1.

	Column I			Column II
(A)	Excess pressure inside a drop → S		(P)	$F = 6\pi\eta rv$
(B)	Stokes' law → P		(Q)	$\frac{V}{t} = \frac{\pi P r^4}{8\eta l}$
(C)	Poiseuille's formula → Q		(R)	$\frac{\rho v D}{\eta}$
(D)	Reynolds number → R		(S)	$\frac{2T}{r}$

✗ (A) A → R ; B → P ; C → Q ; D → S

✓ (B) A → S ; B → P ; C → Q ; D → R

✗ (C) A → S ; B → P ; C → R ; D → Q

✗ (D) A → P , B → S ; C → Q ; D → R

$$\Delta P = \frac{2T}{R}$$

$$\frac{V}{t} = \frac{\pi P r^4}{8\eta l}$$

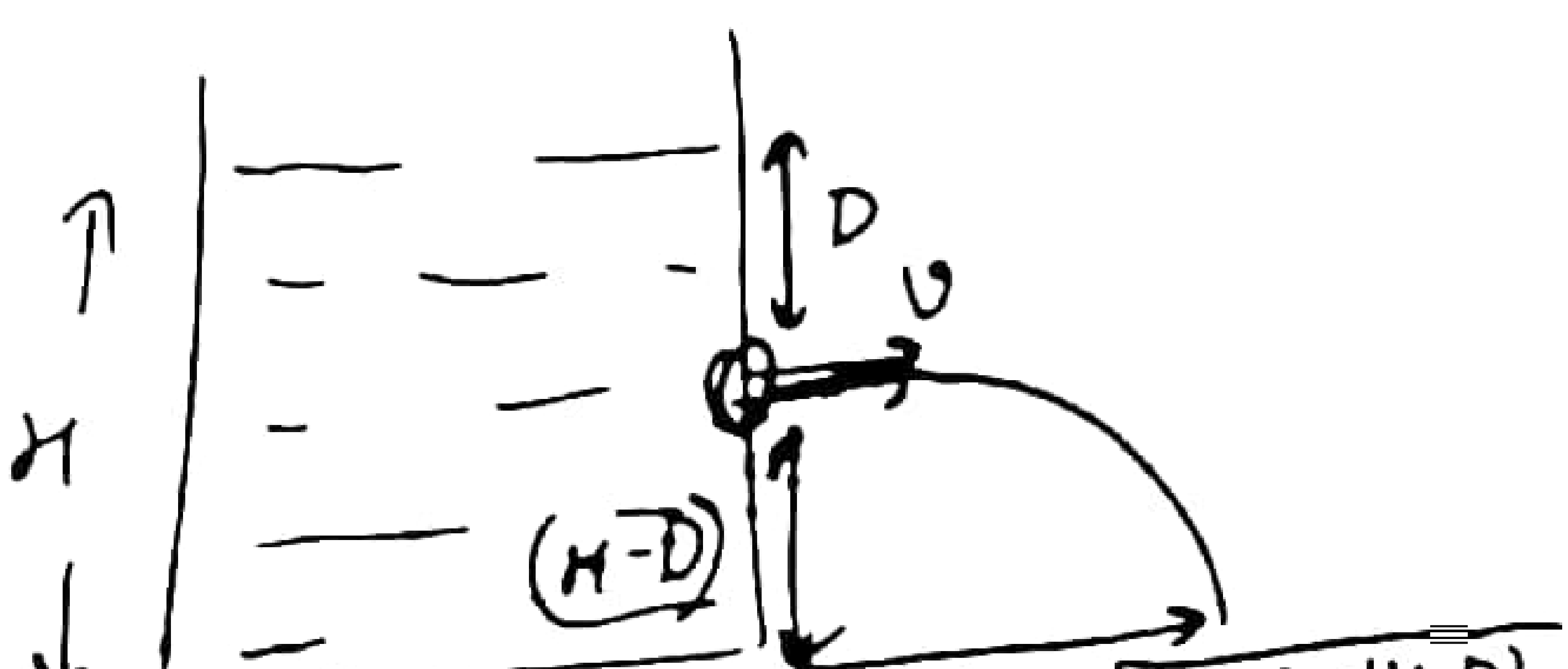
2.

A tank is filled with water to a height H. A hole is made in one of the walls at a depth D below the water surface. The distance x from the foot of the wall at which the stream of water coming out of the tank strikes the ground is given by

(A) $x = 2\,[D\,(H-D)]^{1/2}$ ✓ (B) $x = 2\,(gD)^{1/2}$

(C) $x = 2\,[D\,(H+D)]^{1/2}$ (D) None of these

Sol^n



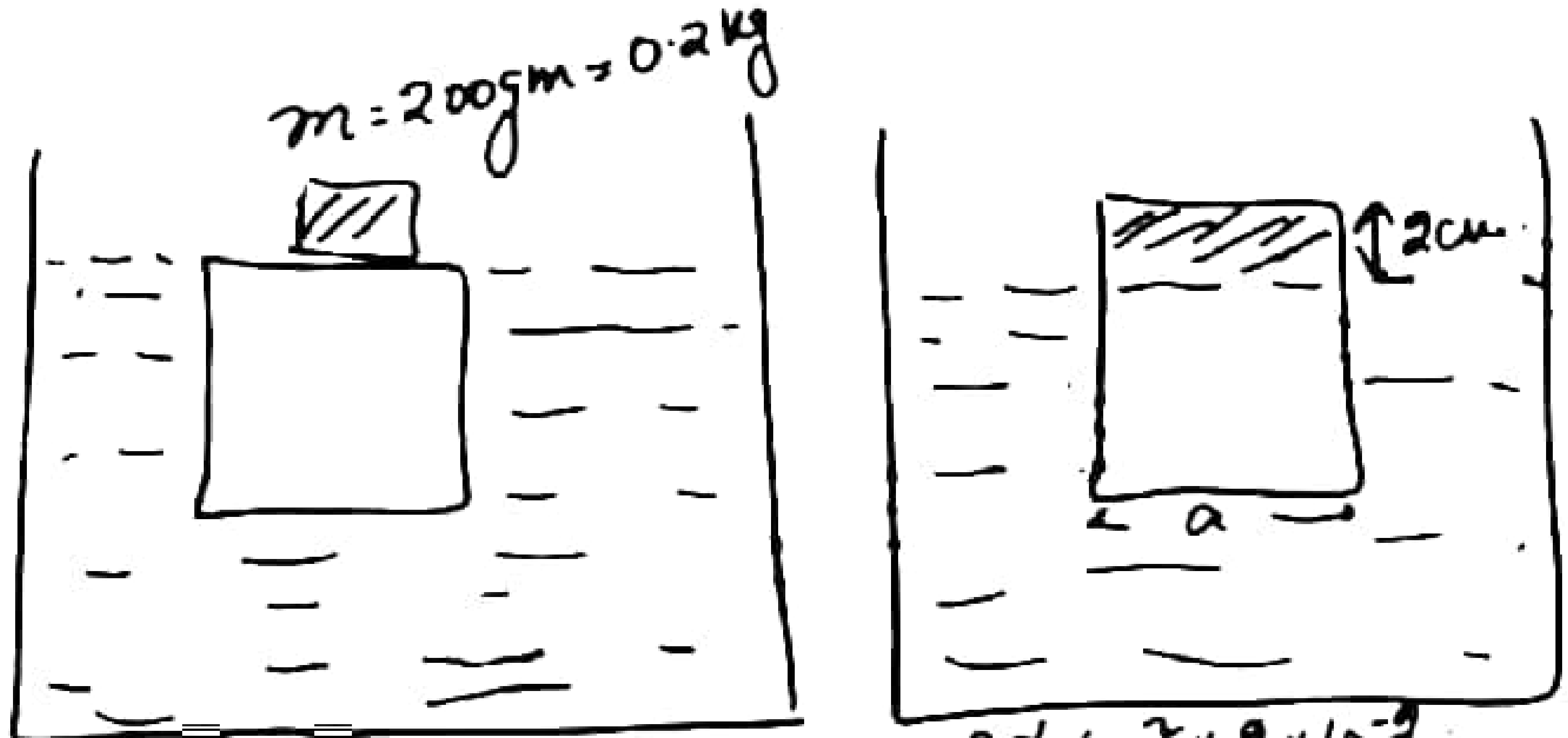
$$x = \sqrt{4 \times D \times (H-D)} = 2\sqrt{D \times (H-D)}$$

3.

A wooden cube just floats inside water when a 200 g mass is placed on it. When the mass is removed, the cube is 2 cm above the water level. What is the size of each sides of the cube?

(A) 6 cm (B) 8 cm (C) 10 cm (D) 12 cm

Sol^n



$mg = U \Rightarrow mg = \rho g \times a^2 \times 2 \times 10^{-2}$

$0.2 = 10^3 \times a^2 \times 2 \times 10^{-2}$

$a^2 = \frac{1}{100}$

$a = \frac{1}{10}\ m$

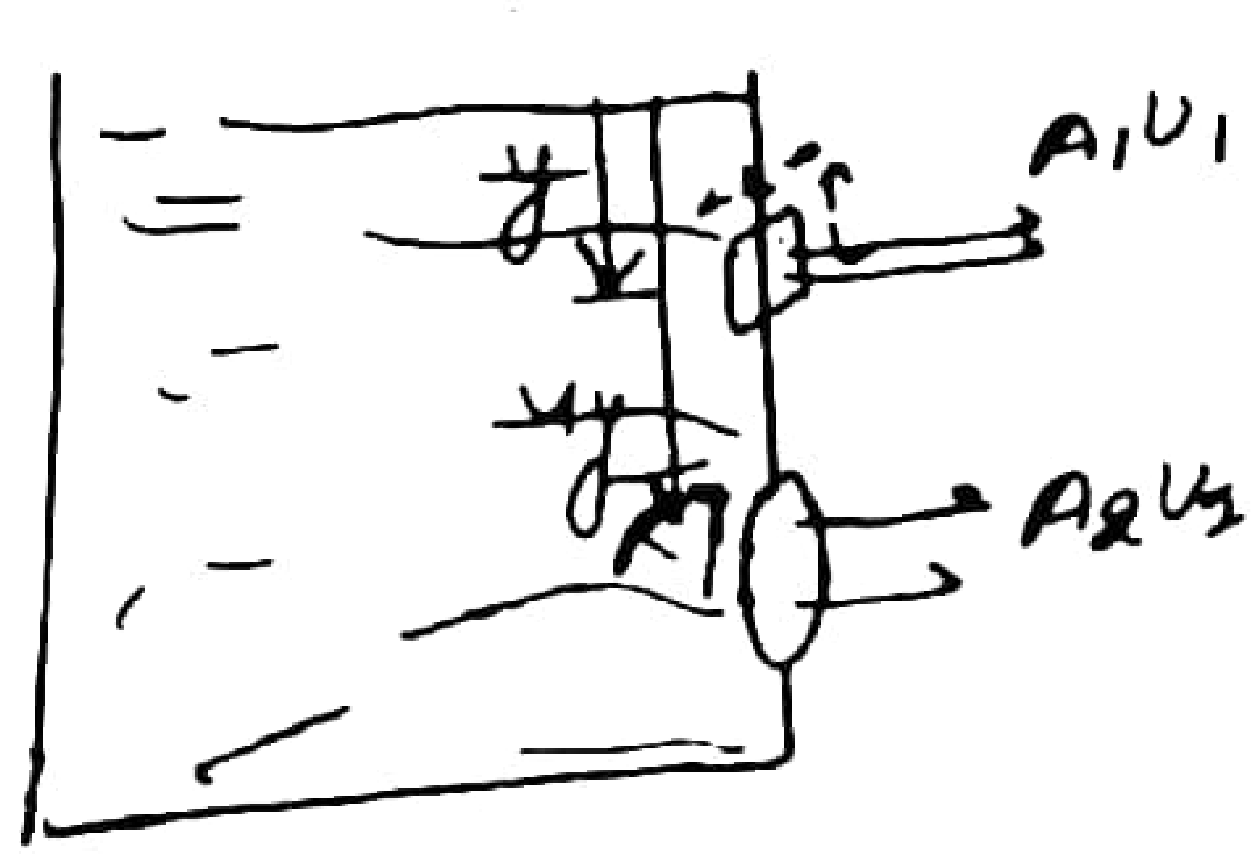
$a = 10\ cm$

4.

