Chapter 15:

In a vacuum chamber on earth, a cylinder of height D contains a gas whose density within the cylinder varies like $\rho(y) = [\rho_0/D](D-y)$, with the bottom of the cylinder being at $y = 0$. Show that the pressure exerted by the gas on the bottom of the cylinder is $(\rho_0 g D)/2$.

An object of mass M is hung from a spring scale. The object has a density 1.5 times that of water, and a volume of 0.5 m^3. If the object is suspended from the scale in a beaker of water, completely submerged, what does the scale read? The density of water is 1000 $\mathrm{kg/m}^2$ and $g = 10$ $\mathrm{m/s}^2$. What would the scale read with the object in air, neglecting the buoyant force due to the air, which is very small.

Answer: In water, 2500 N. In air, 7500 N. Thus the water provides 5000 N of support.

A liquid is flowing in a tube of area A, at speed v_1. If the tube narrows down to $a = A/10$, how does the speed change?

Answer: $v_2/v_1 = 10$.

A liquid is flowing in a tube of area 1 m^2 at 10 m/s,

under a pressure of 10^6 N/m^2. As the tube rises 10 m, it narrows to an area of 0.3 m^2. The liquid has a density of 1000 kg/m^2. What is the pressure in the liquid when it is 10 m above its original level?

Answer: 3.95 $\times 10^5$ N/m^2.