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SECTION # "B"

SUBJECT # FLUID MECHANICS

SEMESTER # 4.

Q1 (A)

VISCOSITY :-

The property of fluid by Virtue of which it offers resistance to shear is known as viscosity absolute dynamic viscosity, μ ($N \cdot s/m^2$) or ($kg/m \cdot s$) The ratio μ/ρ is Caled kinematic viscosity In M.K.S Unit: stoke i.e. $\frac{1 cm^2}{sec}$: S.I unit : m^2/sec.

NEWTON'S LAW OF VISCOITY :-

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

$$F = \frac{\mu AU}{Y}$$

Co-efficient of
μ = Viscosity

$$F = \frac{\mu AU}{Y}$$

$$F/A = \frac{\mu U}{Y}$$

F/A = shear stress

$$\tau = \frac{\mu U}{Y}$$

τ = shear stress

$\frac{du}{dy}$ = rate of shear deformation

For dry,

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

This is Called Newton's Equation of Viscosity.

Q1 B) Define Density, specific weight & specific volume show relation b/w density & specific weight

1) **DENSITY:-**

Density of fluid is its mass per unit volumes of fluid

It is denoted by "ρ" & its unit is kg/m^2.

2) **SPECIFIC WEIGHT:-**

It is the weight per unit volume of fluid. It is represented by gamma & $\gamma = \frac{w}{v}$. It unit is n/m^3.

3) **SPECIFIC VOLUME :-**

It is a volume occupied by unit mass of fluid Its unit is m^3/kg

$$V = \forall/m = 1/\rho.$$

4) **RELATION B/W SPECIFIC WEIGHT & DENSITY.**

As $\gamma = \frac{w}{V}$ where $w = mg$.

Thus $\gamma = \frac{mg}{V}$

As we have

$$\frac{m}{V} = \rho$$

Thus $\gamma = \rho \times g$

or $\rho = \chi$.

Q1 (c):- If the Specific volume of a gas is $0.72\ m^3/kg$, what is its Specific weight in N/m^3?

Solution

Given Data :-

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

Gravity, $g = 9.81\ m/sec^2$

Required Data :-

Specific weight, $\Gamma_s = ?$

Solution :-

$V = 1/\rho$

$\rho = 1/V$

$\rho = 1/0.72$

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

$\Gamma = \rho g$

$\Gamma = 1.38 \times 9.81$

$\Gamma = 13.54\ N/m^3$

Result :-

$\Gamma = 13.54\ N/m^3$

Q2 (A) Define pressure? What is an absolute and guage pressure?

PRESSURE :-

Pressure is define as the average of any three mutually perpendicular normal Compressive Stresses at a point ie.

$$P = \frac{P_x + P_y + P_z}{3}$$

In a fricationless fluid, no shear stresses Can occure at that point for any motion of the fluid, & also at that point the pressure is the Same in all direction.

UNIT :-

It is (S.I) Unit is

Pascal (Pa)

$1Pa = 1/Nm^2$.

