

I. ENVH 557 Exposure Controls
M. Yost, Winter 2009

Problem set I (due Monday Feb 9, 2009)

1. Standard conditions in ventilation are: $T = 70^{\circ}\text{F}$, $P = 29.9\text{in Hg}$, air density = 0.075 lbm/ft^3 . Express the temperature in degrees C, R and K. Express the pressure in the following units: mm Hg, inches of water, atm and psi. What change in temperature or pressure is needed to make a change in the air density of at least 5%?
2. Air is flowing at a velocity of 3500ft/min (FPM) through a circular duct section 15 inches in diameter and 12 ft long. Assume standard conditions. What is the volume flow rate? What is the mass flow rate?
3. Assume a ventilation system is operating with a 4-inch diameter round duct. At what volume flow rate (cfm) will the upper limit of laminar flow (i.e. $Re > 2000$) be reached?
4. Air is moving through a pipe at a volume flow rate of 2000 CFM and a temperature of 70°F . If the temperature increases to 95°F , what is the new volume flow rate, assuming the barometric pressure (1 atm) remains constant? What is the new mass flow rate?
5. The velocity pressure of air in a duct is 2.1 in w.g. What is the velocity?
6. The static pressure in a 5-inch diameter duct is measured as -2.5 in w.g. The total pressure (or stagnation pressure) is -1.3 in w.g. What is the velocity of the air in the duct? What is the volume flow rate? (Assume standard conditions)
7. Assume that the duct system described in problem 2 and problem 5 meet at a junction. Downstream of the junction, the duct diameter of the sub-main is 16 inches. Find the velocity pressure in this duct section downstream of the junction.