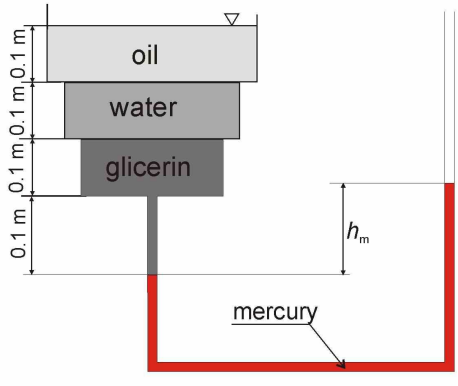
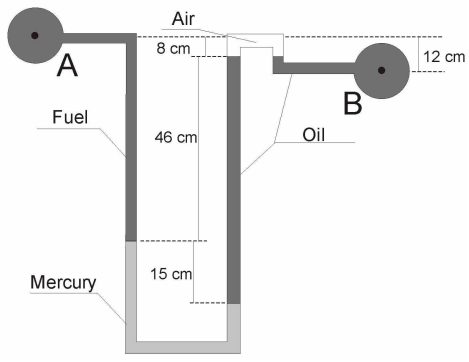
FLUID STATICS. MANOMETERS.

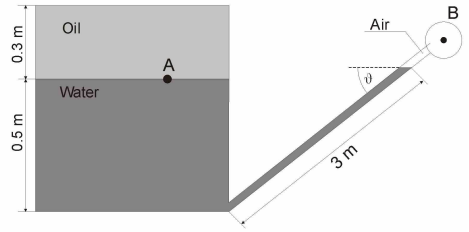
Ex. 1. A tank is constructed of a series of cylinders as shown in a figure. The tank contains: oil $\rho_o = 915\,kg/m^3$, water $\rho_w = 1000\,kg/m^3$, glycerin $\rho_g = 1300\,kg/m^3$, mercury $\rho_m = 13600\,kg/m^3$. A mercury manometer is attached to the bottom of the tank. Calculate the manometer reading h_m. (Ans. $h_m = 3.3\,cm$)



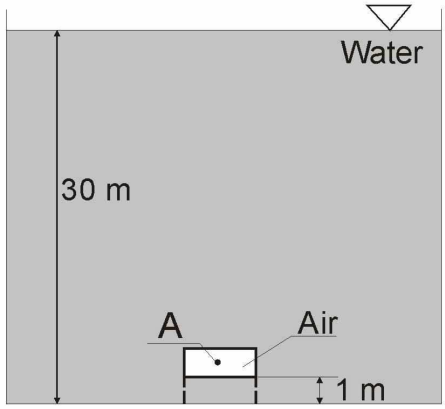
Ex. 2. A mercury manometer is used to measure the pressure difference in the two pipelines as shown in a figure. Fuel ($\rho_f = 850\,kg/m^3$) is flowing in A and oil ($\rho_o = 915\,kg/m^3$) is flowing in B. An air pocket has become entrapped in the oil as indicated. Determine the pressure in pipe B if the pressure in A is 105.5 kPa. (Ans. $p_B = 124.9\,kPa$)



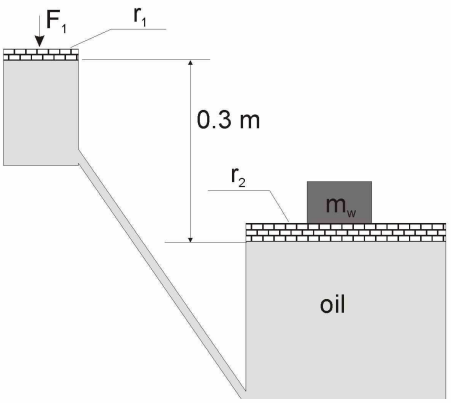
Ex. 3. Determine the angle θ of the inclined tube shown in figure if the pressure at A is 7 kPa greater than that at B. (Ans. $\theta = 23.86°$)



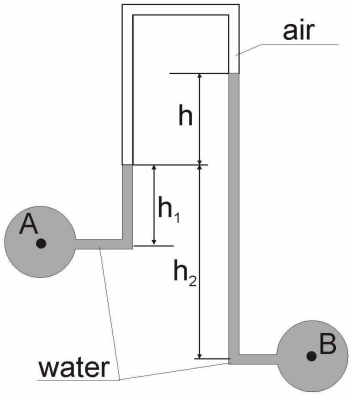
Ex. 4. Determine the pressure at point A. (Ans. $p_A = 385.8\,kPa$)