A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth 4y from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, R is equal to :

(A) $L/\sqrt{2\pi}$ (B) $2\pi L$ (C) L (D) $L/2\pi$

Sol^n



$A_1 v_1 = A_2 v_2$

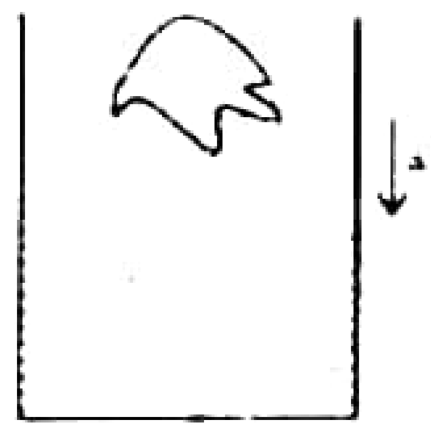
$L^2 \times \sqrt{2gy} = \pi R^2 \sqrt{2g4y}$

$L^2 = 2\pi R^2$

$R^2 = \frac{L^2}{2\pi} \Rightarrow R = \frac{L}{\sqrt{2\pi}}$

5.

[illegible] d in a beaker. The whole system as shown in the figure falls with constant acceleration a. The upthrust on the body due to the liquid is –



(A) zero

(B) equal to the weight of the liquid displaced

(C) less than the weight of the liquid displaced

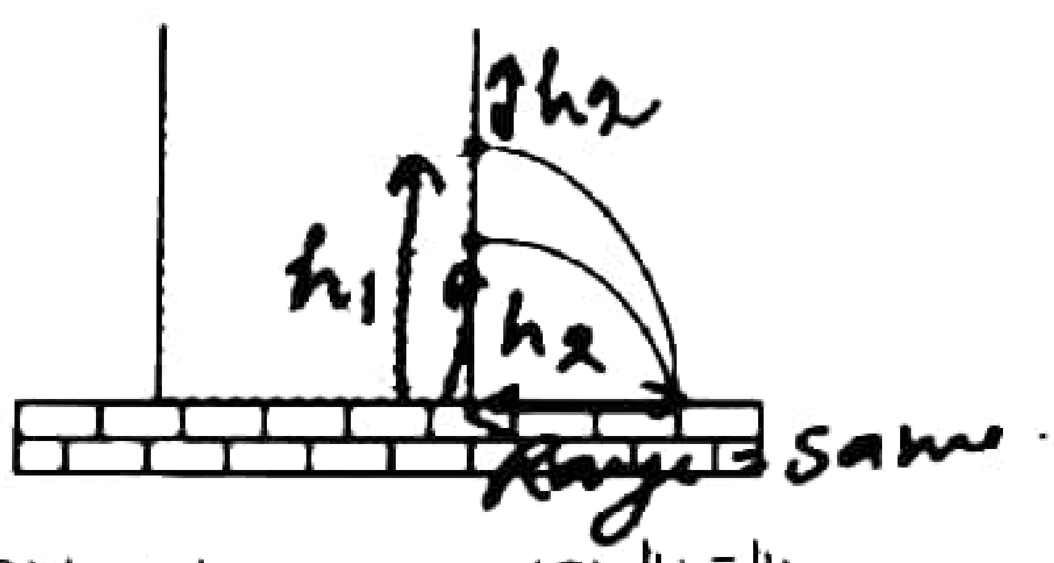
(D) equal to the weight of the immersed portion of the body

Sol^n U = wt of liq disp (when acc^n of cont = 0)

$U = \rho (g - a_0) V \Rightarrow U <$ wt of liq. Disp

6.

In a cylindrical vessel containing liquid of density ρ, there are two holes in the side walls at heights of h_1 and h_2 respectively such that the range of efflux at the bottom of the vessel is same. The height of a hole for which the rage of efflux would be maximum, will be –



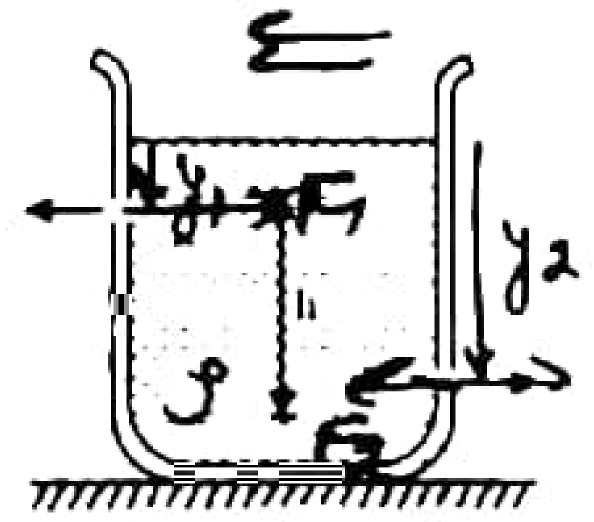
(A) $h_2 - h_1$ (B) $h_2 + h_1$ (C) $\frac{h_2 - h_1}{2}$ (D) $\frac{h_2 + h_1}{2}$

For Max. Range ht of hole $= \frac{h_1 + h_2}{2}$.

7.

There are two identical small holes of area of cross-section a on the opposite sides of a tank containing a liquid of density ρ. The difference in height between the holes is h. Tank is resting on a smooth horizontal surface. Horizontal force which will have to be applied on the tank to keep it in equilibrium is –

$F_{net} = F_2 - F_1$ $F_2 > F_1$



(A) ghρa (B) $\frac{2gh}{\rho a}$ (C) 2ρagh (D) $\frac{\rho gh}{a}$

$F = 2\rho a g y$

$F_N = F_2 - F_1$

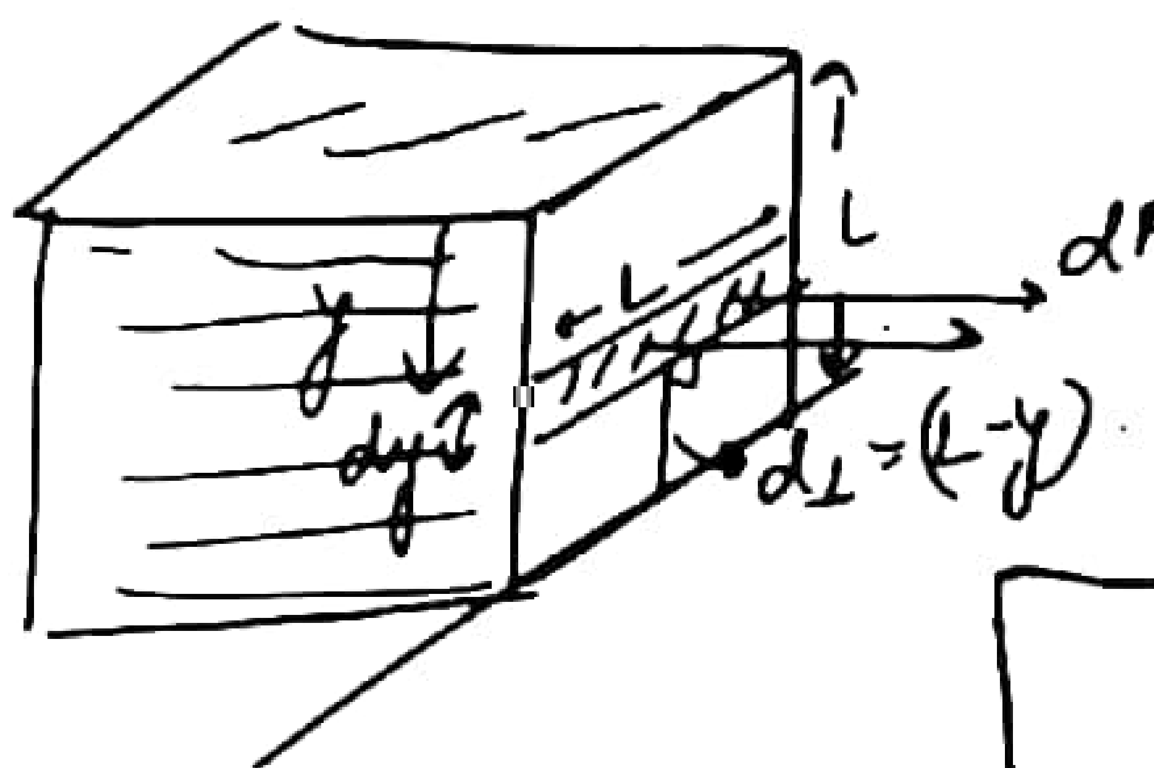
$= 2\rho a g (y_2 - y_1)$

$F_N = 2\rho a g h$

8.

A cubical vessel open from top of side L is filled with a liquid of density ρ then the torque of hydrostatic force on a side wall about an axis passing through one of bottom edges is-

(A) $\frac{\rho g L^4}{4}$ (B) $\frac{\rho g L^4}{6}$ (C) $\frac{2\rho g L^4}{3}$ (D) $\frac{\rho g L^4}{3}$



$dF = \rho g y \, dA$

$\int d\tau = \int_0^L \rho g y L dy \, (L - y)$

$\tau = \rho g L \int_0^L (Ly - y^2) dy$

$\tau = \rho g L \left(\frac{L^3}{2} - \frac{L^3}{3} \right)$

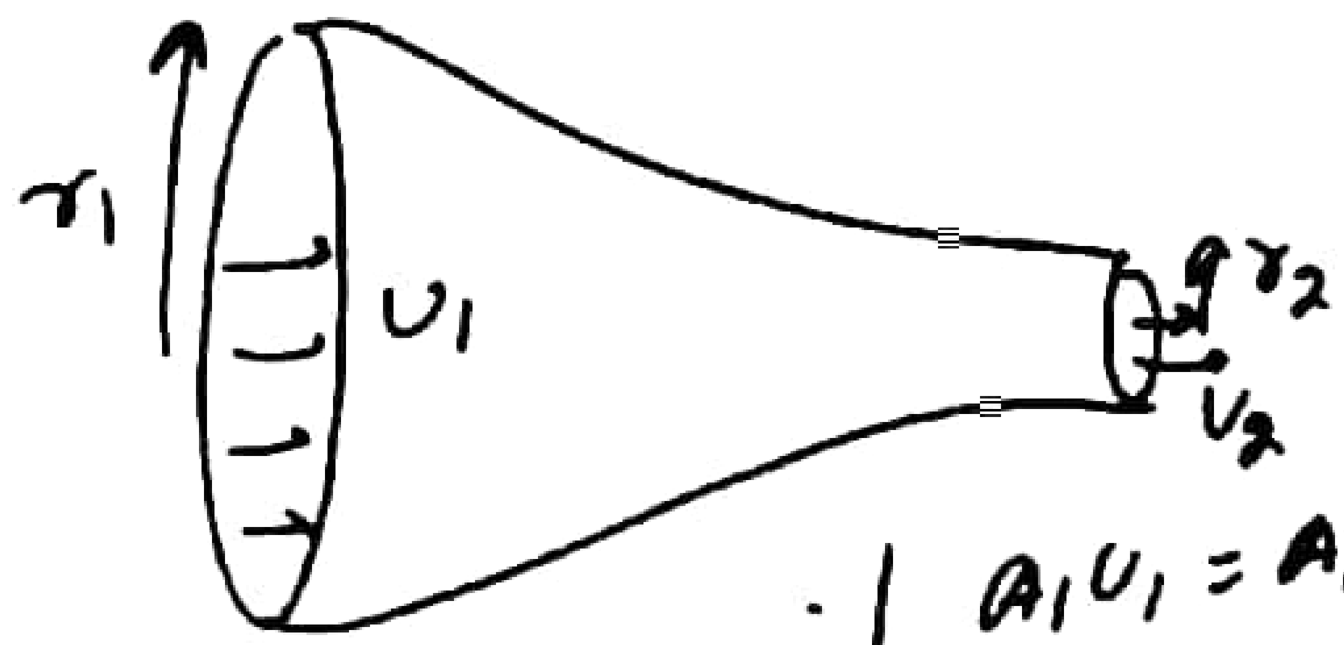
$\tau = \frac{\rho g L^4}{6}$

9.

