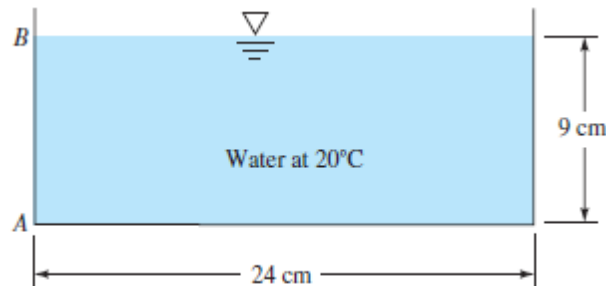


Mechanical, Automotive and Materials Engineering  
Fluid Mechanics I  
MECH3233-F23  
**Assignment Problems Set #4**

**Due: Thursday, October 19, 2023, at 11:59 p.m.**

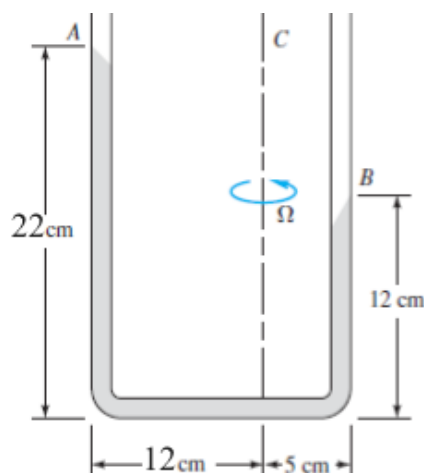
**Problem 1:** A rectangular tank of water shown in the figure below is 12 cm wide into the paper. If the tank is accelerated to the right in rigid-body motion at  $6.0 \text{ m/s}^2$ , Determine:

- (a) the water depth on side  $AB$  (2 points)
- (b) the water-pressure force on panel  $AB$ . Assume no spilling. (2 points)



**Problem 2 (2 points):** A tall cylindrical container, 14 in in diameter, is used to make a mold for forming 14-in salad bowls. The bowls are to be 8 in deep. The cylinder is half-filled with molten plastic,  $\mu = 1.6 \text{ kg/(m-s)}$ , rotated steadily about the central axis, then cooled while rotating. What is the appropriate rotation rate, in r/min?

**Problem 3 (3 points):** For what uniform rotation rate in r/min about axis  $C$  will the U-tube in the figure below take the configuration shown? The fluid is mercury at 20°C.



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**Problem 4:** A thin layer of liquid, draining from an inclined plane, as in the figure below, will have a laminar velocity profile  $u = U_0 \left( \frac{2y}{h} - \frac{y^2}{h^2} \right)$ , where  $U_0$  is the surface velocity at  $y = h$ . If the plane has width  $b$  into the paper,

(a) determine the volume rate of flow of the film. **(3 points)**

(b) Suppose that  $h = 12.7$  mm and the flow rate per m of channel width is 4.73 L/min. Estimate  $U_0$  in mm/s. **(2 points)**

