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Paper: fluid Mechanics

@ :→ **Viscosity :-**

We can define the viscosity.

def :→ The Internal resistance to the flow of a liquid is called viscosity.

OR :-

It is the Property of fluid which it Imparts resistance of fluid motion by offering resistance to fluid motion movement of one layer over another layer.

Unit of viscosity :-

Its SI unit $\mu (N.s/m^2)$

or $kg/ms$ or $kg.m^{-1}.s^{-1}$.

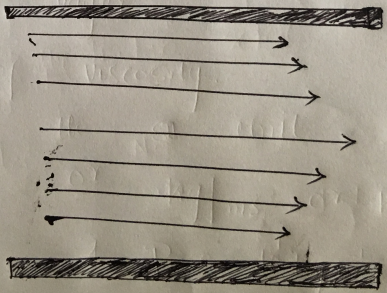
1 Poise = $10^{-1} kg m^{-1}.s^{-1}$

P.t.O → ②

# Co-effieient of viscosity:-

The co-efficient of viscosity "η" is expressed as the force required to maintain a difference of velocity of one m/s b/w two parallel layer of liquid one meter apart.

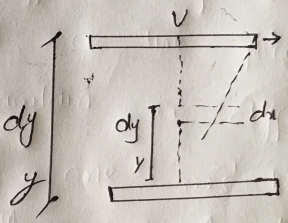
## Explanation with help of digram:-



P.t.o → 03

# Newton equation of Viscosity:-

let consider two Parallel Plates Placed at distance "y" and space b/w is filled with fluid. lower Surface is Considered to be at rest. while The uper moved with Viscosity $\eta \propto U$. Thus




$$F \propto \frac{AU}{y}$$

means if F is increa

Then $\frac{AU}{y}$ will be Increased

And y is Inversly to the F.

So to remove the Proportionality

P.T.O → 04

sign. we Put $\mu$ so we get

$$F = \frac{\mu A U}{y} \text{ or } F/A = \frac{\mu U}{y}.$$

Thus $$\tau = \frac{\mu U}{y}$$

for dy. The velocity with be du.

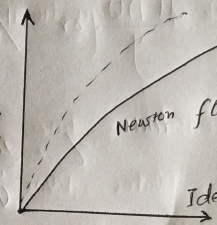
Thus $\tau = \frac{\mu du}{dy}$. Thus This is called Newton equation of viscosity.

$\Rightarrow$ $\mu = \tau / \frac{du}{dy}$. This is dynamic cofficient of velocity as absolute viscosity.

In Ideal fluid with no viscosity is Present in horizental axis.

Unit:- "$\frac{N.S}{m}$"

P.t.o $\rightarrow$ 05




**B:-** **Density**

Genral definition.

defi: mass Per volume of any object is called density.

for fluid.

Density of fluid is its mass Per unit volume of fluid.

It is denoted by "$\rho$" and its unit is $\frac{Kg}{m^3}$ because $\frac{m \to Kg}{V \to m^3}$

P.t.o → 06

Density is derived quantity because it has no direction. only magnitude.

## Specific Weight:-

It is weight per unit volume fluid. It is represented by Gamma

$$\gamma = \frac{W}{V}$$

It unit is $\frac{n}{m^3}$

## Specific Volume:→

It is a Volume Occupied by Unit mass of fluid.

Its unit is $m^3/kg$

$$V = \frac{v}{m} \Rightarrow 1/\rho$$

p.t.o → (7)

## Relation b/w specific weight and density.

As we know that

$\gamma = \frac{W}{V}$ where $W = mg$

mass ↓ gravity

Thus by putting the value of $W$ so we get.

$\gamma = \frac{mg}{V} \Rightarrow \gamma = \rho \times g \quad \because \frac{m}{V} = \rho$

or $\rho = \gamma$

(C):→ Given data:-

Specific volume, $v = 0.72 \ \frac{m^3}{kg}$

Required data:-

Specific weight, $\gamma_s = ?$

Sol:- As we know that

P.t.o → (8)

$V = \frac{1}{P}$

$P = \frac{1}{V}$

$P = \frac{1}{0.72}$

$P = 1.38 \, kg/m^3$

As

$\gamma = Pg$

$\Rightarrow 1.38 \times 9.81$

$\gamma = 13.54 \, \frac{N}{m^3}$

P.T.O ⟶ 09

Q NO 2:-

@ Pressure:-

def:

The force applied Perpendicular to the surface of an object per unit ared over which that force is distributed.

$$P = \frac{F}{A} \Rightarrow \frac{N}{m^2}$$

The SI unit of Pressure is Pascal (Pa).

Absolute Pressure:-

Absolute Pressure is the relative to the Zero Pressure in the empty air-free space to the universe. This refrence pressure is the Ideal or absolute vacum.

P.t.0 → 10

It is denoted with the Subscript "abs" $P_{abs}$.

## Gauge Pressure :-

The guage Pressure is defined as.

def :- The difference b/w an absolute Pressure and The Prevailing atmospheric Pressure.

It is denoted with Subscript "e" $P_e$ and it is calculated by the following

$$P_e = P_{abs} - P_{amb}$$

P.t.o → (11)

(11)

(2 B) Given data.

Lenght of tank = 1500mm x 1500mm

Breath, b = 1500mm = 1.5 m

depth = 7985mm = 7.985

weight of $H_2O$ = 9.81 kn/m³

## Requried data:-

(a) P = ?

(b) location of Force = ?

If water level drops Half depth Find P & Location of Force.

## Net pressure:-

$P = \gamma h$.

$= 9.81 \times 7.985$

$= \boxed{78.33285\ KN/m^2}$

(12)

(b) Force application (centroid)

$$\bar{y} = h/3$$

$$= \frac{7.985}{3}$$

$$\bar{y} = \boxed{2.6626\ m}$$

(c) Half depth:-

pressure at Half depth

$$P = \gamma h/2$$

$$= 9.81 \times \frac{7.985}{2} = \boxed{78.380\ kN/m^2}$$

cetriod = $\bar{y} = h/2 \times 1/3$

$$\boxed{\bar{y} = 1.330\ m}$$