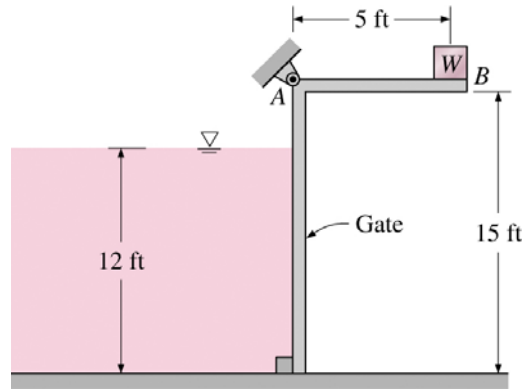


10.303 & 14.301 Fluid Mechanics
Homework Assignment #4 Fall 2006

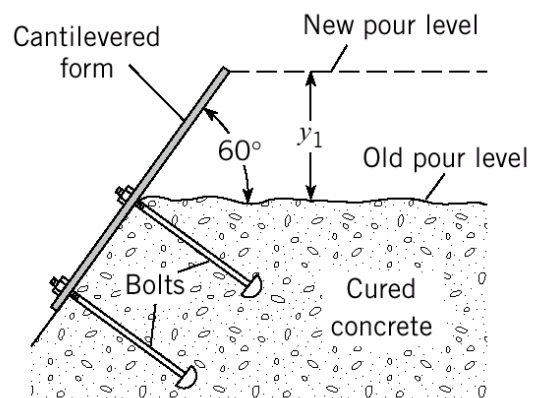
Forces Due to Static Fluids

1. The flow of water from a reservoir is controlled by a 5 ft wide (into the page) L-shaped gate hinged at point A, as shown. If it is desired that the gate open when the water height is 12 ft, determine the mass of the required weight W.



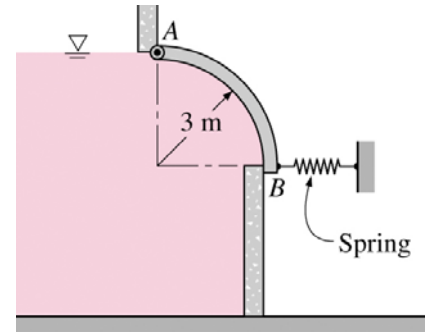
2. In constructing dams, the concrete is poured in lifts of approximately 1.5 m ($y_1 = 1.5$ m in the sketch). The forms for the face of the dam are reused from one lift to the next. The sketch shows one such form, which is bolted to the already cured concrete. For the new pour, what moment will occur at the base of the form near the upper bolt per meter of length (normal to the page)?

For this problem, assume that concrete acts as a liquid when it is first poured and its specific weight is 24 kN/m^3 .



3. A large cylindrical tank with its axis horizontal to the floor has a diameter of 2.0 m and a length of 4.0 m. The ends of the tank are vertical circular planes. A vertical fill pipe (0.1 m diameter) is connected to the top of the tank.
- Assuming that the tank is full of methyl alcohol (methanol), determine the resultant force of the alcohol on one end of the tank (i.e. one of the vertical circular planes). Also show where this resultant force acts.
 - Would the result of Part a change significantly if the tank was overfilled slightly and the vertical fill pipe on the top of the tank also contains methyl alcohol to a depth of 1.5 m above the tank? Justify your answer!!!

4. A 4 m long quarter circular gate with $R = 3$ m and negligible weight is hinged about its upper edge as shown. The gate controls the flow of water over the ledge at B, where the gate is pressed by a spring. Determine the minimum spring force required to keep the gate closed when the water level rises to the upper edge of the gate.



5. A 170 kg granite rock ($\rho = 2700 \text{ kg/m}^3$) is submerged near the shore of a lake. A man who is clearing the shore area of debris tries to lift the rock and move it out of the way. Determine how much force the man needs to apply to lift the rock from the bottom of the lake. Do you think he can do it? Explain...