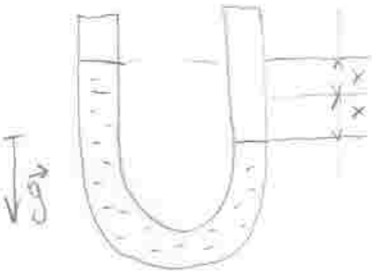
Known:
m - mass of fluid in pipe [kg]
S - area of pipe's section [m^2]
g - gravity acceleration [m/s^2]
ρ - density of fluid in pipe [kg/m^3]



$$F = -\underbrace{\rho \cdot S \cdot 2x}_{} \cdot g \quad \{k = 2 \cdot \rho \cdot S \cdot g\}$$

$$a = \frac{F}{m}$$

$$a = -\frac{2 \cdot S \cdot \rho \cdot g}{m} \cdot x \qquad \left| \frac{k}{m} = \omega^2 \right|$$

$$\omega = \frac{2\pi}{T}$$

$$\omega^2 = \frac{4\pi^2}{T^2}$$

$$T^2 = 4\pi^2 \cdot \frac{m}{2 \cdot S \cdot \rho \cdot g}$$

$$\boxed{T = 2\pi \cdot \sqrt{\frac{m}{2 \cdot S \cdot \rho \cdot g}}}$$

This is harmonic move because force depends from lean Δx.

$$F = -k \cdot x$$

$$m \cdot \frac{d^2x}{dt^2} = -k \cdot x$$

$$m \frac{d^2x}{dt^2} + k \cdot x = 0$$

$$m \cdot \frac{d^2x}{dt^2} + k x = 0$$

$$\frac{d^2x}{dt^2} + \frac{k}{m} x = 0 \qquad \left| \frac{k}{m} = \omega^2 \right.$$

$$\frac{d^2x}{dt^2} + \omega^2 \cdot x = 0$$

$$t^2 + \omega^2 = 0$$

$$t_1 = i\omega \qquad t_2 = -i\omega$$

$$x(t) = A \cdot e^{i \cdot \omega \cdot t} + B\, e^{-i \cdot \omega \cdot t}$$

$$\frac{dy}{dx} - a_0 y = 0$$

$$\frac{dy}{dx} = a_0 \cdot y \qquad \left| \log_a b = c,\ a^c = b \right|$$

$$\frac{dy}{dx} = a_0 \cdot y$$

$$\int \frac{dy}{y} = \int a_0 \cdot dx$$

$$\ln y + C_1 = a_0 \cdot x + C_2 \qquad \left| C_2 - C_1 = C \right|$$

$$\ln y = a_0 \cdot x + C$$

$$y = e^{a_0 \cdot x + C}$$

$$y = e^{a_0 \cdot x} \cdot e^C \qquad \left| e^C = C \right.$$

$$\boxed{y = C \cdot e^{a_0 \cdot x}}$$

http://www.mbstudent.com/physics-examples.html