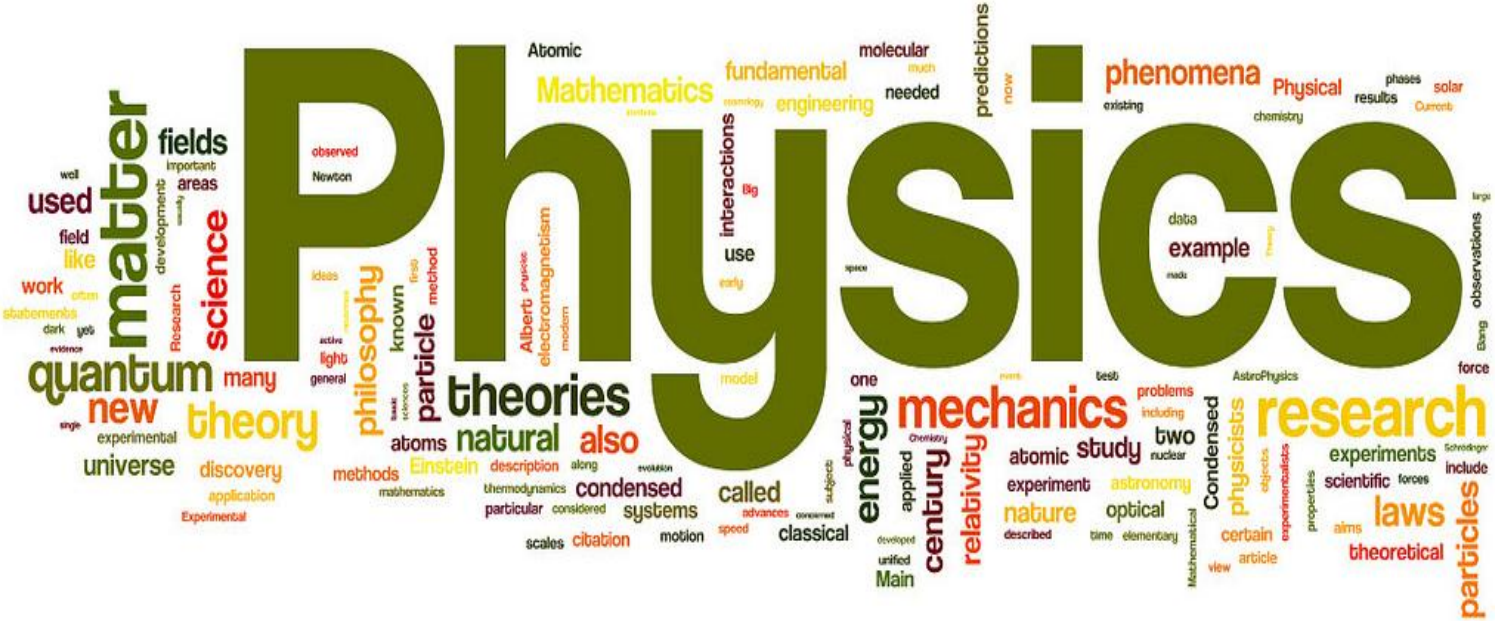

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