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Section : "B"

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Q No. 1

Ans

The Pressure drop ΔP is expected to be depend upon the gate opening h, the overal depth d, the velocity V, density ρ, viscosity μ:

⇒ List the relevent variable

$\Delta P, h, d, V, \rho, \mu$

Dimension

Dp	$ML^{-1}T^{-2}$
h	L
d	L
V	LT^{-1}
ρ	ML^{-3}
μ	$ML^{-1}T^{-1}$

Number of variable = $n = 6$

Number of Independant dimension $m = 3$

Number of non-dimension group $n - m = 3$

⇒ chase $m = 3$ sealing variable: geomatric (d);

Kinamatic / Time - dependant (V) ; dynmic/mass - dependant (P)

Form dimension less groups by non-dimensionalsing the remaining variables : ΔP, h and μ

$$\Pi_1 = \Delta P\, d^a V^b \rho^c$$

$$M^0 L^0 T^0 = (ML^{-1}T^{-2})(L)^a (LT^{-1})^b (ML^{-3})^c$$

$$= M^{1+c} L^{-1+a+b-3c} T^{-2-b}$$

$M : 0 = 1 + c \Rightarrow c = -1$

$T : 0 = -2 - b \Rightarrow b = -2$

$L : 0 = -1 + b + a - 3c \Rightarrow a = 1 + 3c - b = 0$

$$\Pi_1 = \Delta P V^{-2} \rho^{-1} = \frac{\Delta P}{\rho V^2}$$

Now $\Pi_2 = \frac{h}{d}$ (by inspection, since h is the length)

$$\Pi_3 = \mu d^a V^b \rho^c$$

$$M^0 L^0 T^0 = (ML^{-1}T^{-1})(L)^a (LT^{-1})^b (ML^{-3})^c$$

$$= M^{1+c} L^{1+a+b-3c} T^{-1-b}$$

$M : 0 = 1 + c \Rightarrow c = -1$

$T : 0 = -1 - b + 0 \Rightarrow b = -1$

$L: 0 = -1 + a + b - 3c \Rightarrow a = 1 + 3c - b = -1$

$\Pi_3 = \mu d^{-1} v^{-1} \rho^{-1} = \frac{\mu}{\rho v d}$

Recognition of the Reynold number suggest that we replace Π_3 by

$\Pi_3' = (\Pi_3)^{-1} = \frac{\rho v d}{\mu}$

Hence dimensional analysis yields

i-e $\Pi_1 = f(\Pi_2, \Pi_3')$

$$\frac{\Delta P}{\rho v^2} = f\left(\frac{h}{d}, \frac{\rho v d}{\mu}\right)$$

(a) Dynamic similarity requires that all non-dimensional groups be the same in model and prototype i.e

$$\Pi_1 = \left(\frac{\Delta P}{\rho v^2}\right)_p = \left(\frac{\Delta P}{\rho v^2}\right)_m$$

$\Pi_2 = (h/d)_n = (h/d)_m$ (similar shape i.e geomatric Similarity)

$$\Pi_3 = \left(\frac{\rho v d}{\mu}\right)_p = \left(\frac{\rho v d}{\mu}\right)_m$$

From the last, we have a velocity

ration

$$\frac{V_P}{V_m} = \frac{(\nu/\rho)_P}{(\nu/\rho)_m} \quad \frac{d_m}{d_P} = \frac{0.002/800}{1.0\times10^{-6}} \times \frac{1}{5} = 0.5$$

Thus; $V_m = \frac{V_P}{0.5} = 6\,m/s$

(B) The ratio of the quantities of flow is

$$\frac{Q_P}{Q_m} = \frac{(\text{velocity} \times \text{area})_P}{(\text{velocity} \times \text{area})_m} = \frac{V_P}{V_m}\left(\frac{d_P}{d_m}\right) = 0.5 \times 5^2 = 12.5$$

c) Finally for the Pressure drop

$$\pi_1 = \left(\frac{\Delta P}{\rho V^2}\right)_P = \left(\frac{\Delta P}{\rho V^2}\right)_m \Rightarrow \frac{(\Delta P)_P}{(\Delta P)_m} = \frac{\rho_P}{\rho_m}\left(\frac{V_P}{V_m}\right)^2$$

$$= \frac{800}{1000} \times 0.5^2 = 0.2$$

Thus

$$\Delta P_P = 0.2 \times \Delta P_m = 0.2 \times 60$$

$$\boxed{\Delta P_m = 12.0\,kPa}$$

QNo. 2

Sol:-

$$T = 784$$

$$G = 2.4$$

$$c_u = 0$$

(1) $$H_{limiting} = \frac{6\,au}{\gamma_w(G-w+1)} = \frac{120 \times 784 \times 1000}{1000(2.4-0+1)} = 27670.58\,m$$

