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Seetion ⇒ 'B'

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IQRA NATIONAL UNIVERSITY.

QNo # 1

Part (a)

Answer

Total Energy Head: from Bernulli 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 arbilary datum height

OR

The sum of pressure head (p/γ) 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 Head:- It is the potential energy per unit weight It is due to position above some datum line pressure Head + velocity head + putential head = Total head.

Putential Head = Total head - velocity head - pressur head.

Kinetic head:- It represent kinetic energy of fluid. It is height in feet then a flowing fluid will rise in column.

(P.T.V)

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

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

QNo # 1 part (B)

Hydraulic Grade line: (HG2)

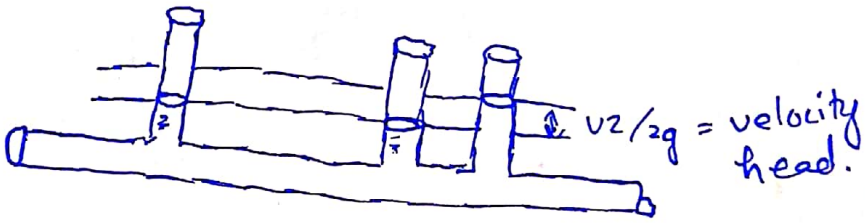
Hydraulic grade line refers to the profile of water streaming in an open channel or a pipe streaming in a part full when a piper is urder pressure the pressure driven review line is the level to which the water would ascend to in a little vertical tube associted with a piper.

- It is denoted as (HG2)
- The hydraulic grade line is line representing the total head avalible to the fuild minus velocity head and can be expresseed as;

HGe = P/γ+h

where HGc = Hydraulic Grade line

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



Energy line :- (EGL)
Grade

Energy line refer to a line that represents to the height of energy head of water streaming in a pipe. course, or channel. The line is drawn over the pressure Hydraulic grade line (inclinatic

(P.T.O)

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

4 the energy lines is a line that represent the total head avalical the fluid can be expressed as

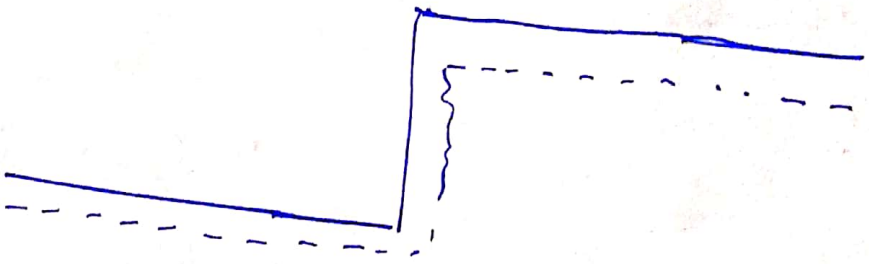
$$EC = H = P/\gamma + \frac{V^2}{2g+n} = \text{constant}$$

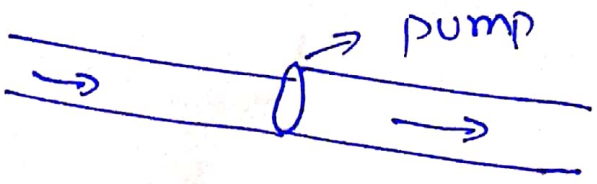
along a stream line.

EL = Energy line

Abrupt rise in EGL equal to hp

EGL

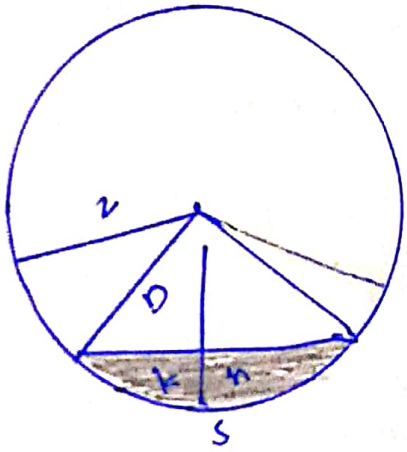




★ **Hydraulic Radius :-** Hydraulic radius is the area of water prism in a pipe or channel divided by the wetted perimeter thus. for a sound condait flowing full or half full the hydraulic radius .is d/4 is Hydraulic radius measure the flow efficiency of a pipe.

