HW2 (Thermodynamics I)

Due: 2021/04/29

1. Find the compressibility factor (Z) for saturated vapor ammonia at 100 kPa and at 2000 kPa, and discuss which one is closer to ideal gas (refer to table B.2.2 & table A.5)

2. The following figure describes three physical situations. Draw the possible process in a *P-v* diagram.

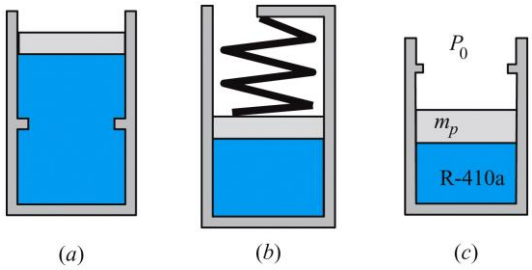

Figure P3.11

3. A piston cylinder contains 2 kg of liquid water at 20°C and 300 kPa, as shown below. There is a linear spring mounted on the piston such that when the water is heated the pressure reaches 3 MPa with a volume of 0.1 m^3.

a) Find the final temperature

b) Plot the process in a P-v diagram.

c) Find the work in the process.

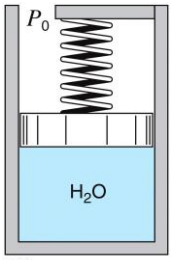

Figure P1.48

4. An air is contained in a vessel of 0.1 m^3 at 1 MPa and 250 °C. Determine the heat transfer from the air when the pressure reaches 0.35 MPa by cooling.

5. Solve the above problem when water instead of the air is contained in the vessel.

6. 0.2 kg of air expands twice in volume at 150°C and 0.5 MPa in an isobaric process. Determine the final temperature, work, and heat transfer.

7. Air goes through a polytropic process from 125 kPa, 325 K to 300 kPa and 500 K. Find the polytropic exponent n and the specific work in the process.

8. Find the phase and the missing properties of T, P, v, u and x for water at:

a. 500 kPa, 100°C

b. 5000 kPa, u = 800 kJ/kg

c. 5000 kPa, v = 0.06 m^3/kg

d. -6°C, v = 1 m^3/kg

9. A piston cylinder contains air at 600 kPa, 290 K and a volume of 0.01 m^3. A constant pressure process gives 54 kJ of work out. Find the final volume, the temperature of the air and the heat transfer.

10. A piston/cylinder contains 1 kg water at 20°C with volume 0.1 m^3. By mistake someone locks the piston preventing it from moving while we heat the water to saturated vapor. Find the final temperature and the amount of heat transfer in the process.