QNO 1 a)

① ⇒ Total energy head :

From bernulli principle 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.

⇒ forms of energy head :

② ⇒ Potential head :

It is the potential energy Per unit weight. 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

③ ⇒ Kinetic head :

It represent kinetic energy of fluid. It is height in feet that a following fluid will rise in column.

⇒ Pressure head :

It is height of liquid column that corresponds to a particular pressure exerted by liquid column that corresponds a particular pressure exerted by liquid column on the base of contain.

Pressure head = Total head - kanectic head - potential head.

Que 2 b)

Hydraulic Grade line :- (HGL)

Hydraulic grade line refers to the profile of line refers to the water streaming on an open channel or a pipe streaming in a part full. when a piper is under is under pressure the pressure driven review line is the level to which the water would ascend to in a little verticle tube associated with a pipe.

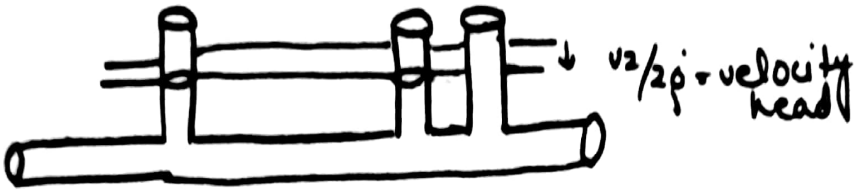
→ It is denoted as (HGL)

→ The hydraulic grade line is line representing the total head available to the fluid minus velocity head and can be expressed as

HGL = P/ρth

where HGL =

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



➡ Energy line (EGL):

Energy Grade line refer to a line that represent to the height of energy head of water streaming in a pipe, course, or channel. the line is drawn over the pressure Hydraulic grad line (inclination)

Q NO=2 (a)

Given data:

velocity = v = 2m/s

Pressure P = 300 KPa

datum z = 5m

Sol:

H = Pressure head + KE + PE

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

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

$$H = 35.7849 m$$

b) Given data

Diameter = d_1 = 300 mm

Diameter = d_2 = 200 mm

Pressure = P_1 = 300 KPa = 300×10^3 N/m²

P_2 = 120 KPa = 120×10^3 N/m²

Datum = z = ?

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

d_1 = 300mm = 0.3m

d_2 = 200mm = 0.2m

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

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

$$A_1 = 0.0706 m^2$$

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

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

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

We know that:

$Q_1 = v_1 A_1$

$v_1 = \frac{Q}{A_1}$

$v_1 = \frac{Q}{A_1}$

$v_1 = \frac{0.04}{0.0701}$

$v_1 = 0.568$

$v_2 = \frac{Q}{A_2}$

$v_2 = \frac{0.04}{0.0314}$

$v_2 = 1.27$

Now

$$\frac{P_1}{\gamma} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{v_2}{2g} + z_2$$

$z_1 = 0$

$\gamma = 9810$

$$\frac{300 \times 10^3}{9810} + \frac{0.568^2}{2(98)} + 0 = \frac{(20 \times 10^3}{9810} + \frac{1.27 + z_2}{2(981)}$$

$$30.59 = 12.314 + z_2$$

$$\boxed{z_2 = 18.27}$$

QNO 38

Required : Pressure loss = DP = ?

As we know

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

where R = Reynolds NO and is Given as

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

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

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

& $v = \frac{Q}{A}$

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

$\Rightarrow v = 1.95$ m/s

Now eqn (1) $R = \frac{1.95 \times 0.2}{6.67 \times 10^{-5}} = 5.73 \times 10^{5}$

Now:

$$f = 0.0032 + \frac{0.221}{(5.73 \times 10^{5})^{0.237}}$$

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

or $f = 0.00879$

Now from Bernoulis eqn

Head loss = $h_L = \frac{fLv^2}{2gD}$ — (ii)

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

$H_L = 4.259\,m$

Now to find pressure loss due to friction pressure head formula is used

$$H_L = \frac{\Delta P}{\delta g}$$

$\Rightarrow \Delta P = h_2 \times \delta g$

$= 4.259 \times 900 \times 9.81$

$= \Delta P = 37602.7\,Pa$

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