Name :- Mian Zeeshanullah

ID :- 7906

Section :- A

Subiect :- Fluid mechanics (I)

Teacher :- Engr - Sir ~~[illegible]~~ Abdul- waheed

Samister : 4th.

21 April 2020

Question # 01 ①

a) Defined viscosity? Derived Newton equation of viscosity?

__Answer :-__

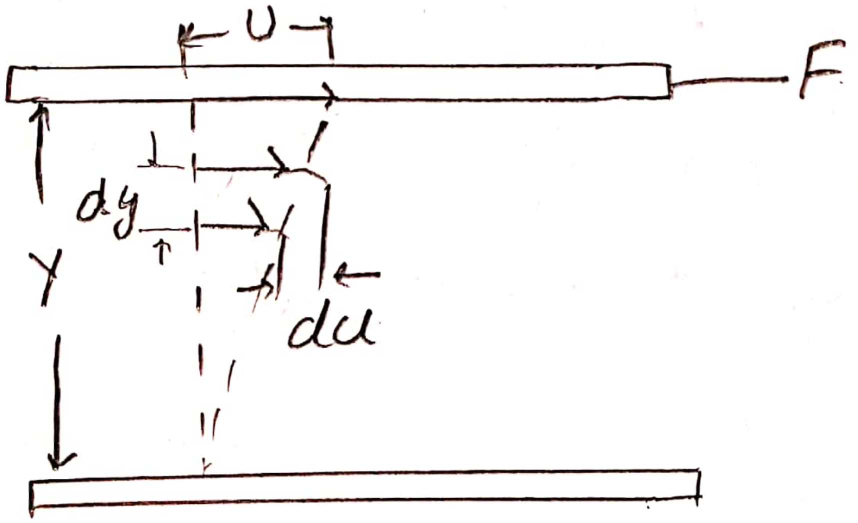
Viscosity is the measure of the internal friction of a fluid. This friction become apparent when a layer of fluid is made to move in relation to another fluid. The greater the friction the greater the amount of force.

The property of fluid by virtue of which it imparts resistance to fluid motion by offering resistance to moment of one layer over after.

P.T.O

viscosity of fluid is measure of its resistance to shear or angular deformation. The friction force are cohesion and moment interchange between the molecules in fluid. As temperature increase the viscosity of liquid decrease as because of cohesion force descrease in gases it increase because of molecul interchange b/w layers

Newton's Equation Of viscosity.



Consider two parallel plate in the above figure sufficiently large so that edge conditions may be neglected placed a small distance "Y"; the space between being filled with the fluid. The lower surface is assumed to be stationary. while the upper one is moved parrallel to it with a velocity "U" by the application of a Force "F' corresponding to some area. A of the moving plate. Such a condition is approximated, for instance, in the clearance space of a flooded journal bearing (any radial load being neglected).

P.T.O

As we know that

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

If the Force increase Area increase.
If the Force increase the distance will be decrease.

$$F = \frac{\mu A U}{Y} \quad \text{or} \quad \frac{F}{A} = \frac{\mu U}{Y}$$

If a constant of proportionality "μ" is now introduced, the shearing stress "τ" b/w any two thin sheets of fluid expressed by.

$$\tau = \frac{F}{A} = \mu \frac{U}{Y} = \mu \frac{du}{dY}.$$

So it becomes

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

This above equation is called Newton's equation of viscosity. ~~and~~

which is also called co-effient of viscosity, the absolute viscosity, the dynamic viscosity or simply the viscosity of the fluid.

QUESTION (01)(b)

b) Define desity, specific weight and specific volume show relation b/w Density and specific weight.

<u>Answer:-</u>

<u>Density:</u>

Density of fluid is its mass per unit volume of fluid. It is denoted by "ρ" its unit is kg/m³

$\rho = m/v.$

Specific weight:.

Specific weight is the weight perunit volume. It is represend by by γ.

Specific weight γ represents the Force exerted by gravity on a unit volume of fluid and therefore must have the unit force per unit volume. Such as N/m^3

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

unit is N/m^3.

Relation between specific weight and density.

As we know that

$\gamma = w/V$. and we also know that

$w = mg$.

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

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

So,

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

or

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

That the above is the relation between specific weight and density.

QUESTION(01) part(C)

c) If specific volume of gas is 0.72 m^3/kg which is specific weight in N/m^3?

Solution:

Given that

specific volume = v = 0.72 m^3/kg.

Required:

we have to find

specific weight = γ_s = ?

As we know that

$v = 1/\rho$

$\rho = 1/v$.

we put the valu of "v"

$\rho = 1/0.72$ so, $\rho = 1.38\ kg/m^3$

As,

$\gamma = \rho g$

$\gamma = 1.38 \times 9.81$

$\gamma = 13.54 N/m^3$

Ans

Question # 02.

Part(a).

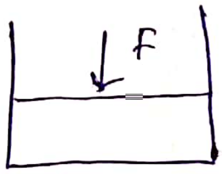
Define pressure? what is an absolute and guage pressure?

Answer.

Pressure

Pressure means Force per unit are. exerted by a fluid on the surface of the container.

$p = F/A$



where.

F = Force (in Newton)

A = Area (meter).

The Force applied perpendicular to the surface of an object per unit area

P.T.O

over which that Force is distributed.

Pressure is of two types

→ Static Pressure.

→ Dynamic Pressure.

Absolute and guage pressure.

→ Absolute pressure:

If the pressure is measured relative to absolute Zero, it is Called absolute pressure.

→ guage pressure.

