Solved problems on Fluid Mechanics(Phys1011)

Properties of Bulk Matter

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1. Suppose that the tension in the cable is 940 N as the actor reaches the lowest point. What diameter should a 10-m-long steel wire have if we do not want it to stretch more than 0.5 cm under these conditions?{Ans:= 3.4 m}

2. A 200.- kg load is hung on a wire of length 4.00 m, cross-sectional area 400cm^2, and Young's modulus 8.00×10^{10} N/m^2. What is its increase in length?

3. A solid brass sphere is initially surrounded by air, and the air pressure exerted on it is1.0×10^5 N/m^2 (normal atmospheric pressure). The sphere is lowered into the ocean to a depth where the pressure is 2.0×10^7 N /m^2. The volume of the sphere in air is 0.50 m3. By how much does this volume change once the sphere is submerged?

4. A horizontal pipe narrows from a radius of 0.250 m to 0.100 m. If the speed of the water in the pipe is 1.00 m/s in the larger radius pipe, what is the speed in the smaller pipe?

Fluid statics

5. solid sphere made of wood has a radius of 0.1 m. The mass of the sphere is 1.0 kg. Determine: (a) density and (b) specific gravity of the wood. {Ans: $\rho = 239\ kg/m^3$; SG= 0.239}

6. The small piston of a hydraulic lift has an area of $450cm^2$. A car weighing 1.2×10^4 kg sits on a rack mounted on the large piston. The large piston has an area of $9000cm^2$. How large force must be applied to the small piston to support the car?{2.7×10^3 N}?

7. A sample of an unknown material weighs 300 N in air and 200 N when submerged in an alcohol solution with a density of0.70×10^3 kg $/m^3$. What is the density of the material? {Ans:= $2.1 \times 10^3\ kg/m^3$}

Fluid statics

7. A container is filled to a depth of 20.0 cm with water. On top of the water floats a 30.0-cm- thick layer of oil with specific gravity 0.700. What is the absolute pressure at the bottom of the container?

8. Blood pressure is normally measured with the cuff of the sphygmomanometer around the arm. Suppose the blood pressure is measured with the cuff around the calf of the leg of a standing person. Would the reading of the blood pressure be (a) the same here as it is for the arm, (b) greater than it is for the arm, or (c) less than it is for the arm?

9. Calculate the absolute pressure at an ocean depth of 1.0×10^3 m. {Take: $\rho_{\text{see water}}$ is 1.025×10^3 kg/m^3}

Moving Fluids and Bernoulli's Equation

10. Show Bernoulli's equation mathematically?

11. The inside diameters of the larger portions of the horizontal pipe depicted in the figure are 2.50 cm. Water flows to the right at a rate of 1.80×10^{-4} m^3/s. Determine the inside diameter of the constriction.

12Water circulates throughout a house in a hot water heating system. If the water is pumped at a speed of 0.50 m/s through a 4.0-cm diameter pipe in the basement under a pressure of $3.03x10^5$ Pa, what will be the velocity and pressure in a 2.6-cm diameter pipe on the second floor 5.0 m above?{Ans: v=11.83m/s, $P_2 = 1.84 \times 10^5$ Pa}