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Assignment No. 5 (Fluid Statics)
Date of Submission: 20 October 2003

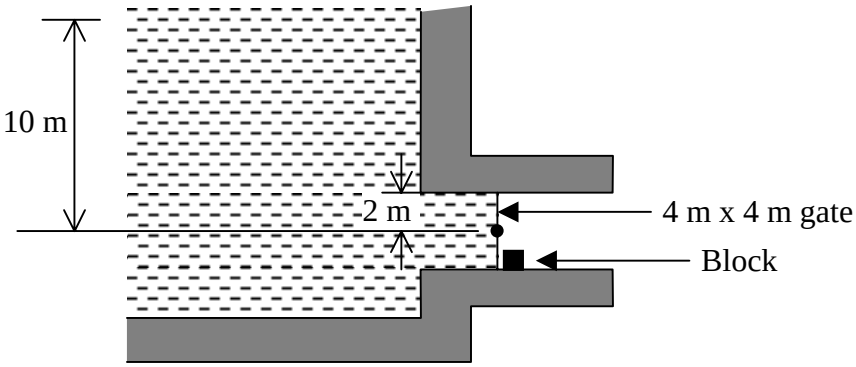
1) A section of the vertical wall is to be constructed from ready-mix concrete poured between forms. The wall is to be 3m high, 0.25m thick, and 5m wide. Calculate the force exerted by the ready mix concrete on each form. Determine the line of application of the force.

2) A door 1m wide and 1.5 m high is located in a plane vertical wall of a water tank. The door is hinged along its upper edge, which is 1m below the water surface. Atmospheric pressure acts on the outer surface of the door and at the water surface. Determine the magnitude and line of action of the total resultant force from all fluids acting on the door. If the pressure at the water surface is atmospheric, what force must be applied at the lower edge of the door in order to keep the door from opening?

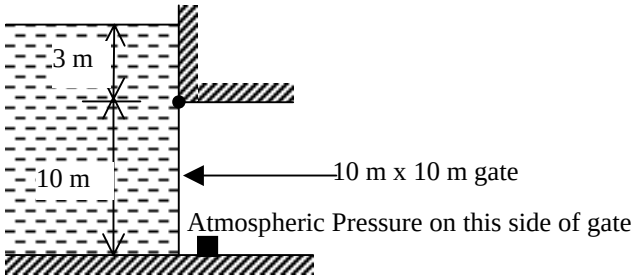
3) A tank with a centre partition has a small door 0.5m wide by 1m high at the bottom. This door is hinged along the top edge. The left side has 0.6m of water and the right side contains 1m of nitric acid (SG = 1.5). What force is required at the lower edge of the door to hold it closed.

4) A triangular access port must be provided in the side of a form containing liquid concrete. Using the coordinates and directions shown, determine the resultant force that acts on the port and its point of application.

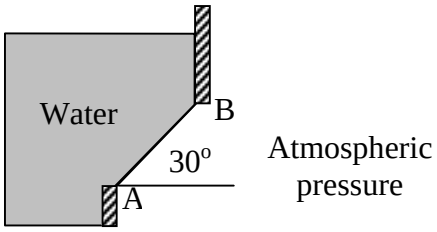
5) Find the force of the gate on the block below.



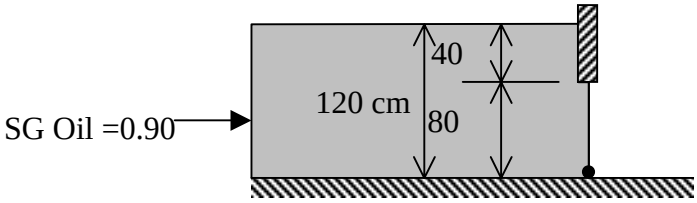
6) Determine the force due to hydrostatic pressure acting on the hinge of the gate shown.



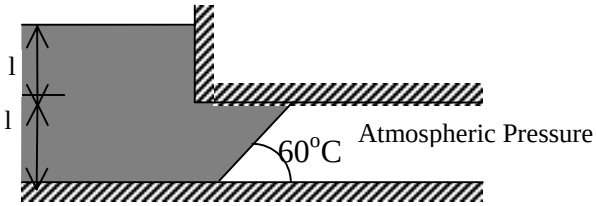
7) The rectangular gate is 10 m x 4m in dimension (l =10 m) and is pin connected at point B. If the surface on which the gate rests at A is frictionless and the water surface is 6 m above point B, what is the reaction at A?



