CNOH 2

PART (A)

Total Energy Head:-

From Bernoulli principal, the Total Energy at a given point in a fluid in the Energy associated with movement of fluid plus Energy from static pressure in the fluid Energy from height of fluid relative to an arbitary datum height.

OR: The sum of pressure head (p/y) and velocity head ($v^2/2g$) and elevation head h is constant along a stream line this constant is called total height H.

Forms OF Energy Head:.

There are three types of Energy head which are given below.

potential Energy:..

It is the potential Energy per unit wight It is due to position above some datum line pressure Head + velocity Head + potential head = Total Head.

potential Head = total head - velocity head - pressure head.

Kinetic Head:.

It represent kinetic Energy of fluid. It is height in fect that a flowing fluid will rise in column.

P.T.O

Pressure Head:- It is height of liquid column that corresponds to a particular pressure exerted by liquid column that corresponds a particullar pressure exerted by liquid column of the base of contains.

Pressure Head = Total Head - Kinetic head - potential Head.

x ~~~ x

P4

QNO#2

Part (B)

Hydraulic Grade line (HGL) :-

Hydraulic grade line refers to the profile of water streaming in an open channel or a pipe streaming in a part full.

when a pipe is under pressure

The pressure driven review line is the level to which the water would ascend to in a little vertical tube associated with a pipes.

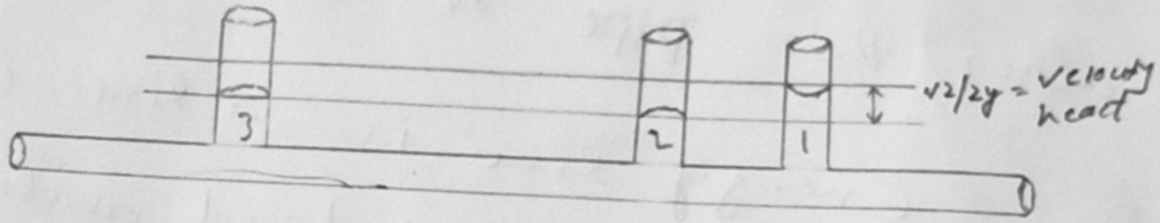
↳ It is denoted as (HGL)

↳ The hydraulic grade line is line representing the total head availiable to the fluid minus velocity head and can be expressed as.

$HGL = P/\gamma + h$ PJ

where HGL = Hydraulic Grade line.

The hydraulic Grade line lies on velocity head below the energy line.



Energy line (EGL)

Energy Grade line refer to a line that represents to the height of energy head of water streaming in a pipe. course or channel.

p.t-6

The line is drawn over the pressure Hydraulic grade line (inclination)

The separation equalant to speed head ($v^2/2g$) of the water streaming at every area or a point along the pipe or channel.

→ The Energy line is a line that represent the total head avaliable the fluid can be expressed as,

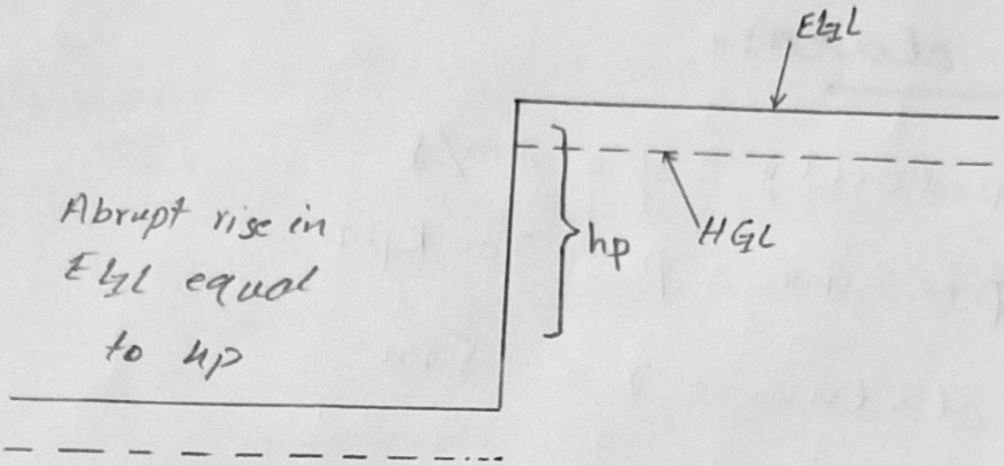
$$EL = H = P/\gamma + \frac{v^2}{2g+h} = \text{constant}$$

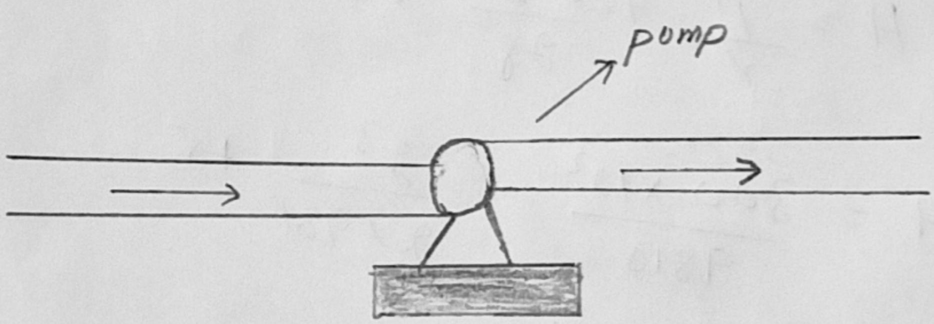
along a stream line.

