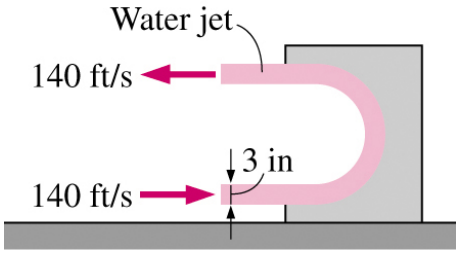
CHEN.3030 Fluid Mechanics

Homework Assignment #8 Spring 2017

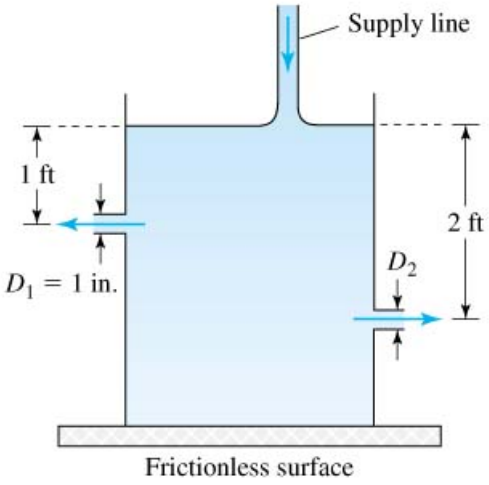
The Linear Momentum Equation

1. A 3 inch diameter horizontal water jet having a velocity of 140 ft/s strikes a curved plate which deflects the stream by 180^o at the same speed. Ignoring friction losses, determine the force required to hold the plate in place against the water stream.



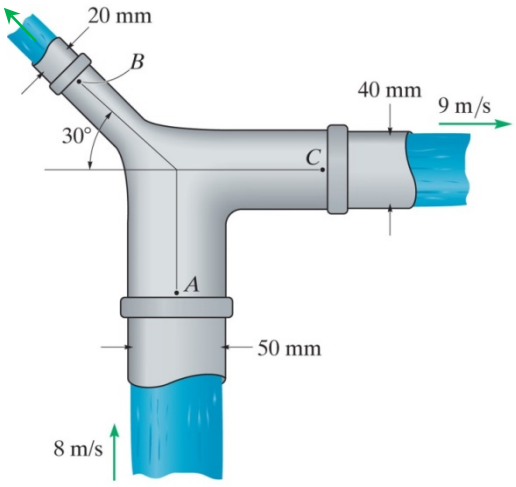
2. The large tank shown is resting on a frictionless surface. The volume flow rate through the supply line is adjusted so that the water level in the tank remains constant. The water surface and the exit nozzles are open to the atmosphere.

With the information given in the diagram (neglecting friction losses at the inlet and exits), determine the diameter D_2 needed so that the tank remains motionless. Explain the logic used in your analysis!



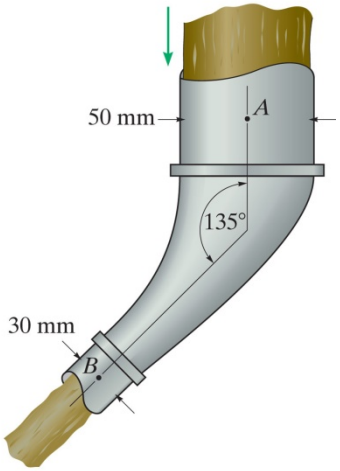
3. Water enters at Point A as shown with P_A = 70 kPa. With the remaining data given in the sketch, determine the horizontal and vertical components of the resultant force that is needed to hold the pipe transition segment in place.

Neglect the size of the transition.

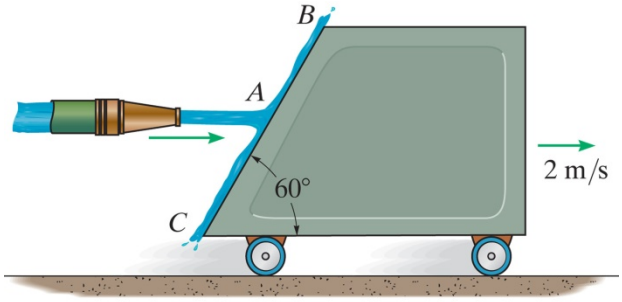


4. Crude oil flows through the horizontal tapered 45° elbow at 0.025 m^3/s. If the pressure at Point A is 450 kPa, determine the horizontal and vertical components of the resultant force that the oil exerts on the elbow.

Neglect the size of the elbow.



5. Flow from the water stream strikes the inclined surface of the cart. Determine the power produced by the stream if, due to rolling friction, the cart moves to the right with a constant velocity of 2 m/s. The discharge from the 5 cm diameter nozzle is 0.04 m^3/s. Assume that one-third of the discharge flows down the incline, and two-thirds flows up the incline.



Hint: Power is simply F×v when the force F and speed v are in the same direction.