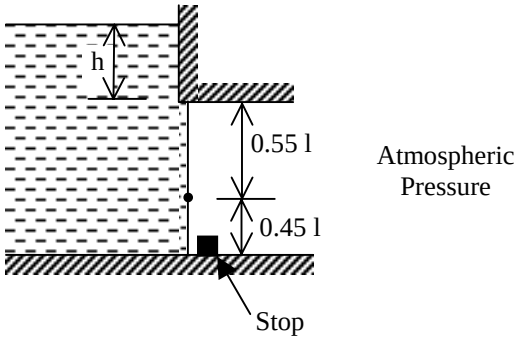
8) In the figure below the gate, holding back the oil is 80 cm high by 120 cm long. If it is held in place only along the bottom edge, what is the necessary resisting moment at that edge?



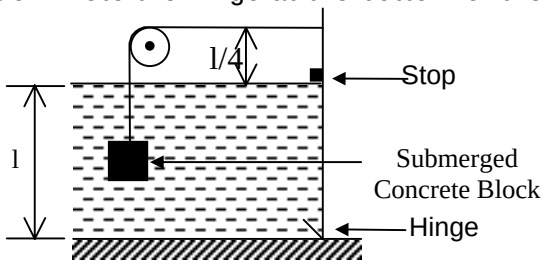
9) If the rectangular gate shown is attached to a horizontal shaft at its mid point, what torque would have to be applied to the shaft to open the gate. The dimensions are l = 5 m and the rectangular conduit and gate width are both 4m.



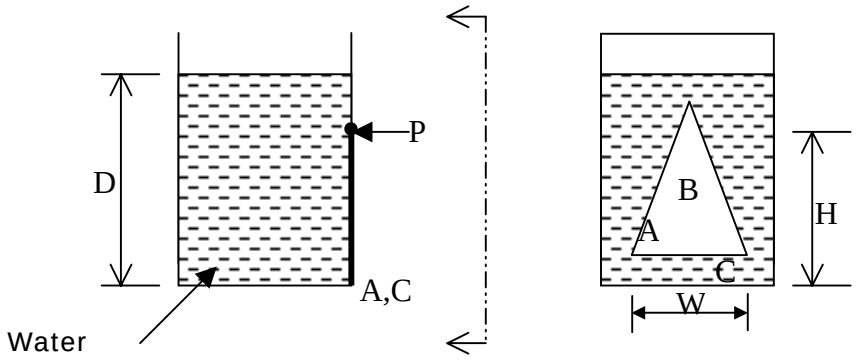
10) The square gate shown is eccentrically pivoted so that it automatically opens with a certain value of h. What is that value in terms of l?



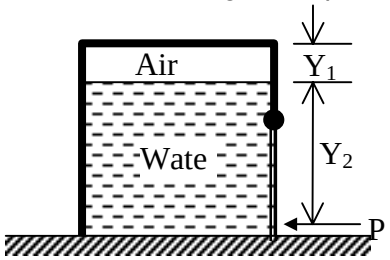
11) Determine the minimum volume of concrete (γ = 23.6 kN/m3) needed to keep the 1 m wide gate in a closed position. Note the hinge at the bottom of the gate. L = 2m.



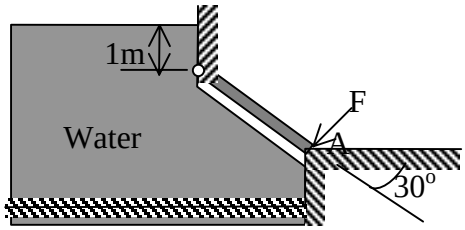
12) The triangular gate ABC is pivoted at the bottom edge AC and closes a triangular opening ABC in the wall of the tank. The opening is 4m wide (W = 4m) and 9 m high (H = 9m). The depth d of water in the tank is 10 m. Determine the hydrostatic force on the gate and determine the horizontal force p at B required to hold the gate closed.



