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Q# 01 Part (a)

Answer::

Total Energy head: from Bernoulic Principal, the total Energy at a given point in a fluid. in the energy associated with movement of fluid. plus energy form static pressure in the fluid energy from height of fluid relative to an arbitary datum height.

OR

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

Form. of Energy head

There are Three types of energy head which are given

1) potential Head
2) Kinetic head
3) pressure head.

1) Head : H : The total energy of fluid particles per unit weight as is know as head

Units : The units of head is meter

Potential head : It is the potential energy per unit weight It is due to position above some datum line pressure head

velocity head = total head - velocity head - pressure head

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

Pressure head = total head − kinetic head − potential head

pressure head = P/γ

3) Kinetic head:- It is represent kinetic energy of fluid. It is height in the feet that a ~~following~~ flowing fluid will be rise in column

$$K.H = V^2/2g$$

Total head: The sum of all head will be total head

$$\text{Total head} = V^2/2g + Z + P/\gamma$$

Q#1 Part B

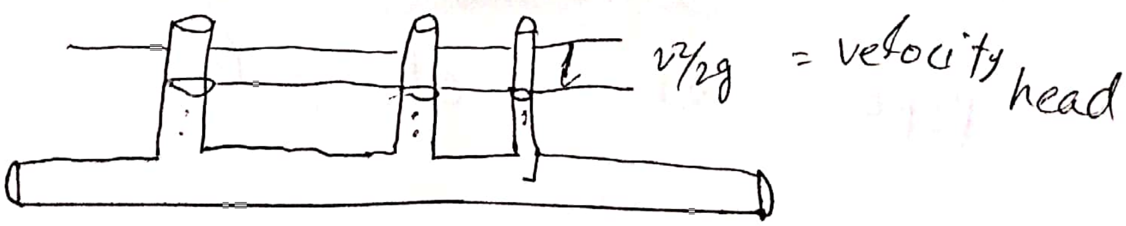
Hydraulic Grad line : (HGL)

Hydraulic grade line : refers to the profile of water streaming in an open channel or a Pipe streaming in a part full when a pipes as under pressure the pressure ~~d rive~~ drive ~~review~~ review line as the level to which the water would ascend to in a little vertical tube ~~Asso ciated~~ associted with a pipe.

-> The hydraulic grade line is line representing the total head available to the fluid minus ~~veleco~~ velocity head and can be expressed as

$$HGL = P/\gamma + h$$

Where HGL = hydraulic Grade line. The hydraulic grade line lies on velocity head below the energy line



Energy line: (EGL)

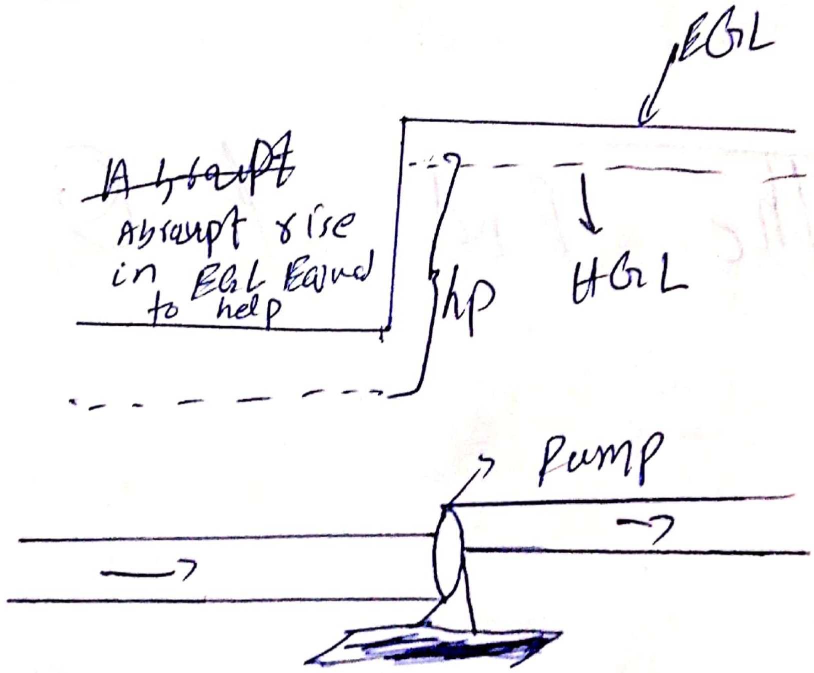
Energy Grade line refers to a line that represent to the height of energy head of water streaming in a pipe course or channel. the line is drawn over the pressure Hydraulic grade line. The separation equalant to speed head ($v^2/2g$) of the water streaming at every area or a point along the pipe or channel

→ The energy line is a line that represent total head available the fluid can be expressed as

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

along a streamline

EL = Energy line



Hydraulic radius:- Hydraulic radius is defined as the cross sectional area of flow divided by the wetted perimeter. So the calculation of rectangle and trapezoid area and triangle area will be include along with the perimeter for each.