When it is measured relative to atmospheric Pressure as a base it is Called guage pressure

Explanation:

Practically all pressure gages register zero when open to the atmosphere and hence measure the difference between the pressure of the fluid to which they are connected and that of the surrounding air.

If the pressure is below that of the atmosphere, it is designed as a vaccum and its guage value is the amount by which it is below that of the atmosphere which is called a "high vaccum" is really a low absolute pressure. A perfect vacum should corresponding to absolute zero pressure.

we have the following relation

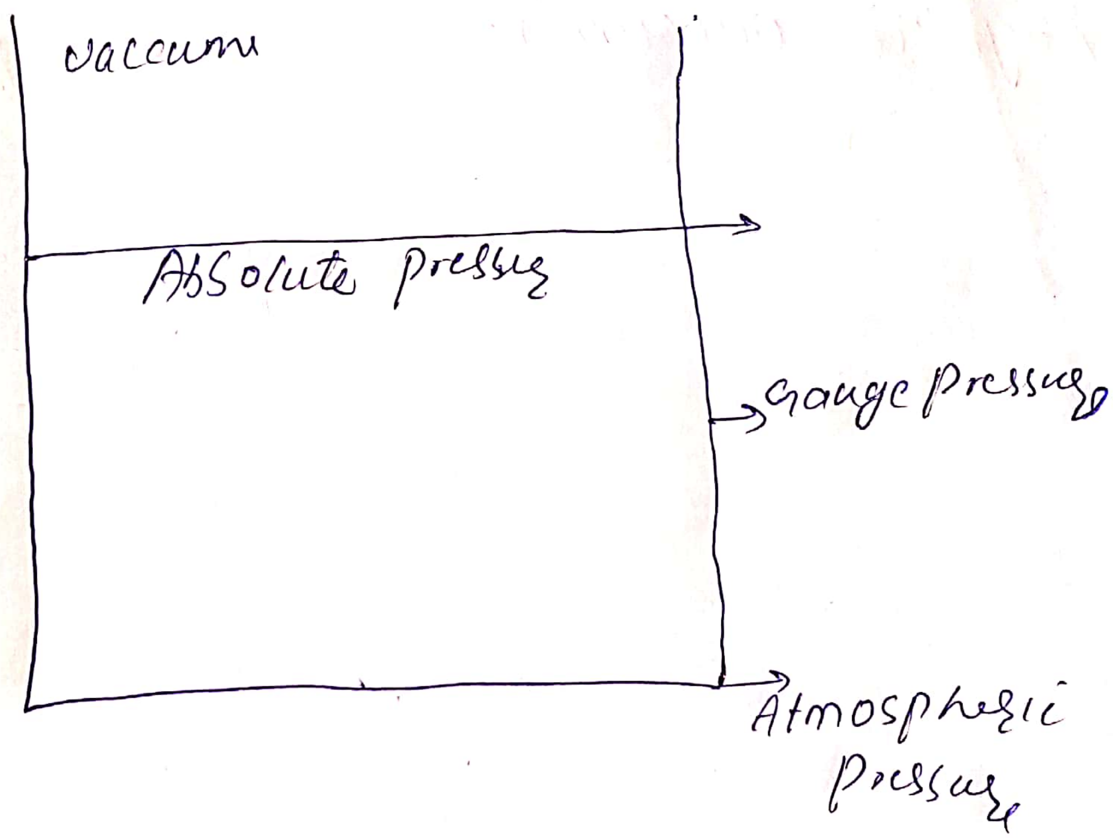
$$P_{abs} = P_{atm} + P_{gauge}$$

where P_{gauge} may be positive or negative (vaccum).

Question#02(b)

part(b)

Diagram



(14) QUESTION # 02(b)

(Part B)

A water tank having dimension of 1500mm × 1500mm. Depth of the water tank is equal to your student ID number in mm. What is the net pressure force on wall of water tank? Find the location of force application?

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

GIVEN:-

Length = 1500 mm = 1.500m

Bredth = 1500mm = 1.500m

height or depth = 7906 = 7.906m

Density of water = 1000 kg/m^3

(15)

Solution:-

As we know that

$p = \gamma g h$

$\rho g = \gamma$

$p = \gamma h$

$p = 9.81 \times 7.906$

$p = 77.5578$ kPa

Per unit width

$p_1 = \frac{p}{\text{width}}$

$p_1 = \frac{77.5578}{1.5}$

$p_1 = 51.705$ kN/m

Location of Force

$y' = h/3$

$$y' = \frac{7.906}{3}$$

$y' = 2.635$.

Resultant Force :-

$\text{Resultant Force} = \frac{1}{2} bh.$

$= \frac{1}{2}(52.110)(7.906)$

$\text{Resultant Force} = 205.9908 \text{ kN}$

Water level at Half Height

$$h = \frac{7.906}{2} = 3.953$$

Jet pressure :

$p = \gamma h/2$

$p = 9.81 \times \frac{7.906}{2}$

$p = 9.81 \times 3.953$

$p = 38.778$ kPa.

Pressure Per unit weight

$p = \frac{P}{width}$

$p = \frac{38.778}{1.5}$

$p = 25.825$ kN/m

Resultant Force :

$R.F = \frac{1}{2} bh$

$R.F = \frac{1}{2}(38.778)(3.953)$

R.F = 76.644717 kN

Resnet:-

P_1 = 76.644717 kPa.

P_2 = 38.778 kPa

P_1' = 51.705 kN/m

P_2' = 25.825 kN/m

y' = 2.635 m

f = 76.6447 kN

R.F = 205.99 kN

y' = 1992

location force

$y' = \frac{3.953}{2} = 1.976$