Water is flowing in a tube of non-uniform radius. The ratio of the radii at entrance and exit ends of the tube is 3:2. The ratio of the velocities of water entering in and exiting from the tube will be -

(A) 8 : 27 (B) 4 : 9 (C) 1:1 (D) 3 : 2

Sol



$\frac{r_1}{r_2} = \frac{3}{2}$

$\frac{v_1}{v_2} = ?$

$A_1 v_1 = A_2 v_2$

$r_1^2 v_1 = r_2^2 v_2$

$\frac{v_1}{v_2} = \left(\frac{r_2}{r_1}\right)^2 = \frac{4}{9}$

10.

Bernoulli's theorem based upon –

(A) Conservation of momentum

(B) Conservation of energy

(C) Conservation mass

(D) None of these

11.

The rate of flowing of water from the orifice in a wall of a tank will be more if the orific is –

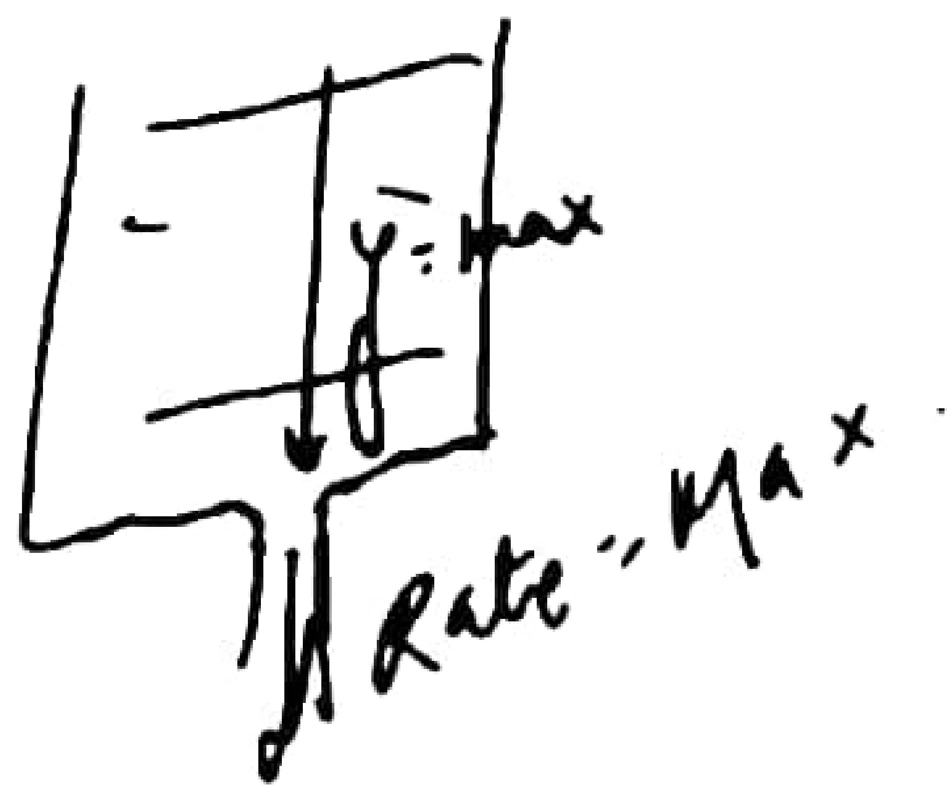
(A) Near the bottom

(B) Near the upper end

(C) Exactly in the middle

(D) Does not depend upon the position of orific

Sol^n Rate = $AU = A\sqrt{2gy}$

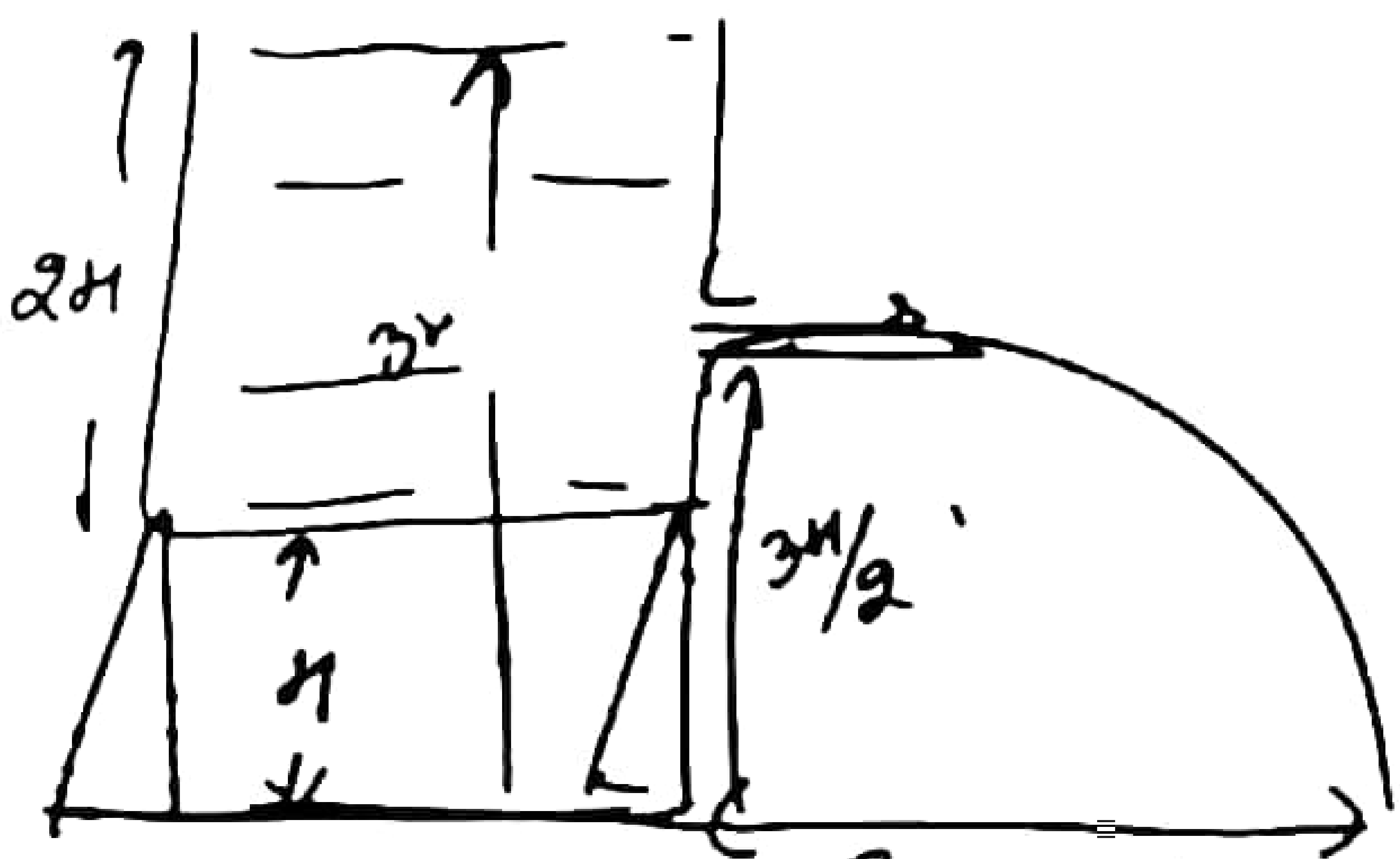


12.

A tank is filled up to a height 2H with a liquid and is placed on a platform of height H from the ground. The distance x from the ground where a small hole is punched to get the maximum range R is -

(A) H (B) 1.25 H (C) 1.5 H (D) 2H

Sol



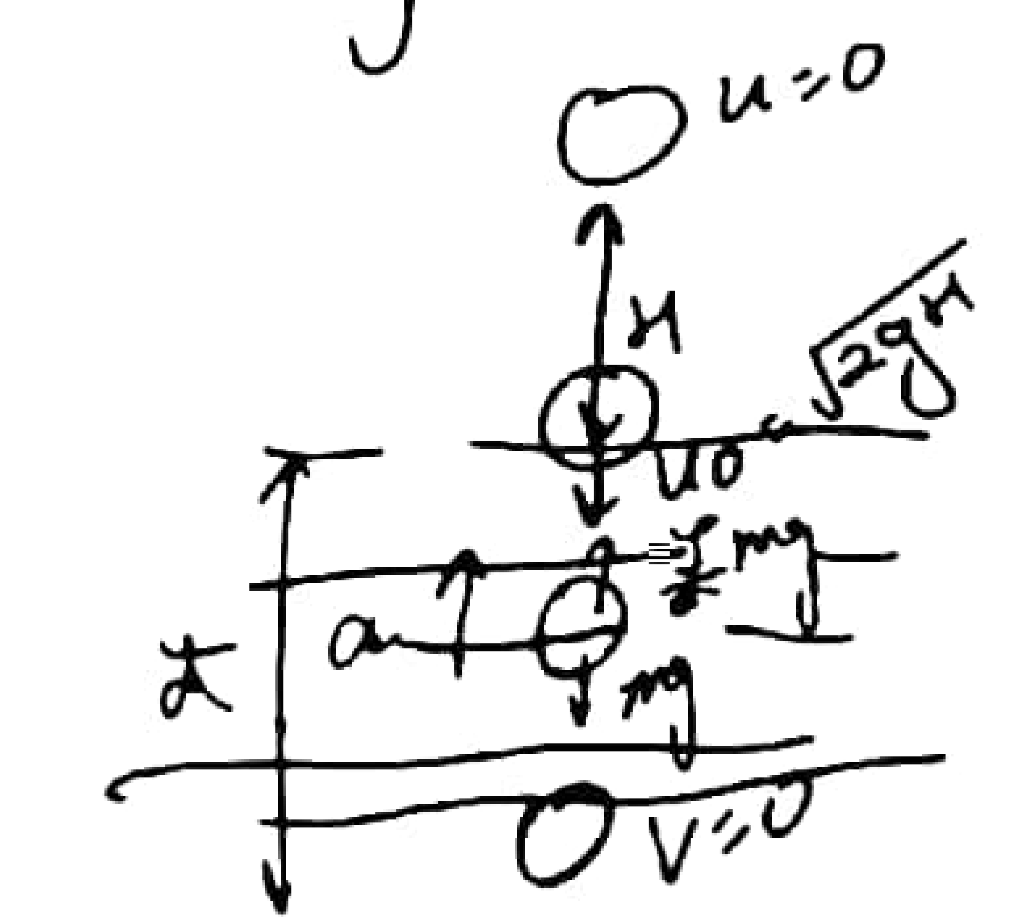
$R_{max} = 3H$

13.

A ball of relative density 0.8 falls into water from a height of 2m. The depth to which the ball will sink is (neglect viscous forces) –

(A*) 8m (B) 2 m (C) 6m (D) 4 m

$\frac{\sigma}{\rho} = 0.8$



$\frac{\rho}{\sigma} mg - mg = ma$

$a = \left(\frac{\rho}{\sigma} - 1\right) g$

$v^2 = u^2 - 2as$

$0 = u_0^2 - 2ad$

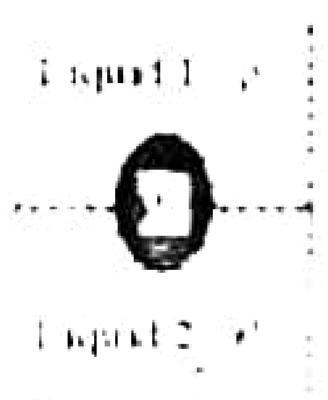
$d = \frac{u_0^2}{2a} = \frac{2gH}{2\left[\frac{\rho}{\sigma} - 1\right] g}$

$$d = \frac{H}{\left(\frac{\rho}{\sigma} - 1\right)}$$

$d = \frac{2}{\left(\frac{10}{8} - 1\right)} = 8\,m$

14.