- In treneless temology it is a fuction of the shape of the pipe in which the liquid is flowing.
- It does not indicate half of the diameter as the name suggests.
- Another term some times used for

this quantity is hydraulic mean depth.



(P.T.O)

Question # 2 part (a)

Given data :-

$v = 2 m/sec$

$p = 300 kps = 300 \times 10^3 N/m^2$

$Z = 5m$

$\gamma = 98\%$

Required :-

H = Total energy per unit weight = ?

Solution :-

As we know that

H = pressure head + kinetic energy (Head) + potential energy (Head)

$$H = \frac{p}{\gamma} + \frac{v^2}{2g} + Z$$

putting the values in the above equation

P.T.O

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

$$H = 30.581 + 0.20 + 5$$

$$\boxed{H = 35.784\,m}$$ Ans

P.T.O

Question No # 2

part (b)

Answer

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

Required data :-

Datum = z = ?

Solution :-

$Q = \frac{40}{100}$ m³/sec = 0.04

d_1 = 300 mm = 0.3m

d_2 = 200 mm = 0.2m

(P.T.O)

$$A_1 = \frac{22d^2}{4}$$

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

$$\boxed{A1 = 0.0706\ m^2}$$

$$A_2 = \frac{22d^2}{4}$$

$$\Rightarrow \frac{(3.14)(0.2)}{4}$$

$$\boxed{A_2 = 0.034}$$

we know that

$$Q = V_1 A_1$$

$$V_1 = \frac{Q}{A_1} \Rightarrow \frac{0.04}{0.0706}$$

$$\boxed{V1 = 0.566}$$

$$V_2 = \frac{Q}{A_2} \Rightarrow \frac{0.04}{0.0314} \Rightarrow \boxed{V_2 = 1.27}$$

Now

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + Z_2$$

put $Z_1 = 0$

$$\gamma = 9810$$

$$\frac{300 \times 10^3}{9810} + \frac{(0.566)}{2(9.81)} + 0 = \frac{120 \times 10^3}{9810} + \frac{(1.27)^2}{2(9.81)} + Z_2$$

$$30.597 = 12.314 + Z_2$$

$$\boxed{Z_2 = 18.283}$$

Now Datum

$$= \boxed{Z = 18.283\ m}$$

Question No#03

Sol Given data:-

Length of pipe = $l = 500m$

dia = $d = 0.2m$

Specific gravity of oil = $\sigma = 0.4$

flow rate = $Q = 0.06 m^3/s$

Viscosty = $H = 6 \times 10^{-5}$ $N.s/m^2$

Required:

Pressure loss = $DP = ?$

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:

$$R = \frac{V \times d}{V} \Rightarrow (1)$$

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

$V = 6.67 \times 10^{-8}$ m^2/s

$\longrightarrow$

and $v = \frac{Q}{A}$ i. for Circular pipe

$A = \pi/4 \, d^2$

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

$A = \pi/4 \, (0.2)^2$

$\Rightarrow v = 1.95 \text{ m/s}$ (1.935 m/s)

$A = 6.031 \text{ m}^2$

Now eq (i) $\Rightarrow$ $R = \frac{1.95 \times 0.2}{667 \times 10^{-5}} = 5.73 \times 10^6$

Now

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

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

or $f = 0.00879$

Now from Bernoulli's equation:

Head loss $= h_2 = \frac{f 2 v^2}{2gD}$ = (ii)

putting values in eq (ii)

$$h_2 = \frac{(0.00879)(500)(1.95)^2}{2(9.81)(0.2)}$$

$h_2 = 4.259\ m$

Now. to find pressure loss due to friction.

Pressure Head formula is used

$$h_2 = \frac{DP}{\rho g}$$

$$\Rightarrow DP = h_2 \times \rho g$$

putt values

$$DP = 4.259 \times 950 \times 9.81$$

$$DP = 37602.7\ Pa$$

$$\Rightarrow \boxed{DP = 37.602\ kPa}$$