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Section :- "B"

Subject :- fluid mechanis (Theory)

Q1 Ⓐ:- Define viscosity? derive the newton equation of viscosity.

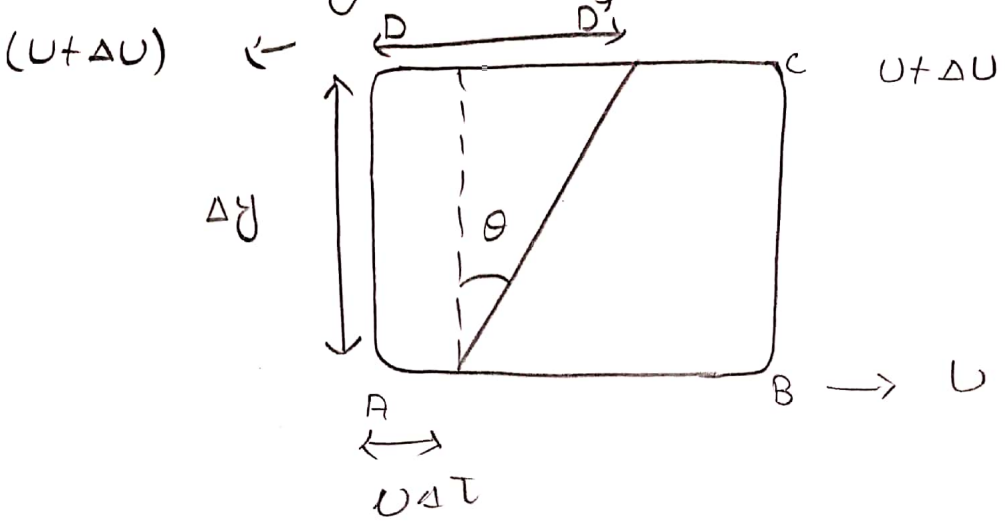
Ans:- The viscosity of a fluid is to measure of its resistance of deformation at a given rate. For liquids, it corresponds to the informal concepts of thickness

* for example syrup has a higher viscosity than water

* viscosity can be conceptulized as Quantifying the internal frictional force that arises b/w adjecent layers of fluids that are in relative motion.

Newton equation of viscosity

Rectangular fluid element



$$\tan \Delta\theta = \frac{(U+\Delta U)\,\Delta t - U\,\Delta t}{\Delta y}$$

$$\Delta\theta = \text{small} = \frac{\Delta U\,\Delta t}{\Delta y}$$

$$\lim_{\Delta t \to 0} \frac{\Delta\theta}{\Delta t} = \lim_{\Delta y \to 0} \frac{\Delta U}{\Delta y}$$

$$\Rightarrow \frac{d\theta}{dt} = \frac{du}{dy}$$

rate of deformation.

$$\theta = \frac{du}{dy}$$

for fluids rate of deformation is important parameter

fluids which have linear relation with τ and θ is called newtonian fluids

$$\tau \propto \theta$$

$$\tau = \mu \theta$$

→ Newton law of viscosity

μ → co-efficient of viscosity

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

Part "B"

⑥:- Define density, specific weight and specific volume, show relation b/w density and specific weight.

Density :-

→ It is a property of fluid.

* Density can be defined as "mass per unit volume of a fluid"

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

$$\rho = \frac{m}{V} = \frac{kg}{m^3}$$

Specific weight :-

Specific weight is the weight possessed by unit volume of a fluid and it's denoted by "w"

$$w = \frac{\text{weight}}{\text{volume}}$$

$$\boxed{w = \frac{N}{m^3}}$$

Specific volume :- It is a property of a fluid-

Specific volume is the volume of a fluid (V) occupied per unit mass (m)

→ It is the reciprocal of density

Specific volume $v = \frac{V}{m}$

$v = \frac{m^3}{kg}$

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

Relation b/w density and specific weight:-

as we know that

$$w = \frac{W}{V}$$

we know that $W = mg$

$$w = \frac{mg}{V}$$

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

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

$\rho \Rightarrow$ density

Part "C" P=(6)

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

Given data:- specific volume of gas = $v = 0.72 m^3/kg$

Required data:- specific weight in $N/m^3 = ?$

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

so density "ρ" $= \frac{1}{v}$

$$\rho = \frac{1}{0.72}$$

$$\boxed{\rho = 1.389 \text{ kg/m3}}$$

specific weight "w" $= \rho \times g$

$$w = 1.389 \times 9.8$$

$$\boxed{w = 13.62 \text{ N/m}^3} \quad \text{ans}$$

Q2:- Define Pressure? What is absolute and gauge Pressure?

Ans:- **Pressure:-** Pressure is defined as the physical force exerted on an object. The force applied is perpendicular to the surface of objects per unit area - the basic formula for pressure is

$$P = F/A$$

Base Unit of pressure = $1\ N/m^2$, $1\ kg/m\text{-}s^2$

Dimension = $ML^{-1}T^{-2}$

SI Unit = pascal

Absolute pressure:- Absolute pressure is the sum of gauge pressure and atmospheric pressure

Gauge pressure :- Gauge pressure is the pressure relative to atmospheric pressure. gauge pressure is positive for pressures above atmospheric pressure and negative for pressures below it.

Part B

Q2:-

(B:-) **Given data:-**

Length, $l = 1500mm = 1.5m$

Bredth $= b = 1500mm = 1.5m$

Depth = 7939 = 7.939

Unit weight of water $= 9.81 N/m^3$

Required data:- Net pressure = ?

location of force = ?

If water level drops half of depth find p and location of force = ?

Solution:- Net pressure:-

$P = \gamma h$

$P = 9.81 \times 7.939$

$$\boxed{P = 77.88159\ KN/m^2}$$

Force application:- (centroid)

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

$$\bar{y} = \frac{7.939}{3}$$

$$\boxed{\bar{y} = 2.6463\ m}$$

Half depth:-

Pressure at half depth

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

$$p' = 9.81 \times \frac{7.939}{2}$$

$$\boxed{p' = 38.940 \text{ KN}/m^2}$$

centroid,

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

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