

Homework Set #1

(due January 26, 2001)

- 1.) In class we showed that the log-mean ΔT (LMDT) is the proper type of *average* driving force to use in a counter-current heat exchanger when U and c_p 's are constants and when no phase change occurs. Show that the same relationship between q_T and LMDT also applies when:
 - a. the flow is co-current, or
 - b. the flow is counter-current, but the hot fluid is condensing steam which remains at its boiling point over the entire length of the heat exchanger.

- 2.) Prob. 4.3-8 from Geankoplis

Estimate the thermal conductivity of steel (at average temperature) by linearly interpolating data for 1% carbon steel: see Appendix A.3-16. Dimensions of standard steel pipe can be found in Appendix A.5-1.

- 3.) Prob. 4.5-3

Heat capacity of liquid water at 1 atm can be found at any temperature by interpolation of Appendix A.2-5

- 4.) Prob. 4.5-5

- 5.) Prob. 4.5-7

Physical properties of air are given in Table A.3-3; at the temperatures of this problem, the density of air can be estimated using the ideal gas law. Use (4.5-9) as an approximation for the heat-transfer correlation given by (4.5-8). At steady state, the mass flowrate of air will be the same at any axial position along the length of the tube, but the air velocity v will increase as the air temperature increases and the density of air decreases. Evaluate v at the average of the inlet and outlet temperature of the air.