PHYSICS

BOOKS - GK PUBLICATIONS PHYSICS (HINGLISH)

FLUID MECHANICS

Illustration

1. A beaker of circular ceross sectionof radius 4 cm is filled with mercury up to a height of 10 cm.

Find the force exerted by the mercury on the bottom of the beaker. The atmospheric pressure $= 10^5 Nm^{-2}$. Density of mercury $= 13600 kgm^{-3}. Takeg10ms^{-2}$

Watch Video Solution

2. A cubical block of iron 5 cm on each side is floating on mercury in a vessel. (i) what is the height of the block above mercury level ?

(ii) Water is poured in the vessel unitl it just covers the iron block. What is the height of

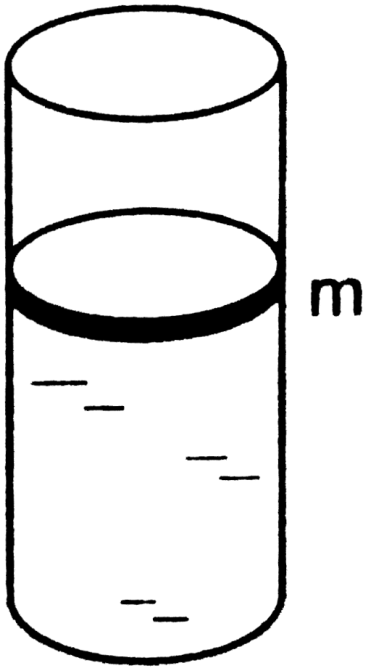
water column . density of mercur $13.6gm/cm^3$. Density of iron 7.2 gm/cm^3

Watch Video Solution

3. A tank containing water is placed on a spring balance. A stone of weight w is hung and lowered into the water without touching the sides and the bottom of the tank. Explain how the reading will change.

Watch Video Solution

4. A cylidrical vesel containing a liquid is closed by a smooth piston of mass m as shown in the figure. The area of cross section of the piston is A. If the atmospheric pressure is P_0, find the pressure of the liquid just below the piston.



,

Watch Video Solution

5. A rubber ball of mass m and radius r is submerged in water to a depth h and released. What height will the ball jump up to above the surface of the water? Neglect ther resistance of water and air. Take water density ρ.

Watch Video Solution

6. A cube of wood supporting 200gm mass just floats in water. When the mass is removed, the cube ruses by 2cm. What is the size of the cube?

Watch Video Solution

7. A boat floating in a water tank is carrying a number of large stones. If the stones are unloaded into water, what will happen to the water level?

Watch Video Solution

8. Two solid uniform spheres each of radius 5 cm are connected by a light and totally immersed in a tank of water. If the specific gravities of the

pressure are 0.5 and 2, find the tension in the string and the contact force between the bottom of the tank and the heavier sphere.

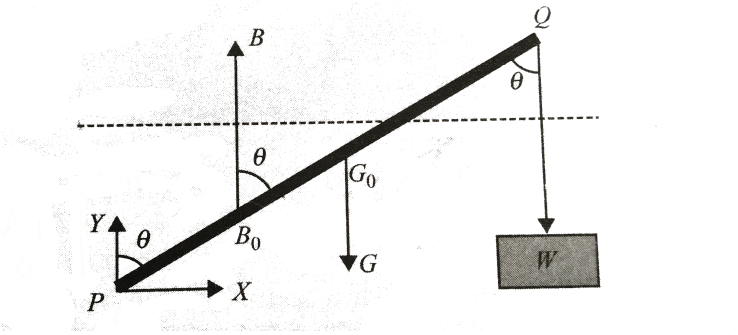
Watch Video Solution

9. A rod of length $6m$ has a mass of $12kg$. It is hinged at one end of the rod at a distance of $3m$ below the water surface.

a.What must be the weight of a block that is attached to the other end of the rod so that $5m$ of the rod's length is under water?

b. Find the magnitude and direction of the force

exerted by the hinge on the rod. The specific gravity of the material of rod is 0.5.



Watch Video Solution

10. A cylinder of area $300cm^2$ and length 10 cm made of material of specific gravity 0.8 is floated in water with its axis vertical. It is then pushed downward, so as to be just immersed. Calculate

the work done by the agent who pushes the cylinder into the water.

Watch Video Solution

11. A thin uniform rod of length 2l and specific gravity 3/4 is hinged at one end to height l/2 above the surface of water, with the other end immersed. Find the inclination of rod in equilibrium

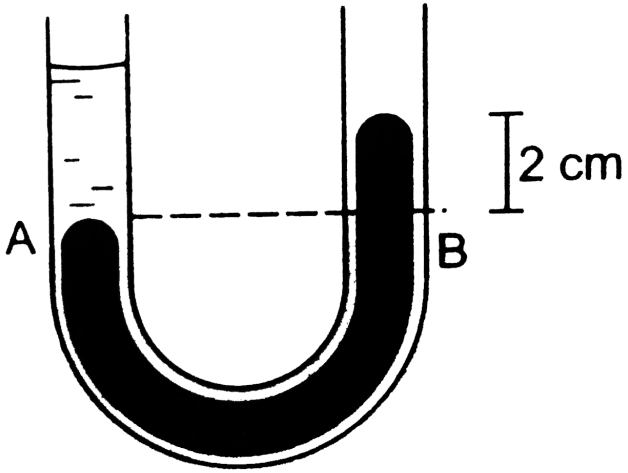
Watch Video Solution

12. A piece of an alloy of mass 96 gm is composed of two metals whose specific gravities are 11.4 and 7.4. if the weight of the alloy is 86 gm in water, find the mass of each metal in alloy.

Watch Video Solution

13. The liquids shown in figure in the two arms are mercury (specific gravity =13.6) and water. If the difference of heights of the mercury columns

is 2 cm, find the height of the water column.



,

Watch Video Solution

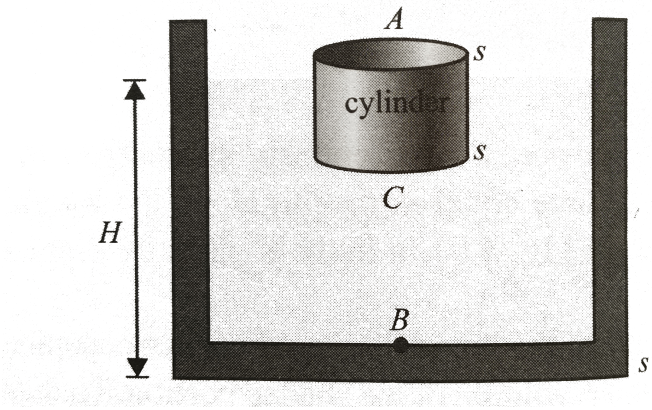
14. A liquid of density ρ is filled in a beaker of cross section S to a height H and then a cylinder of mass m and cross section s is made to float in it as shown in figure. It the

atmospheric pressure is p_0, find the pressure

a. at the top face A of the cylinder

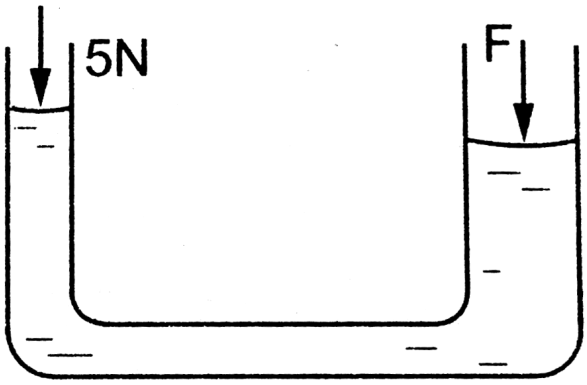
b. at the bottom face C of the cylinder and

c. at the base B of the beaker. Can ever these three pressures be equal?