The End of Q #1

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Q# 2 Part A

Given Data:

Velocity = $V = 2 \, m/s$

Pressure = $P = 300 \, kPa$

datum = $Z = 5m$

Solution:

H = Pressure head + KE + PE

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

$$H = \frac{300 \times 10^3}{9810} + \frac{(2)^2}{2 \times 981} + 5$$

$$H = 35.7848 \, m$$

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Q# 2 part b

<u>Given Data</u>

Diameter = d_1 = 300mm

Diameter = d_2 = 200mm

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

=> P_2 = 120 Kpa = 120×10^3 N/m²

Dutum = z = ?

$Q = \frac{40}{1000}$ m²/sec

d_1 = 300mm = 0.3m

d_2 = 200mm = 0.2m

Required:

Z_1 = ?

Solution:

$$A1 = \frac{\pi d_1^2}{4} \Rightarrow \frac{3.14 \times (0.3)^2}{4}$$

$$\boxed{A_1 = 0.0706}\ m^2$$

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

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

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

We Know that

$$Q_1 = V_1 A_1$$

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

$$\boxed{Q = \frac{40}{1000} \Rightarrow 0.04}$$

$$V_1 = \frac{0.04}{0.0706} = 0.5667$$

$$\boxed{V_1 = 0.5667}$$

1 (4)

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

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

$$\boxed{V_2 = 1.273}$$

Now

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

$$Z_2 = 0$$

$$\gamma = 9810$$

$$\frac{300 \times 10^3}{9810} + \frac{0.5667}{2(9.81)} + Z_1 = \frac{120 \times 10^3}{9810} + \frac{1.27 + 0}{2(9.81)}$$

$$30.60 + Z_1 = 12.314$$

$$Z_1 = -30.60 + 12.314$$

$$\boxed{Z_1 = -18.286}$$

Q# 3

Given Data

Length of pipe = 800 m

diameter = d = 0.2 m

specific gravity of oil = 0.9

flow rate = Q = 0.06 m^3/sec

viscosity = μ = 6×10^{-6} N.s/m^2

Required:

Pressure loss = ΔP = ?

Solution:

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

where

R = Reynolds Number and is

by

$$R = \frac{v \times d}{\nu} \longrightarrow a$$

$\nu = \frac{\mu}{\rho} = \frac{6\times10^{-5}}{900}$

$\nu = 6.67\times10^{-8} m^2/sec$

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

for Area of circuler pipe

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

$A = 0.0314 m^2$

$A = \pi r^2$
$A = \pi\left(\frac{d}{2}\right)^2$
$A = \pi d^2/4$
$A\ \frac{\pi}{4} d^2$

$V = \frac{0.06}{0.31} = 1.935\, m/se$

Putting the value ~~of~~ in eq (a)

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a) ⇒ $R = \frac{1.935 \times 0.2}{6.67 \times 10^{-8}} \Rightarrow \frac{0.387}{6.67 \times 10^{-8}}$

$R = 5.80 \times 10^{3}$

Now $f = 0.0032 + \frac{0.221}{(5.802 \times 10^{3})^{0.237}}$

⇒ $f = 0.3154$

eq (b) ⟹ 18 4

h_L ·

Now from Bernoulis equation

Head loss $= h_L = \frac{FLV^2}{2gD} \rightarrow (b)$

Putting value in eq b

$$h_L = \frac{(0.~~321~~3154)(500)(1.95)^2}{2(9.81)(0.2)}$$

(0.3154)

$$h_L = \frac{~~340~~\ 590.464}{3.9243}$$

$$\boxed{h_L = 150.475\,m}$$

Now pressure ~~d~~ loss due friction

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

$\Delta P = \lambda L \times \delta g$

Putting the values

$\Delta P = 150.475 \times 900 \times 9.81$

$\Delta P = 1328543.775$

$\Delta P = 1.328$ Mpa → preverse loss

←———→

The End of Q# 3