UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF CIVIL AND

ENVIRONMENTAL ENGINEERING

CEE3311

TUTORIAL 1. FLUID PROPERTIES

1. A tank contains 500 kg of a liquid whose specific gravity is 2. Determine the volume of the liquid in the tank
2. The density of a certain type of jet fuel is 775 kg/m3. Determine its specific gravity and specific weight.
3. A hydrometer is used to measure the specific gravity of liquids. For a certain liquid, a hydrometer reading indicates a specific gravity of 1.15. What is the liquid's density and specific weight? Express your answer in SI units.
4. If 1 cup of cream having a density of 1005 kg/m3 is turned into 3 cups of whipped cream, determine the specific gravity and specific weight of the whipped cream.
5. A 25-mm-diameter shaft is pulled through a cylindrical bearing as shown in Fig. P1.63. the lubricant that fills the 0.3-mm gap between the shaft and bearing is an oil having a kinematic viscosity of and a specific gravity of 0.91. Determine the force *P* required to pull the shaft at a velocity of 3 m/s. Assume the velocity distribution in the gap is linear.

TUTORIAL 2. MANOMETRY

1. A closed cylindrical tank filled with water has a hemispherical dome and is connected to an inverted piping system as shown in Fig. P2.39. The liquid in the top part of the piping system has a specific gravity of 0.8, and the remaining parts of the system are filled with water. If the pressure gage reading at *A* is 60 kPa, determine (a) the pressure in pipe *B*, and (b) the pressure head, in millimeters of mercury, at the top of the dome (point *C*).

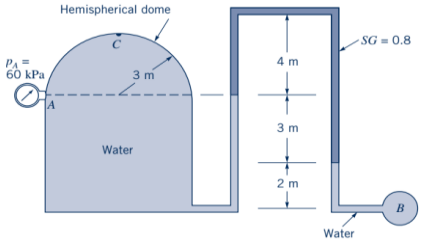


Figure P2.39

2. An unknown immiscible liquid seeps into the bottom of an open oil tank. Some measurements indicate that the depth of the unknown liquid is 1.5 m and the depth of the oil (specific weight 8.5 kN/m3) floating on top is 5.0 m. A pressure gage connected to the bottom of the tank reads 65 kPa. What is the specific gravity of the unknown liquid?

3. The cylindrical tank with hemispherical ends shown in Fig. P2.46 contains a volatile liquid and its vapor. The liquid density is 800 kg/m3, and its vapor density is negligible. The pressure in the vapor is 120 kPa (abs) and the atmospheric pressure is 101 kPa (abs). Determine: (a) the gage pressure reading on the pressure gage, and (b) the height, h, of the mercury, manometer

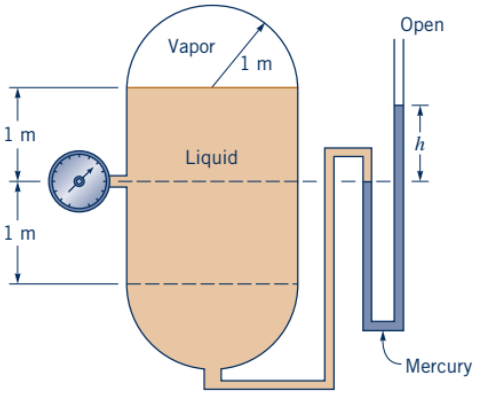


Figure P2.46

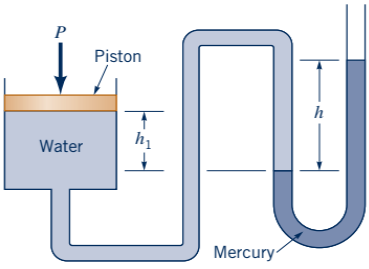
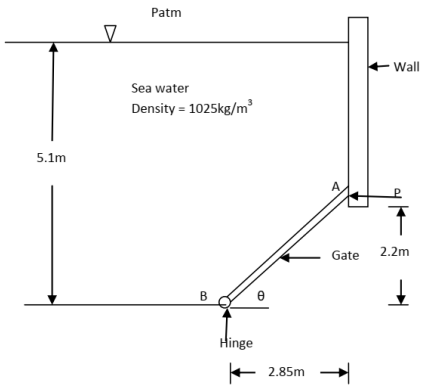


Figure P2.73

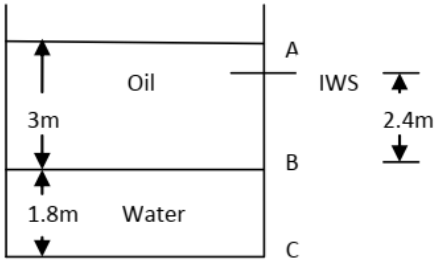
4. A piston having a cross-sectional area of 0.07 m2 is located in a cylinder containing water as shown in Fig. P2.73. An open U-tube manometer is connected to the cylinder as shown. For *h*1 60 mm and *h* 100 mm, what is the value of the applied force, *P*, acting on the piston? The weight of the piston is negligible.

