PHY250 - Fall 2021: Fluids

Exercise 1

The surface of the water in a storage tank is 30 m above a water faucet in the kitchen of a house. Calculate the difference in water pressure between the faucet and the surface of the water in the tank.

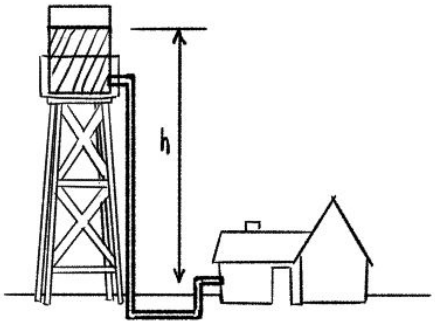

Figure 1: Exercise 1

Exercise 2

Force on aquarium window. Calculate the force due to water pressure exerted on a 1.0 m X 3.0 m aquarium viewing window whose top edge is 1.0 m below the water surface

Exercise 3

At what elevation is the air pressure equal to half the pressure atsea level?

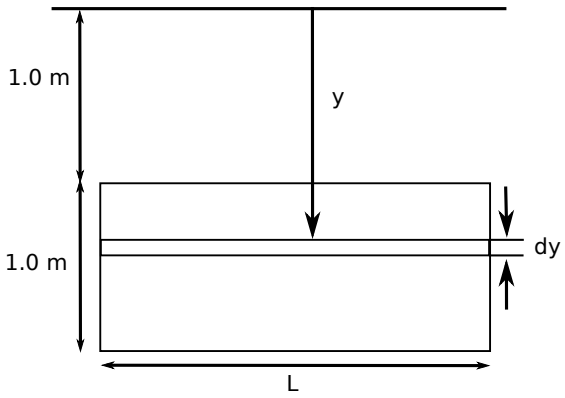

Figure 2: Exercise 2

Exercise 4

A U-shaped tube with a horizontal portion of length ℓ contains a liquid. What is the difference in height between the liquid columns in the vertical arms (a) if the tube has an acceleration a toward the right and (b) if the tube is mounted on a horizontal turntable rotating with an angular speed $\omega$with one of the vertical arms on the axis of rotation? (c) Explain why the difference in height does not depend on the density of the liquid or on the crosssectional area of the tube. Would it be the same if the vertical tubes did not have equal cross-sectional areas? Would it be the same if the horizontal portion were tapered from one end to the other? Explain.

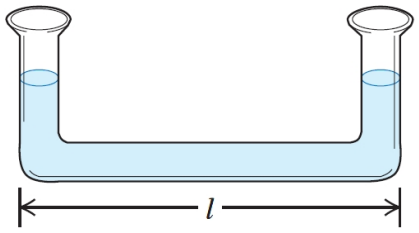

Figure 3: Exercise 4

Exercise 5

A 70-kg ancient statue lies atthe bottom of the sea. Its volume is 3.0X104cm3. How much forceis needed to lift it?

Exercise 6

Is the crown gold? When a crown of mass 14.7 kg is submerged in water, an accurate scale reads only 13.4 kg. Is the crown made of gold?

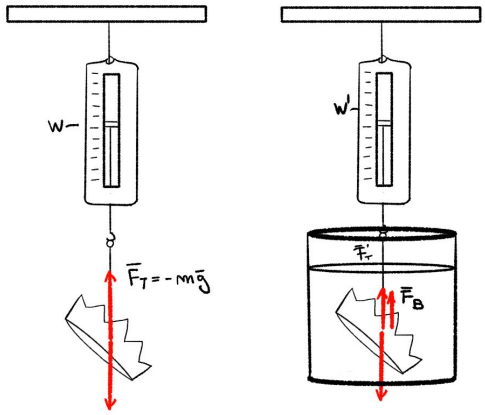

Figure 4: Exercise 6

Exercise 7

Helium balloon. What volume V of helium is needed if a balloon is to lift a load of 180 kg (including the weight of the empty balloon)?

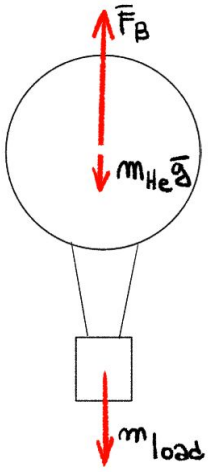

Figure 5: Exercise 7

Exercise 8

Suppose a piece of styrofoam, $\rho = 180\ kg/m^3$ is held completely submerged in water. (a) What is the tension in the cord? Find this using Archimedes's principle. (b) Use $p = p_0 + \rho gh$ to calculate directly the force exerted by the water on the two sloped sides and the bottom of the styrofoam; then show that the vector sum of these forces is the buoyant force.

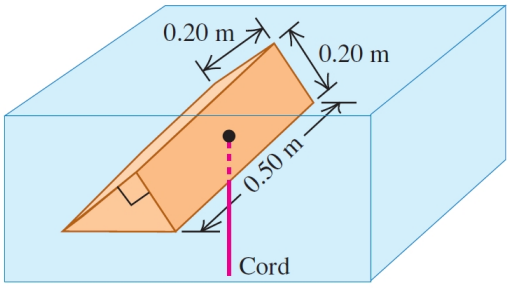

Figure 6: Exercise 8