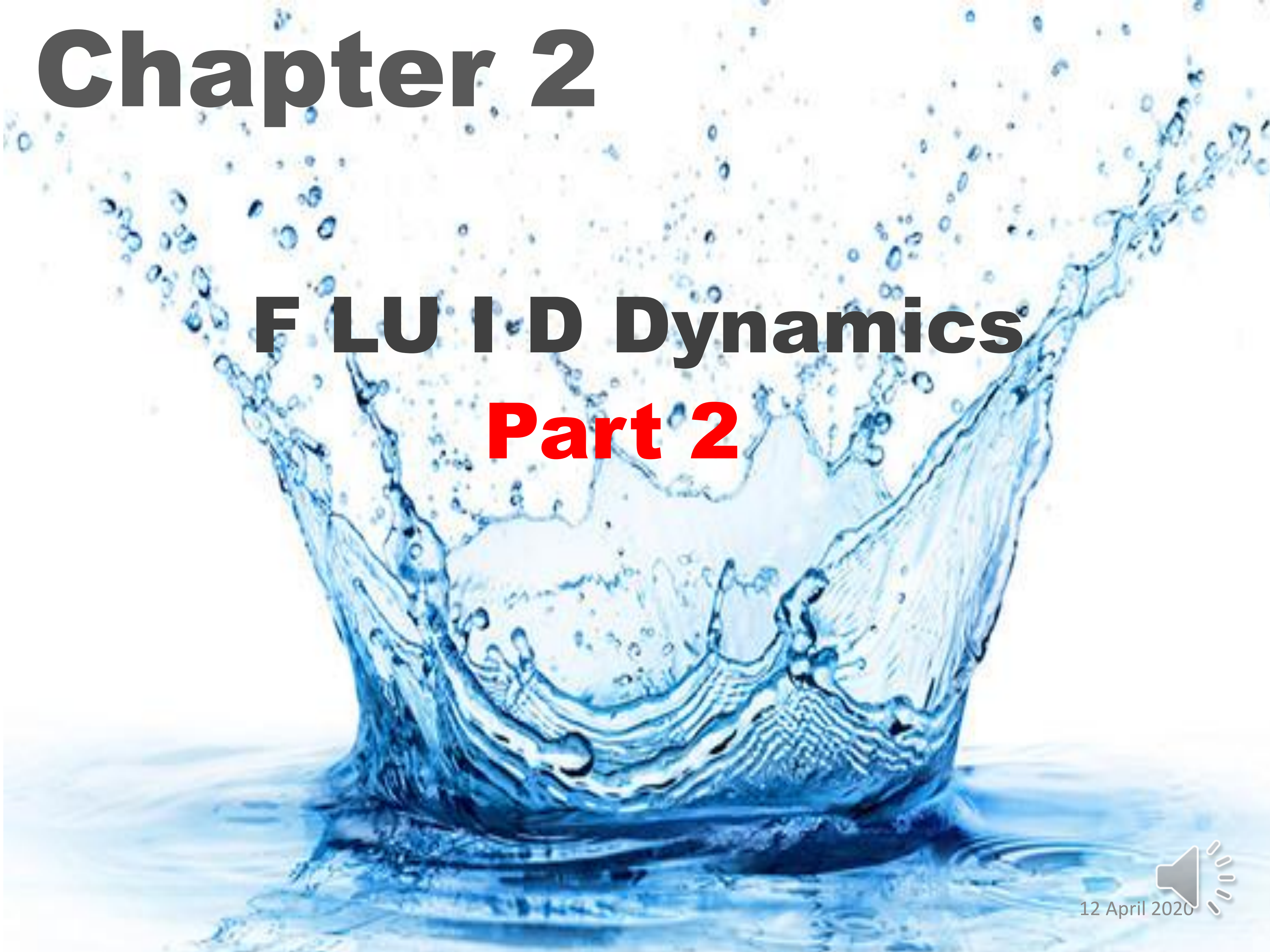
(PHY 001)

