1] Complete the Fluid Mechanics Concept Inventory by logging in to Learn@UW, selecting this course from the Spring 2008 list, then going to the Quizzes tab on the top line near the left-hand side. There will be only one option to choose from, called the Fluid Mechanics Concept Inventory. Do your best to answer the questions, and don’t look up answers in the book. You will fill this out again at the end of the semester (it is part of ongoing assessment of the instruction at the University). Completion of the Concept Inventory both before and after the semester is REQUIRED, but you will not be graded on it.

2] Imagine you connect a very long garden hose to a Madison home and fasten it at regular intervals to a tall tower near the house. The hose is long enough that the water never leaves the hose. After you’ve opened the valve and waited for the system to reach equilibrium, approximately how tall in [m] will the vertical column of water be?

3] Researchers at the University of Delaware have recently demonstrated a new type of body armor – “liquid armor” (http://www.sciencecentral.com/articles/view.php3?language=english&type=&article_id=218392807). The armor operates using non-Newtonian shear thickening fluids. The apparent viscosity of these fluids rapidly increases with the shear rate, inhibiting bullet penetration. Let us consider the case of a small firearm bullet, which is capable of penetrating water to the depth of 2 m. Assuming that the hydrodynamic drag force acting on the bullet is proportional to the fluid viscosity, find the apparent viscosity $\eta_1$ of the shear thickening fluid required to reduce bullet penetration to 2 cm. Assume that at high shear rates the apparent viscosity $\eta$ of the shear thickening fluid depends on the shear rate $\dot{\gamma}$ according to the power law

$$\eta = \eta_0 \left( \frac{\dot{\gamma}}{\dot{\gamma}_0} \right)^{n-1},$$

where $\eta_0$ is viscosity of water and $\dot{\gamma}_0 = 1 \text{ s}^{-1}$. Find the value of $n$ required to achieve the apparent viscosity $\eta_1$ in the above example.