Watch Video Solution

15. The area of cross section of the two arms of a hydraulilc press are 1 cm^2 and 10 cm^2 respectively figure. A force of 5N is applied on the water in the thinner arm. What force should be applied on the water in the thicker arm so that the water may remain in equilibrium?



,

Watch Video Solution

16. An open U -tube of uniform cross-section contains mercury. When 27.2 cm of water is poured into one limb of the tube, (a) how high does the mercury rise in the limb from its initial level ? (b) what is the difference in levels of liquids of the two sides ? ($\rho_w = 1$ and $\rho_{Hg} = 13.6$ units)

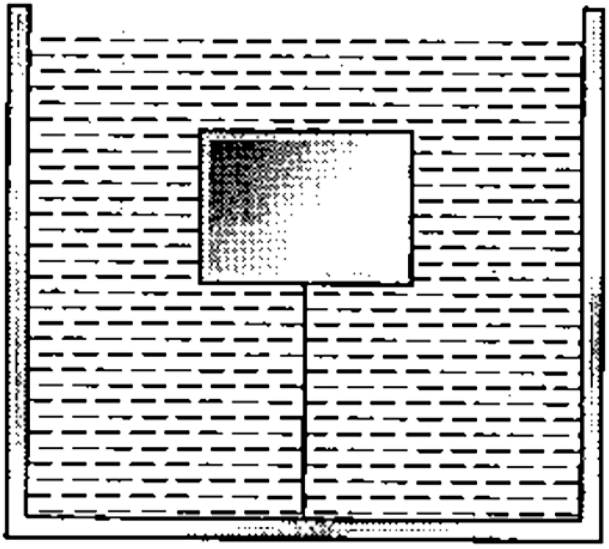
Watch Video Solution

17. Find the tension in the string holding a solid block of volume $1000cm^3$ and density

$0.8gm/cm^3$ dipped in liquid and tied to the bottom of a container filled with liquid of density $1.2gm/cm^3$ shown in figure

(i) When container is moving upwards with an acceleration $4.9m/s^2$.

(ii) When container is stationary .



Watch Video Solution

18. Length of a horizontal arm of U-tube is L and ends of both the vertical arms are open to atompsheric pressure P_0, A liquid of density ρ is poured in the tube such that liquid just fills the horizontal part of the tube as shown in figure . Now one end of the opened ends is sealed and the tube is then rotated about a vertical axis passing through the other vertical arm with angular speed ω_0. if length of each vertical arm is a and in the sealed end liquid rises to a height y, find pressure in the sealed tube during rotation.

Watch Video Solution

19. Two identical cylindrical vessel with their bases at the same level each contain a liquid of density ρ. The height of the liquid in one vessel is h_1 and in the other is h_2 the area of either base is A. What is the work done by gravity is equalising the levels when the two vessels are connected?

Watch Video Solution

20. A water pipe with internal diameter of 1 inch carries water at ground floor of a house with velocity 3 ft/ sec and at pressrue 25 lb/inch.^{2} . Another pipe of of internal diameter 1/2 inch is connected to it and takes water to the first floor 25 feet above ground. what is the velocity and water pressure at first floor ?

Watch Video Solution

21. Water stands up height H in a tank, whose side walls are vertical. A hole is made on one of

the walls does the emerging stream of water strike the floor and for what value of h this range is maximum ?

Watch Video Solution

22. In a horizontal pipeline of uniform cross section the pressure falls by $8N/m^2$ between two points separated by $1km$. If oil of density $800kg/m^3$ flows through the pipe, find the change in KE per kg of oil at these points.

Watch Video Solution

23. Air is streaming past a horizontal air plane wing such that its speed is $120ms^{-1}$ over the upper surface and $90ms^{-1}$ at the lower surface. If the density of air is $1.3kgm^{-3}$m find the difference in pressure between the top and bottom of the wing. If the wing is $10m$ long and has an average width of $2m$, calculate the gross lift of the wing.

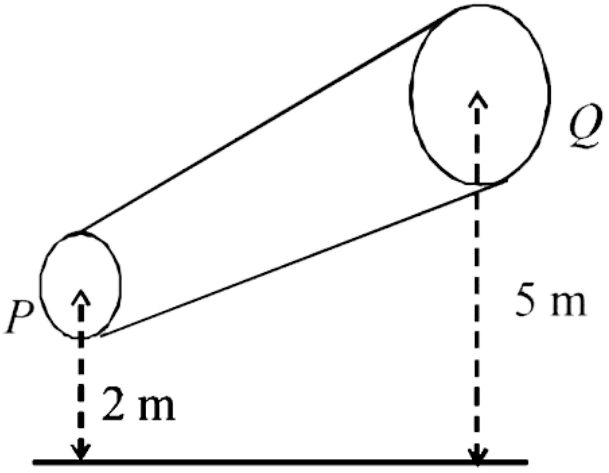
Watch Video Solution

24. In an experimental model of the venturimeter, the diameter of the pipe is 4 cm and that of constriction is 3 cm. With water filling the pipe and flowing at a certain rate the height of the liquids in the pressure tube is 20 cm at the pipe and 15 cm at the constrictions. what is the discharge rate ?

Watch Video Solution

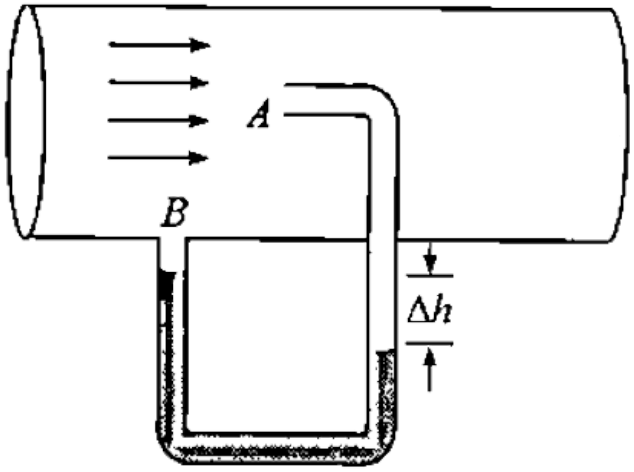
25. A non-viscous liquid of constant density $1000kg/m^3$ flows in a streamline motion along a

tube of variable cross section. The tube is kept inclined in the vertical plane as shown in Figure. The area of cross section of the tube two point P and Q at heights of 2 metres and 5 metres are respectively $4 \times 10^{-3} m^2$ and $8 \times 10^{-3} m^2$. The velocity of the liquid at point P is $1 m/s$. Find the work done per unit volume by the pressure and the gravity forces as the fluid flows from point P to Q.



