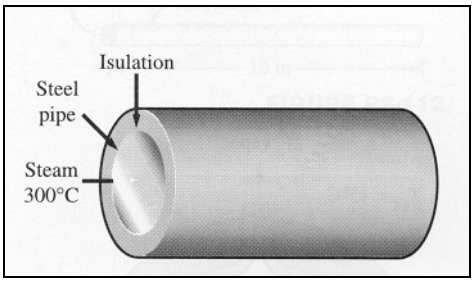
**Introduction to Thermodynamics and Heat Transfer (ECE 309)**
Suggested Problems for Chapter 8

1. Steam at 300 °C is flowing through a steel pipe [k = 15.1 W/(m.°C) ] whose inner and outer diameters are 8 and 8.8 cm, respectively, in an environment at 15 °C. The pipe is insulated with 3-cm-thick fiberglass insulation [k = 0.035 W/(m.°C)]. If the heat transfer coefficients on the inside and the outside of the pipe are 150 and 25W/(m2.°C), respectively, determine the rate of heat loss from the steam per meter length of the pipe. What is the error involved in neglecting the thermal resistance of the steel pipe in calculations?




2. The plumbing system of a house involves a 0.5-m section of a plastic pipe [k = 0.16 W/(m.°C)] of inner diameter 2 cm and outer diameter 2.4 cm, exposed to the ambient air. During a cold and windy night, the ambient air temperature remains at about –5 °C for a period of 14 h. The combined convection and radiation heat transfer coefficient on the outer surface of the pipe is estimated to be 40 W/($m^2$.°C), and the heat of fusion of water is 333.7 kJ /kg. Assuming the pipe to contain stationary water initially at 0 °C, determine if the water in that section of the pipe will completely freeze that night.