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QNO 1 (a)

Define total energy head and various form of energy head with mathematical equations.

ANSWER:

HEAD:

The total energy of fluid particles per unit weight is know as head.

Total Energy Head:

the total energy at a given point in a fluid is the energy associated with the movement of the fluid, plus energy from static pressure in the fluid, plus energy from the height of fluid relative tee an arbitary datum.

$$T.H = V^2/2g + z + P/\gamma$$

Kinetic Head:

Kinetic energy per unit weight of fluid is known as kinetic Head

$$K \cdot H = V^2/2g$$

Potential Head:

Potential Head is potential energy per unit weight

Potential Head = Z

Pressure Head:

It is pressure energy per unit weight

Pressure Head = P/γ

QNo 1(b)

Define Hydraulic grade line, Energy line and hydraulic radius.

ANSWER:

Hydraulic Grade line:

The surface or profile of water flowing in an open channel or a pipe Partially full. If a pipe is under pressure, the hydraulic grade line is that level water would rise to in a small, verticle tube connected to the pipe.

or

It is a line showing the pressure head and potential head at a point in a fluid. The term $P/\gamma + z$ is static head or perometric head.

Energy Line:

the line showing total head of fluid at any point is Energy line, line Joining level of pitot tube is energy line

Hydraulic Radius:

the ratio of the cross sectional area of channel or pipe in which fluid is flowing to the wetted Parameter.

(5)

QNo 2(a)

GIVEN DATA:

$V = 2 m/s$

$P = 300 \text{ KPa}$

$z = 5m$

REQUIRED:

Total energy Per unit head, H = ?

SOLUTION:

As we know

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

$$\because \gamma = \rho g$$

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

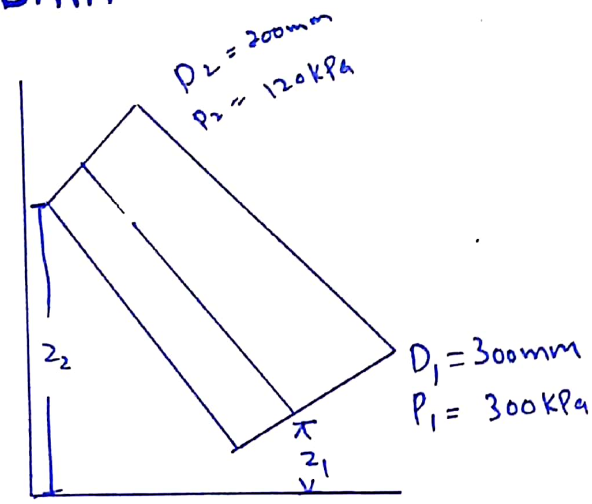
$$= \frac{300 \text{ KPa}}{1000 \times 9.81} + \frac{(2)^2}{2 \times 9.81} + 5$$

$$H = 35.78 \text{ Nm/N}$$

(b)

Q No 2(b)

GIVEN DATA:



Discharge, Q = 40 lps

REQ:

$Z_2 - Z_1 = ?$

SOLUTION:

$D_1 = 0.3 m$

$P_1 = 300 \times 10^3 N/m^2$

Now

$A_1 V_1 = A_2 V_2 = 0.04 m^3/s$

$V_1 = \frac{0.04}{A_1}$, $V_2 = \frac{0.04}{A_2}$

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

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

$\boxed{V_1 = 0.56 m/s}$, $\boxed{V_2 = 1.274 m/s}$

By Bernoulis theorem: (7)

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + Z_2$$

$$\frac{300\times10^3}{1000\times9.81} + \frac{0.56^2}{2\times9.81} + z_1 = \frac{120\times10^3}{1000\times9.81} + \frac{1.274^2}{2\times9.81} + Z_2$$

$$30.58 + 0.016 + z_1 = 12.22 + 0.08 + z_2$$

$$z_2 - z_1 = 18.28\text{m}$$

RESULT

$$z_2 - z_1 = 18.28\text{m}$$

Q No 3 (8)

GIVEN DATA:

Length of pipe, L = 500m

dia, d = 0.1m

Specific gravity, = 0.9

flow rate, Q = 0.06 m^3/s

Viscosity, $\mu = 6 \times 10^{-5}$ $N \cdot s/m^2$

REQ:

Pressure loss, $\Delta P = ?$

Solution:

As we know

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

R is reynold number

$$R = \frac{V \times d}{\nu} \quad — (i)$$

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

$V = Q/A$

for circular pipe

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

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

$V = 1.95 m/s$

Now cal (1)

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

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

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

$f = 0.00879$

Head Loss $= h_L = \frac{fLV^2}{2gD}$

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

$$h_L = 4.259m$$

Now to find Pressure Loss due to friction.

Pressure Head formula is used

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

$$\Delta P = h_L \times \delta g$$

Put Values

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

$$\Delta P = 37602.7 \text{ Pa}$$

$$\Delta P = 37.602 \text{ KPa}$$