[illegible] with two non mixing liquids 1 and 2 having densities ρ1 and ρ2 respectively. A solid ball, made of a material of density ρ3, is dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for ρ1, ρ2 and ρ3 ?



$$\rho_1 < \rho_3 < \rho_2$$

(A) ρ1 > ρ3 > ρ2 (B) ρ1 < ρ2 < ρ3

(C*) ρ1 < ρ3 < ρ2 (D) ρ3 < ρ1 < ρ2

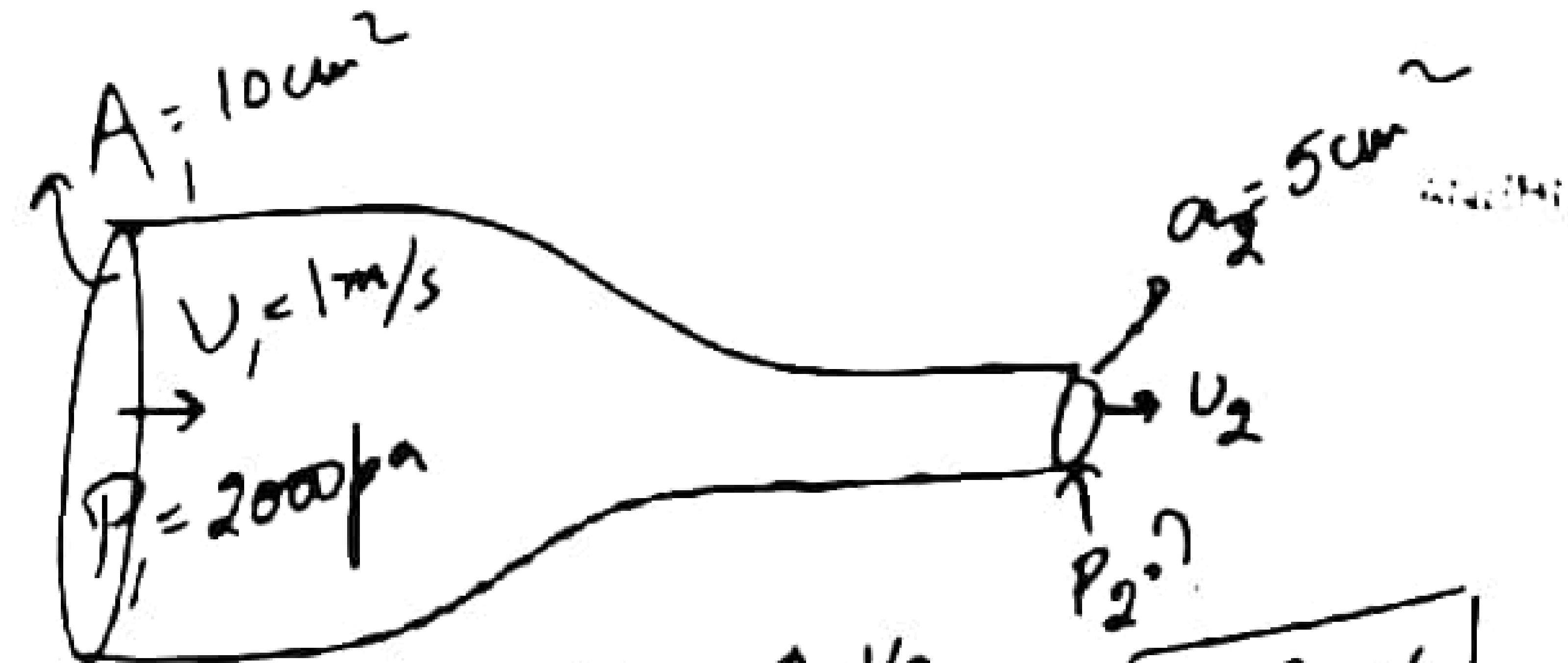
15.

A horizontal pipeline carries water in a streamline flow. At a point along the pipe where the cross-sectional area is 10 cm^2, the water velocity is 1 $m\,s^{-1}$ and the pressure is 2000 Pa. The pressure of water at another point where the cross-sectional area is 5 cm^2 is :

(Density of water = 10^3 kg m^{-3})

✓(A) 500 Pa (B) 1000 Pa (C) 250 Pa (D) 750 Pa

Sol^n



$A_1 V_1 = A_2 V_2$

$10 \times 1 = 5\, V_2 \Rightarrow V_2 = 2\ m/s$

$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$

$P_2 = P_1 + \frac{1}{2}\rho\left(v_1^2 - v_2^2\right)$

$P_2 = 2000 + \frac{1}{2} \times 1000 \times (1 - 4)$

$P_2 = 2000 - 1500$

$= 500\ pa$

16.

Statement-1 : Bigger rain drops have smaller terminal speeds. False

Statement-2 : Terminal speed of a body depends on its size and density. Correct

(1) Both Statements (1) and (2) are true

(2) Statement (1) is true but statement (2) is false.

✓(3*) Statement (1) is false but statement (2) is true

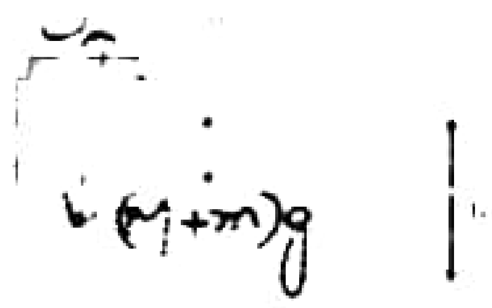
(4) Both Statements (1) and (2) are False

$$V_t = \frac{2}{9}\frac{r^2 g(\sigma - \rho)}{\eta}$$

Bigger drop ⇒ Bigger rad ⇒ V_t = large

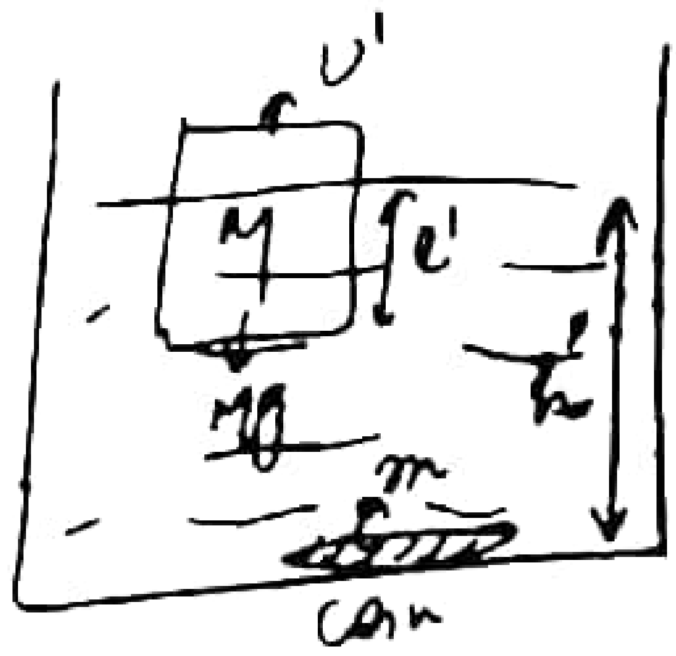
17.

[illegible] a coin placed on its top, floats in water as shown in [illegible] and h are shown there. After some time the coin [illegible] the water. Then



(A) [illegible] decreases and h increases
(B) [illegible] increases and h decreases
(C) both [illegible] and h increase
(D) both [illegible] and h decrease

Sol[n]



Initial :-

$\rho A l g = (M+m) g$

$l = \frac{(M+m)}{\rho A}$

Final

$\rho A l' g = M g$

$l' = \frac{M}{\rho A}$

$\boxed{l' < l}$

$\rightarrow \rho V g = (M+m) g$

$V_{initial\ liq\ disp} = \frac{M+m}{\rho} = \frac{M}{\rho} + \frac{m}{\rho}$

$\rightarrow$ Final Vol of liq disp

$\rho V' g = M g$

$V' = \frac{M}{\rho}$

$\rightarrow$ Coin $m = \sigma V''$

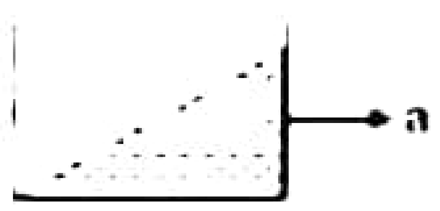
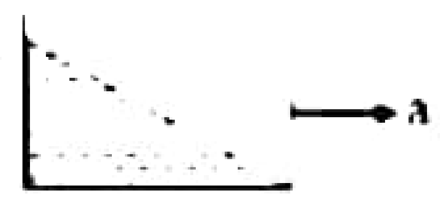
$V'' = \frac{m}{\sigma}$

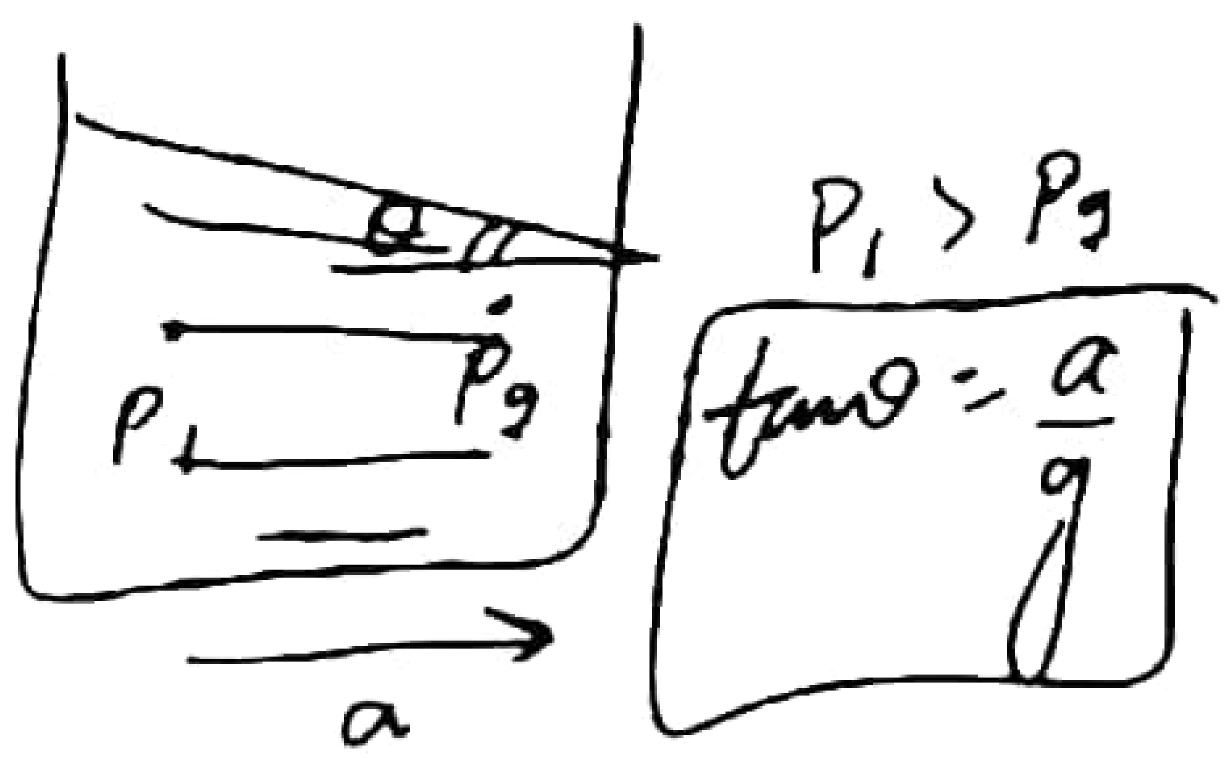
$V_{final} = \frac{M}{\rho} + \frac{m}{\sigma}$

$\sigma > \rho \Rightarrow V_{final} < V_{initial} \Rightarrow \boxed{h' < h}$

18.

A vessel containing water is given a constant acceleration 'a' towards the right along a straight horizontal path. Which of the following diagrams in figure represents the surface of the liquid ?

(A)  (B)  (C)  (D) All of these



19.

