Thermodynamics 2$^{nd}$ HW

Chapter 2:
Conceptual Questions:
2.2C, 2.17C, 2.37C, 2.55C
2.10, 2.14, 2.39, 2.45, 2.61, 2.69, 2.91, 2.95, 2.101, 2.107

In addition to the above questions from the text please also answer:

A. What is a boundary layer? How does a thermodynamic boundary layer differ from a hydrodynamic boundary layer?

B. Calculate the Reynolds number for 300K air flow across the outside of a pipe with a diameter of 2.0cm  flowing at a speed of 10m/s.

C. Calculate the critical speed for water flow through the inside of the pipe in question B. Note that the critical Reynolds number is 2300.

D. How does the convective coefficient h relate to the Nusselt number? What is its value for fully developed laminar flow inside a pipe given that the pipe surface is kept at a constant temperature?

|  | $\rho$ (kg/m$^3$) | $C_p$ (kJ/kg K) | $\mu$ (N s/m$^2$) | k  (W/m K) | Pr () |
|---|---|---|---|---|---|
| Air at 300K | 1.161 | 1.007 | 18.46e-6 | 26.3e-3 | 0.707 |
| Water at 365K | 965 | 4.209 | 306e-6 | 677e-3 | 1.91 |