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I.D :- 7379
Subject :- Fluid Mechanics 1
Instructor :- Abdul waheed.

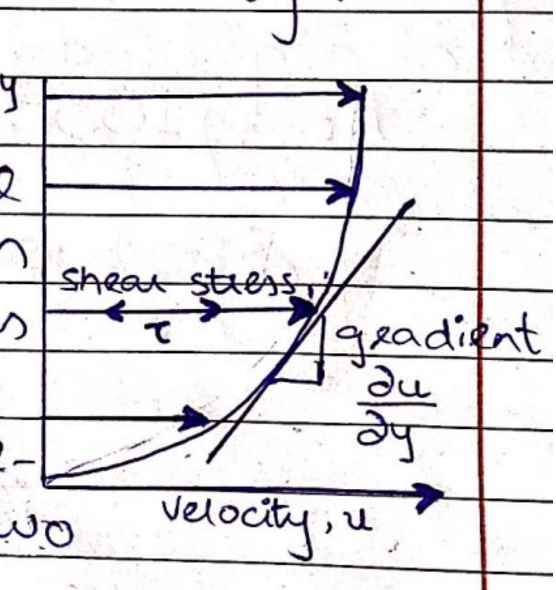
Q1:- (a):- Define viscosity ? Derive newton equation of viscosity.

Ans :- Viscosity :-

Viscosity is the measure of a substance's resistance to motion under an applied force. It is often referred to as the thickness of a fluid. Low viscosity means that it is easy to flow heating reduces the viscosity but moisture increases the viscosity.

Newton equation of Viscosity :-

Newton's viscosity Law's state that, the shear stress between adjacent fluid layers is proportional to the velocity gradients between the two layers.



The ratio of shear stress to shear rate is constant, for a given temperature and pressure, and is defined as the viscosity or coefficient of viscosity.

Newton's Law of viscosity :-

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

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

where,

μ = Viscosity.

τ = Shear stress = F/A

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

Q1(b) :- Define density, specific weight and specific volume. Show relation between Density and specific weight

Density :-

Density is defined as mass per unit volume.

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Density commonly is expressed in units of grams per milliliter and kilograms per Liter.

The equation for density is :-

density = mass / volume

$$p = m / V$$

Specific Weight :-

The ratio between weight and volume is called specific weight. The symbol used for specific weight is Y and the SI unit of measurement is N/m^3.

$$r = \frac{G}{V} = \frac{m \cdot g}{V}$$

Specific weight, unlike density is not absolute, it depends on the value of the gravitational acceleration (g), which varies depending on altitude and Latitude.

Specific Volume :-

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.

Relation between Density and Specific weight :-

Density is simly mass per unit volume of a body, where as specific weight is the weight per unit volume of a body. So, specific weight has a "g" term associated with it.

$S = (m*g)/V$ and $d = (m/V)$
so, $S = d*g$,

So, density of a material is constant for a given set of physical conditions (the porosity, the packing of atoms with in the material etc.), but the specific weight might vary depending on the value of g. A body will have same density in moon and earth, but will have different specific weights.

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Q1(C) :- If specific volume of gas is 0.72 m^3 /Kg. what is specific weight in N/m^3 ?

Given Data :-

Specific volume, v = 0.72 m^2 /Kg

we have to find specific weight, γ_s = ?

As $V = \frac{1}{\rho}$

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

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

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

As,

$\gamma = \rho g$

$\gamma = 1.38 \times 9.81$

$\gamma = 13.54 \, N/m^3$ Ans.

Q2(a) Define Pressure? What is an absolute and guage 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 F/A (Force per unit area). Unit of Pressure is Pascals (Pa).

Absolute Pressure:-

The absolute Pressure or total Pressure is thus the sum of gauge Pressure and atmospheric Pressure. It is measured by barometer.

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

where P_{guage} is gauge pressure and P_{atm} is atmospheric pressure.

Guage Pressure:-

The difference between absolute Pressure and atmospheric pressure is called gauge Pressure. It can be calculated if we know the ay: M T W T F S S

absolute and atmospheric pressure using this formula:-

$$P_{guage} = P_{abs} - P_{atm}.$$

(Q2)(b) A water tank having dimensions of 1500mm × 1500mm Depth of the water tank is equal to your student I.d number 7379 ----- ?

Note I.D = 7379

Given Data:-

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

$$\text{Width} = w = \frac{1500}{1000} = 1.5\,m$$

$$\text{Depth} = D = 7379\,mm = \frac{7379}{1000} = 7.379\,m$$

Required:-

Net Pressure force when

① $D = 7.379\,m$

② $D' = \frac{D}{2} = \frac{7.379\,m}{2} = 3.6895$

① Net Pressure force when D=7379

$F = P_{avg} \times A$

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

$F = (1000)(9.8)\left(\frac{7.379}{2}\right) \times (1.5 \times 7.379)$

$F = 400,204.86\,N$

or

$F = 400.204\ K.N$

(ii) when Pressure force when $D' = 3.6895$

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

$F = (1000)(9.8)\left(\frac{3.6895}{2}\right) \times (1.5 \times 3.6895)$

$F = 100051.21\ N$

$F = 100.05\ K.N$