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Water Engineering for Surveying Students

CE 323

* 1st Semester 1442 (2020-2021)
* By: Abdulmohsen Alshaikh
* Pre-req: Dynamics
* Credits: 3 hrs lectures
  1 hr tutorial

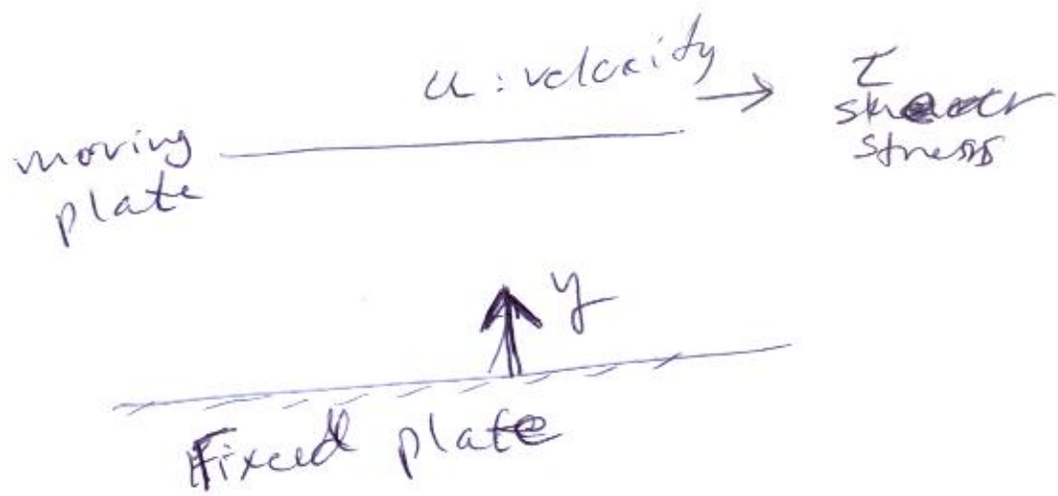
* Water Engineering as discipline in civil Eng.
* Online (~~7~~ weeks + ???)
* First midterm : ~~7~~ th week
  Second " : 12 th week
  on lectures hours

1. Introduction

1-1 Definition of fluid

Fluid is defined as a substance that deforms continuously when shear stress is applied.

Fluids : liquids + gases



$\tau \propto du/dy$

or $\boxed{\tau = \mu \, du/dy}$

Newton law

μ : Viscosity

3) 1.2 Fluid properties

* ρ : density (mass/vol.)

γ : force of gravity . $\rho g = \gamma$

ρ_w = 1 gram / cm^3 (or 1 ton / m^3)

γ_w = 9810 Newton / m^3

Newton $\equiv$ $kg \cdot m / s^2$

* Specific density, S

$= \rho_f / \rho_w$

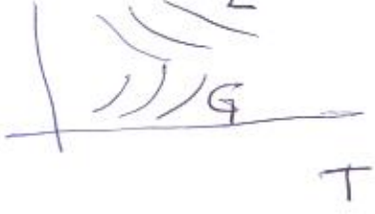
(for mercury $\approx$ 13.6)

* Viscosity, μ

Property causes resistance to shear due to cohesion of fluid particles. It is highly effected by temp.

$\mu_{liq} \propto 1/T$

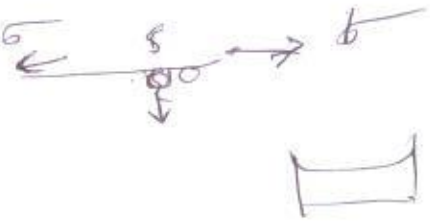
$\mu_{gas} \propto T$



4) * Surface tension, σ

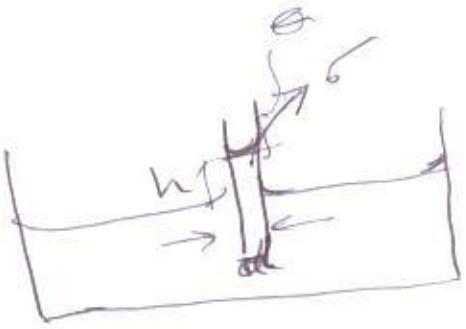
At interface of liquid & gas, equilibrium of molecules creats thir surface tension

It is a stretching force



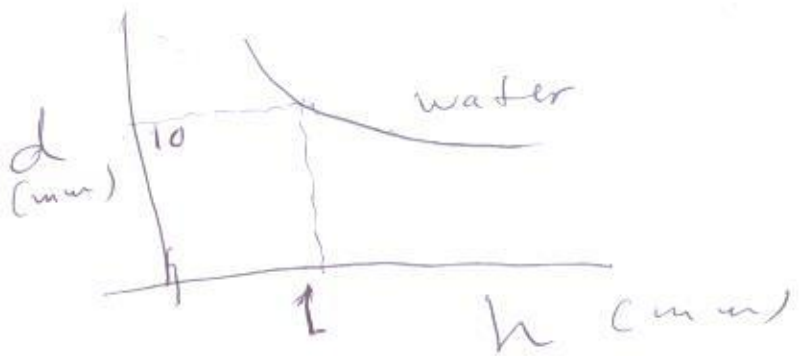
* Cappillarity, h

Rise of water in tubes:



$$\pi d \sigma \cos\theta = \left(\frac{\pi d^2}{4}\right) h \rho g$$

$$\text{then } h = \frac{4\sigma \cos\theta}{\gamma d}$$



5) Compressibility, k

* Gases are very compressible
* liquids are little comp.

$\Rightarrow$ water is considered as incompressible

K is measured by modulus of elasticity,

$$K = dp / dv/v$$

dp : change in pressure

dv : " " volume