Watch Video Solution

26. A piot tube figure is mounted along the axis of a gas pipeline whose cross -sectional area is equal to S.



Assuming the viscosity to be negligible, find the volume of the gas flowing across the section of

the pipe per unit time, if the difference in the liquid columns is equal to Δh, and the densities of the liquids and the gas are ρ_0 and ρ respectively.

Watch Video Solution

27. A cylindrical tank $1m$ in radius rests on a platform $5m$ high. Initially the tank is filled with water to a height of $5m$. A plug whose area is $10^{-4}m^2$, is removed from an orifice on the side of the tank at the bottom. Calculate the following :

(a) Initial speed with which the water flows from the orifice.

(b) Initial speed with which the water strikes the ground,

(c) Time taken to empty the tank to half its original value.

Watch Video Solution

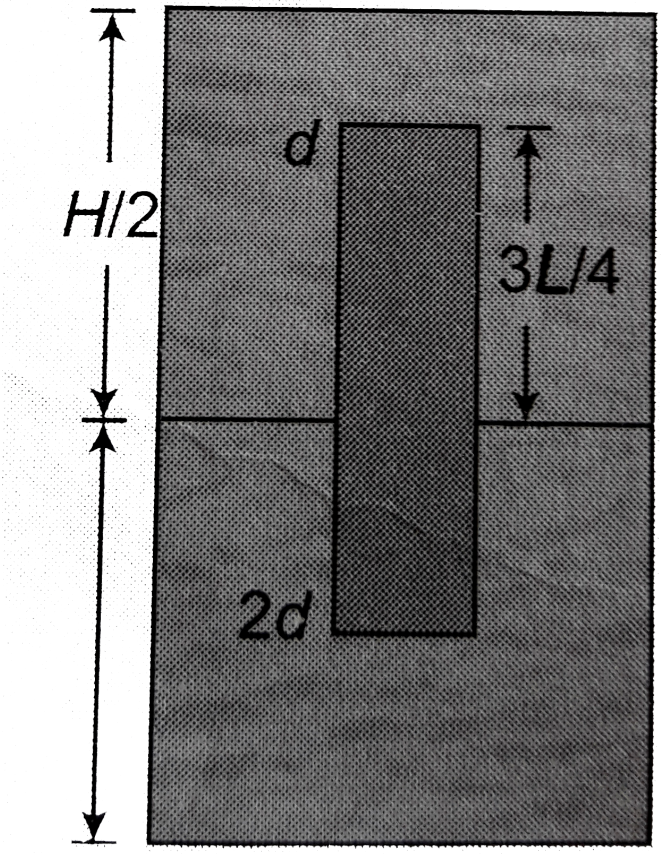
28. A container of a large uniform cross-sectional area A resting on a horizontal surface holds two immiscible, non viscous and incompressible liquids of densities d and $2d$, each of height

$H/2$ as shown in figure. The lower density liquid is open to atmosphere. A homogeneous solid cylinder of length $L\left(L < \frac{H}{2}\right)$, cross-sectional area $A/5$ is immersed such that it floats with its axis vertical of the liquid-liquid interface with length $L/4$ denser liquid. Determine

(a) density D of the solid and

(b) the total pressure at the bottom of the

container. (Atmospheric pressure $= P_0$).

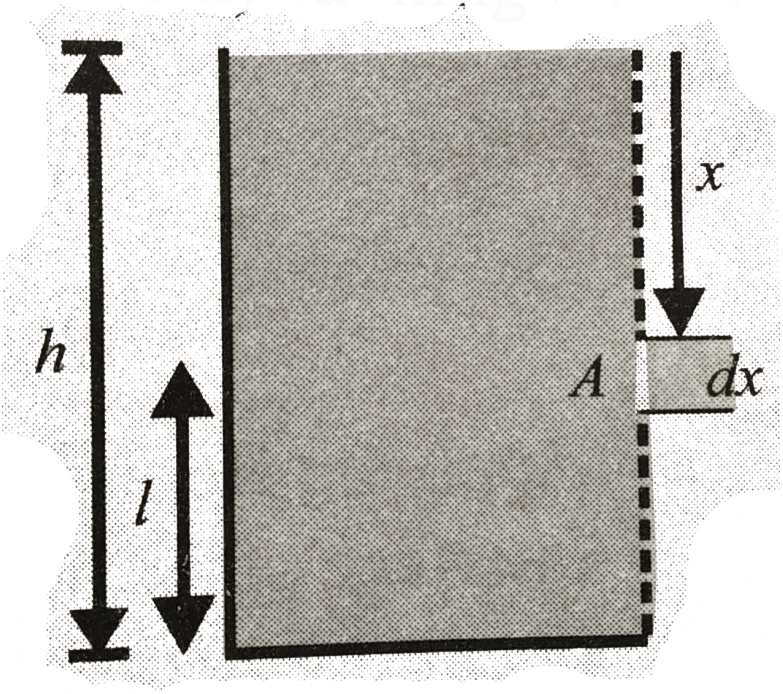


Watch Video Solution

29. The side wall of a wide vertical vessel of height $h = 75cm$ has a narrow slit (vertical) running all the way down to the bottom of the vessel.

The length of the slit is $l = 50cm$ and the width is $b = 1mm$. With the slit closed, water is filled to the top. Find the resultant reaction force of

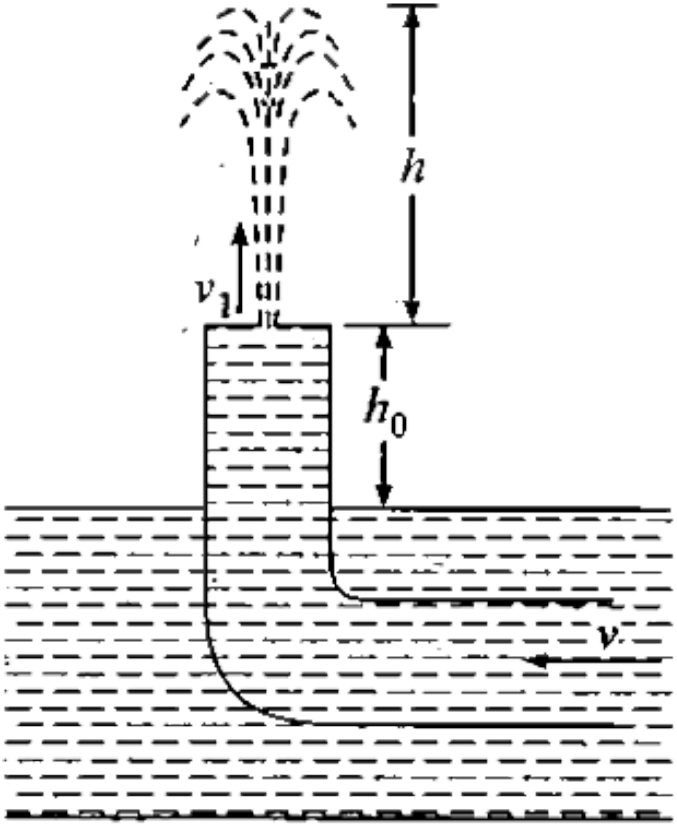
water coming out as the slit is opened.