Dr. Hossam Bhy El-Din

Chapter 2

F LU I D Dynamics

Part 2



Typing of fluids

Ideal fluids

Real fluids

Assumptions to study fluids

The fluid is non-viscous

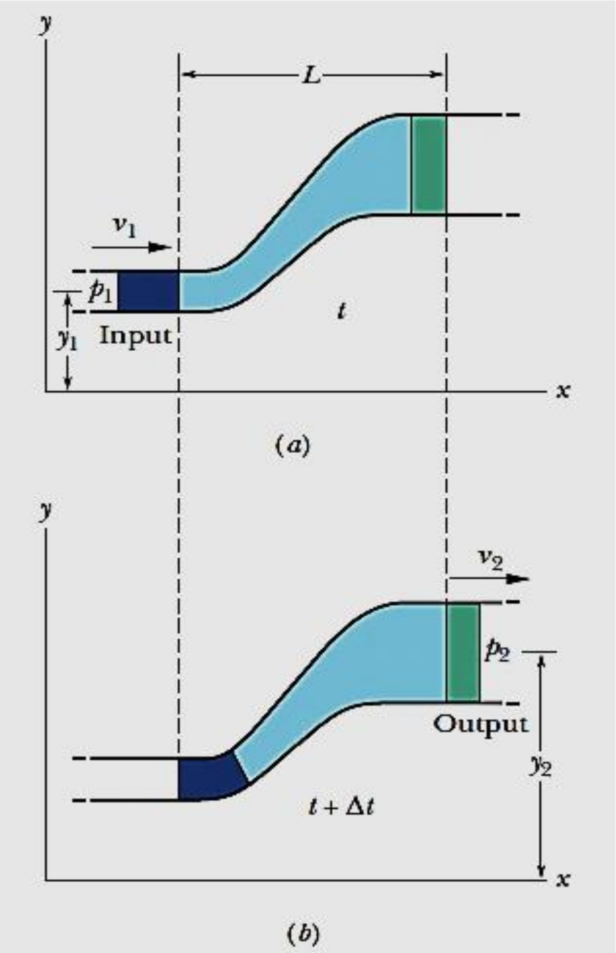
The Flow is steady or irrotational

The fluid is incompressible

Chapter 2

The Bernoulli's Equation

Bernoulli's Equation is general expression that relates the **pressure difference** between two point in a flow tube to **both velocity changes and elevation changes**



First, we apply energy conservation in the form of the work–kinetic energy theorem

W= ΔK

$$\therefore P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$$

$$\therefore P + \frac{1}{2}\rho v^2 + \rho g y = const.$$

(Bernoulli's equation)

This expression shows that

- **The pressure** of a fluid **decreases** as the **speed** of the fluid **increases**.
- The **pressure decreases** as the **elevation increases**.

Chapter 2

EXAMPLE 5

Water enters a house through a pipe 2 cm in inside diameter , at an absolute pressure of 4×10^5 pa (about 4 atm). The pipe leading to the second-floor bathroom 5 m above is 1 cm in diameter. When the flow velocity at the inlet pipe is 4 $m.s^{-1}$. **Find velocity and pressure in the bathroom.**