Two wires of the same radius and material and having lengths in the ratio 8.9 : 7.6 are stretched by the same force. The strains produced in the two cases will be in the ratio-

(A) 1 : 1 (B) 1 : 7.6 (C) 8.9 : 1 (D) 1: 3.2

$Y_1 = Y_2$

$r_1 = r_2$

$\frac{l_1}{l_2} = \frac{8.9}{7.6}$

$F_1 = F_2$

$k_1 x_1 = k_2 x_2$

$\frac{Y_1 A_1}{l_1} \cdot x_1 = \frac{Y_2 A_2}{l_2} \cdot x_2$

$(\text{Strain})_1 = (\text{Strain})_2$

20.

What is the Young's modulus of elasticity for a perfectly rigid body ?

(A) infinity (B) zero (C) 1 (D) – 1

21.

The ratio of diameters of two wires of same material in n : 1. The length of each wire is 4m. on applying the same load, the increase in length of thin wire will be (n > 1) -

(A) n^2 times (B) n times (C) 2n times (D) (2n + 1) times

$\frac{d_1}{d_2} = \frac{n}{1}$

d_1 = Thick

d_2 – Thin

$Y_1 = Y_2$

$l_1 = l_2 = 4m$

$F_1 = F_2$

$k_1 x_1 = k_2 x_2$

$\frac{Y_1 A_1}{l_1} x_1 = \frac{Y_2 A_2}{l_2} x_2$

$d_1^2 x_1 = d_2^2 x_2$

$x_2 = \left(\frac{d_1}{d_2}\right)^2 x_1 = n^2 x_1$

22.

The following four wires of the same material, which of these will have the largest extension when the same tension is applied -

(A) Length = 50 cm & diameter = 0.5 mm

(B) Length = 100 cm & diameter = 1 mm

(C) Length = 200 cm & diameter = 2 mm

(D) Length = 300 cm & diameter = 3 mm

Y = Same

x = Max

F = Same.

$F = \frac{YA}{l} x$

$x \propto \frac{l}{d^2}$

$x_A \propto \frac{l_A}{d_A^2} \propto 200$

$x_B \propto \frac{l_B}{d_B^2} \propto 100$

$x_C \propto \frac{l_C}{d_C^2} \propto 50$

$x_D \propto \frac{l_D}{d_D^2} \propto 33.3$

23.

If there is no change in the volume of wire on stretching, then poisson's ratio for the material of wire is -

(A) −1 (B) 0 (C) 0.5 (D) 0.25

Sol $V = \pi r^2 l$

$\frac{\Delta V}{V} = 2\frac{\Delta r}{r} + \frac{\Delta l}{l} = 0$

$-2\frac{\Delta r}{r} + \frac{\Delta l}{l} = 0$

$\frac{\frac{\Delta r}{r}}{\frac{\Delta l}{l}} = \frac{1}{2} = 0.5$

24.

A cube of aluminium of sides 0.1 m is subjected to a shearing force of 100 N. The top face of the cube is displaced through 0.02 cm with respect to the bottom face. The shearing strain would be–

(A) 0.02 (B) 0.1 (C) 0.005 (D) 0.002

Shearing strain $= \theta = \frac{x}{l}$

$= \frac{0.02}{10} = \underline{0.002}$

25.

A wire of length L and area of cross-section A is made of a material of Young's modulus Y. If the wire is stretched by the amount x, the work done is –

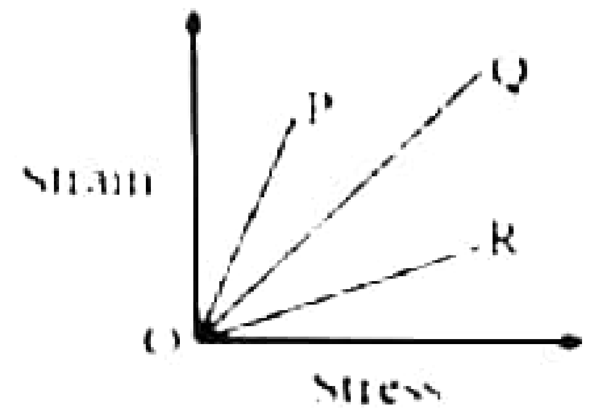
(A) $YAx^2/2L$ (B) YAx^2L (C) $YAx/2L$ (D) YAx^2/L

$W = \frac{1}{2} kx^2$

$= \frac{1}{2} \frac{YA}{l} . x^2$

26.

... of three wire of different materials are shown in the figure P, Q and R are the elastic limits of the wires. The figure shows that



Slope = $\frac{1}{E}$

(A) Elasticity of wire P is maximum ✗
(B) Elasticity of wire Q is maximum ✗
(C) Tensile strength of R is maximum ✗
(D) None of the above is true ✓

$$\frac{\text{Stress}}{\text{Strain}} = E$$

$$\frac{x}{y} = E \Rightarrow y = \frac{1}{E} \cdot x$$

27.

If a liquid does not wet glass, its angle of contact is:

(A) zero (B) acute (C) obtuse ✓ (D) right angle

$\theta > 90$

28.

Two rain drops reach the earth with the terminal velocities in the ratio 4 : 9. The ratio of radii is :

(A) 4 : 9 (B) 2 : 3 (C) 3 : 2 (D) 9 : 4

$$v = \frac{2}{9}\frac{r^2 g}{\eta}(\sigma - \rho)$$

$$v \propto r^2$$

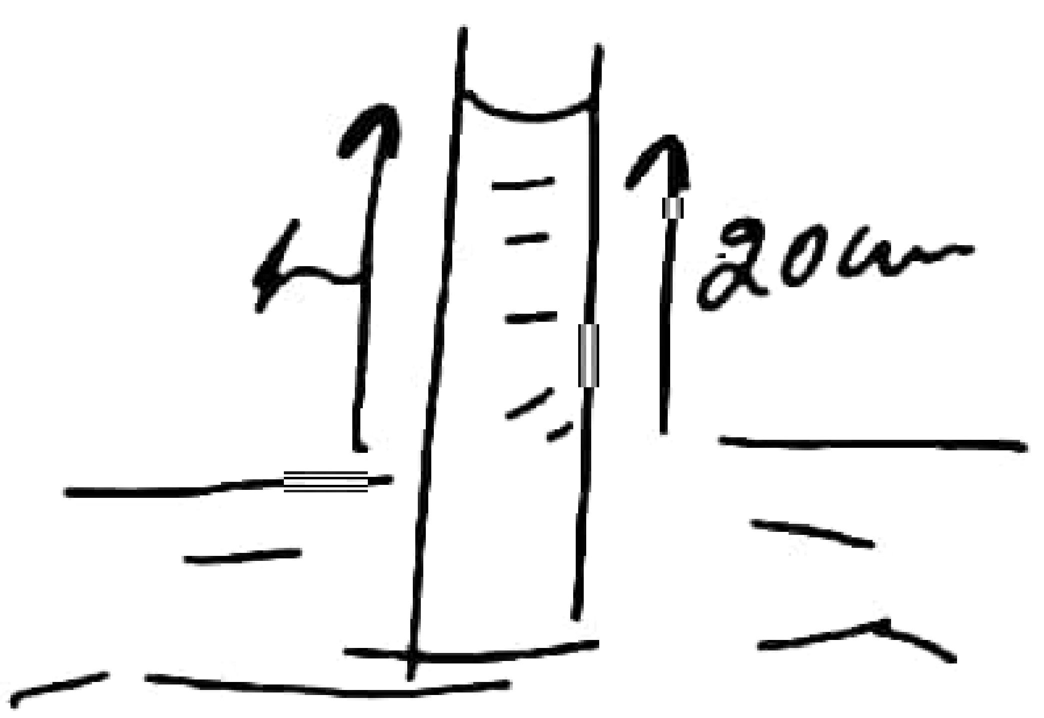
$$\frac{v_1}{v_2} = \left(\frac{r_1}{r_2}\right)^2$$

$$\frac{r_1}{r_2} = \sqrt{\frac{4}{9}} = \frac{2}{3}$$

29.

A very narrow capillary tube records a rise of 20 cm when dipped in water. When the area of cross section is reduced to one fourth of the former value, water will rise to a height of -

(A) 10 cm (B) 20 cm (C) 40 cm (D) 80 cm



$$h = \frac{2T\cos\theta}{r\rho g}$$

$$A_2 = \frac{1}{4}A_1$$

$$r_2 = \frac{1}{2}r_1$$

$$h \propto \frac{1}{r}$$

$$h_2 = 2h_1 = 40\text{cm}$$

30.

With rise in temperature

(A) surface tension increases

(B) surface tension decreases

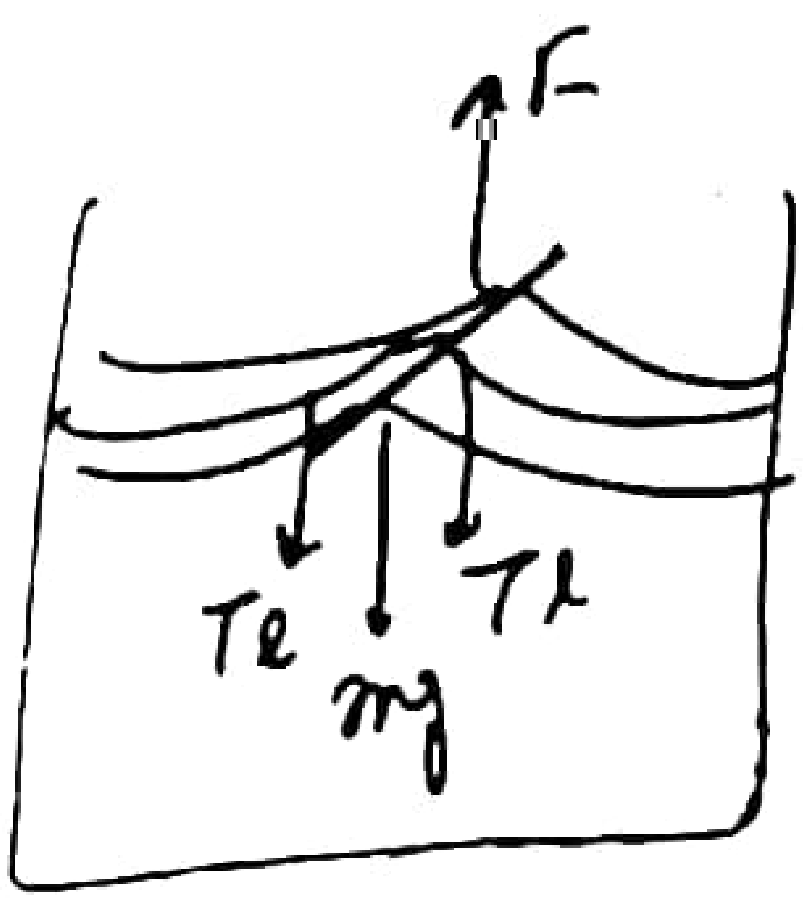
(C) surface tension may become zero if temperature reaches the critical value

(D) (B) and (C) both

31..

The length of a needle floating on water is 2.5 cm. The minimum force in addition to its weight needed to lift the needle above the surface of water will be -

(A) 36×10^{-4} N (B) 10×10^{-4} N (C) 9×10^{-4} N (D) 6×10^{-4} N



$F_N = 2Tl + W$

Force other than wt $= 2Tl$

$= 2\times0.071\,N/m \times 2.5\times10^{-2}$

$= 36\times10^{-4}\,N$

32.

If W is the amount of work done in forming a soap bubble of volume V, then the amount of work done in forming a bubble of volume 2V from the same solution will be -

(A) W/2 (B) 2W (C) $\sqrt{2}$ W (D) $4^{1/3}$ W

$$W = T \times 2 \times 4\pi r^2$$
$$W' = T \times 2 . 4\pi r'^2$$
$$\frac{W}{W'} = \left(\frac{r}{r'}\right)^2$$

$$V = \frac{4}{3}\pi r^3$$
$$2V = \frac{4}{3}\pi r'^3$$
$$\frac{1}{2} = \left(\frac{r}{r'}\right)^3$$
$$\frac{r}{r'} = \left(\frac{1}{2}\right)^{1/3}$$
$$\left(\frac{r}{r'}\right)^2 = \left(\frac{1}{4}\right)^{1/3}$$

$$\frac{W}{W'} = \left(\frac{1}{4}\right)^{1/3}$$
$$W' = (4)^{1/3}\, W$$

33.

