Name______________________________Pd________

## Drink Plenty of Fluids!

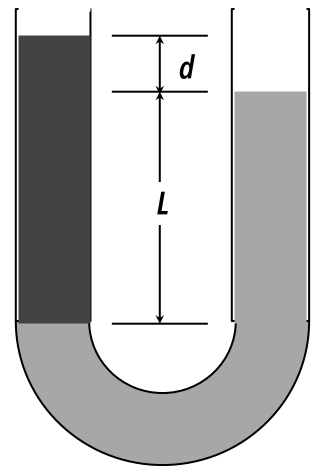
1. If a 20 N force acts on a 116 cm diameter piston, what is the pressure on the piston?

diameter=1.16 m; radius=0.58 m; area=$\pi r^2$=1.056 $m^2$ $P = F/A = 20/1.056 = 18.93$ Pa

2. Explain why you cannot use the formula $P = \rho \cdot g \cdot \Delta h$ to calculate the pressure difference between two points in the earth's atmosphere.

Air is compressible, which means that its pressure varies with depth. the formula only works well for incompressible fluids, like water

3. A U-tube is partially filled with water. Another liquid, which does not mix with water, is poured into the left side until the tops of the two columns of liquid differ in height by an amount ***d***. The top of the water on the left side is a distance ***L*** below the level of the right side. What is the ratio of the density of the unknown liquid to that of water?




At the point where the two fluids meet, pressure must be equal:

$P_{unk} = P_{H2O}$

$\rho \cdot g \cdot h = \rho \cdot g \cdot h$ (g's cancel)

$\rho_{unk}(d+L) = \rho_{H2O}L$

$\rho_{unk}/\rho_{H2O} = L/(d+L)$

4. You own a watch that can be used underwater. It is rated, according to the top of the dial, for a maximum depth of 200 m. Assuming you were going to use this in the ocean, what gauge pressure would the watch face be withstanding at that depth? What total pressure would it be withstanding? Could a 70 kg woman in high heels stand on the watch face with just one heel (A=1 $cm^2$) without breaking the glass?

$P_G = \rho gh = 1000(10)(200) = 2 \cdot 10^6$ Pa

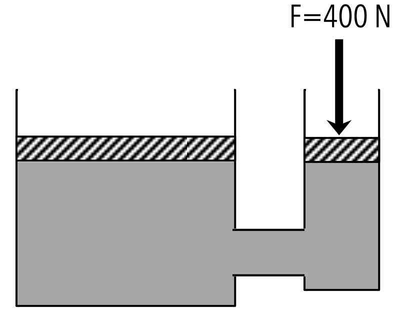
$P_{total} = P_0 + P_G = 10^5 + 2 \cdot 10^6$ Pa $= 2.1 \cdot 10^6$ Pa

$P_{woman} = F/A = 700/0.0001 = 7 \cdot 10^6$ Pa No, she'll break the glass.

5. The manufacturer of a steel-belted radial tire recommends a pressure of $2.6 \cdot 10^5$ $N/m^2$ (38 lb/$in^2$).
   a) is this an absolute, or a gauge pressure?
   b) if your tire is completely flat after a blowout, what would be the pressure reading of a standard tire gauge?
   c) the tire is re-inflated until the tire gauge reads $1.38 \cdot 10^5$ $N/m^2$. What is the absolute pressure inside the tire?

a) Gauge pressure
b) 0 Pa
c) $2.38 \cdot 10^5$ Pa

6. The small cylinder has a diameter of 4 cm, and the larger cylinder it is connected to has a diameter of 24 cm. Each cylinder contains a frictionless piston, as shown. If 400 N is applied to the smaller piston, what force will be exerted by the fluid on the larger piston? (The weight of the small piston is negligible.)




Area=$\pi r^2$ Small area = 0.00126 $m^2$ Large area = 0.04522 $m^2$

$P_1 = P_2$ So: $F_1/A_1 = F_2/A_2$

$400/0.00126 = F_2/0.04522$ $F_2$=14,354 N

7. A local water tower is 220 m tall. When filled to the brim inside with water, what will be the pressure at ground level as it flows out of a tap? (THINK!) Does it matter that the water could be connected to the tap by several miles of pipes?

$P = \rho gh = 1000(10)(220) = 2.2 \cdot 10^6$ Pa

Nope, the pipes don't matter; only the height of the fluid above a point determines pressure of a fluid.