Watch Video Solution

30. A bent tube is lowered into a water stream as shown in figure. The velocity of the stream

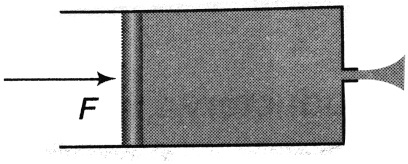
relative to the tube is equal to v=2.5 m/s. The closed upper end of the tube located at the height $h_0 = 12cm$ has a small orifice. To what height h will the water jet spurt ?



Watch Video Solution

31. What work should be done in order to sqeeze all water from a horizontally located cylinder (figure) during the time t by means of a constant force acting on the poston? The volume of water in the cylinder is equal to V, the cross-sectional area of the orifice is s, with s being considerablu less than the piston area. The friction and viscosity are negligibly small. Density of water is

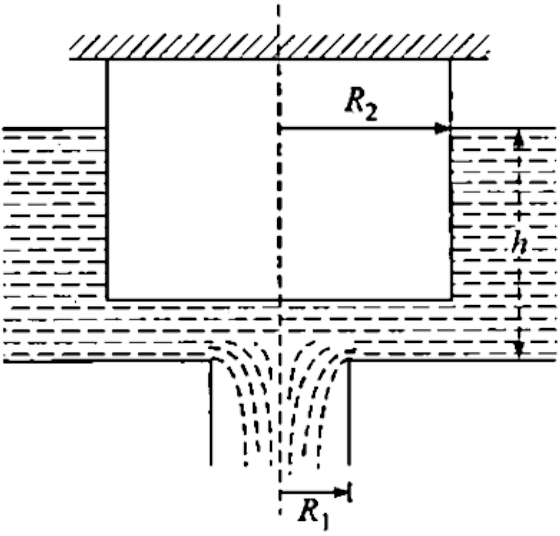
ρ



Watch Video Solution

32. The horizontal bottom of a wide vessel with an ideal fluid has a round orifice of radius R_1

over which a round closed cylinder is mounted, whose radius $R_2 > R_1$ figure. The clearance between the cylinder and the bottom of the vessel is very small, the fluid density is ρ. find the static pressure of the fluid in the clearance as a function of the distance r from the axis of the orifice (and the cylinder) , if the height of the fluid is equal to h.



Watch Video Solution

Practice Exercise 7 1

1. The height to which a cylindrical vessel be filled with a homogenous liquid, to make the average force with which the liquid presses the side of the vessel equal to the force exerted by the liquid on the bottom of the vessel, is equal to.

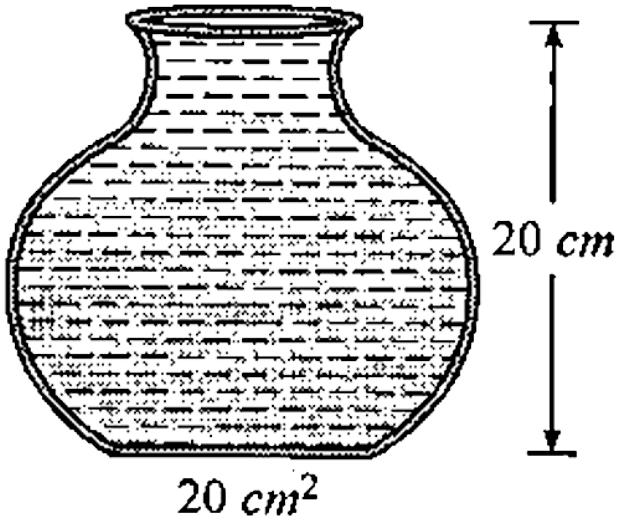
Watch Video Solution

2. A piece of copper having an internal cavity weights 264 g in air and 221 g in water. Find the volume of the cavity. Density of copper is $8.8g/cm^3$

Watch Video Solution

3. A vessel full of water has a bottom of area $20cm^2$, top of area $20cm^2$, height 20 cm and volume half a litre as shown in figure.

(a) find the force exerted by the water on the bottom.



(b) considering the equilibrium of the water, find the resultant force exerted by the sides of the glass vessel on the water. atmospheric pressure $= 1.0 \times 10^5 N/m^2$. density of water $= 1000 kg/m^3$ and $g = 10 m/s^2$

Watch Video Solution

4. A hollow sphere of innder radius 9 cm and outer radius 10 cm floats half-submerged in a liquid of specific gravity 0.8. calculate the density of the material of which the sphere is made. What would be the density of a liquid in which the hollow sphere would just floats completely sumberged. ?

Watch Video Solution

5. An ornament weighing $36g$ in air weighs only $34g$ in water. Assuming that some copper is

mixed with gold to prepare the ornament, find the amount of copper in it. Specific gravity of gold is 19.3 and that of copper is 8.9

Watch Video Solution

6. In previous problem if the piece is made of pure gold with some air cavities In it. Calculate the volume of the cavities left that will allow the weights given in that problem.

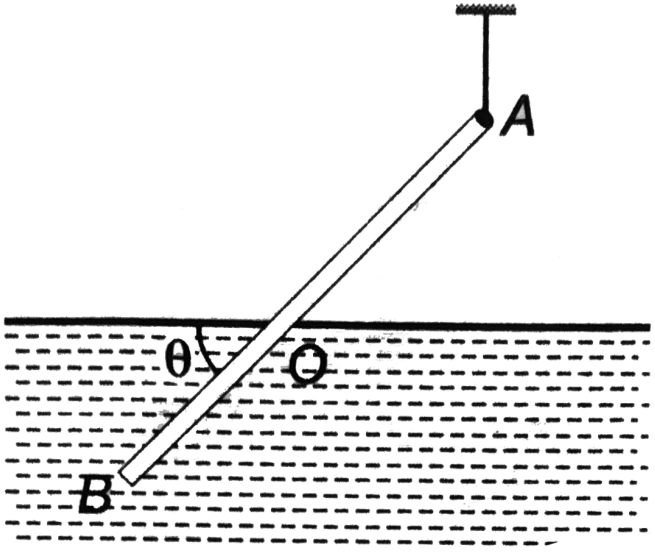
View Text Solution

7. A flat bottomed thin-walled glass tube has a diameter of 4 cm and it weights 30 g. the centre of gravity of the empty tube is 10 cm above the bottom, find the amount of water which must be poured into the tube so that when it is floating vertically in a tank of water, the centre of gravity of the tube and its contents is at the midpoint ot the immersed length of the tube.