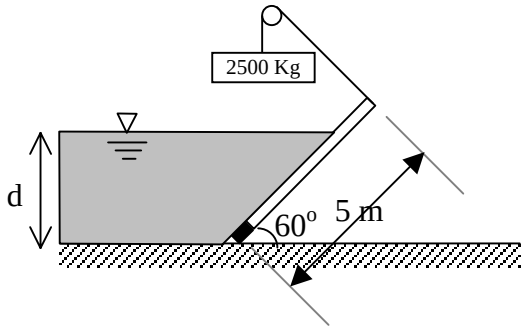
13) The air above the liquid is under a pressure of 30 kPa gage and the specific gravity of the liquid in the tank is 0.80. If the rectangular gate is 1.0 m wide and if y_1 = 1.0 m and y_2 = 3 m, what force P is required to hold the gate in place?



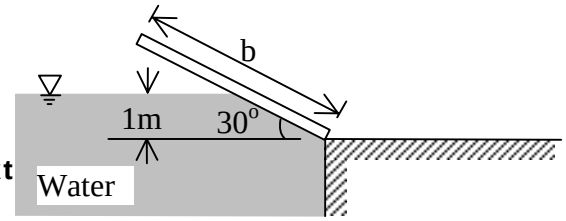
14) The gate shown is hinged at H. The gate is 2m wide normal to the plane of the diagram. Calculate the force required at A to hold the gate closed.



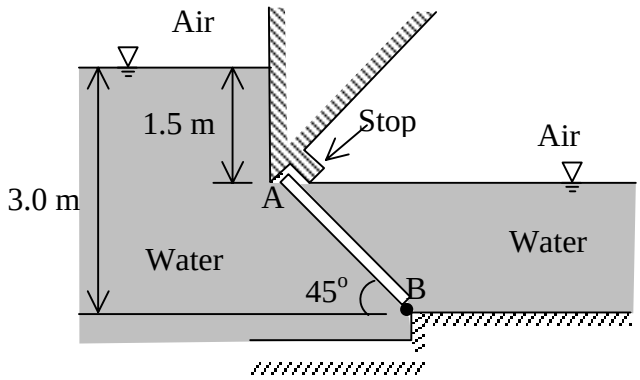
15) The gate shown in Figure below is 3m wide and for analysis can be considered massless. For what depth of water will this rectangular gate be in equilibrium as shown.



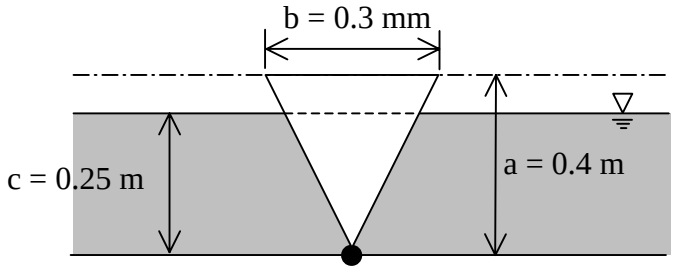
16) The gate of mass 2000 kg is mounted on a frictionless hinge along the lower edge. The length of the reservoir and gate (perpendicular tot he plane of view) is 8m. For the equilibrium conditions shown, compute the width, b, of the gate.



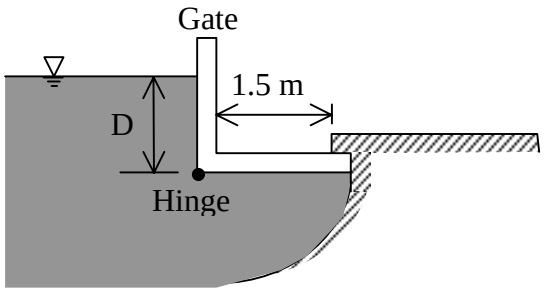
17) The rectangular gate AB, as shown in figure below, is 2 m wide. Find the force per unit width exerted against the stop at A. Assume that the gate mass is negligible.



18) A window in the shape of an isosceles triangle and hinged at the top is placed in the vertical wall of a form that contains liquid concrete. Determine the minimum force that must be applied at point D to keep the window closed for the configuration of the form and concrete.



19) As water rises on the left side of the rectangular gate, the gate will open automatically. At what depth above the hinge will this occur?. Neglect the mass of the gate.



20) A long, square wooden block is pivoted along one edge. The block is in equilibrium when immersed in water to the depth shown. Evaluate the specific gravity of the wood if friction in the pivot is negligible.