

CIVL 7132 Advanced Soil Mechanics
Spring 2019 - Homework 1

- 1) The end of a clean glass tube is inserted in a container of distilled water. If the tube has an inside diameter of 0.02 mm,
 - a) What is the height of capillary rise in the tube?
 - b) What is the capillary pressure at the top of the water column?
 - c) How much air pressure would have to be applied to the top of the tube to get the water level to drop by 0.5 m?
 - d) If the tube was cut to a length of 1 m and reinserted in the container of distilled water, what would be the radius of curvature of the meniscus at the top of the water column?
- 2) Use the effective grain size to estimate the height of capillary rise in the well-graded soil depicted in Figure 2.6 in the textbook.
- 3) A long vertical glass tube with an inside diameter of 0.003 mm and open at both ends is filled with water from the top. What is the maximum height of the column of water that can be supported before it starts dripping out the bottom of the tube? (Caution: there will be two menisci—one at the top of the tube and another one at the bottom.)
- 4) Estimate the shrinkage limit of organic silty clay with a liquid limit of 62 and a plastic limit of 42.
- 5) Would the shrinkage limit of the soil in the previous problem be different if the water in the voids was replaced with acetic acid (which has a surface tension of 27.6 mN/m)? Why?
- 6) Estimate the volume change the soil in Problem 4 when its water content is reduced from 50% to 20%. Assume the specific gravity of the soil solids is 2.65 and the soil is initially saturated. Keep in mind that the volume change may be limited if the soil reaches the shrinkage limit first!