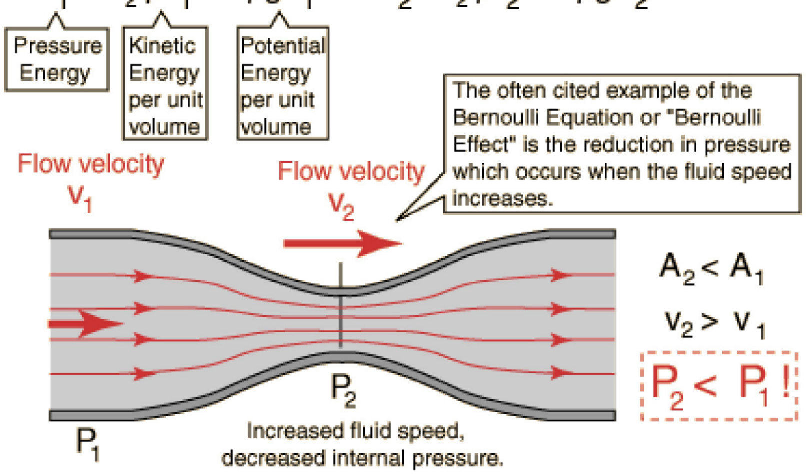
Bernoulli Equation

The Bernoulli Equation can be considered to be a statement of the conservation of energy principle appropriate for flowing fluids. The qualitative behavior that is usually labeled with the term "Bernoulli effect" is the lowering of fluid pressure in regions where the flow velocity is increased. This lowering of pressure in a constriction of a flow path may seem counterintuitive, but seems less so when you consider pressure to be energy density. In the high velocity flow through the constriction, kinetic energy must increase at the expense of pressure energy.

Energy per unit volume before = Energy per unit volume after

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$



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The calculation of the "real world" pressure in a constriction of a tube is difficult to do because of viscous losses, turbulence, and the assumptions which must be made about the velocity profile (which affect the calculated kinetic energy). The model calculation here assumes laminar flow (no turbulence), assumes that the distance from the larger diameter to the smaller is short enough that viscous losses can be neglected, and assumes that the velocity profile follows that of theoretical laminar flow. Specifically, this involves assuming that the effective flow velocity is one half of the maximum velocity, and that the average kinetic energy density is given by one third of the maximum kinetic energy density.