A big drop of water whose diameter is 0.2 cm, is broken into 27000 small drops of equal volume. Work done in this process will be - (surface tension of water is 7×10^{-2} N/m).

(A) 5×10^{5} joule (B) 2.9×10^{-5} joule

(C) 2.55×10^{-5} joule (D) zero

Sol^n
$$W = 4\pi r^2 T \left(n^{1/3} - 1\right)$$
$$= 4\pi (0.1)^2 \times 10^{-4} \times 7 \times 10^{-2} . \left((27000)^{1/3} - 1\right)$$
$$= 2.55 \times 10^{-5}\ J.$$

34.

A number of little droplets of a liquid of density ρ, surface tension T and specific heat c, each of radius r, coalesce to form a single drop of radius R, the rise in temperature will be–

(A) $\frac{2T}{\rho c}\left(\frac{1}{r}-\frac{1}{R}\right)$ (B*) $\frac{3T}{\rho c}\left(\frac{1}{r}-\frac{1}{R}\right)$ (C) $\frac{3T}{2\rho c}\left(\frac{1}{r}-\frac{1}{R}\right)$ (D) $\frac{3T}{2\rho c}\left(\frac{1}{r}-\frac{1}{R}\right)$

$W = ms\Delta T = T\times(n4\pi r^2 - 4\pi R^2)$

$mc\,\Delta T = T\times 4\pi\cdot(nr^2 - R^2)$

$\Rightarrow n\times\frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$

$n = \left(\frac{R}{r}\right)^3$

$mc\,\Delta T = 4\pi T\left(\frac{R^3}{r} - R^2\right)$

$mc\,\Delta T = 4\pi T R^3\left(\frac{1}{r}-\frac{1}{R}\right)$

$\rho\frac{4}{3}\pi R^3 c\,\Delta T = 4\pi T R^3\left(\frac{1}{r}-\frac{1}{R}\right)$

$\Delta T = \frac{3T}{\rho c}\left[\frac{1}{r}-\frac{1}{R}\right]$

35.

Two spherical soap bubbles of radii r_1 and r_2 in vacuum coalesce under isothermal conditions. The resulting bubble has a radius equal to–

(A) $\frac{r_1+r_2}{2}$ (B) $\frac{r_1 r_2}{r_1+r_2}$ (C) $\sqrt{r_1 r_2}$ (D*) $\sqrt{r_1^2+r_2^2}$

$n_1 + n_2 = n$

$P_1V_1 + P_2V_2 = PV$

$\frac{4T}{r_1}\times\frac{4}{3}\pi r_1^3 + \frac{4T}{r_2}\times\frac{4}{3}\pi r_2^3 = \frac{4T}{r}\cdot\frac{4}{3}\pi r^3$

$r_1^2 + r_2^2 = r^2$

$r = \sqrt{r_1^2+r_2^2}$

36.

A rain drop reaching the ground with terminal velocity has momentum p. Another drop of twice the radius, also reaching the ground with terminal velocity, will have momentum–

(A) 4p (B) 8p (C) 16p (D) 32p

Sol

$$p = mv = d \times \frac{4}{3}\pi r^3 \times \frac{2}{9}\frac{r^2 g}{\eta}(\sigma - \rho)$$

$$p \propto r^5$$

$$\frac{p}{p'} = \left(\frac{r_1}{r_2}\right)^5 = \left(\frac{r}{2r}\right)^5$$

$$\boxed{p' = 32p}$$

37.

The pressure inside two soap bubbles is 1.01 and 1.02 atmosphere. If surrounding pressure is 1 atm, then ratio of their volume is -

(A) 1.02 : 1.01 (B) $(1.02)^3 : (1.01)^3$ (C) 8 : 1 (D) 2 : 1

$$P_i - P_0 = \frac{4T}{R}$$

$$0.01 = \frac{4T}{R_1}$$

$$0.02 = \frac{4T}{R_2}$$

$$\frac{1}{2} = \frac{R_2}{R_1}$$

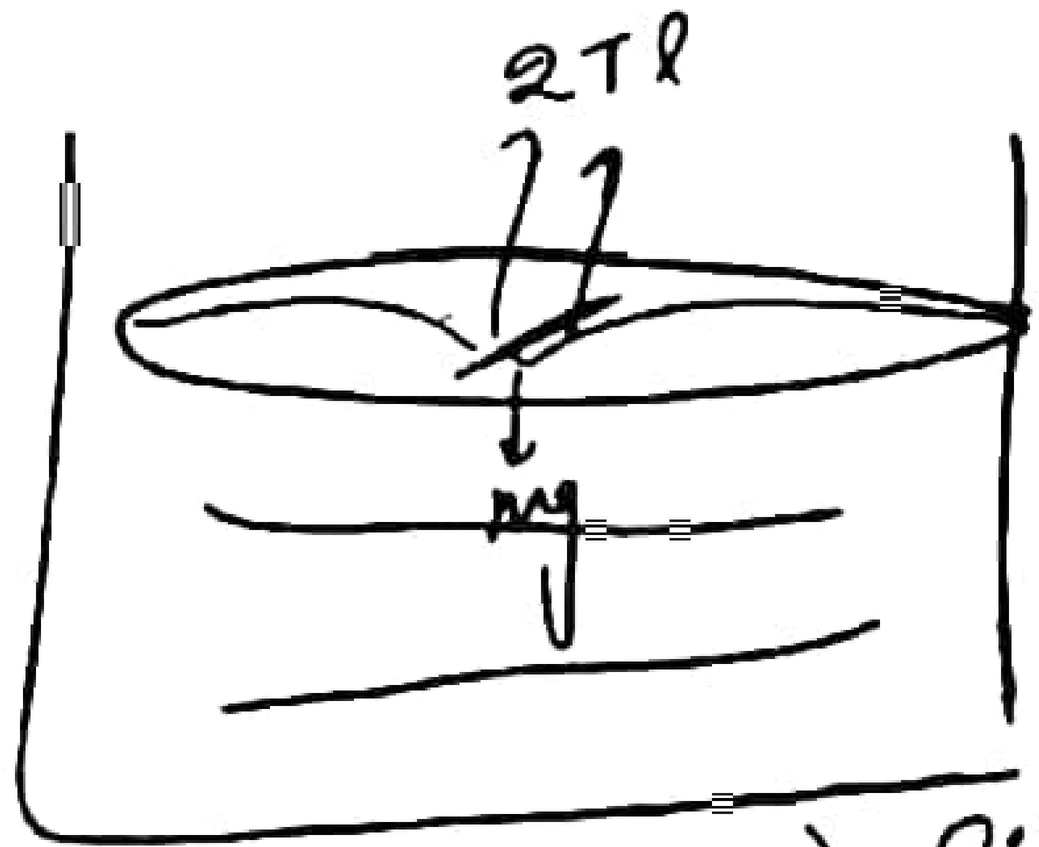
$$\frac{R_1}{R_2} = \frac{2}{1}$$

$$\frac{V_1}{V_2} = \left(\frac{R_1}{R_2}\right)^3 = \frac{8}{1}$$

38.

A wire of mass 0.3 gm is lying horizontal on the surface of water. The maximum length of wire so that it may not sink, will be $(T = 70 \times 10^{-3}$ N/m)

(A*) 0.021m (B) 0.21 m (C) 2.1 m (D) 21 m



$mg = 2Tl \Rightarrow 0.3 \times 10^{-3} \times 10 = 2 \times 7 \times 10^{-2} \times l_{max}$

$l_{max} = 0.021 m$

39.

A ring of radius r and weight W is lying on a liquid surface. If the surface tension of the liquid is T, then the minimum force required to be applied in order to lift the ring up-