Watch Video Solution

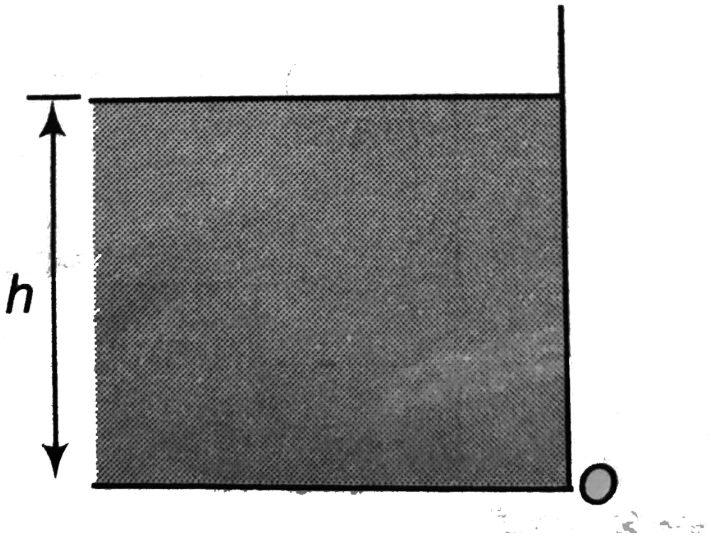
8. A uniform rod AB, 4m long and weighing 12 kg, is supported at end A, with a 6 kg lead weight at

B. The rod floats as shown in figure with one-half of its length submerged. The buoyant force on the lead mass is negligible as it is of negligible volume. Find the tension in the cord and the total volume of the rod



Watch Video Solution

9. Water stands at a depth h behind the vertical face of a dam. It exerts a resultant horizontal force on the dam tendibg to slide it along its foundation and a torque tending to overturn the dam about the point O. Find



(a) Horizontal force,(b) torque about O, (c) the height at which the resultant force would have

to act to produce the same torque,l=cross-sectional length and $\rho =$ density of water.

Watch Video Solution

10. The density of air in atomsphere decreases with height and can be expressed by the relation.

$\rho = \rho_0 e^{-Ah}$

Where ρ_0 is the density at sea-level, A is a constant and h is the height. Calculate the atmospheric pressure at sea -level. assume g to be constant.

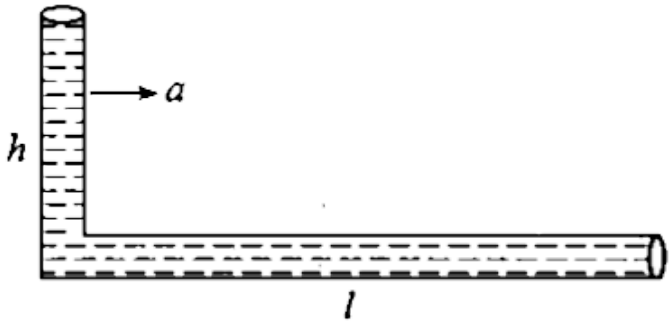
Watch Video Solution

Practice Exercise 7 2

1. A rubber ball of mass 10 gram and volume $15cm^3$ is dipped in water to a depth of 10m. Assuming density of water uniform throughtout the depth, find (a) the ac celeration of the ball, and (b) the time taken by it to reach the surface if it is relased from rest. $\left(Takeg = 980cm / s^2\right)$

Watch Video Solution

2. Figure shows as a L-shaped tube in which a liquid of density ρ is filled. Find with what acceleration the tube is accelerated towards right so that no liquid will fall out of the tube.



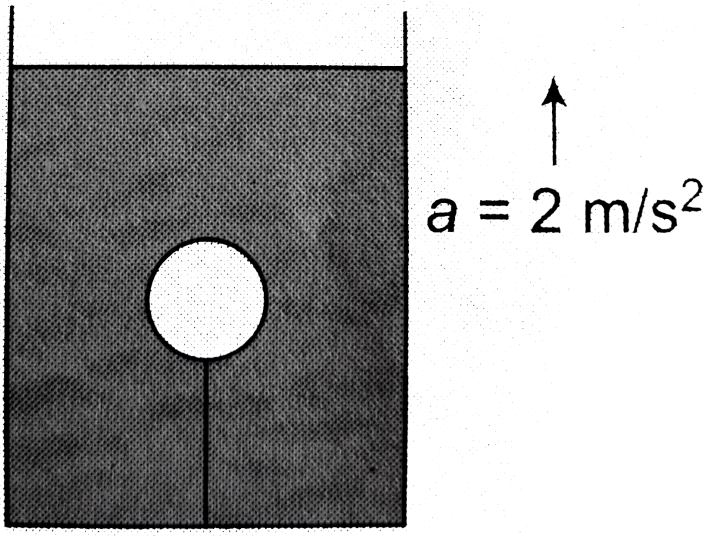
Watch Video Solution

3. A solid sphere of mass $m = 2kg$ and specific gravity $s = 0.5$ is held stationary relative to a tank filled with water. The tank is accelerating upward with acceleration $2m/s^2$. Calculate

(a) Tension in the thread connected between the sphere and the bottom of the tank.

(b) If the thread snaps, calculate the acceleration of sphere with respect to the tank.

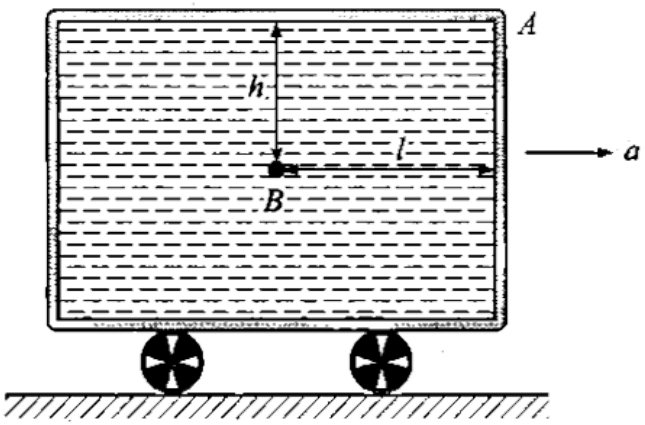
(Density of water $= 1000 kgm^{-3}, g = 10 ms^{-2}$).



Watch Video Solution

4. A closed tank filled with water is mounted on a cart. The cart moves with an acceleration 'a' on a plane plane road. What is the difference in

pressure between point B and A shown in figure



Watch Video Solution

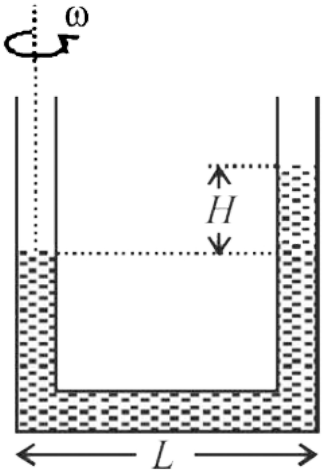
5. A meta cube is plced in an empty vessel. When water is filed in the vessel so that the cubeis completely immersed in the water, the fore on

the bottom of the vessel in contact with the cube

Watch Video Solution

6. A U tube is rotated about one of it's limbs with an angular velocity ω. Find the difference in height H of the liquid (density ρ) level, where

