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Engineering Thermodynamics (CH-161)

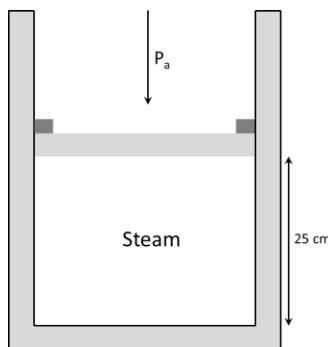
Tutorial-3

Q1. A closed batch reactor with a volume of 0.2 m^3 contains saturated steam at 0.2 MPa . Due to improper insulation, heat is transferred to the surrounding as loss. Due to this thermal loss, the pressure of the batch reactor is dropped to 0.15 MPa . Determine the following and draw the p-v diagram of this process:

- (i) Change in temperature of the steam due to the heat loss.
- (ii) Quality of the steam in the final pressure.
- (iii) Masses of the liquid and vapor at the final pressure.

Q2. Consider a piston-cylinder assembly initially containing steam at 250 kPa and 300°C . The mass of the piston is 50 kg and diameter of 0.1 m . Initially, piston is held at its position with the help of latch as shown in the figure below. The atmospheric pressure is 100 kPa and temperature is 20°C . The assembly is cooled as the heat is transferred to the surrounding due to heat losses. Determine the following.

- (i) At what temperature does the piston begins to move down?
- (ii) How far has the piston dropped when the temperature reaches ambient?



Q3. Two Kilogram of CO_2 gas is contained in a piston-cylinder assembly at a pressure of 6.5 bar and a temperature of 300 K . The piston has a mass of 5000 kg and a surface area of 1 m^2 . The friction of the piston on the walls is significant and cannot be ignored. The atmospheric pressure is 1.01325 bar . Piston is held at its position using a latch. The latch is suddenly removed, and the gas is allowed to expand till the final volume is double the original volume. Determine the work appearing in the surrounding. Will it be same as work done by the gas? State the assumptions made.