TUTORIAL 3. HYDROSTATIC FORCES

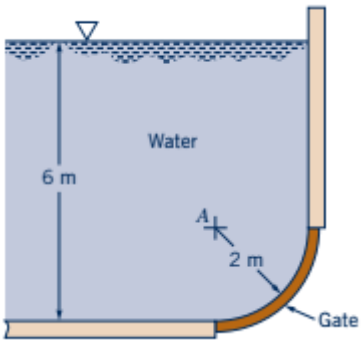
1. The gate is 1.2m wide ,hinged at point B, and rests against a smooth wall at A. Compute
(a) the force on the gate due to sea water pressure, (b) the horizontal force exerted by the wall at point A, and
(c) the reaction at hinge B.



2. The tank in the fig. contains oil (sp gr = 0.8) and water as shown. Find the resultant force on side ABC and its point of application. ABC is 1.2m wide



*3.*A 4-m-long curved gate is located in the side of a reservoir containing water as shown . Determine the magnitude of the horizontal and vertical components of the force of the water on the gate. Will this force pass through point ***A***? Explain



TUTORIAL 4. BUOYANCY AND FLOATATION

1. A rectangular pontoon has a width of 6m, length of 10m and a draught of 2m in fresh water. Calculate

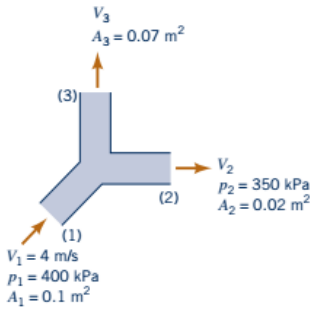
(a) weight of pontoon,
(b) its draught in seawater of density 1025 kg/m^3 and
(c) the load that can be supported by the pontoon in fresh water if the maximum draught permissible is 2.3m.

2. A steel pipeline carrying gas has an internal diameter of 1200mm and an external diameter of 1250mm. It is laid across the bed of a river, completely immersed in water and is anchored at intervals of 3m along its length. Calculate the buoyancy force per meter run and upward force on each anchorage. Take density of steel = 7900 kg/m3.

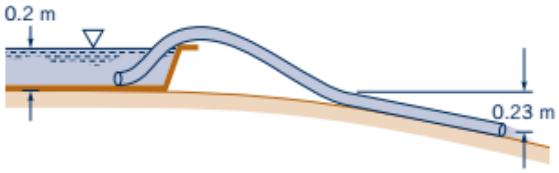
3. A wooden block of width 2m, depth 1.5m and length 4m floats horizontally in water. Find the volume of water displaced and the position of center of buoyancy. The specific gravity of wooden block is 0.7

TUTORIAL 5. FLUID KINEMATICS (BERNOULLI EQUATION)

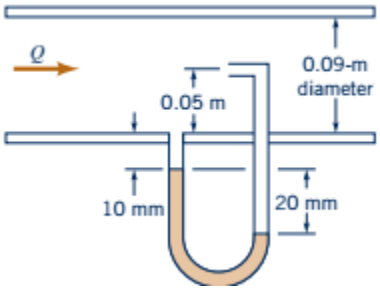
1. Water flows through a horizontal branching pipe. Determine the pressure at section (3).



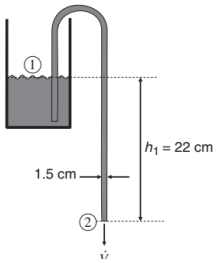
2. A smooth plastic, 10-m-long garden hose with an inside diameter of 20 mm is used to drain a wading pool as is shown in Fig. P3.63. If viscous effects are neglected, what is the flowrate from the pool?

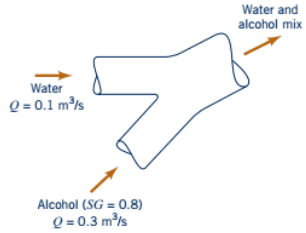


3. The specific gravity of the manometer fluid is 1.07. Determine the volume flowrate, ***Q***, if the flow is inviscid and incompressible and the flowing fluid is *(a)* water,



4. Water is siphoned from a tank as shown. What is the flow rate of water in the siphon tube (inner diameter *is* 15 mm)? What is the limit in the wall height that the siphon can overcome? Vapor pressure of water is 3.167kPa and Atmospheric pressure is 101.3kPpa





1. Water at 0.1 m^3/s and Black label (*SG* **0.8**) at 0.3 m^3/s are mixed in a *y*-duct as shown in What is the average density of the mixture of alcohol and water?