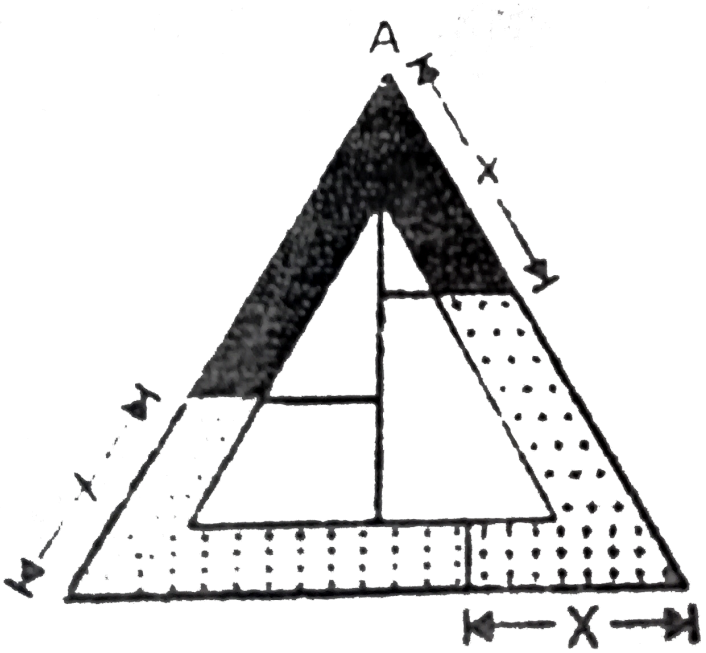
diameter of the tube $d << L$.



Watch Video Solution

7. A closed tube in the form of an equilateral triangle of side l contains equal volumes of three liquids which do not mix and is placed vertically with its lowest side horizonta. Find 'x' in the

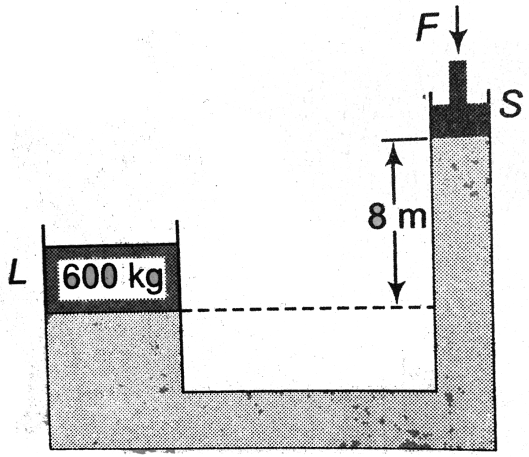
figure if the densities of the liquids are in $A.\ P.$



Watch Video Solution

8. For the system shown in figure, the cylinder on the left, at L, has a mass of 600 kg and a cross-sectional area of $800cm^2$. The piston on the

right, at S, has cross-sectional area $25cm^2$ and negligible weight. If the apparatus is filled with oil $\left(\rho = 0.78g/cm^3\right)$, what is the force F required to hold the system is equilibrium?



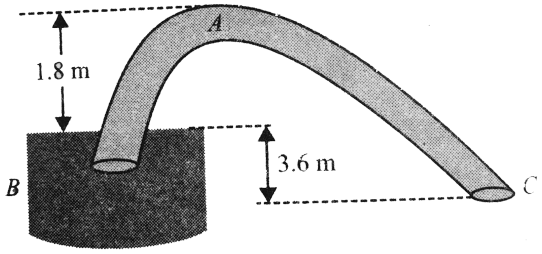
Watch Video Solution

Practice Exercise 7 3

1. At Deoprayag (Garhwal, UP) river Alaknanda mixes with the river Bhagirathi and becomes river Ganga. Suppose Alaknand has a width of 12 m, Bhagirathi has a width of 8m and Ganga ha sa width of 16m. Assume that the depth of water is same in the three rivers. Let the average speed of water in Alaknanda be $20kmh^{-1}$ and in Bhagirathi be $16kmh^{-1}$. Find the average speed of water in the river Ganga.

Watch Video Solution

2. A siphon has a uniform circular base of diameter $8/\sqrt{\pi}cm$ with its crest A, $1.8m$ above the water level vessel B is of large cross section ($g = 10m/s^2$ and atmospheric pressure $P_0 = 10^5 N/m^2$).



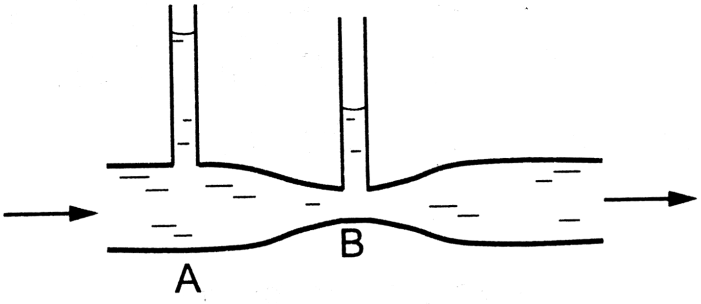
Watch Video Solution

3. On the opposite sides of a wide vertical vessel filled with water two identical holes are opened each having the cross-sectional area $S = 0.50cm^2$ the height difference between them is equal to $\Delta h = 51cm$ find the resultant force of reaction of the water flowing out of the vessel.

Watch Video Solution

4. Water flows through a horizontal tube as shown in figure. If the difference of heights of

water colun in the vertical tubes is 2 cm and the area of cross section at A and B are $4cm^2$ and $2cm^2$ respectively, find the rate of flow of water across any section.



A. $146.05cm^3/\sec$

B. $\frac{146.05}{3}cm^3/\sec$

C. zero

D. $292.1cm^3/\sec$

Answer: A

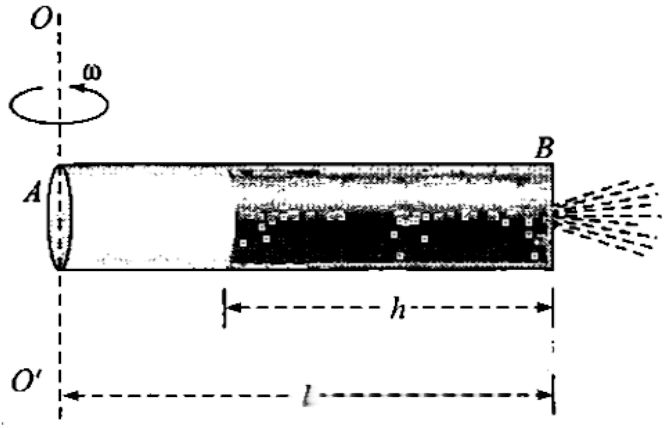
5. A cylindrical vessel filled with water up to a height of $2m$ stands on a horizontal plane. The side of the vessel has a plugged circular hole so that the vessel begins to move on the floor it the plug is removed. The coefficient of friction between the bottom of the vessel and the plane is 0.4, and total mass of water plus vessel is $100kg$.

Watch Video Solution

6. Water is flowing through two horizontal pipes of different diameters which are connected together. In the first pipe the speed of water 4 m/s and the pressure is $2.0 \times 10^4 N/m^2$. Calculate the speed and pressure of water in the second pipe. The diameter of the pipes the diameter of the pipes are 3 cm and 6 cm respectively.

