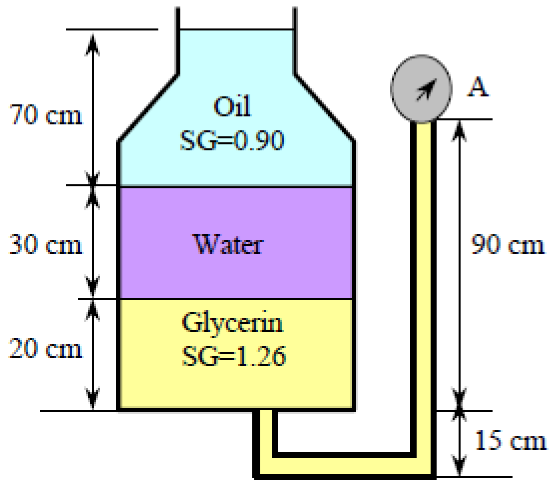
Hydraulics I (CEng 2003) Chapter Two Assignment

1. A multi-fluid container is connected to a U-tube. For the given specific gravities and fluid column heights, calculate the gage pressure at A and the height of a mercury column that would create the same pressure at A.

Assumptions 1 All the liquids are incompressible.

2 The multi-fluid container is open to the atmosphere.

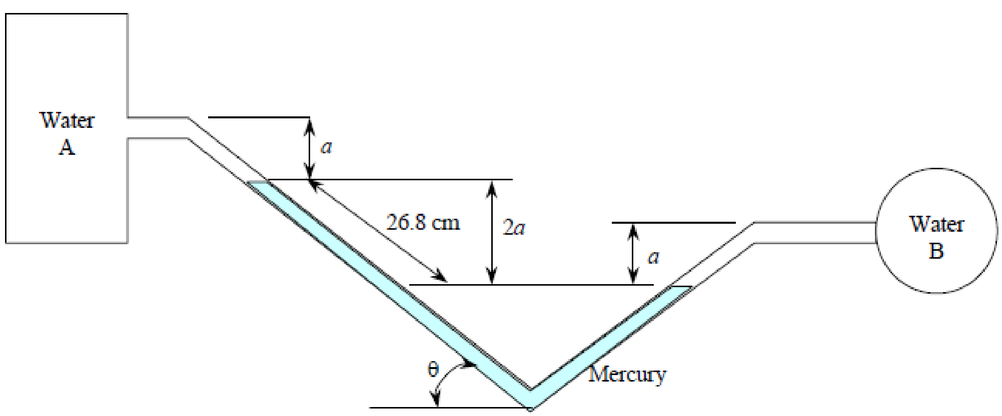
Properties The specific gravities are given to be 1.26 for glycerin and 0.90 for oil. We take the standard density of water to be ρ_w =1000 kg/m^3, and the specific gravity of mercury to be 13.6.



2. Two water tanks are connected to each other through a mercury manometer with inclined tubes. If the pressure difference between the two tanks is 20 KN/m^2, calculate the parameters **a** and **θ**.

Assumptions Both water and mercury are incompressible.

Properties The specific gravity of mercury is given to be 13.6. We take the standard density of water to be ρw =1000 kg/m^3.



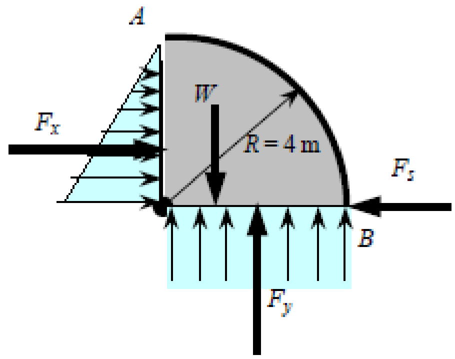
3. A quarter-circular gate with 4m length is hinged about its upper edge controls the flow of water over the ledge at B where the gate is pressed by a spring. Calculate the minimum spring force required to keep the gate closed when the water level rises to A at the upper edge of the gate.

Assumptions 1 The hinge is frictionless.

2 The atmospheric pressure acts on both sides of the gate, and thus it can be ignored in calculations for convenience.

3 The weight of the gate is negligible.

Properties We take the density of water to be 1000 kg/m^3 throughout.

