NAME: ELENWOKE OBINNA MICHAEL

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DEPARTMENT: MECHANICAL ENGINEERING

1. Solution. Given: Sp. gravity = 0.8, D1 = 150mm = 0.15m; D2 = 75mm = 0.075m; z2 – z1 = 150mm = 0.15m, Qact = 40 liters/sec. = 0.04m3/s, Cd = 0.96.

Pressure difference (P1 – P2):

A1 = D12 = x 0.152 = 0.01767m2

A2 = D22 = x (0.075)2 = 0.00442m2

Qact = Cd x ((A1A2)/(A12  - A22)), we get: h = ((0.04)/(0.96x0.004565x4.429))2 = 4.247m

Also, h = (P1/w + z1) – (P2/w + z2)

(P1 – P2) = pg (4.247 + 0.15)

= (0.8 x 1000 x 9.81) (4.247+0.15) N/m2

= 34.51 KN/m2

2. Solutions: Diameter at inlet, D1 = 300mm = 0.3m

Area of inlet, A1 = x 0.32 = 0.07m2

Diameter at throat, D2 = 150mm = 0.15m

Area at throat, A2 = x 0.152 = 0.01767m2

Specific gravity of heavy liquid (mercury) in U-tube manometer, Shl = 13.6

Specific gravity of liquid (oil) flowing through pipe, Sp = 0.9

Reading of differential manometer, y = 250mm = 0.25m

The differential ‘h’ is given by: h = (P1/w + z1) – (P2/w + z2)

= y [ SW/SP – 1] = 0.25 [13.6/0.9 – 1] = 3.53m of oil

1. Discharge of oil, Q:

Using the relation, Q = Cd x A1A2/(A21 – A22) X , we have:

Q = 0.98 x (0.07 x 0.01767/(0.072 – 0.017672) x 2x9.81x3.53

= 0.001212/0.0677 x 8.32 = 0.1489 m3/s.

1. Pressure difference between entrance and throat sections, P1-P2

We know that, h = (P1/w + z1) – (P2/w + z2) = 3.53

Or, (P1/w – P2/w) + (z1-z2) = 3.53

But, z2 – z1 = 300mm or 0.3m

(P1/w – P2/w) – 0.3 = 3.53 or (P1 – P2)/w = 3.83

Or, P1 – P2 = (9.81 x 0.9) x 3.83 = 33.8 KN/m2