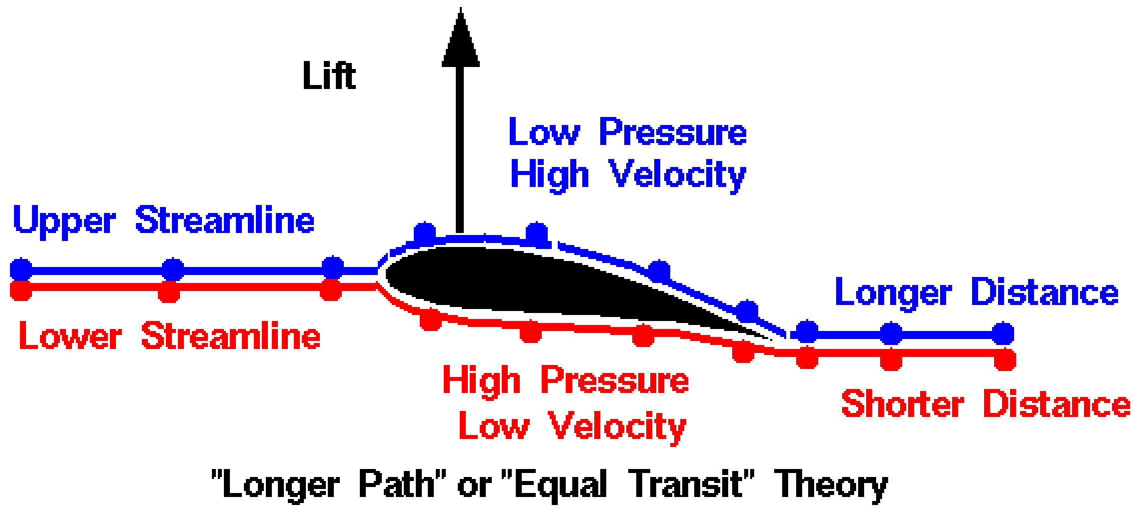
$$v_2 = \frac{A_1}{A_2} v_1$$

$$\therefore P_2 = P_1 - \frac{1}{2}\rho(v_2^2 - v_1^2) - \rho g(y_2 - y_1)$$

Show the details in pag 35

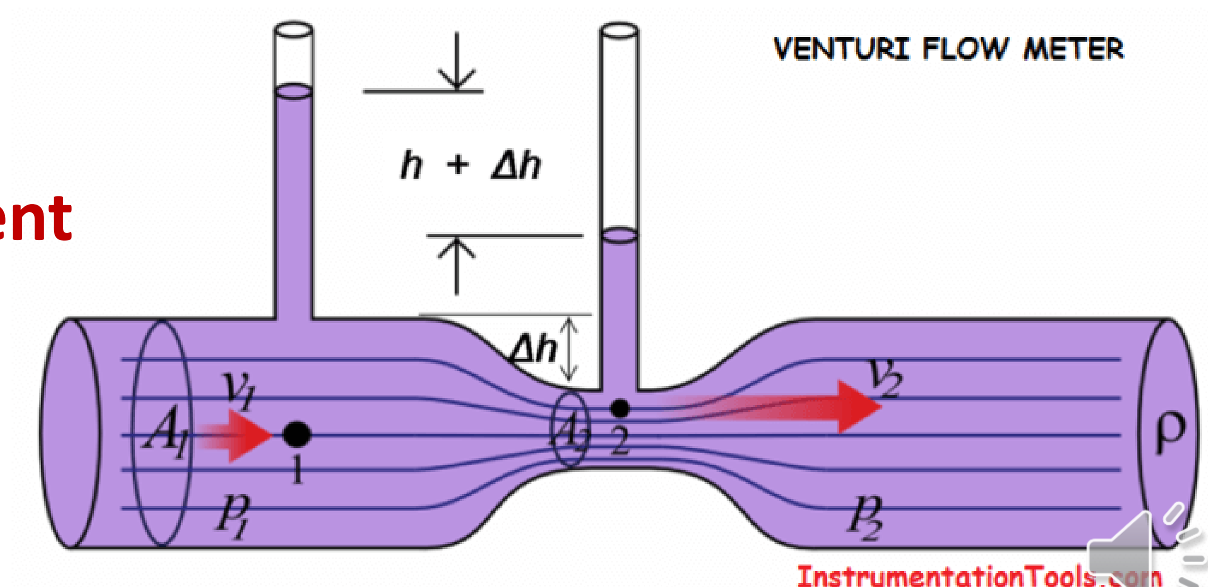
Applications of Bernoulli's Equation

1. Aircraft wing

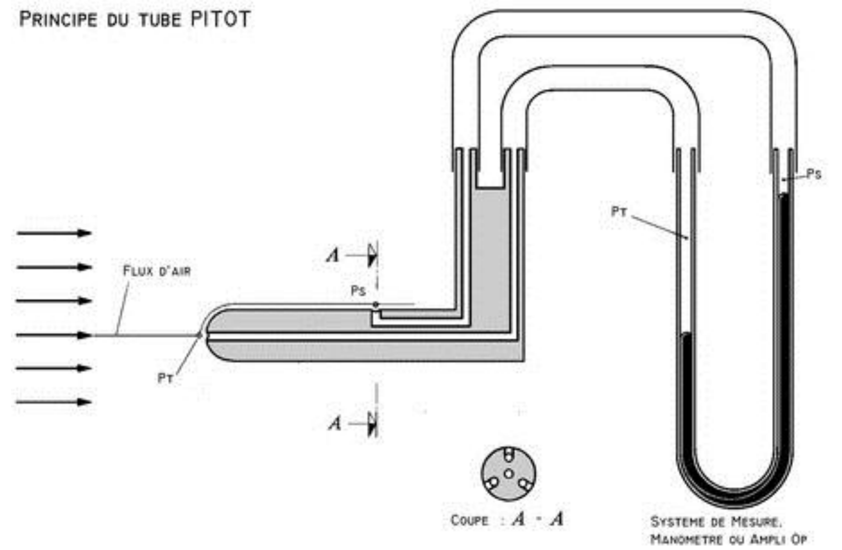


2. Venturi Meter

Using in measurement the speed of fluids



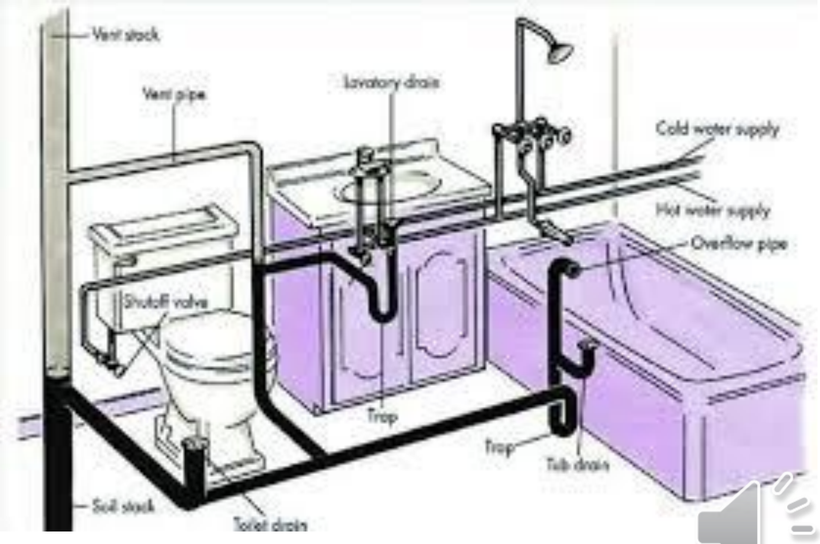
Applications of Bernoulli's Equation



3. Pitot Tube

Using in measurement the speed of Gases

4. Trap house system



Chapter 2

Viscosity

Viscosity

- is a fluid property
- measures the resistance of a fluid to flow

Viscosity describes fluid's internal resistance to flow and may be thought of as a measure of fluid friction

Fluids that have a high viscosity, such as honey or molasses, have a high resistance