EL = Energy line.

P.T.O

P7





Q2 (part a)

Given data:-

velocity $= v = 2 m/s$

pressure $= P = 300 kPa$

datum $= z = 5 m$

Sol:-

H = pressure Head + KE + PE

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

$$H = \frac{300 \times 10^2}{9810} + \frac{2^3}{2 \times 9.81} + 5$$

$$\boxed{H = 35.7849 \, m}$$

QNO #2
part (b).-

Pg:

Given data.-

Diameter = d_1 = 300mm

Diameter = d_2 = 200 mm

pressure = p_1 = 300 kpa = $300 \times 10^3 N/m^2$

= p_2 = 120 kpa = $120 \times 10^3 N/m^2$

Datum = Z = ?

$Q = \frac{40 m^3/sec}{1000}$

d_1 = 300 mm = 0.3m

d_2 = 200mm = 0.2 m

Required:-

Z_2 = ?

Sol:

P.T.O

Sol:

$$A_1 = \frac{\pi d_1^2}{4}$$

$$A_1 = \frac{3.14 \times (0.3)^2}{4}$$

$$\boxed{A_1 = 0.706 \, m^2}$$

$$A_2 = \frac{\pi d_2^2}{4}$$

$$A_2 = \frac{3.14 \times (0.2)^2}{4}$$

$$\boxed{A_2 = 0.0314} \, m^2$$

We know that

$$Q_1 = V_1 A_1$$

$$V_1 = \frac{Q}{A_1}$$

$$V_1 = \frac{0.04}{0.0706}$$

$$\boxed{V_1 = 0.566}$$

$$Q = \frac{40}{1000}$$

$$Q \Rightarrow 0.04$$

$$V_2 = \frac{Q}{A_2}$$

$$V_2 = \frac{0.04}{0.0314}$$

P.T.O

$$U_2 = 1.27$$

Now

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

$$z_1 = 0$$

$$\gamma = 9810$$

$$\frac{300 \times 10^3}{9810} + \frac{0.566^2}{2(9.8)} + 0 = \frac{120 \times 10^3}{9810} + \frac{1.27^2}{2(9.8)} + z_2$$

$$30.59 = 12.314 + z_2$$

$$z_2 = 18.276$$

Question No 3

Sol:-

Given data:-

Length of pipe $= l = 500m$

dia $= d = 0.2m$

Specific gravity of oil $= 0.9$

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

viscosity $= \mu = 6\times10^{-5} \, N.s/m^3$

Required:-

Pressure loss $= \Delta p = ?$

As we know

$$f = \left(0.0032 + \left(\frac{0.221}{R^{0.237}}\right)\right)$$

Where R = Reynold's No and is given as ..

$$R = \frac{v \times d}{\nu} \rightarrow (1)$$

And $\nu = \frac{\mu}{\rho} = \frac{6 \times 10^{-5}}{900}$

$\nu = 6.67 \times 10^{-8}\ m^3/s$

and $V = \frac{Q}{A}$

∵ For circular pipe

$A = \frac{\pi d^2}{4}$

$A = 0.031\ m^2$

$\Rightarrow V = \frac{0.06}{0.031}$

$\Rightarrow V = 1.95\ m/s$

Now eq (1)

$R = \frac{1.95 \times 0.2}{6.67 \times 10^{-5}} = 5.73 \times 10^{6}$

Now

$f = 0.0032 + \frac{0.221}{(5.73 \times 10^{6})^{0.237}}$

$\Rightarrow f = 8.79 \times 10^{-3}$

or $f = 0.00879$

P.S.O

Now from Bernoulis equation..

Head loss $= h_L = \frac{f L v^2}{2g D}$ → (ii)

putting values in eq (iii)

$$h_L = \frac{(0.00879)(500)(1.95)^2}{2(9.81)(0.2)}$$

$\Rightarrow h_L = 4.259\,m$

Now to find pressure loss due to friction.

pressure Head Formula is used

$$h_2 = \frac{\Delta P}{\rho g}$$

p.t.o

$$h_L = \frac{\Delta P}{\rho g}$$

$$\Rightarrow \Delta P = h_L \times \rho g$$

put values

$$\Delta P = 4.259 \times 900 \times 9.81$$

$$\Rightarrow \Delta P = 37602.7 \ Pa$$

$$\boxed{\Rightarrow \Delta P = 37.602 \ KPa}$$

$\therefore$ $\therefore$ $\therefore$