

Fluid mechanics



Fluids

The fluid state is a state of matter in which particles don't have a fixed position and can move more or less freely with respect to one another (generally consisting of only one substance or a mixture of several substances); it includes liquids, aeriforms, plasma and, in some cases, plastic solids.

Pressure

- *Pressure is an intensive physical quantity. It is defined as the relationship between the force module acting orthogonally on a surface and its area.*
- In the international system the unit of measurement of **pressure** is the Newton divided by the square meter, which is called Pascal(Pa)

$$\text{Pressure(Pa)} \longleftarrow P = F / S \longrightarrow \text{Superface area}(m^2)$$

↓
Perpendicular force(N)

Stevino's law

- *Stevino's law measures the pressure inside a fluid.*
- Is expressed by the following equation:

$$p = p_0 + \rho gh$$

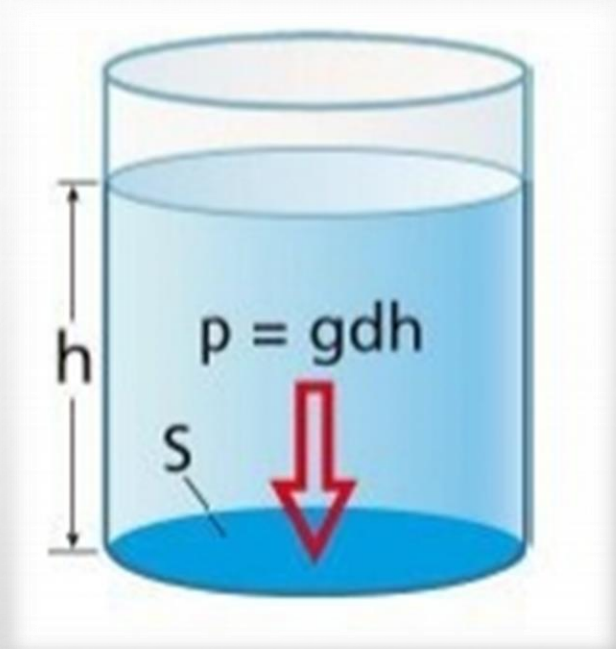
Pressure at depth(Pa) ←

→ Depth(m)

↓ Atmospheric pressure(Pa)

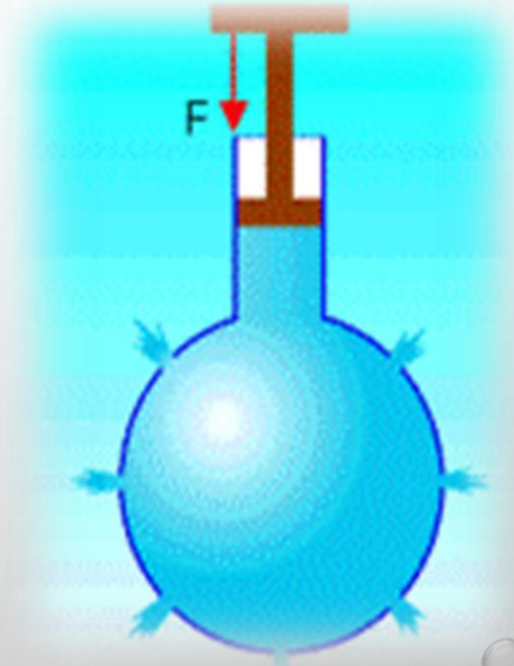
↓ Density(kg/m^3)

↓ Gravity acceleration(m/s)



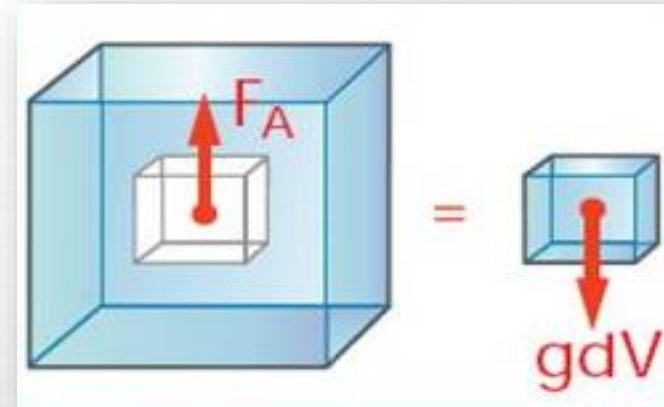
The Pascal's law

- *This law establishes that: a variation of pressure produced on every surface in contact with a liquid in equilibrium, completely enclosed by walls, is transmitted unaltered to every other surface in contact with the liquid.*



The Archimede's law

- The fluid exert an upward force on a submerged body, called the push of Archimedes. The Archimedes law establishes that: a body immersed in a fluid undergoes a direct upward force, of intensity F_a equal to the weight of the displaced fluid.



$$F_a = dVg$$

Push of Archimedes(N) ←

Volume of fluid moved(m^3)

Gravity acceleration(m/s^2)

Fluid density(kg/m^3)

Current

- *An ordered movement of a liquid or a gas is called **current**.*

This is a current.



This is not a current.

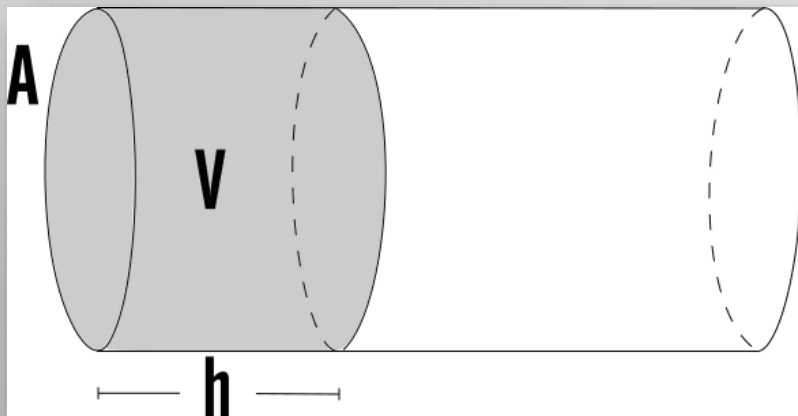


The flow

- A «**pipeline**» is a tube in which a liquid or a gas flows.
- The **flow** q is defined by the ratio ΔV of a fluid which in a time interval Δt crosses a cross-section of the pipeline and the interval Δt itself.

$$\text{Flow}(m^3/s) \longleftarrow q = \Delta V / \Delta t \longrightarrow \text{Time lapse}(s)$$

Volume(m^3)



A **current** is said to be stationary when its flow is constant over time