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I.D : 7351

Subject : Fluid Mechanics

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Q 9:- Define vescosity? Derive newton of viscosity.

Sol:- **Vicosity:-** Vescosity is the property of fluid which opposses the relative motion b/w the two surface of the fluid. Different Fluid have different viscosity depend upon the intermolecular force in fluid.

Example has great viscosity then water → H_2O

Newton Equation of viscosity:-

It is state that

"The shear stress in a flowing Fluid is directly proportional to the rate of shear strain.

Mathematically

$$\tau \propto \frac{du}{dy}$$

$\tau \rightarrow$ shear stress

$$\tau \propto \frac{du}{dy}$$

change the sign of proportionality

$$\tau = \mu \frac{du}{dy}$$

μ = viscosity (Dynamic viscosity)

$$\mu = \tau \, dy/du$$

μ = viscosity (dynamic viscosity)

$$\mu = \frac{\tau dy}{du}$$

The Fluid which follows "Newton's Law of viscosity are called "Newtonian Fluid"

Part B Define density, Specific weight and Specific volume Show relation b/w Density and Specific weight.

Density:-

Property of Fluid

Density can be define as "mass per unit volume of a Fluid

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$$\rho = \frac{m}{V} = Kg/m^3$$

⇒ **Specific Weight:-** Specific weight is the weight passessed by unit volume of Fluid. Denoted by "W"

$$W = \frac{\text{Weight}}{\text{Volume}}$$

$$W = \frac{N}{m^3}$$

→ **Specific Volume:-** property of fluid. Specific volume is the volume of a fluid (v) occupied per unit (m)

It is the receprocal of density.

$$\text{Specific Volume } V = V/m$$

$$V = m^3/kg$$

$$V = 1/\rho .$$

Relation b/w Density and specific ~~wt~~ weight.

As $W = W/V$

We know that

$$W = mg$$

$$W = mg/V \qquad \rho = m/V$$

$$\boxed{W = \rho g}$$

ρ = density.

Q1© If Specific volume of a gas is 0.72 m^3/kg what its specific weight in N/m^3 = ?

Sol: Given data :-

Specific volume $V = 0.72\ m^3/kg$

We have to Find

Specific weight γ = ?

As $V = 1/\rho$

$\rho = 1/V$

$\rho = \frac{1}{0.72}$ ∴ ρ - density

$\rho = 1.38\ kg/m^3$

As $\gamma = \rho g$

$\gamma = 1.38 \times 9.81$

$\gamma = 13.54\ N/m^3$.

Q2 Define & pressure :-

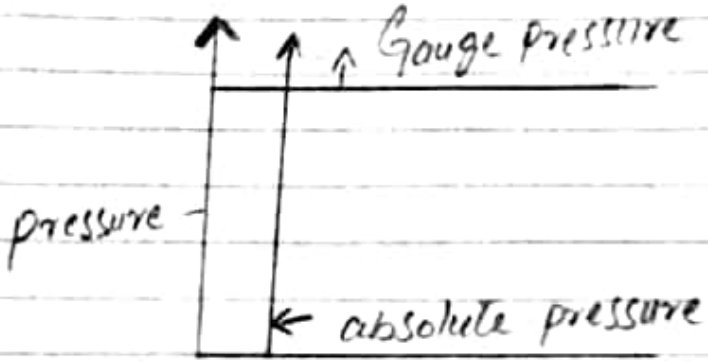
Pressure is the ratio of applied Normal force action an area to the area on which it is applied.

$$\text{pressure} = \frac{\text{Normal force}}{\text{Area of surface}}$$

Normal force is applied perpendicular to gives surface pressure is also defined as Normal force per unit area.

⇒ **Absolute pressure:-**

it is the pressure measure from absolute vaccum Absolute vaccum mean zero The pressure up to pressure which is above atmosphere.



⇒ **Gauge pressure:-**

Gauge pressure is the pressure use measure use measure on measuring The instrument it with start from zero reading it is above atmospheric pressure.

Q2) A water tank having dimension of 1500 mm x 1500 mm. Depth of water tank is equal to your student I.D number in mm. What is the net pressure force on wall of water tank? Find the location of force application? If the water level drop to the half of the depth, what will be the force and point of application of force?

Given data:-

$$\text{Length} = L = 1500\,mm = \frac{1500}{1000} = 1.5\,mm$$

$$\text{Width} = W = \frac{1500}{1000} = 1.5\,mm.$$

$$\text{Depth} = D = 7351\,mm = \frac{7351}{1000} = 7.351\,mm.$$

Required

Net pressure force when

(i) $D = 7.351$

(ii) $D' = \frac{D}{2} = \frac{7.351}{2} = 3.6755$

(i) Net pressure force

When $D = 7.351\,mm$

$$F = P_{avg} \times A$$

$$F = (\rho g h_{1/2}) \times (L \times D)$$

$$F = (1000)(9.8)\left(\frac{7.351}{2}\right) \times 1.5 \times 7.351$$

$$F = 397\,173\ N$$

(ii) Net pressure force

When $D' = 3.6755$

$$F = (\rho g D'/2) \times (L \times D')$$

$$F = \left(1000 (9.8) \left(\frac{3.7655}{2}\right) \times 1.5 \times 3.6755\right.$$

$$F = 101721\ N$$

$$F = 10.1\ K.N$$