Watch Video Solution

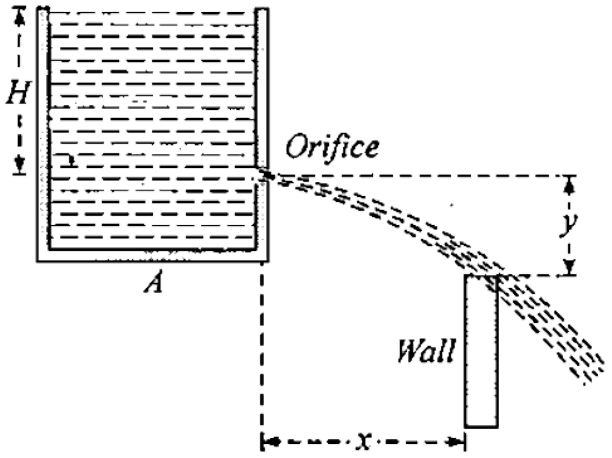
7. A horizontal oriented tube AB of length l rotates with a constant angular velocity ω about a stationary vertical axis OO' passing thorugh the end A figure. The tube is filled with an ideal fluid. The end A of the tube is open, the closed end B has a very small orifice. find the velocity of the fluid relative to the tube as a function of the column height h.



Watch Video Solution

Watch Video Solution

8. For the arragement shown in figure, find the time interval after which the water jet ceases to cross the wall. Area of the tank is A and area of orifice is a.



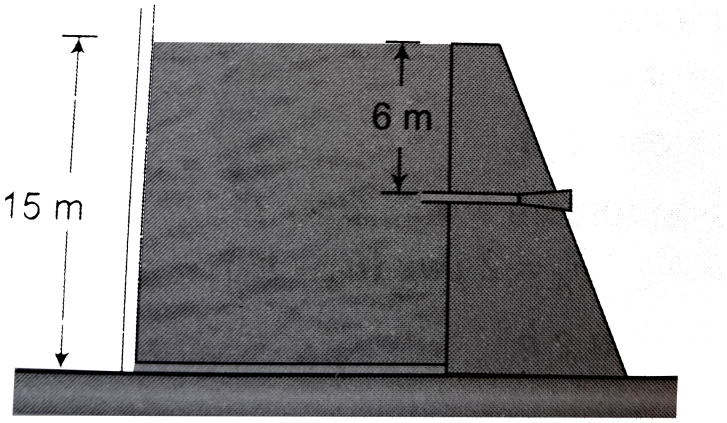
Watch Video Solution

9. The fresh water behind a reservoir dam is $15m$ deep. A horizontal pipe $4.0cm$ in diameter passes through the dam $6.0m$ below the water surface as shown in the figure. A plug secures the pipe opening :

(a) Find the friction force between the plug and the pipe wall.

(b) The plug is removed. What volume of water flows out of the pipe in 3.0 hour ? Assume that

reservoir is large.



Watch Video Solution

Discussion Question

1. Why does a uniform wooden stick or log float horizontally ? If enough iron is added to one

end, it will float vertically , explain also.

Watch Video Solution

2. A block of wood is floating on water at $0^\circ C$ with a certain volume V outside the water-level. The temperature of water is slowly raised from $0^\circ C$ to $20^\circ C$. How will the volume V change with rise in temperature ?

Watch Video Solution

3. Explain why a soft plastic bag weighs the same when empty or when filled with air at atmospheric pressure ? Would the weights be the same if measured in vacuum ?

Watch Video Solution

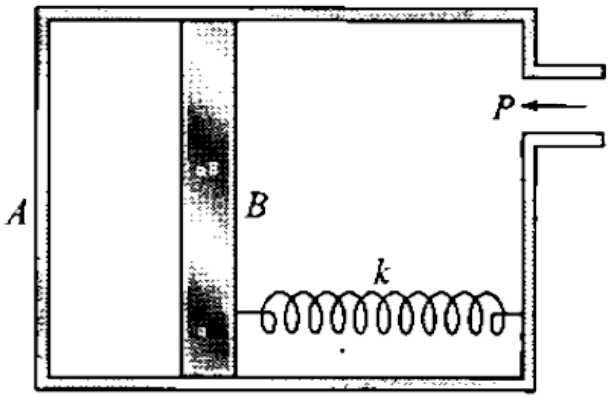
4. Explain why an air bubble in water rises frim bottom to top and grows in size.

Watch Video Solution

5. A beaker containing water is placed on the pan of a balance which shows a reading of M. A lump of sugar of mass m and volume v is now suspend by a thread (from an independent support) in such a way that it is completely immersed in water without touching the beaker and without any overflow of water. How will the reading change as time passes on?

Watch Video Solution

6. A smooth air-tight piston connected to a spring of force constant k and unstretched length l separates two regions of a tube as shown in figure. Region A is evacuated and region B is open to the atmosphere. How will you use this set up to determine the atmospheric pressure ?



Watch Video Solution

7. A ball floats on the surface of water in a container exposed to the atmosphere. Will the ball remain immersed at its initial depth or will it sink or rise somewhat if the container is shifted to the moon?

Watch Video Solution

8. A bucket of water is suspended from a spring balance. What happens to reading of balance

(a) when a piece of stone suspended from a

string is immersed in the water without touching the bucket

(b) when a piece of lead or cork is put in the water in the bucket.

Watch Video Solution

9. A boy is carrying a fish in one hand and a bucket full of water in the other hand. He hen places the fish in the bucket thinking that is accordance with Archimedes' principle he is now carrying less weight as the weight of the fish will reduce due to upthrust. Is he right ?

Watch Video Solution

10. Explain why a soft plastic bag weighs the same when empty or when filled with air at atmospheric pressure ? Would the weights be the same if measured in vacuum ?

Watch Video Solution

11. A piece of ice is floating in water. What will happen to the level of water when all ice melts? What will happen if the beaker is filled not with

water but with liquid

a. denser than water,

b. lighter than water?

Watch Video Solution

12. A man is sitting in a boat which is floating in a pond. If the man drinks some water from the pond, the level of water in the pond decreases.

Watch Video Solution

13. A boy is carrying a fish in one hand and a bucket full of water in the other hand. He hen places the fish in the bucket thinking that is accordance with Archimedes' principle he is now carrying less weight as the weight of the fish will reduce due to upthrust. Is he right ?

Watch Video Solution

14. A bucket of water is suspended from a spring balance. What happens to reading of balance

(a) when a piece of stone suspended from a

string is immersed in the water without touching the bucket

(b) when a piece of lead or cork is put in the water in the bucket.

Watch Video Solution

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

Watch Video Solution

16. A beaker exactly full of water has an ice piece floating on it. As the cube melts what happens to the water level if

(a) the cube contains an air bubble,

(b) lead piece and

(c) a cork piece.

Watch Video Solution

17. Two vessels have the same base area but differnent shapes. The first vessel takes twice the

vloume of water that the second vessel requires to fill up to a paricular common height . Is the force exerted by water on the base of the vessel the same in the two case? If so, why do the vessels filled with water to that same height give different reading on a weighting scale ?

