

ENGRD 221: ENGINEERING THERMODYNAMICS

Lecture 5: September 6, 2007

Reading Assignments (from Moran & Shapiro, Sixth Edition): Review of lecture 4 plus Sections 3.6–3.14. Equation 3.13 (pp. 106) on computing the enthalpy for compressed liquids by mistake was omitted from the lecture: Please keep that equation in mind, $h(T, P) = h_f(T) + v_f(T)(P - p_{sat}(T))$, as it will be needed in many HWs. Please read ALL example problems in Chapter 3. The next two lectures will cover chapter 4.

Topics covered:

- Evaluating thermodynamic properties
- Phase changes for water: Compressed liquid, saturated liquid, saturated vapor, superheated vapor
- Saturation pressure & saturation temperature
- The liquid-vapor saturation curve
- Latent heat of fusion, latent heat of vaporization
- T-v diagram for the heating process of water at constant pressure
- T-v diagram of constant pressure phase-change processes of a pure substance at various pressures
- Supercritical pressures, the critical point
- The compressed liquid region, the saturated liquid/vapor region and the superheated vapor region
- p-v and p-T diagrams of a pure substance, the triple point
- p-v-T surface of substance that contracts or expands on freezing
- Using compressed liquid tables and superheated vapor tables
- Liquid-vapor equilibrium, states inside the vapor liquid region, using tables in the vapor-liquid region, introducing quality factor x
- Approximating compressed liquid as saturated liquid
- Introducing enthalpy
- Specific heat at constant volume & specific heat at constant pressure
- Equations of state for gases, The ideal gas approximation
- Internal energy of an ideal gas, enthalpy of an ideal gas
- Specific heats of an ideal gas $c_p = c_v + R$
- The perfect gas: constant c_p and c_v
- Changes in internal energy and enthalpy for a perfect gas
- Real gases