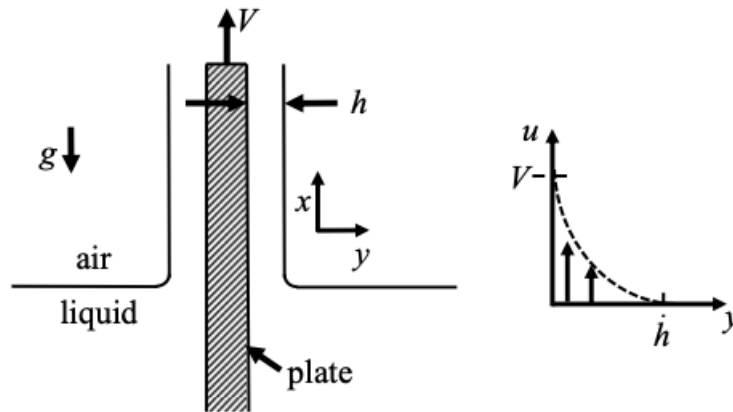

Collection of in Class Practice Problems
(Material included in 13-16)

P1. A continuous plate is pulled vertically up out of a liquid at a constant velocity V (see figure). As a result of this motion, a thin layer of liquid of thickness h forms on the plate surface with the liquid velocity at the outer edge of the layer ($u(h)$) equal to zero (see profile sketch on the right hand side of the figure). Assume the flow is steady state, fully developed in the x direction (vertical as indicated), and uniform into the page.



- (a) Solve for the plate normal (y -direction) v velocity in the liquid using conservation of mass (state all assumptions).
- (b) Simplify the x -direction momentum equation (Navier-Stokes) for this problem (state all assumptions).
- (c) Obtain an expression for the liquid x -direction velocity profile.
- (d) Using your velocity profile from the previous part, find an expression for the layer thickness h .