

## Problem Set # 1

**Given:** Wed., Sep. 05, 2012

**Recommended Completion Date:** Wed, Sep. 12, 2012

**Do not submit for grading**

### Review Questions

1. State the zero, first, and second laws of thermodynamics.
2. What is the state postulate in thermodynamics?
3. What are the equations that express the principles of conservation of mass and energy for (a) a closed system, and (b) an open system with multiple inlets and outlets?
4. What is a fluid? What is a solid? What is an elastic solid?
5. What is a Newtonian fluid?
6. What is Poiseuille \* flow? State the mathematical model (differential equation and boundary conditions) of this flow. What is the solution of this mathematical model? What are the definitions of the Fanning and Darcy friction factors, and what are their values for Poiseuille flow?

\*Note: This flow is sometimes referred to as Hagen-Poiseuille flow.

**Please do the following problems** (Selected from “Heat Transfer,” by J.P. Holman, 6<sup>th</sup> Edition, 2010):

- A woman informs an engineer that she frequently feels cooler in the summer when standing in front of an open refrigerator. The engineer tells her that she is only “imagining things” because there is no fan in the refrigerator to blow the cool air over her. A lively argument ensues. Whose side of the argument do you take? Why?
- A woman informs her engineer husband that “hot water will freeze faster than cold water.” He calls this statement nonsense. She answers by saying that she has actually timed the freezing process for ice trays in the home refrigerator and found that hot water does indeed freeze faster. As a friend, you are asked to settle the argument. Is there any logical explanation for the woman’s observation?
- An air-conditioned classroom in Texas is maintained at 72°F in the summer. The students attend classes in shorts, sandals, and tee shirts and are quite comfortable. In the same classroom during the winter, the same students wear wool slacks, long-sleeve shirts, and sweaters, and are equally comfortable with the room temperature maintained at 75°F. Assuming that humidity is not a factor, explain this apparent anomaly in “temperature comfort.”