(A) W (B) 2W (C*) W + 4πrT (D) W + 2πrT

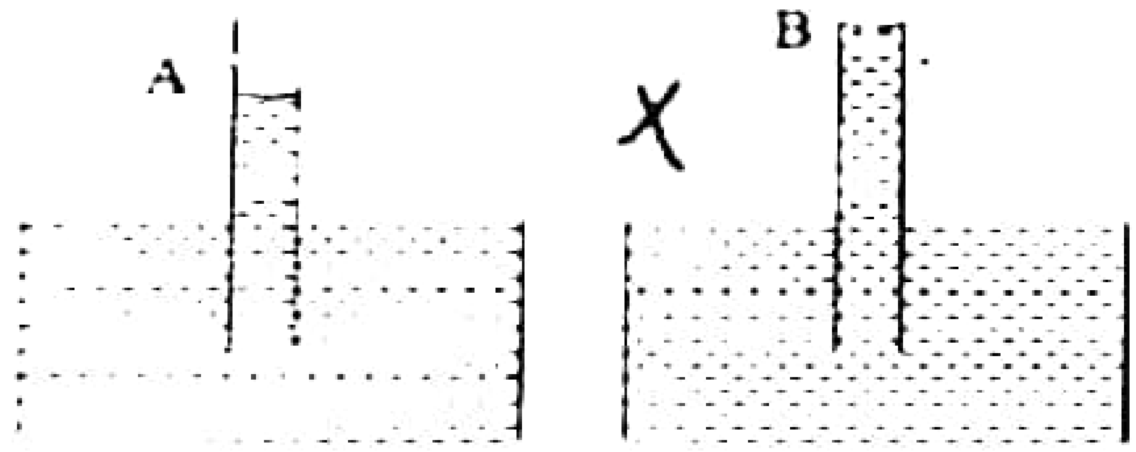
$F = W + 2Tl$

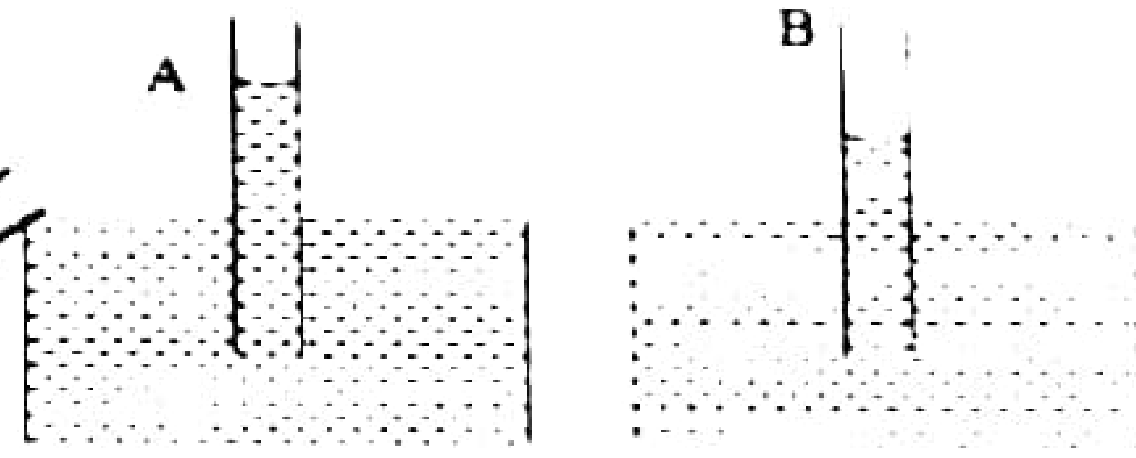
$= W + 2 \times T \times 2\pi r$

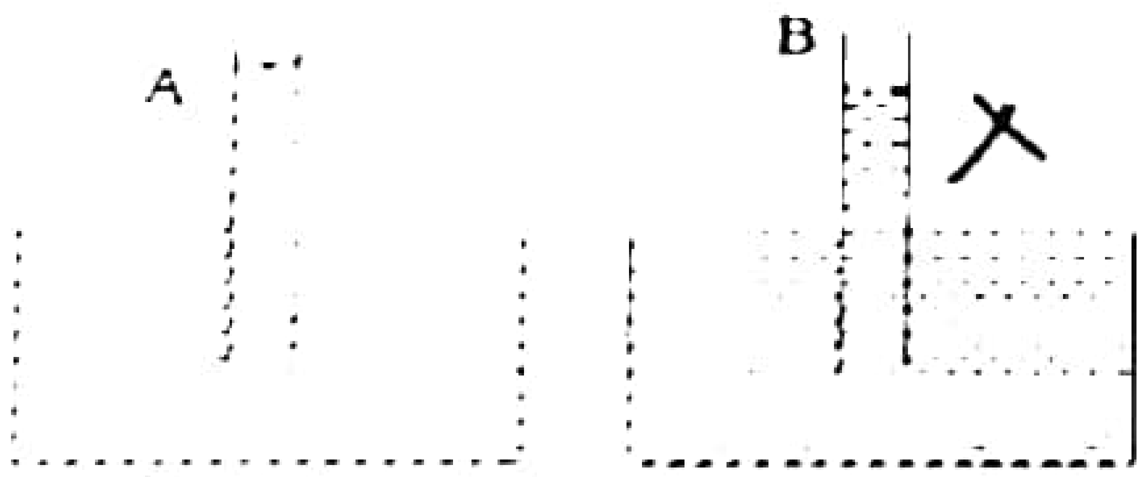
$F = W + T \times 4\pi r$

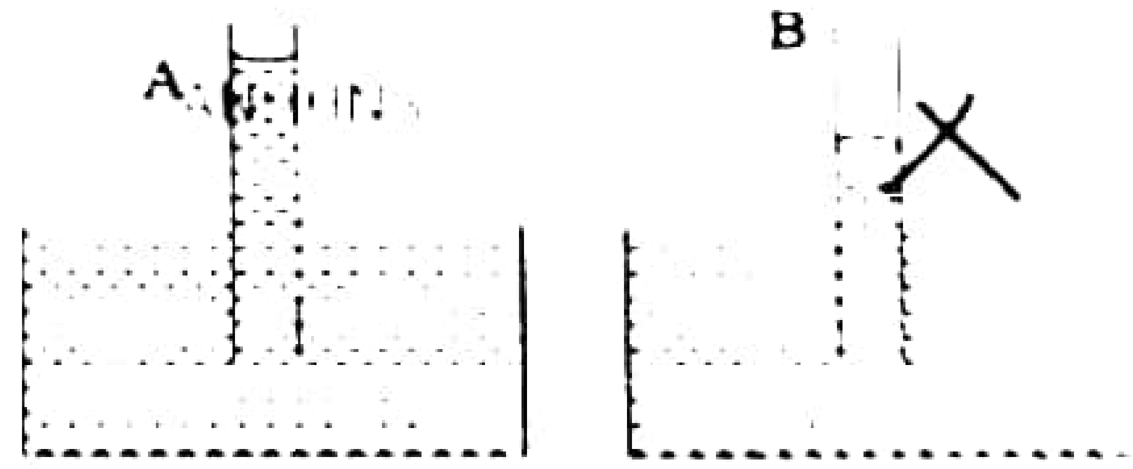
40.

A capillary tube (A) is dipped in water. Another identical tube (B) is dipped in a soap-water solution. Which of the following shows the relative nature of the liquid columns in the two tubes ?

(A) 

(B) ✓ 

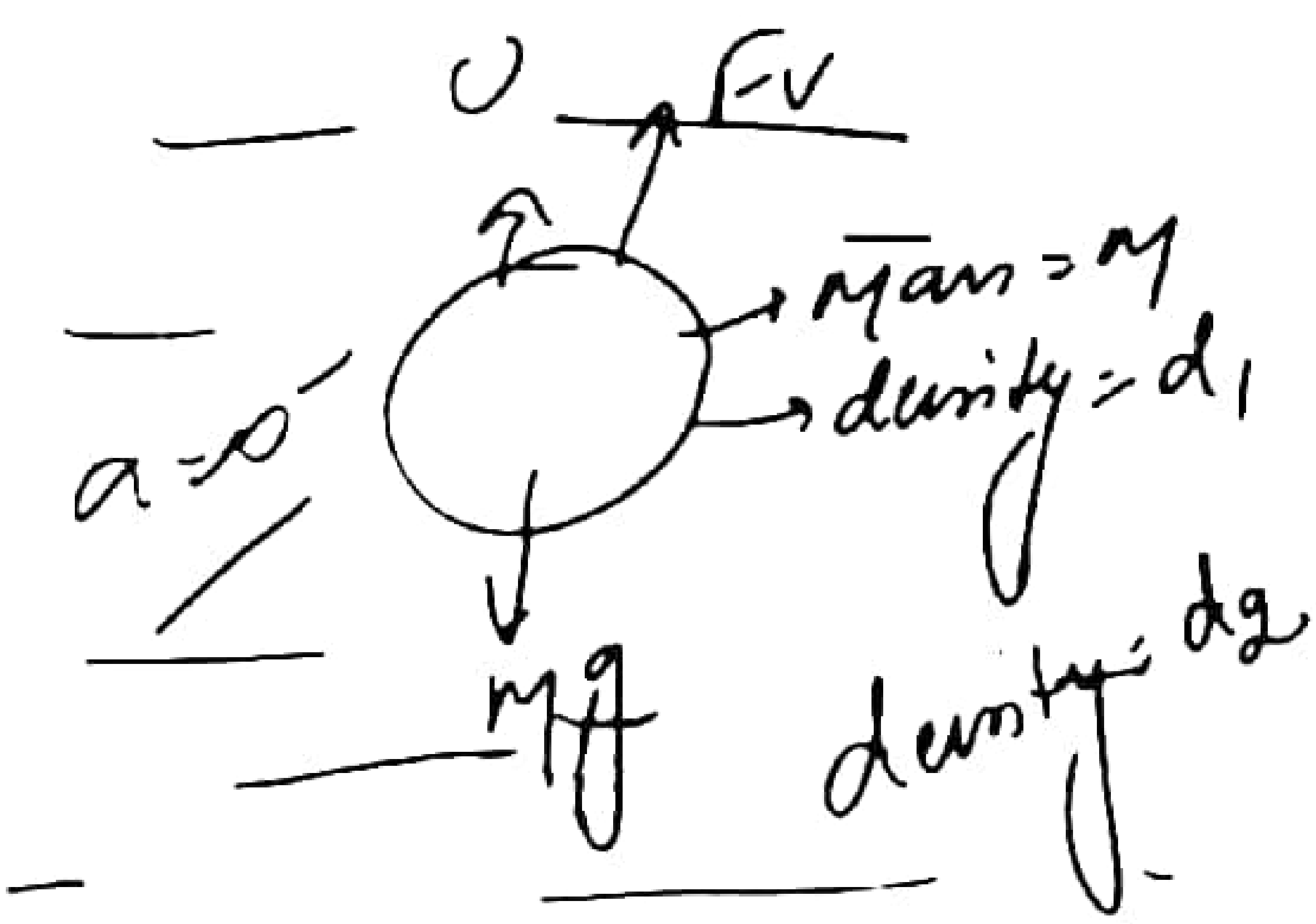
(C) 

(D) 

41.

The velocity of a small ball of mass M and density d_1, when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is d_2, the viscous force acting on the ball will be

(A) $\frac{M d_2 g}{d_1}$ (B) ✓ $Mg\left(1-\frac{d_2}{d_1}\right)$ (C) $\frac{M(d_1+d_2)}{g}$ (D) $M d_1 d_2$



$F_V = Mg - U$

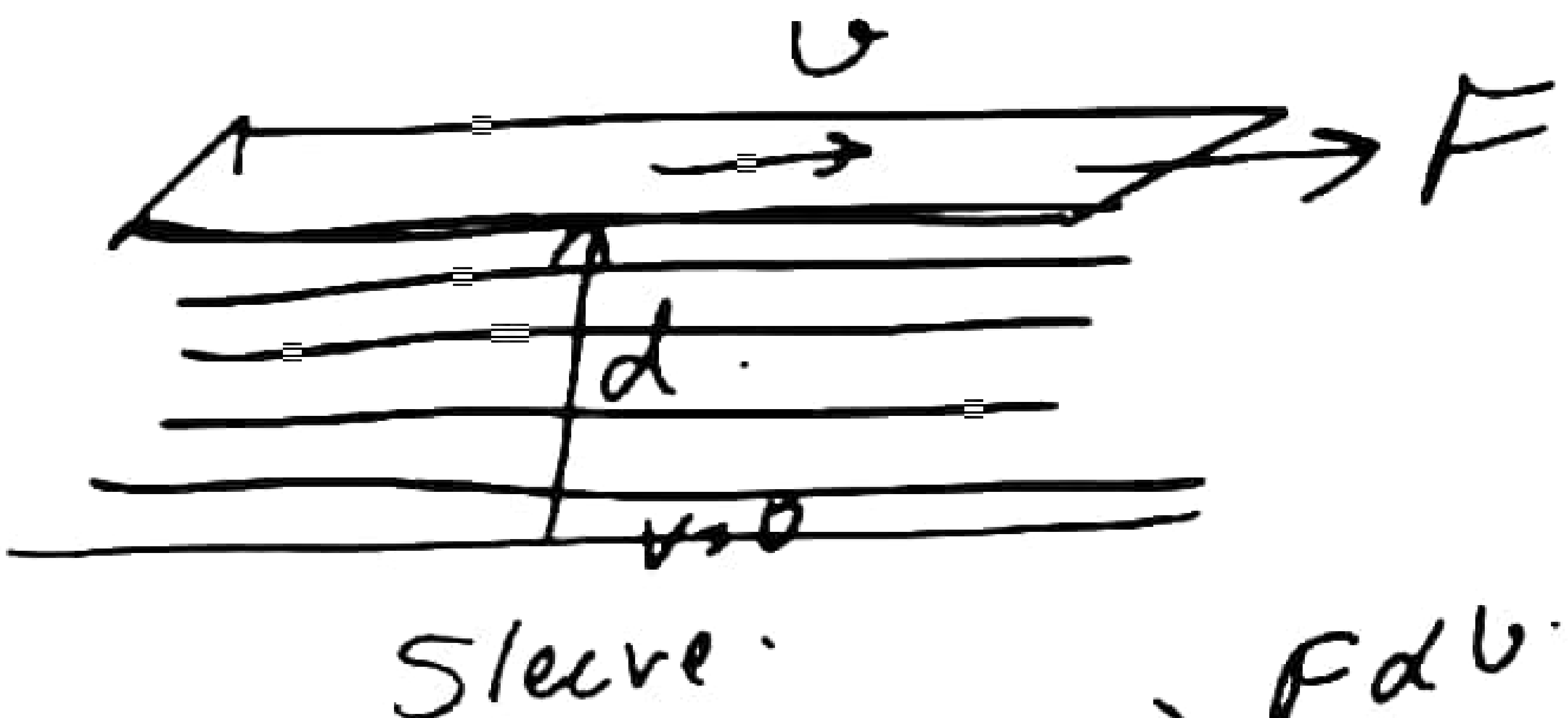
$= Mg - \frac{d_2}{d_1} Mg$

$= Mg\left(1 - \frac{d_2}{d_1}\right)$

42.

A newtonion fluid fills the clearance between a shaft and a sleeve. When a force of 800 N is applied to the shaft, parallel to the sleeve, the shaft attains a speed of 2 cm/s. If a force of 2.4 kN is applied instead, the shaft would move with a speed of -

(A) 2 cm/s (B) 15 cm/s (C) 6 cm/s (D)None of these



$F = \eta A \frac{v}{d} \Rightarrow F \propto v$

$\frac{F_1}{F_2} = \frac{v_1}{v_2}$

$\frac{800N}{2400N} = \frac{2 cm/s}{v_2}$

$\Rightarrow v_2 = 6 cm/s$

43.

