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Section	A
Subject	Fluid Mechanics I
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Question No. 1

(a) Define viscosity? Derive Newton captions of viscosity.

Viscosity:

Difinition:-

it is the property of a fluid which resist relative motion of its adjacent layers due to cohesion and molecular mementum exchanged between the fluid layers.

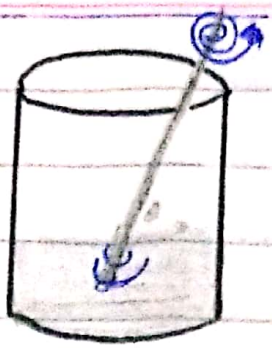
Unit:-

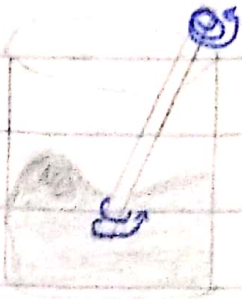
The unit of viscosity is **poise**.

Example:-

Syrup has a greater viscosity

Lower viscosity





better viscosity

Water Syrup

Newton Equation of viscosity

Statements:-

" The shear stress in a flowing fluid is directly proportional to the rate of shear strain. it states that

Mathematical Representation

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

$\tau \rightarrow$ shear stress

change the sign of proportionality.

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

where

μ = viscosity (dynamic viscosity)

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

$\frac{du}{dy}$ = Rate of shear deformation.

Newton's fluid:- The which is follows "Newton's law of viscosity are called "Newton's fluid".

(b) Define density, specific weight and volume. show relation between density and specific weight.

Density:-

Difinition:-

Density of a fluid is derived as:

"The ratio of mass of a fluid to the volume of a fluid.

OR

Mass per unit volume

Mathematical form:-

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

where

ρ = Rho = density

m = mass

v = volume

Specific weight :-

Difinition :-

Specific weight of a fluid is defined as:

"The ratio of the weight of a fluid to the volume of the fluid

OR

Weight of a fluid per

unit volume"

MATHEMATICAL Form:-

$$W = mg/V = \rho g = N/m^3$$

where

W = Specific weight
mg = weight of the fluid
V = volume

Specific Volume :-

Specific volume is defined as:
"The ratio of the volume of a fluid to the mass of the fluid.

Mathematical form:-

$$\text{Specific volume} = V/m = 1/\rho$$

Relation between density and Specific wieght :-

As we

know that.

$$w = W/V$$

and that,

$$W = mg$$

So,

$$w = mg/V \Rightarrow \boxed{w = \rho g}$$

$\therefore \rho = m/V \Rightarrow \rho =$ density

(c) If specific volum of gas is $0.72\ m^3/kg$. what is specific weight ρ in N/m^3 ?

Given Data:-

Specific volume, $v = 0.72\ m^3/kg$

Required Data:-

Specific weight, $w = ?$

Solutions:-

As,

$$v = 1/\rho$$

$$\rho = 1/v$$

$\rho = 1/0.72$

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

eqs.

$W = \rho g$

$g = 9.81\ m/s^2$

$W = 1.38\ kg/m^3 \times 9.81\ m/s^2$

$W = 13.54\ N/m^3$

$\boxed{W = 13.54\ N/m^3}$

Question No. 6

(a) Define pressure? what is absolute and gauge pressure?

ANS: **Pressure :-**

Definition :-

Pressure is defined as:

"The force applied perpendicular to the surface of an object per unit over

which that force is distributed.

Unit :-

The SI unit of pressure is **pascal (Pa)**.

Gauge Pressure :-

Definition :-

Gauge pressure is pressure relative to atmospheric pressure. Gauge pressure is positive for pressure above atmospheric pressure and negative for pressure below it.

Mathematically :-

total pressure or absolute pressure is thus the sum of gauge pressure and atmospheric pressure.

$$P_{abs} = P_g + P_{atm}$$

where

P_{abs} = Absolute pressure
P_g = gauge pressure
P_{atm} = atmospheric pressure

Absolute pressure :-

Definition :-

it is the total pressure at the point in a fluid equalling the sum of gauge pressure and the atmospheric pressure.