Let $H_w = 26500\ m$

Thus $27670.58 > H_w = 26500$

So it low gravity dam

2. Top width "a"

: Free board $= 1.5\ h_{wave} = 1.5 \times 26500$

$F.B = 39750$

Height of Da $= H_D = H_w + F.B = 26500 + 39750$

$= 66250$

$a = 14\%$ of $H_D \Rightarrow 0.14 \times 66250$

$\Rightarrow a = 9275$

3. Base width "b" (without offset)

i) For No ; Sliding Criteria

$$b' = \frac{H_w}{\mu G} = \frac{26500}{0.7 \times 2.4} = 15773.80$$

$b' \simeq 15773.80$

ii) For no tension criteria

$$b' = \frac{H_w}{\sqrt{G}} = \frac{26500}{\sqrt{2.4}}$$

$b' \simeq 17105.07$

Depth of vertical Portion on u/s side

$h' = 2a\sqrt{G-1}$

$h' = 2 \times 9275\sqrt{2.4-0}$

$h' = 28737.53$

$h' = 28737\,m$

5) Upstream offset $= \frac{a}{16} = \frac{9275}{16} = 579.687$

6) Depth below the water level to the end of inclined Portion in u/s $= 3.14\,a\sqrt{G}$

$= 45117.93\,m$

7) Total width of the base of the dam

$b = b' + \frac{a}{16} =$

$= 17105 + \frac{9275}{16}$

$b = 17684.68$

8) $\tan\alpha = \frac{b'}{H} = \frac{17105}{26500}$

$\alpha = \tan^{-1}\left(\frac{17105}{26500}\right)$

$\boxed{\alpha = 32.84}$

9)

