 (M=28 kg/kmol) at 25 °C & 800 kPa. Some of it is released until the pressure drops to 600 kPa. If the final temperature is 20 °C, find the mass of the gas released.

2. 1 kg of air undergoes a cycle consisting of 3 processes;
   1 – 2 ; constant volume
   2 – 3 ; constant temperature expansion
   3 – 1 ; constant pressure compression
   At state 1; T = 25 °C, P = 1 bar, state 2; P = 2 bar
   Sketch the cycle on a p-v diagram and find
   a) Temperature at state 2
   b) Volume at state 3

3. A 0.5 m^3 rigid tank contains H_2 (M=2.016 kg/kmol) at 20 °C & 600 kPa. This tank is connected by a valve to another rigid tank also with the volume of 0.5 m^3 containing H_2 but at 30 °C & 150 kPa. The valve is opened and the contents were allowed to mix until equilibrium. If the surrounding temperature is 15 °C, find the final pressure.

Examples (ctd.)

1. A unit mass of steam initially at P_1=20 Mpa, T_1=520°C is cooled at constant volume to T_2=400°C. Using the compressibility chart, find
   a) Specific volume at state 1
   b) Pressure at state 2

   Compare with data from the superheated steam table.