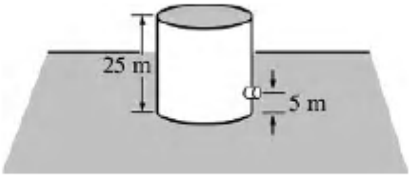
Fizzix AP2 – Greenwichstein High School
Worksheet Thingee
WS 12-1



5. (10 points)

A large tank, 25 m in height and open at the top, is completely filled with saltwater (density 1025 kg/m^3). A small drain plug with a cross-sectional area of 4.0×10^{-5} m^2 is located 5.0 m from the bottom of the tank. The plug breaks loose from the tank, and water flows from the drain.

(a) Calculate the force exerted by the water on the plug before the plug breaks free.

(b) Calculate the speed of the water as it leaves the hole in the side of the tank.

(c) Calculate the volume flow rate of the water from the hole.

a) $P = P_{ATM} + \rho g h$

$= (1\times10^5\ Pa) + (1025)(10)(20)$

$P = 3.1\times10^5\ Pa$

$F = PA = (3.1\times10^5)(4\times10^{-5})$

$\boxed{F = 12\ N}$

b) BERNOULLI @ TOP & DRAIN

$P_{0TOP} + \rho g y_{TOP} + \frac{1}{2}\rho v_{TOP}^2 = P_{0DRAIN} + \rho g y_{DRAIN} + \frac{1}{2}\rho v_{DRAIN}^2$

$P_{0TOP} = P_{0DRAIN} = P_{ATM}$ & $v_{TOP} = 0$

so: $\rho g y_{TOP} = \rho g y_{DRAIN} + \frac{1}{2}\rho v_D^2$

$\frac{1}{2}\rho v_D^2 = \rho g (y_{TOP} - y_{DR})$

$v_D = \sqrt{2gh} = \sqrt{2(10)(20)}$

$\boxed{v_D = 20\ m/s}$

c) $\frac{V}{t} = vA$

$= (20\ m/s)(4\times10^{-5}\ m^2)$

$\boxed{\frac{V}{t} = 8\times10^{-4}\ m^3/s}$