ABSOLUTE PRESSURE:-

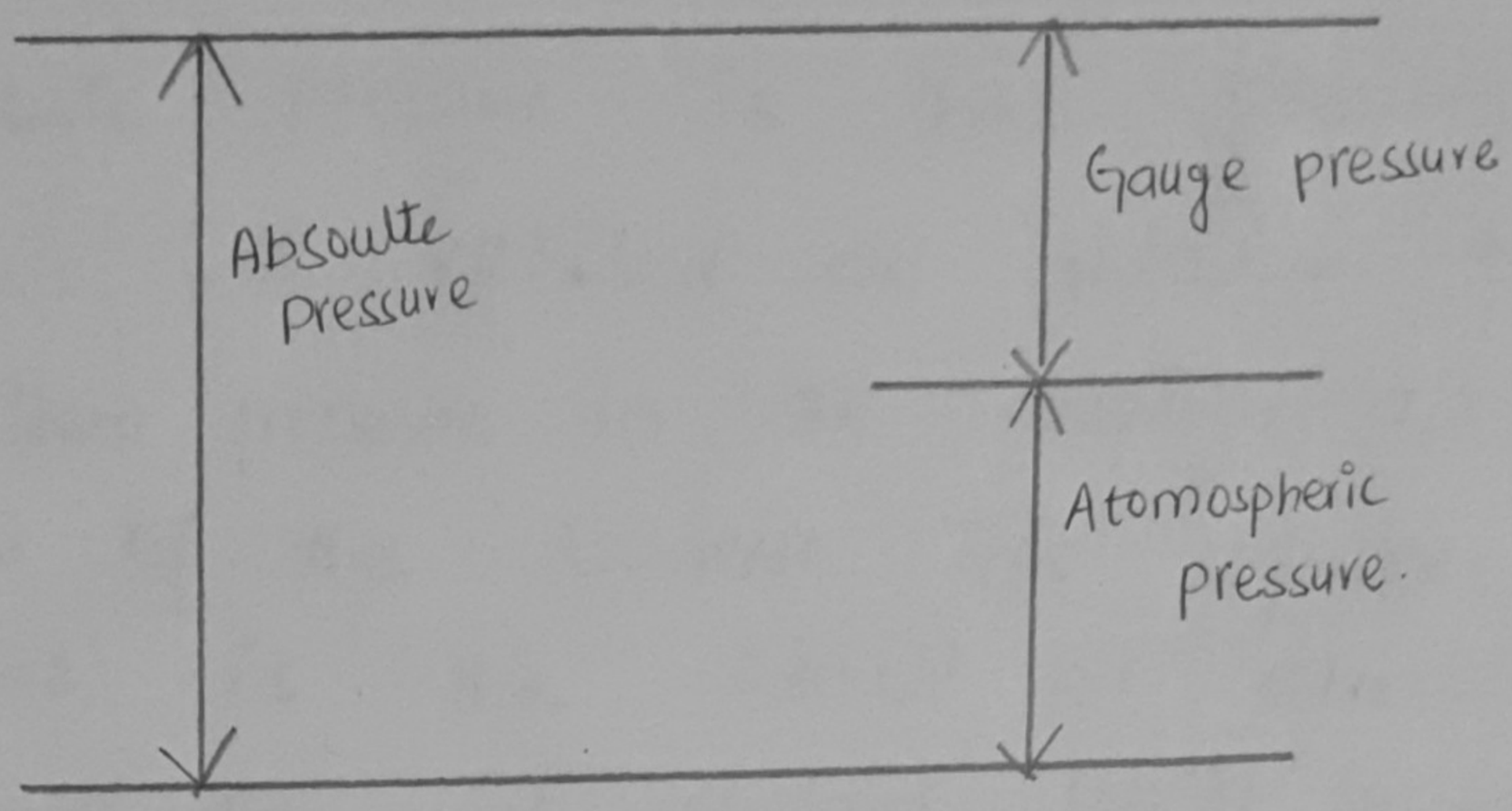
Absolute pressure is that pressure that is related or relative to the zero pressure in the empty, air free space of the Universe. This reference pressure is the ideal or absolute vaccum. It is noted with subscript "abs" - Pabs.

GAUGE PRESSURE:-

The gauge pressure is defined as the difference b/w an absolute pressure (Pabs) and the prevailing atmospheric (Pamb). It is denoted with subscript "e". Pe and is calculate

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

Q 2(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 on the wall of water tank? Find the location of force application?

If the water tank level drops to the half of the depth, what will be the force & point of application of force?

Given data:

Length, $l = 1500mm = 1.5m$

Breadth, $b = 1500mm = 1.5m$

Depth, $h = 7943mm = 7.943$

Unit weight of water $= 9.81 KN/m^3$.

REQUIRED DATA:-

→ a) net pressure, $P = ?$

→ b) location of force

→ c) If water level drops half of depth find P and location of force

SOLUTION:-

A) NET PRESSURE:-

$$P = \gamma h$$

$$P = 9.81 \times 7.943$$

$$\boxed{P = 77.99083 KN/m^2}$$

B) FORCE APPLICATION (CENTROID)

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

$$\bar{y} = 7.943/3$$

$$\boxed{\bar{y} = 2.64767m}$$

c) HALF DEPTH :-

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

$$P' = 9.81 \times \frac{7.943}{2}$$

$$\boxed{P' = 39 \text{ KN/m}^2}$$

Centroid,

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

$$\bar{y}' = 1/3 \times \frac{7.943}{2}$$

$$\boxed{\bar{y}' = 1.3238}$$