A small drop of steel falls from rest through a long height h in coaltar, the final velocity will be proportional to h^n, then n is -

(A) 1/2 (B) 1 (C) – 1 (D) 0

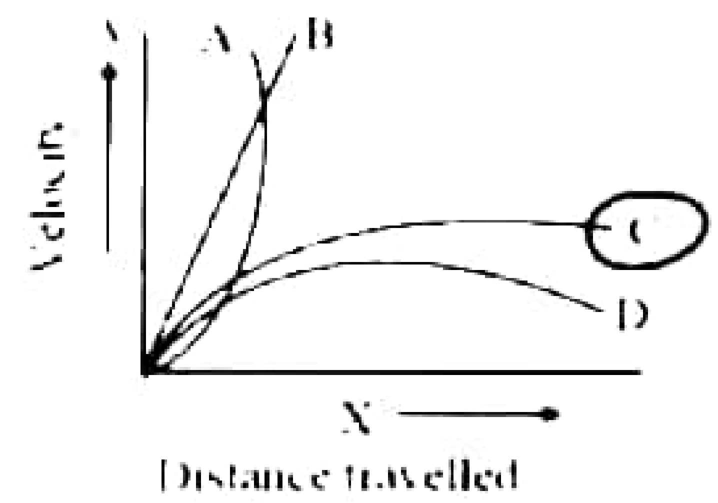
$v = \frac{2}{9}\frac{r^2 g}{\eta}(\sigma - \rho)$

v does not depends on 'h'

$n = 0$

44.

A small spherical solid ball is dropped in a viscous liquid. Its journey in the liquid is best described in the figure by –



(A) Curve A (B) Curve B (C*) Curve C (D) Curve D

45.

With the increase in temperature viscosity of a liquid -

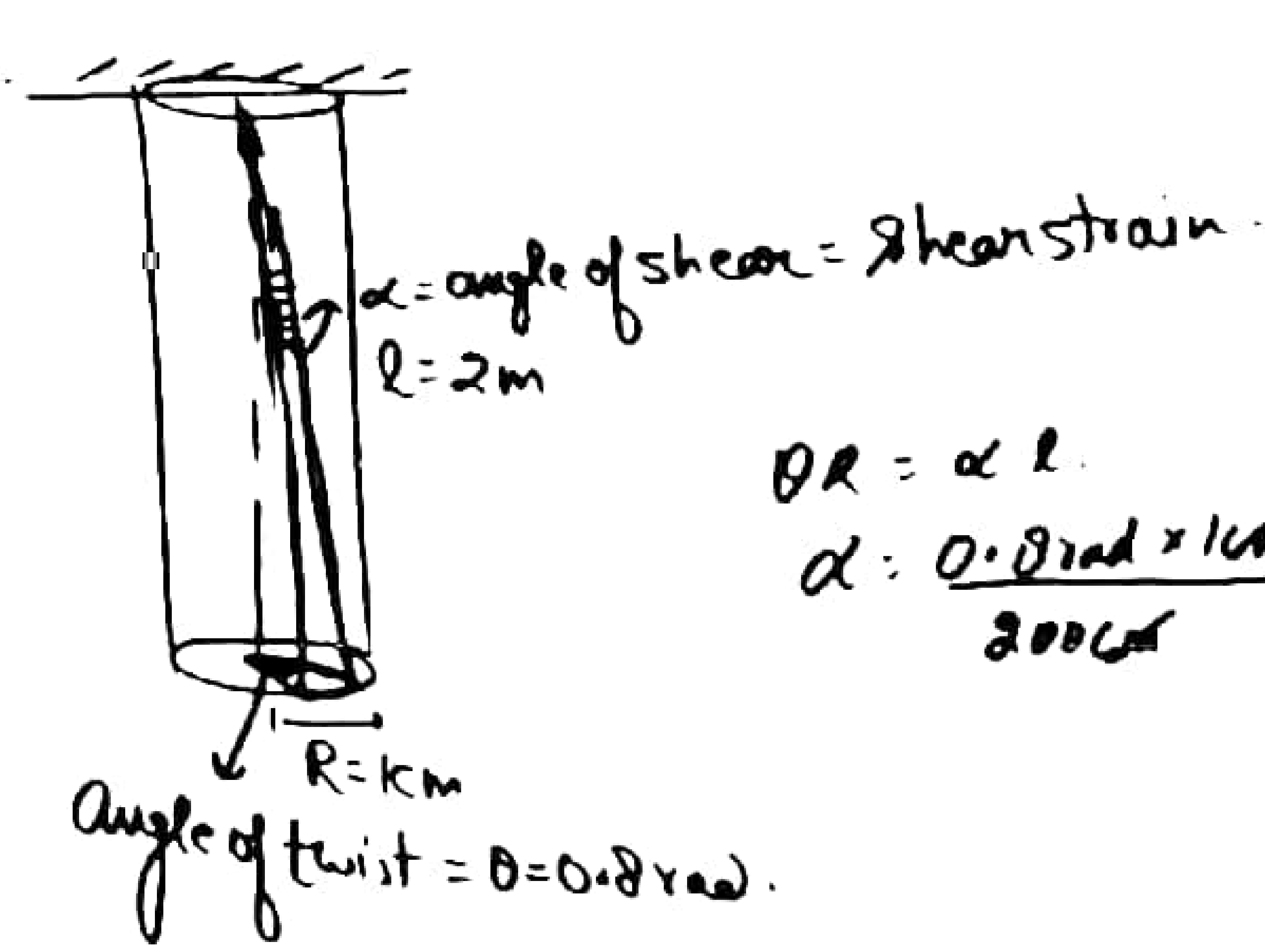
(A) increases (B*) decreases (C) remain same (D) None

46.

A 2 m long rod of radius 1 cm which is fixed from one end is given a twist of 0.8 radians. The shear strain developed will be

a) 0.002 b*) 0.004

c) 0.008 d) 0.016



$\theta R = \alpha l$

$\alpha = \frac{0.8 \text{ rad} \times 1 \text{cm}}{200 \text{cm}} = 0.004$

If Poisson's ratio σ is $-\frac{1}{2}$ for a material, then the material is

a) Uncompressible b) Elastic fatigue

c) Compressible d) None of the above

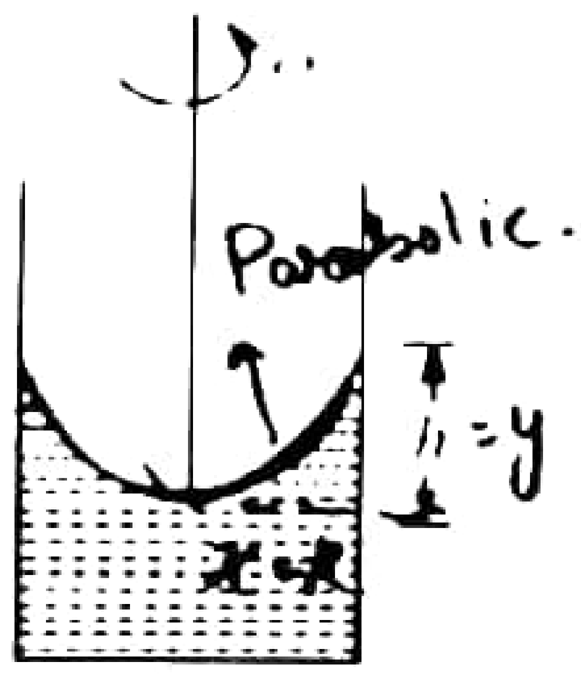
Sol^n

$$\frac{\Delta V}{V} = 0$$

Material uncompressible.

48.

A liquid is kept in a cylindrical vessel which is rotated along its axis. The liquid rises at the sides (figure). If the radius of the vessel is 0.05 m and the frequency of rotation is 2 s^{-1}, find the difference in the height of the liquid at the centre of the vessel and its sides



a) 20 cm b) 4 cm

c) 2 cm d) 0.2 cm

Sol^n

$$y = \frac{1}{2}\frac{x^2\omega^2}{g}$$

$R = 0.05 m$

$\omega = 2\pi\nu = 4\pi$ rad/s

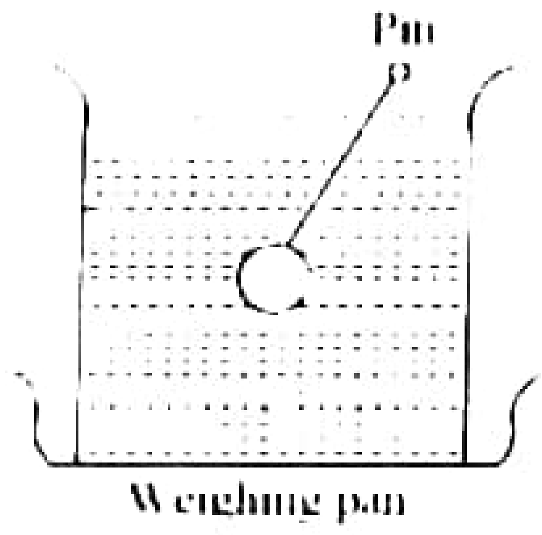
$$h = \frac{1}{2} \times \frac{25\times10^{-4} \times 16\pi^2}{9.8}$$

$= 200 \times 10^{-4}$ m

$h = 2$ cm

49.

A vessel with water is placed on a weighing pan and it reads 600 gm a ball having mass 32 gm and density $0.8\ g\,cc^{-1}$ is sunk into the water with a pin of negligible volume as shown in figure keeping it sunk. The weighing pan will show a reading



$N = Mg + U$

$N = Mg + \frac{\rho_w}{\rho} mg$

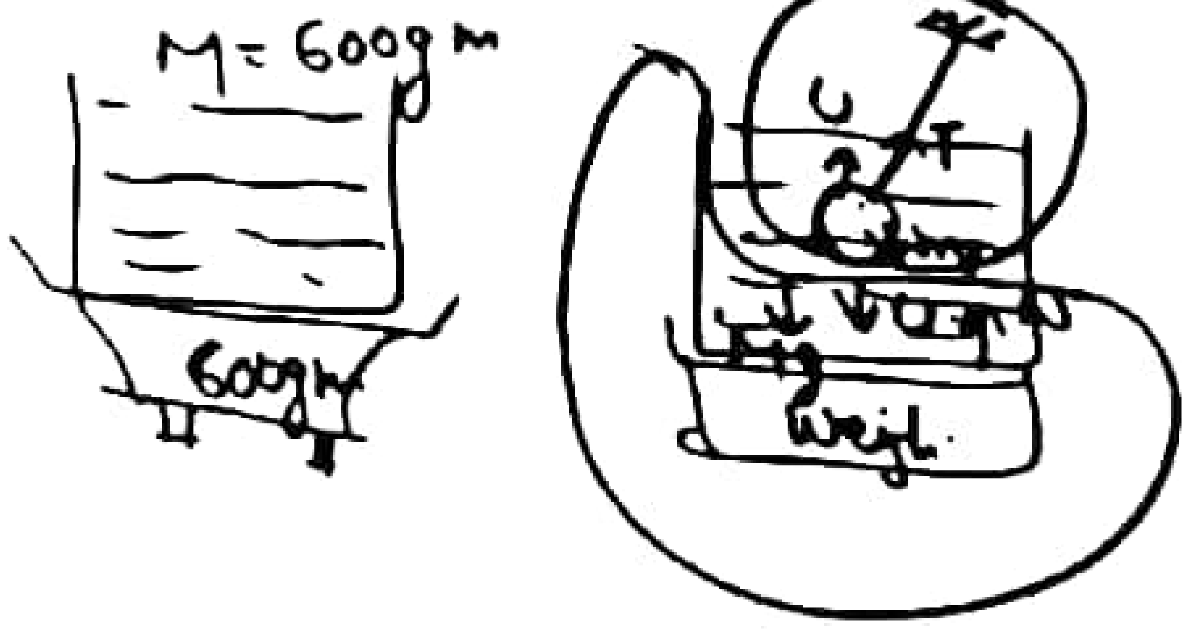
$N\,(\text{in gm}) = M + \frac{\rho_w}{\rho} m$

$= 600\,gm + \frac{1}{0.8} \times 32\,gm$

$= 600 + 40$

$= 640\,gm$

a) 600 g
b) 632 g
c) 642 g
d) 640 g ✓



50.

An object of weight w and density ρ is submerged in a fluid of density ρ_1. Its apparent weight will be

a) $w(\rho - \rho_1)$
b) $(\rho - \rho_1)/w$
c) $w\left(1 - \frac{\rho_1}{\rho}\right)$ ✓
d) $w(\rho_1 - \rho)$

51.

App wt $= W - U$

$= W - \frac{\rho_1}{\rho} W$

$= W\left(1 - \frac{\rho_1}{\rho}\right)$