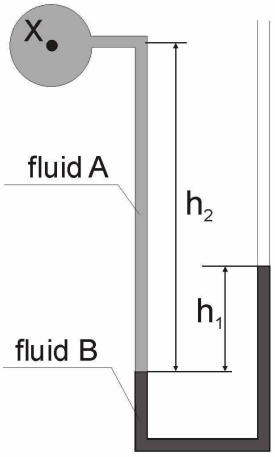
Ex. 5. A weight lies on a piston with a radius $r_2 = 1.0\,m$. Determine the force F_1 applied to the piston with radius $r_1 = 20\,cm$ if the hydraulic jack is in a balance. The jack is filled by an oil with $\rho_o = 850\,kg/m^3$. A mass of weight is $m_w = 1000\,kg$. Neglect the mass of the pistons. (Ans. $F_1 = 392.4\,N$)



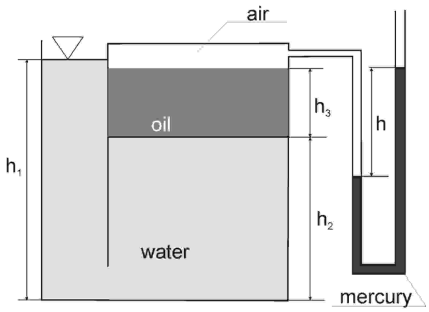
Ex. 6. An inverted U-tube manometer is used to measure the difference of water pressure between two points in a pipe. Find the difference of pressure between point B and A if the density of water is $\rho = 10^3\,kg/m^3$, $h_1 = 60\,cm$, $h = 45\,cm$, $h_2 = 180\,cm$. (Ans. $p_{BA} = 16.2\,kPa$)



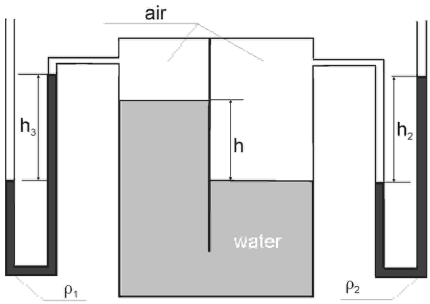
Ex. 7. In figure, fluid A is water and fluid B is mercury. What will be the difference in level h_1 if the pressure at X is $140\,kN/m^2$ and $h_2 = 1.5\,m$. (Ans. $h_1 = 40\,cm$)



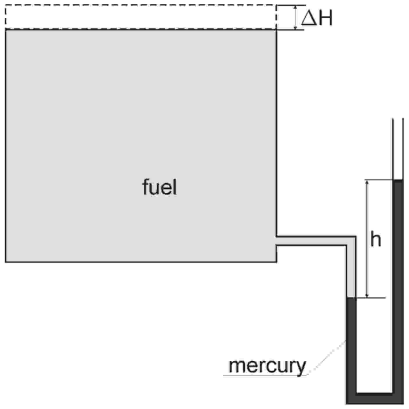
Ex. 8. Calculate a manometer reading h if density of oil $\rho_o = 800\,kg/m^3$, density of water $\rho_w = 1000\,kg/m^3$ and density of mercury $\rho_m = 13600\,kg/m^3$, $h_1 = 8m$ $h_2 = 4\,m$, $h_3 = 2\,m$. (Ans. $h = 0.45\,m$)



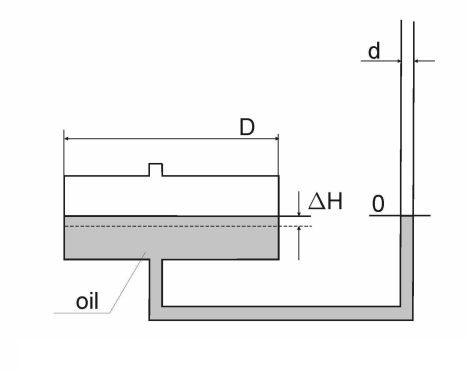
Ex. 9. Calculate a formula for manometer reading h_2 for a situation shows at figure. As a known values we have: $h_3,\ h,\ \rho_1,\ \rho_2,\ \rho_w$.
(Ans. $h_2 = (h\rho_w - h_3\rho_1)/\rho_2$)



Ex. 10. A mercury manometer is connected to open tank of fuel. Calculate a change of manometer reading h if a level of fuel increases about ΔH.
(Ans. $\Delta h = \Delta H\,\rho_f/(2\rho_m - \rho_f)$)



Ex. 11. In well-type manometer (with constant zero level) there is neglected a change of fluid level in w big vessel (diameter D). Calculate a ratio d/D for which an error connected with a change of fluid level ΔH is less than 1%. (Ans. $d/D \leqslant 0.1$)



Ex. 12. A mercury manometer connects two oil pipelines. Calculate a pressure difference between points A and B if $H = 2\,m$, $\Delta h = 0.2\,m$, $\rho_o = 800\,kg/m^3$, $\rho_m = 13600\,kg/m^3$.
(Ans. $p_{AB} = 9.418\,kPa$)