ID 7337

Name Waseem Khan

Instructor Engr Abdul Waheed

Program B (civil)

Course fluid Mechanis 1

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Mid term

Q 1 Define viscosity? Derive .newton equation of viscosity.

Ans

Viscosity :-

Viscosity is the resistance of fluid to flow

when a fluid is flowing the molecules comprise the experience friction due to the molecular interaction among them

Diffrent fluid have diffrent viscosites flow at diffrent speed when same force is applied

viscosity is key for any Process Involving fluid flow

it for determine for example how long will reservoir take to fill and settle. it will also determine how much energy is required TO Pump our process fluid

Newton Equation of Viscosity

It is stated that the shear stress in a flowing fluid is directly proportional to the rate of shear strain

Mathmtically :-

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

τ is shear stress

$$\tau \propto du/dy$$

change ~~sing~~ sign of Propotionalty

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

μ = viscosity (Dynamic viscosity)

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

μ = viscosity (

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

fluid which follow "Newton's law of viscosity are called "Newtonion fluid"

Q 1
Part "B"

Ans

i) Density :-

It is measure of mass per unit volume. The average density of an object equal to its total mass divided by its total volume $\rho = m/V$ (Mass / Volume)

density

ii) Specific weight :-

It is also known as weight density. it is the measure that weight of substance which occupie cubic meter of space

in fluid it is defined as the ratio of weight of fluid to its volume denoted by w

$$w = \frac{\text{weight of volume}}{\text{volume of fluid}} = \frac{W}{V}$$

we know that $W = \text{mass} \times \text{acceleration due to Gravity}$

$$W = mg$$

$$w = W/V = \frac{mg}{V} = \rho g$$

Specific Volume :-

It is property of material, define as the number of cubic meter occupied by one kg of particular substance

It is the ratio of volume of the material to its mass. denoted by "v"

It is reciprocal to specific mass

$$V = \frac{\text{volume of the fluid}}{\text{Mass of the fluid}} = \frac{V}{m} = \frac{1}{\rho}$$

Relation between density and specific weight

As specific weight $\gamma = W/V$

$\Rightarrow$ we also know that : $W = mg$

$\Rightarrow$ $\gamma = mg/V$

$\Rightarrow$ where as $\rho = m/V$

$\Rightarrow$ so $\gamma = (m/V)g$

$$\gamma = \rho g$$

and $\rho = \gamma/g$

Q 1 Part C

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

Ans

Given data

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

Specific weight $\gamma_s = ?$

Solution

As

$V = 1/\rho$

$\Rightarrow \rho = 1/V$

$\Rightarrow \rho = 1/0.72$

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

As $\gamma = \rho g$

$\Rightarrow \gamma = 1.38 \times 9.81$

$\gamma = 13.54\ N/m3$

Q1

Part-A Define Pressure:-

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

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

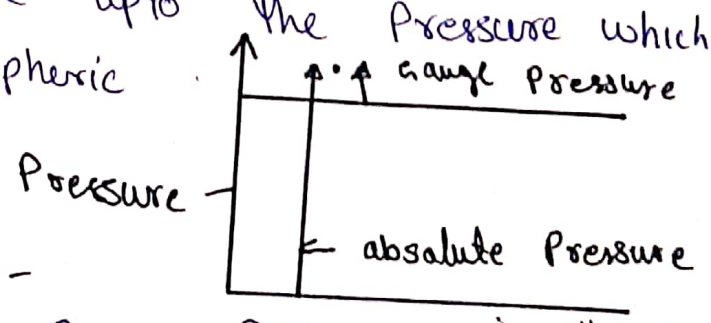
Normal force is applied perpendicular obo given surface Pressure is also defiend as Normal force per unit area

→ Absolute Pressure :-

It is the Pressure measure from absolute vaccum

Absolute vaccum mean zero

The Pressure upto is above atmospheric



Gauge Pressure :-

Gauge Pressure is the Pressure we measure on measuring instrument. It will start from zero reading It is above atmospheric Pressure

Q2
Part B
Ans

Given data

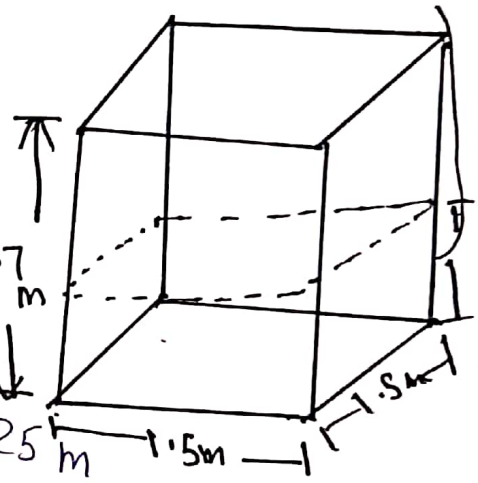
Length = L = ~~16mm~~

$$L = 1500\ mm = \frac{1500}{1000} = 1.5\ m$$

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

$$Depth = D = 7337\ mm = \frac{7337}{1000} = 7.337\ m$$

Wat Depth 3.6625



water tank

Required

Net Pressure force where

i) $D = 7.337m$

ii) $D' = D/2 = \frac{7.337m}{2} = 3.6625\ m$

D Net Pressure force

when $D = 7.337m$

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

$$F = (\rho g h/2) \times (L \times D) \quad \therefore h = D$$

$$F = (1000)(9.8)\left(\frac{7.337}{2}\right) \times 1.5 \times 7.337$$

$$F = 395662\ N$$

or $F = 395.7\ K.N$

ii) Net Pressure force when $D' = 3.6685$

$$F = (\rho g \frac{D'}{2}) \times (L \times D)$$

$$F = (1000)(9.8)(\frac{3.6685}{2}) \times 1.5 \times 3.6685$$

$$F = 98915.5\ N$$

$$F = 98.9\ k.N$$