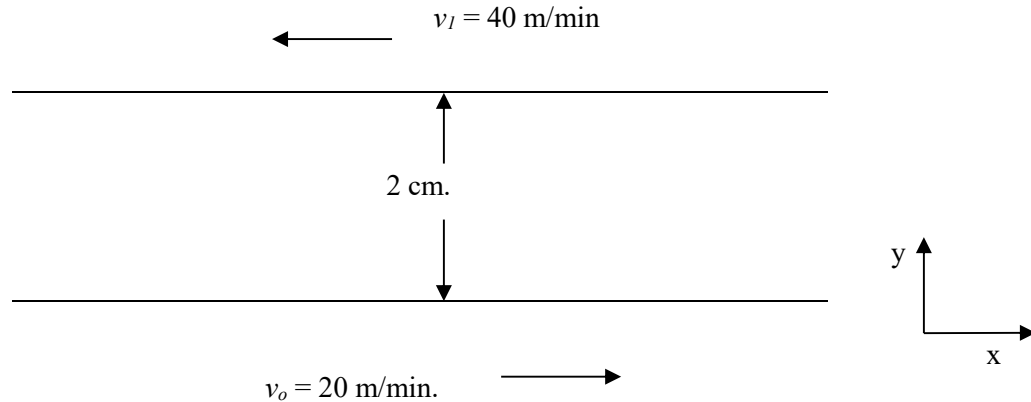


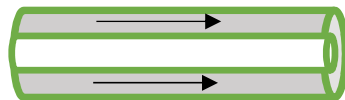
CHG 3316 TRANSPORT PHENOMENA
University of Ottawa
Assignment #2
Due on : October 9, 2020 at 9 pm

1.



- (a) Calculate the shear stress for the one-dimensional flow of a Newtonian liquid between the above plates. The speed of the lower plate is 20 m/min to the right and the speed of the upper plate is 40 m/min to the left (x is positive to the right). The distance between the plates is 2 cm and the viscosity of the liquid is 250 cP .
- (b) Calculate and plot the velocity profile between the two plates. Also, calculate the distance from the lower plate where the fluid velocity is zero.

2. An incompressible fluid flows axially at steady state within the annular region between two tubes. The two tubes are concentric and placed horizontally. The flow is fully developed and laminar. The outer radius of the small tube is R_1 and the inner radius of the large tube is R_2 .



Apply Newton's Law and use the equations in BSLK's Appendix B4, B5, or B6 to find expressions for:

- The velocity of the fluid as a function of the radius r
- The shear stress in the fluid as a function of the radius r
- Minimum and maximum fluid velocities
- The volumetric flowrate
- The value of r where the maximum speed is observed

f) Numerical example: Make a graph of the velocity profile and the shear stress between the two tubes.

(For part f only: take $R_1 = 13$ cm, $R_2 = 20$ cm, $\mu = 1$ cP and a pressure drop of 20 kPa per meter of tube length. Use Excel to make the graph. Use 10 radii between R_1 and R_2).