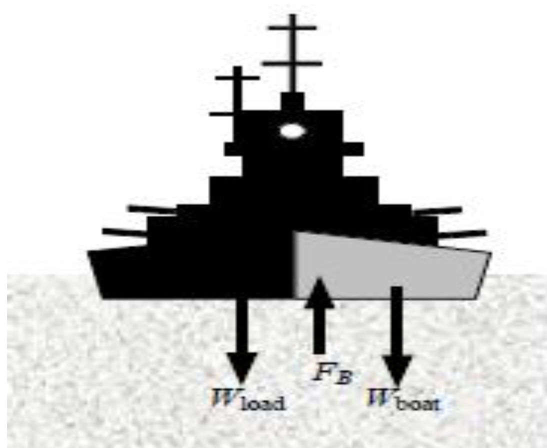


4. The volume of the hull of a boat is given to be 150 m^3 and has a mass of 8.56 ton. Determine the amounts of load the boat can carry in a lake and in the sea water. Can this boat carry more load in the sea or in fresh water? Explain why.

Assumptions 1 The dynamic effects of the waves are disregarded.

2 The buoyancy force in air is negligible.

Properties The density of sea water is given to be 1.03×1000 = 1030 kg/m^3. We take the density of water to be 1000 kg/m^3.

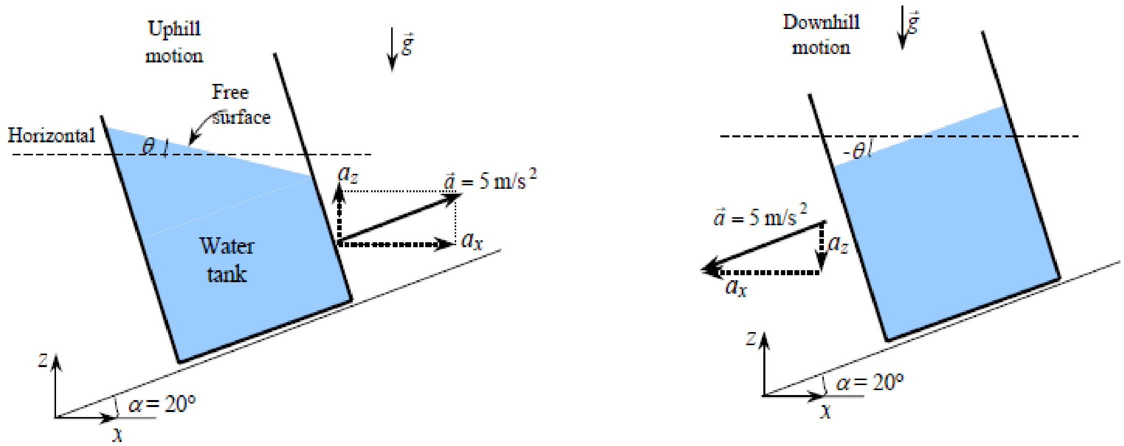


5. An open cylindrical tank 1.2m in diameter and 1.8m deep is filled with water and rotated about its axis at 60rpm. How much liquid is spilled and how deep is the water at the axis?

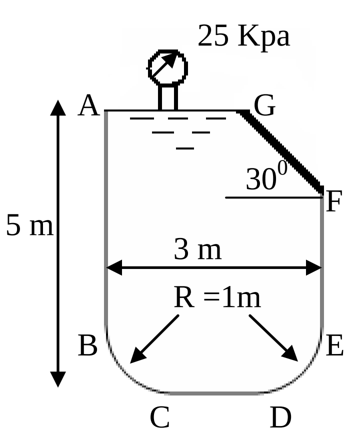
6. A water tank is being towed on an uphill road at constant acceleration. Determine the angle the free surface of water makes with the horizontal .And do the same for the downhill motion.

Assumptions 1 Effects of splashing, breaking, driving over bumps, and climbing hills are assumed to be secondary, and are not considered.

2 The acceleration remains constant.



7. A container is filled under pressure with an oil of specific gravity 0.65. Its cover plate measuring 4m x 1m is held in position by a force R as shown in the figure. Calculate the force R, magnitude, direction and line of action of the forces exerted up on the plane surface AB and CD and the curved surface BC of the tank.



8. An open steel tank having a 3.3 m x 3.3 m plan section and a draft of 1.3 m has its centre of gravity at the water line. The tank has to be delivered by towing after fabrication to its final location. Determine whether it will float stably without adding ballast.

9. An open cylindrical tank 1.2 m in diameter and 1.8 m deep is filled with water and rotated about its axis at 60 rpm. How much liquid is spilled and how deep is the water at the axis ? At what speed should the tank be rotated in order that the center of the bottom of the tank have. zero depth of water?

10. A 6 m x 2 m rectangular gate is hinged at the base and is inclined at an angle of 60' (Fig P 3.6). If W =39.2kN acting at angle of 90' to the gate find the depth of the water when the gate begins to fall. Neglect the weight of the gate and the friction of the pulley.