

ENPE 250: Properties & Phase behavior of Petroleum Systems



Midterm – Fall 2000
Closed Book & Notes (60 min)

Problem 1 (20 min, 20 marks)

A piston-cylinder device contains 0.1 m^3 of liquid water and 0.9 m^3 of water vapor in equilibrium at 800 kPa. Heat is transferred at constant pressure until the temperature reaches $350 \text{ }^\circ\text{C}$.

- What is the initial temperature of water?
- Determine the total mass of the water
- Calculate the final volume
- Show the process on a P-v diagram with respect to saturation lines.

Problem 2 (20 min, 20 marks)

A 0.5 m^3 rigid tank contains refrigerant 134 a initially at 200 kPa and 40 % quality. Heat is now transferred to the refrigerant until the pressure reaches 800 kPa. Determine

- The mass of refrigerant in the tank
- The amount of heat transferred. Show process on a P-v diagram with respect to saturation lines

Problem 3 (20 min, 20 marks)

A volume of 0.3 m^3 of O_2 at 200 K and 8 MPa is mixed with 0.5 m^3 of N_2 at the same temperature and pressure, forming a mixture at 200 K and 8 MPa. Determine the volume of the mixture, using

- The ideal-gas equation of state
- Kay's rule

$$Q - W = \Delta U + \Delta KE + \Delta PE$$

$$T_c = \sum T_{ci}$$

$$P_c = \sum P_{ci}$$