fluids with a low viscosity, such as a gas, water, flow easily

The viscosity of fluid depends on temperature (there are Inverse relation between the viscosity and temperature)

Chapter 2

Viscosity

$$\therefore F \alpha v$$

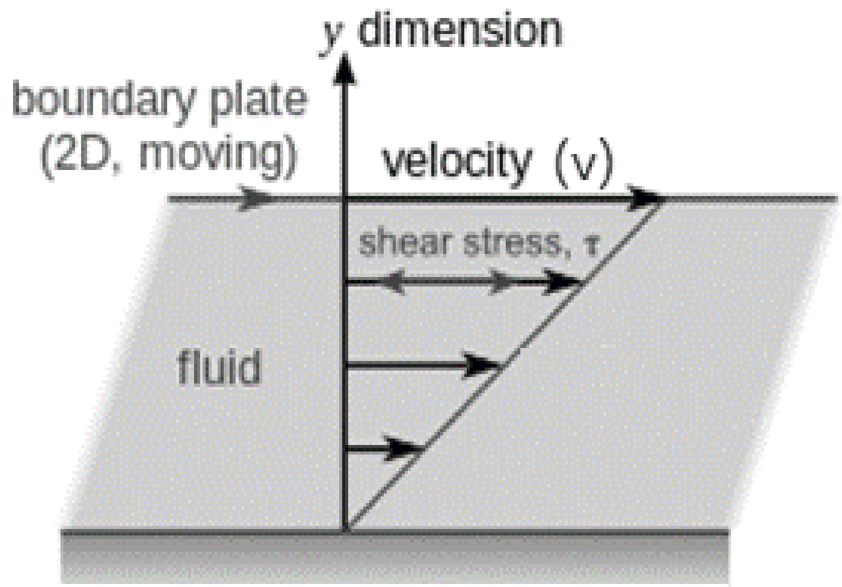
$$\therefore F \alpha A$$

$$\therefore F \alpha \frac{1}{l}$$

$$\therefore F \alpha A \frac{\Delta v}{\Delta l}$$

$$\therefore F = -\eta A \frac{\Delta v}{\Delta l}$$

$$\therefore \frac{F}{A} = -\eta \frac{\Delta v}{\Delta l}$$



Viscosity

Where ***A*** is the area of the fluid over which the force F is exerted

F/A is the shear stress exerted on the fluid

η is the coefficient of viscosity

$$\therefore \eta = \frac{F/A}{\Delta v / \Delta l} = \frac{Fl}{Av}$$

S.I unit :- Pa.S =1 poise = 1dyne-sec/cm^2).


Thank
You