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SECTION "B"

Deptt: BE Civil

Q.No(1) (1)

a) Define Viscosity? Derive of Viscosity

* VISCOSITY:-

It describe the internal friction of a moving fluid. A fluid with large viscosity resists motion because its molecular makeup gives it alot of internal friction. A fluid with low viscosity flows easily because its molecular makeup results in very little friction when it is in motion.

It is property of fluid by which it imparts resistance to fluid motion by offering resistance to movement of one

layer over another. The viscosity of fluid is measure of its resistance to shear or angular deformation. The friction forces are form cohension and momentum interchange between molecules in the fluid. As temperature increases the viscosity of liquids decreases as because of cohension forces decreases In gases, viscosity increases molecular interchang b/w layers.

Derive Newton Equation of Viscosity:-

Now consider two parallel plates place at distance X & Y space in b/w is filled with fluid lower surface is assumed to be stationary while upper moved with velocity "V"

Thus

$$F \propto \frac{AV}{y} \quad \text{or} \quad F = \frac{\mu AV}{y} \quad \text{or}$$

$$\frac{F}{A} = \frac{\mu V}{X}$$

Thus

$$\tau = \frac{\mu V}{y}$$

for dy the velocity will be du. Thus $\tau = \mu \frac{du}{dy}$. This is known as newton equation of viscosity.

b) Define density, specific weight & specific volume. Show relation between Density and specific weight.

* DENSITY:-

Is a very common & important property of matter. For a liquid density is define as the mass contained in a unit volume. The more precise name for density is volumetric mass density.

The symbol used for density is the Greek letter ρ (rho).

Mathematically, density (ρ) is defined as the mass (m) and the volume (V) of a substance body.

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

The unit of measurement for density is kg/m^3.

SPECIFIC WEIGHT:-

Specific Weight, γ of a fluid is defined as the weight per unit volume and is related to density.

$$\gamma = \rho g$$

where g is acceleration due to gravity. It unit in SI system is N/m^3. Noting that the value of g is $9.807 m/s^2$ specific weight of water at 60C is $9.81 kN/m^3$. for air 15c and atmospheric pressure specific weight is $12.0 N/m^3$

SPECIFIC VOLUME:-

The specific volume of a substance is the ratio of the substance volume to its mass. It is the reciporcal of density and an intrinsic property of matter as well. Specific volume

is defined as the number of cubic meters occupied by one kilogram of a particular substance. The Standard unit is the cubic meter per kilogram (m^3/kg).

$$v = \frac{V}{m} = \rho^{-1}$$

Relation Between Density & Specific Weight:

As $\gamma = w/v$ where $w = mg$

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

$$\frac{m}{v} = \delta$$

So $\gamma = \delta \times g$ or $\delta = \frac{\gamma}{g}$

(7)

Question no # 01

If Specfic volume of gas is $0.72 m^3/kg$ what is Specific weight in N/m^3?

Solution :- * Data

Specfic volume = $0.72 m^3/kg$

Specfic weight = γ = ?

→ **A from Specfic volume:**

$$v = \frac{1}{\rho}$$

$$\rho = \frac{1}{v}$$

$$\rho = \frac{1}{0.72} = 1.388 \, kg/m^3$$

we know:

$$\rho = \frac{\gamma}{g}$$

$$\gamma = \rho \times g$$

$$\gamma = 1.38 \times 9.8$$

$$\boxed{\gamma = 13.524 \, N/m^3}$$

Q20) Define Pressure? What is an absolute & guage pressure?

PRESSURE:

A measurement of the force per unit area on a object in the fluid or on the surface of a closed container. This pressure can be caused by gravity, acceleration, or by forces outside a closed container. Since a fluid has no definite shape. its pressure applies in all directions. The force applied is perpendicular to the suface of object per unit area. The basic formula for pressure is F/A (force per unit area). Unit of pressure is pascal (Pa).

ABSOLUTE PRESSURE.

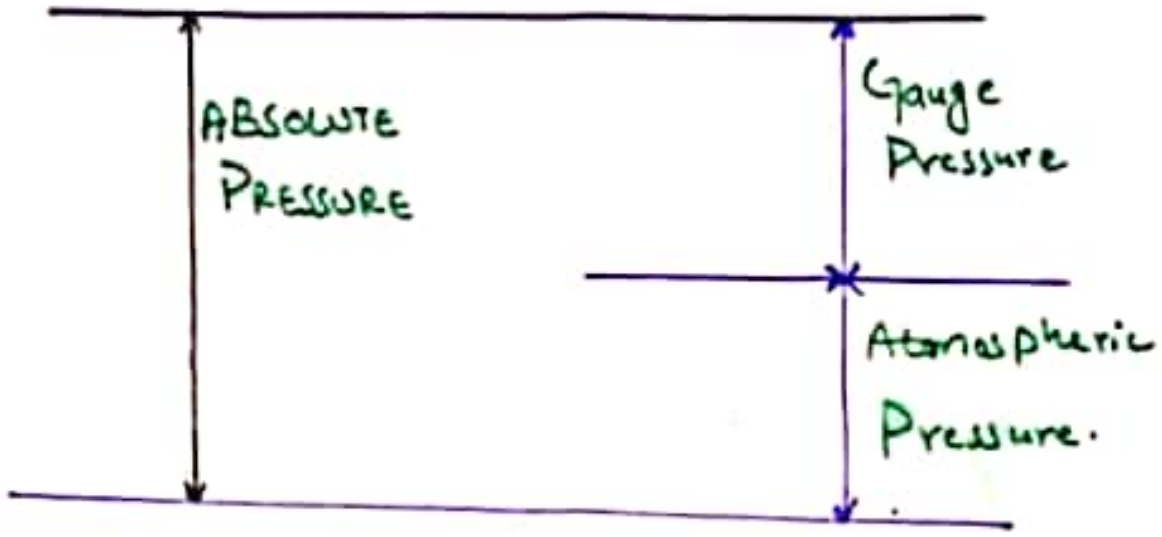
If the pressure is measured relation to absolute zero it is called absolute.

*: Total pressure at a point in a fluid equaling the sum of the gauge end the atomospheric pressure.

GAUGE PRESSURE:

When it is measured idation is to atmosphere pressure as base is called gauge pressure. Gauge pressure is zero referenced against ambient air pressure, so it is equal to absolute pressure minus atompheric pressure Negative sign usually omitted.

DIAGRAM



(b) A water tank having dimensions of 1500mm X 1500mm 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 application.

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

GIVEN DATA :-

Length, l = 1500mm = 1.5m

Breadth, b = 1500mm = 1.5m

Depth, h = 7957 = 7.957

Unit weight of water = 9.81KN/m³

Required Data

⇒ a.. net pressure, P = ?

⇒ b.. Location of force.

⇒ c.. If water level drop half of depth, find P and location of force.

Solution:-

a. Net Pressure

$$P = \gamma h$$

$$P = 9.81 \times 7.957$$

$$\boxed{P = 78.058 KN/m^2}$$

b: Force application (centroid).

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

$$\bar{y} = \frac{7.957}{3}$$

$$\boxed{\bar{y} = 2.652m}$$

C. Half Depth :-

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

$$p' = 9.81 \times \frac{7.957}{2}$$

$$\boxed{p' = 39.02}$$