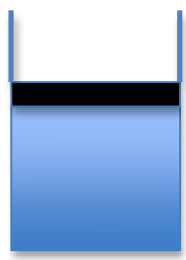
AREN 2110
Spring 2011

Homework #2: Due Friday, Jan 28, 6 PM

1. What is the difference between a saturated liquid and a compressed liquid?

2. A mixture of liquid water and water vapor fills a rigid-wall tank. Heat is added until all the liquid is converted to saturated vapor. Will the temperature and pressure of the water change during the process.

3. Water is heated in a vertical piston-cylinder device. The piston has a mass of 20 kg and cross sectional area of 100 cm^2. The local atmospheric pressure is 100 kPa. At what temperature will the water begin to boil?



4. Determine the pressure exerted on a diver at 30 m below the free surface of the ocean. Assume the barometric pressure is 101 kPa and the specific gravity of seawater is 1.03.

5. The value for the gas constant, R, for an ideal gas is 0.4119 kJ/kg-K. What is the gas?

6. Does the amount of heat absorbed as 1 kg of saturated liquid water boils to saturated vapor have to the same as the heat released when 1 kg saturated water vapor condenses at 100 ^{o}C? Explain.

7. Complete the following table for H_2O

P (kPa)	T (^{o}C)	v (m^3/kg)	phase
	50	4.16	
200			Saturated vapor
400	250		
600	110		

8. Complete the following table for H_2O:

P (kPa)	T (°C)	h (kJ/kg)	x	phase
200			0.7	
	140	1800		
950			0.0	
500	80			
800		3162.2		

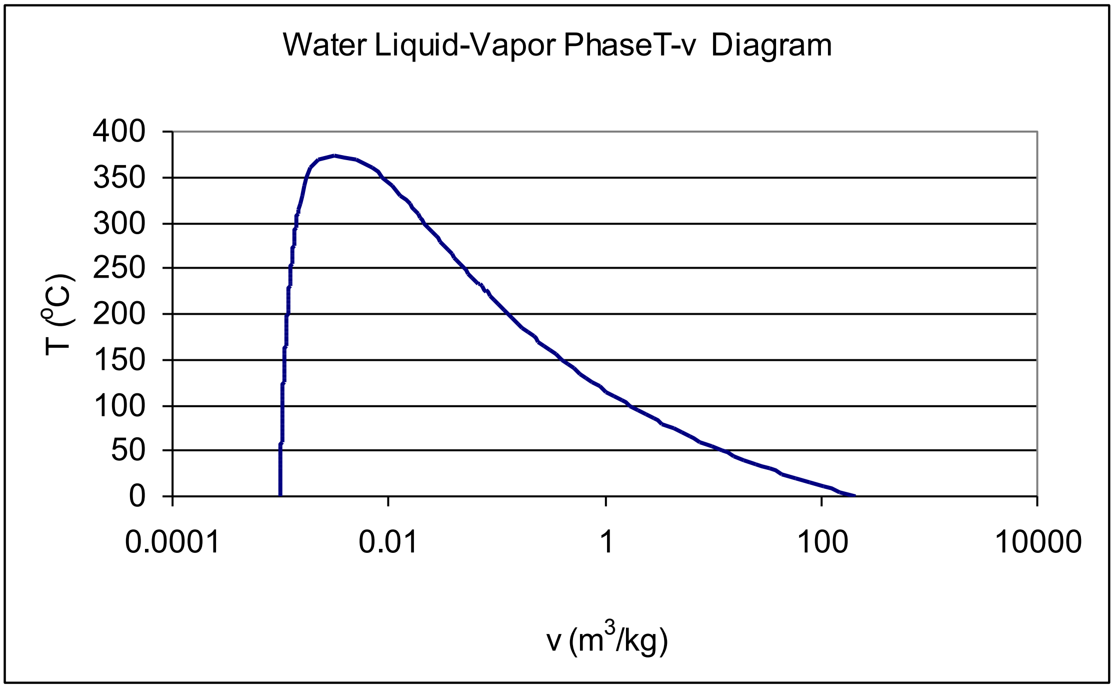
9. Complete the following table for the various substances

substance	P (kPa)	T (°C)	v (m^3/kg)	x*	phase
H_2O		150		0.4	
H_2O		150	0.4708		
R-134a		0	0.0500		
R-134a	400	0			

* use "na" for "not applicable" where quality does not apply

10. A piston-cylinder device contains 0.85 kg of refrigerant 134a at -10 °C (263 K). The piston has a mass of 12 kg and a diameter of 25 cm. The local atmospheric pressure is 88 kPa. Now, heat is transferred to the refrigerant until the temperature is 15 °C. Determine:
    a. The final pressure
    b. The change in volume of the cylinder space
    c. The change in enthalpy of the refrigerant

11. A rigid-wall tank with a volume of 2.5 m^3 initially contains 15 kg of saturated liquid-vapor mixture of water at 75 °C. The water is slowly heated until all the water is saturated vapor.
    d. What is the quality of the mixture at the initial state (before heating)?
    e. Determine the temperature at with the liquid in the tank is completely vaporized to saturated vapor.
    f. What is the pressure in the tank?
    g. Show the process on the T-v diagram on the next page.



12. One kilogram (1 kg) of water vapor at 200 kPa fills the left chamber of a partitioned system shown below. The volume of this chamber is 1.1989 m^3. The right chamber has twice the volume of the left chamber and is evacuated at the initial state.

Now the partition is removed and heat is transferred so that the temperature of the water is 3 ^oC.

a. What is the initial temperature of the water (before the partition is removed)?
b. What is the pressure of the water after the partition is removed and heat transferred?
c. What is the quality of water at the final equilibrium state?