Q) Define discharge? Write its equation?

Ans: Discharge:

The amount of fluid passing a section of a stream in unit time is called discharge.

(V) is a mean velocity.

(A) is a cross section area.

The discharge Q is define as.

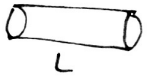
$$Q = A V$$

which is known as volume flow rate.

Discharge is also expressed as mass flow rate and weight flow rate.

$$Q = \frac{Vol}{time} = \frac{V}{t}$$

Now $Q = \frac{V}{t} = \frac{A \times l}{t}$ ->



$$Q = A \times Velocity.$$

Thus velocity x Area = discharge

Q. Define head and its types?

Ans: **Head**: It is the sum of all energy head at a point in liquid or total energy per unit weight of fluid at a point.

Types

(1) Kinatic head:

It is Kinetic energy per unit weight of fluid.

$$\frac{K.E}{W} = \frac{1}{2}\frac{mv^2}{mg} = \frac{1}{2}\frac{v^2}{g}$$ is kinetic head.

This is also known as velocity head. its unit is meter.

(2) Potential head:

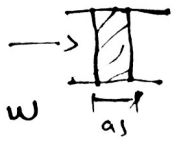
It is potential energy per unit weight of fluid.

$$\frac{P.E}{W} = \frac{mgh}{mg} = h$$

(3) Pressure head: The vertical height of a free surface above any point in a liquid at rest in pressure head or level of fluid due to pressure exerted by fluid.

Which is $\frac{\text{work}}{W} = \frac{F.dl}{W}$

$$= \frac{PA.dl}{W} = \frac{P \times \text{volume}}{W} = \frac{P}{\gamma}$$



Q2

Part(a)

Given data

Mean velocity = 20 cm/s = 0.2 m/s

Pressure = 30 kpa = 30000 N/m²

Hieght = 40 cm = (0.4) m

Required

Head of water=?

Soln

$$H = z + \frac{V^2}{2g} + \frac{P}{\gamma}$$

$\therefore \gamma_w = 9.810\ kN/m^3$

$= 9810\ N/m^3$

$$H = 0.4 + \frac{(0.2)^2}{2(9.81)} + \frac{30000}{9810}$$

$$H = 0.4 + 0.00203 + 3.058$$

$$H = 3.46\ m$$

Q No 2

(b) Find the velocity of water in pipe having diameter 150mm flowing at 0.5 m^3/s

Given data.

Diameter of Pipe = 150mm or 0.15m

Discharge = Q = 0.5 m^3/se

Velocity = V = ?

Sol>

formula = $Q = AV$

$$V = \frac{Q}{A} \quad \text{—①}$$

Now we find Area of pipe (cross section.

$$A = \frac{\pi D^2}{4} = \frac{3.142(0.15)^2}{4} = 0.0176m^2$$

Put value

$$V = \frac{Q}{A} = \frac{0.5\ m^3/s}{0.0176m^2} = 28.4$$

$V = 28.4\ m/s.$

Q3

Given data

oil Specific gravity = 0.9

pipe length = 40m

pipe dia = 200mm = 0.2m

oil Viscosity = 6×10^{-5} N.s/m²

$Q = 0.06 \, m^3/s$

Coefficient of friction = 0.032

Find head loss due to friction = ?

Sol

Velocity = V = Q/Area

$$\text{area} = \frac{\pi D^2}{4} = \frac{3.142 (0.2)^2}{4} = 0.03142 \, m^2$$

$$\text{Velocity} = V = \frac{Q}{A} = \frac{0.06}{0.03142} = 1.9 \, m/s$$

Now find hf

$$hf = \frac{flv^2}{2gd} = \frac{0.0032 \times 40 (1.9)^2}{2 (9.81) (0.2)} = \frac{0.462}{3.924}$$

$$hf = \frac{0.462}{3.924} = 0.11 \, m$$