Mathematically :-

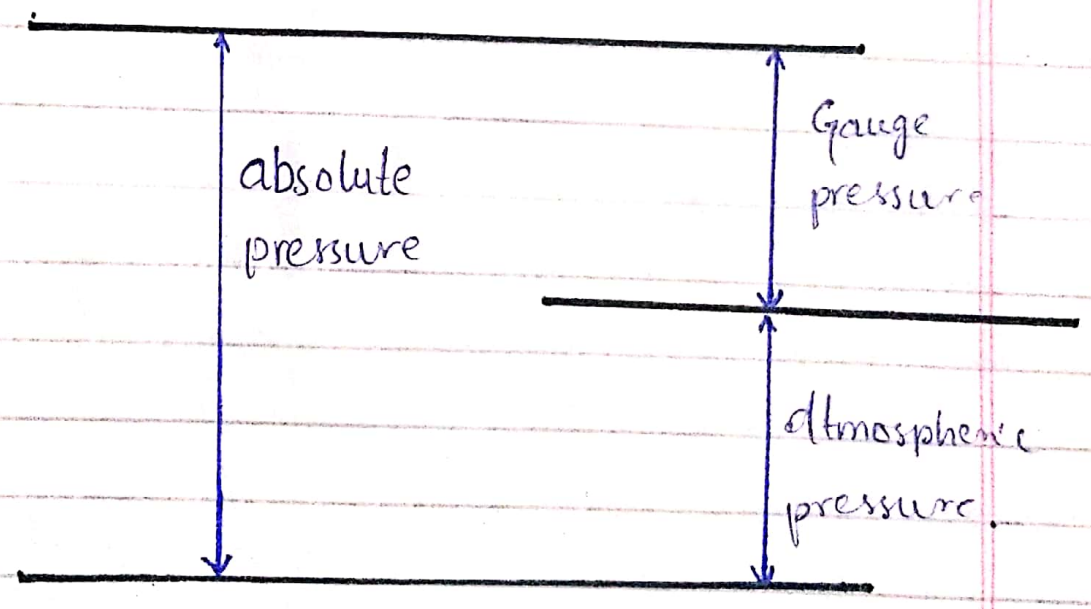
$$P_{abs} = P_g + P_{atm}$$

- P_{abs} → absolute pressure
- P_g → gauge pressure
- P_{atm} → atmospheric pressure

Example:-

If your line gauge reads 39 psi (ponds per square inch) then the absolute pressure is 39 psi plus 14.7 psi (pdm in psi) or 53.7 psi (equivelant 337 kpa)

Daigram:-



(b) A water tank having dimension of 1500mm x 1500mm Depth of water tank is equal to your student ID number in mm.

What is the net pressure in the wall of water tank? Find the location of force application?
if the water tank levels drop to the half of the depth? what will be the force and point of application of force?

Given data :-

Length, l = 1500 mm = 1.5m
Breadth, b = 1500 m = 1.5m
Depth, h = 7940mm = 7.940
unit weight of water = 9.81 kN/m³

Required Data :-

→ a.. net pressure, P = ?
→ b.. location of force = ?
→ c.. if water level drops half P and location of force

Solution :-

a. Net pressure :-

$$p = \gamma h$$

$$p = 9.81 \times 7.940$$

$$\boxed{p = 77.8914\ KN/m^2}$$

b. force Application :- (centeriod)

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

$$\bar{y} = \frac{7.940}{3}$$

$$\boxed{\bar{y} = 2.646\ m}$$

c. half Depth :-

Pressure at half depth, $p' = \gamma h/2$

$$p' = \gamma h/2$$

$$p' = 9.81 \times \frac{7.940}{2}$$

$$\boxed{p' = 38.94\ KN/m^2}$$

Centeriod,

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

$$\boxed{\bar{y}' = 1.323\ m}$$