Depth of vertical Portion on D/s

$$\text{Tan}\,\theta = \frac{a}{d'} = \frac{9275}{d'}$$

$$\left(\frac{17105}{26500}\right) d' = 9275$$

$$d' = \frac{9275 \times 26500}{17105}$$

$$d' = 14369.33$$

Depth of vertical Portion

$$d = d' + F.B = 14369 + 39750$$

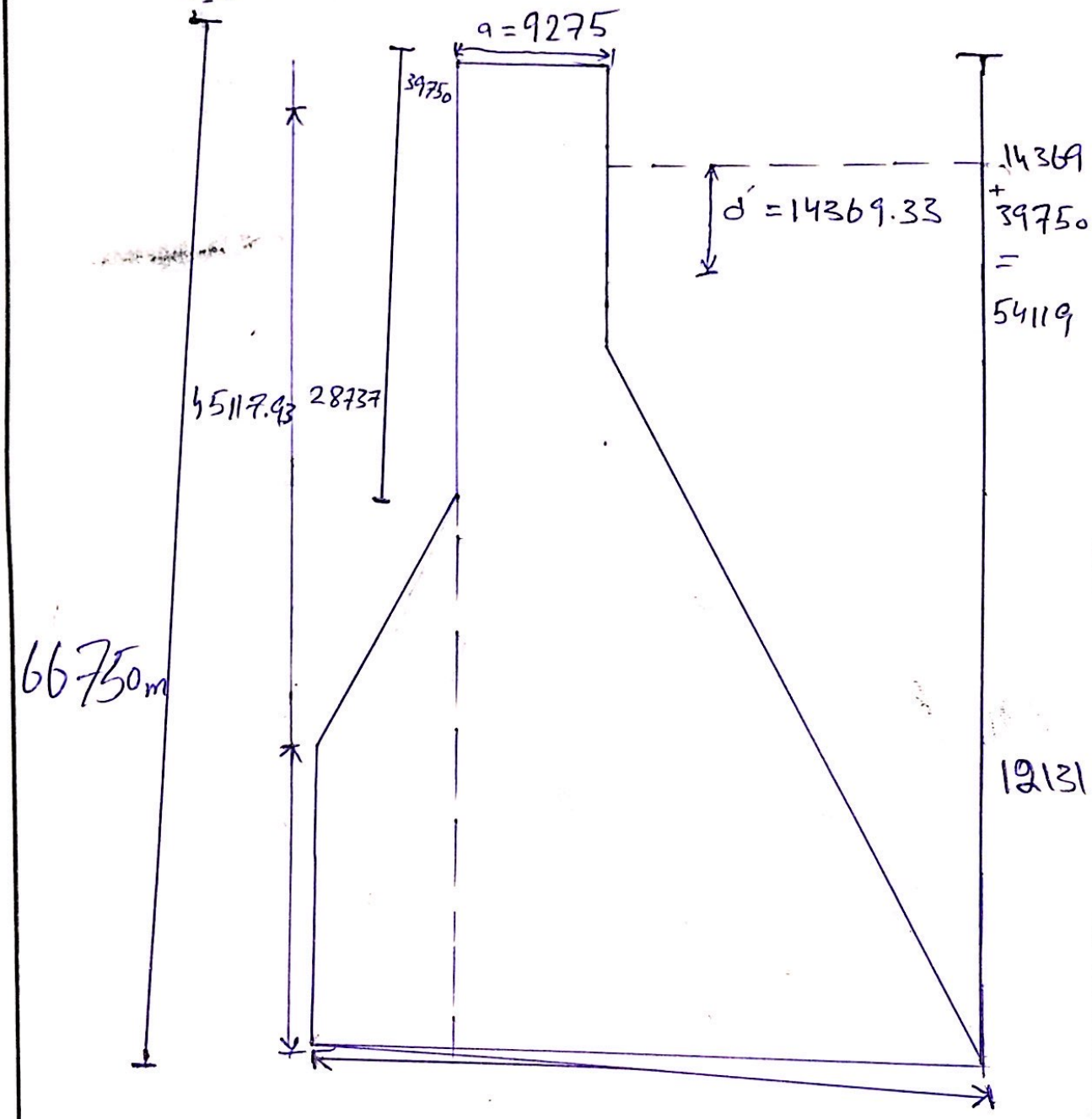
$$d = 54119.$$

Dia gram

P.T.O

ID : 7845 Pg : (8)

Dia gram :-



$\frac{a}{16} = \frac{9275}{16} = 579.68$

$b' = 17105$

$b = 17684.68$

Qno:3:

Ans:

=> **Dimensional Analysis:-**

Using the fact that Physical quantities added to or equated with each other must be expressed in terms of the same fundamental quantities (such as mass, length, or time) for inferences to be made about the relations b/w them.

For example:

How many seconds are in a day.

$$\frac{24\ hr}{1\ day} \quad \frac{60\ min}{1\ hr} \quad \frac{60\ s}{1\ min} = \frac{86,400\ s}{day}.$$

$$= 86,400\ s/day.$$

=> **Similitude:**

Similitude is a concept applicable to the testing of

Engeering models. A model is said to ~~be~~ have similitude with the real application. If the two share geometeric similarity, kinematic similarity and dynamic similarity. Similarity and similitude are interchangeable in this context.

-> Someone or something that closely resembles another, a duplicate or twin.

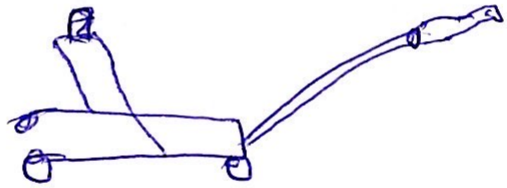
=> Hydraulic Model:-

~~Various cars suspensions contain~~ ∴ A Hydraulic model is a mathematical model of water/sewer/storm system and is used to ~~analyt~~ analyse the system hydraulic bahaviour.

⇒ Hydrulic Jack :-

A mechnical Jack employs a screw thread for lifting have equipment. A hydrulic Jack uses hydrulic Power. The most common form is a car Jack, floor Jack or garage Jack, which lift vahicles So that maintaince can be Performed.

Dia gram :



Q.4

PARTICLE DIAMETER:-

The Particles diameter is directly Proportional to the full velocity because greater the size of Particle so it will tend to move faster as compared to the particle of Small size Thus there will be more gravitational force on Particle of greater size so it will fall Quickly due to its weight.

d) ⇒ **PARTICLE DENSITY:-**

Density of the Particle is directly Proportional to the rate of fall velocity since Particle with high density tends

tends to settle down early as compared with particle of low density.

3 **PARTICLE Concentration:-**

Concentration of particle size will considerably effect its fall velocity as the section having greater concentration will be settle down, at the place Thus causing more velocity compared with the section of low velocity

4 **"Particle shape":**

Particle having regular shape tends to be effected more than irregular shapes since regular shape particles have even surfaces which offers way little or no friction while particles with irregular shape

offers more friction, as the Particle with smaller surface area are more likely to be effected due to their less resistance.

5. **Viscosity of water:-**

From the experimental study we can see that Parameter such as temp, and Pressure changes the magnitude of viscosity so that the section of water having more temperature and Pressure will more due to full objectively increase in the kinetic energy so full velocity will be more.

6. **"Turbulance of water:"**

Turbulance of water depends upon the different factors such as velocity it will

effect the full velocity because of it's zigzag motion thus the velocity varies at every Point which is why it effect the fall velocity moreover in the kinetic energy tends to effect the full velocity compared with steady fluid.

THE END.