Watch Video Solution

18. A boat containing some piece of material is floating in a pond. What will happen to the level of water in the pond if on unloading the pieces in the pond, the piece (a) floats, (b) sinks?

Watch Video Solution

19. A weightless balloon is filled with water. What will be its apparent weight when weighted in water?

Watch Video Solution

20. Explain why a small iron needle sinks in water while a large iron ship floats?

Watch Video Solution

21. A block of wood floats in a bucket of water placed in a lift. Will the block sink more or less if the lift starts accelerating up?

Watch Video Solution

22. A bottle full of a liquid is fitted with a tight cork. Explain why a slight blow on the cork may be sufficient to break the bottle.

Watch Video Solution

23. A beaker containing water is placed on the pan of a balance which shows a reading of M. A lump of sugar of mass m and volume v is now suspend by a thread (from an independent support) in such a way that it is completely immersed in water without touching the beaker and without any overflow of water. How will the reading change as time passes on?

Watch Video Solution

24. A metal cube is floating in mercury in a bottle. The bottle is connected to a vacuum pump so that all the air in it is evacuated.Find whether the submerged part of metal cube will increase or decrease. Explain why ?

Watch Video Solution

Mcq

1. A body of density ρ is dropped from rest from height h (from the surface of water) into a lake

of density of water $\sigma(\sigma > \rho)$. Neglecting all disspative effects, the acceleration of body while it is in the take is

A. $g\left(\frac{\sigma}{\rho} - 1\right)$ upwards

B. $g\left(\frac{\sigma}{\rho} - 1\right)$ downwards

C. $g\left(\frac{\sigma}{\rho}\right)$ upwards

D. $g\left(\frac{\sigma}{\rho}\right)$ downwards

Answer: B

Watch Video Solution

2. A piece of ice, with a stone frozen inside it , is floating in water contained in a beaker. What will be the position of level of water in the beaker if the whole ice melts?

A. Rises

B. Falls

C. Remain unchanged

D. Falls at first and then rises to the same height as before

Answer: A

Watch Video Solution

3. Bernouli theorem is based on conservtion of

A. Law of Conservation of Energy

B. Law of Conservation of Mass

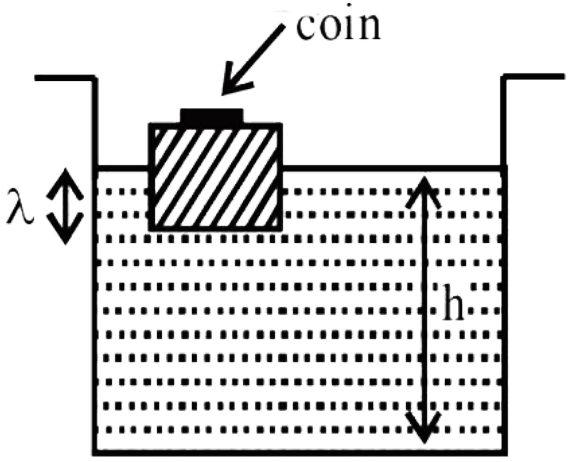
C. Law of Conservation of Momentum

D. Law of Conservation of Angular Momentum

Answer: C

Watch Video Solution

4. A wooden block, with a coin placed on its top, floats in water as shown in figure. The distance l and h are shown here. After some time the coin falls into water. Then



A. l decreases and h increases

B. l increases and h decreases

C. Both l and h increase

D. Both l and h decrease

Answer: C

Watch Video Solution

5. A block of wood floats in a liquid in a beaker with 3/4ths of the its volume submerged under the liquid.If the beaker is placed is in an enclosure that is falling freely under gravity, the block will :

A. Float with 3/4ths of its volume submerged

B. Float completely submerged

C. Float with any fraction of its volume submerged

D. Sink to the bottom

Answer: C

Watch Video Solution

6. Which one of the following statements is correct ? When a fluid passes through the

narrow part of non-uniform pipe :

A. Its velocity and pressure both increase

B. Its velocity and pressure both decrease

C. Its velocity decreases but its pressure increase

D. Its velocity increases but its pressure decreases

Answer: A

Watch Video Solution

7. A solid iron ball and solid aluminium ball of the same diameter are released together on a deep lake.Which ball will reach the bottom first ?

A. Aluminium ball

B. Iron ball

C. Both balls will reach the bottom at the same time

D. The aluminium ball will never reach the bottom and will remain suspended in the lake .

Answer: C

8. A cube of ice is floating in a liquid of relative density 1.25 contained in a beaker . When the ice melts, the level of the liquid in the beaker ?

A. Rises

B. Falls

C. Remain unchanged

D. Falls at first and then rises to the same height as before

Answer: B

Watch Video Solution

9. A boat floating in a water tank is carrying a number of large stones. If the stones are unloaded into water, what will happen to the water level?

A. Remains uncharged

B. Rises

C. Falls

D. Rises till half the number of stones are unloaded and then begins to fall

Answer: A

Watch Video Solution

10. A body floats in a liquid contained in a vessel. The vessel falls vertically with an acceleration (a

($<$ g). If V_i and V_f be the initial and final volume of the body immersed in the liquid then :

A. $V_i > V_f$

B. $V_i < V_f$

C. $V_i = V_f$

D. Data Insufficient

Answer: D

Watch Video Solution

11. A medical suspension bottle is shaken well to disperse the sediment uniformly and immediate, the bottle is placed on a digital weighing machine gently. If W be the actual combined weight of the bottle and the medicine, then the weight recorded by the weighing machine immediately after placing the bottle will be :

A. More than W

B. Less than W

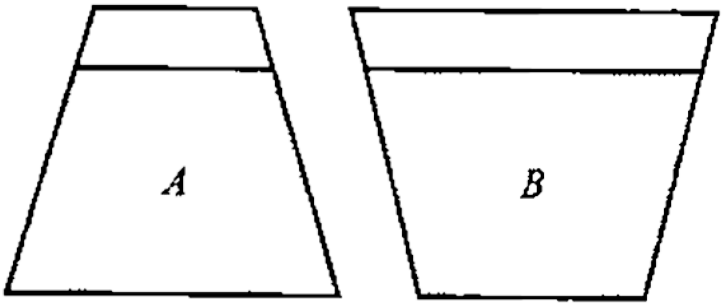
C. Equal to W

D. Nothing can be said

Answer: A

Watch Video Solution

12. Two vessels A and B of cross sections as shown contain a liquid up to the same height. As the temperature rises, the liquid pressure at the bottom (neglecting expansion of the vessels) will :



A. Increase in A , decrease in B

B. increase in B , decrease in A

C. Increase in both A and B but more in A

D. Increase in both A and B equally

Answer: C

 Watch Video Solution

13. It is found that the measured weight ($\neq$ zero) of an empty thin polythene bag has not changed when the bag in filled with air. Two

students were asked reason for this :

Saara: Air is so light that weighing machine need to have large precision to measure weight of filled air.

Vasu : Force of buoyance increases by the same amount as the weight of added air .

A. Saara is correct , Vasu is wrong

B. Vasu is correct , Saara is wrong

C. Both are correct

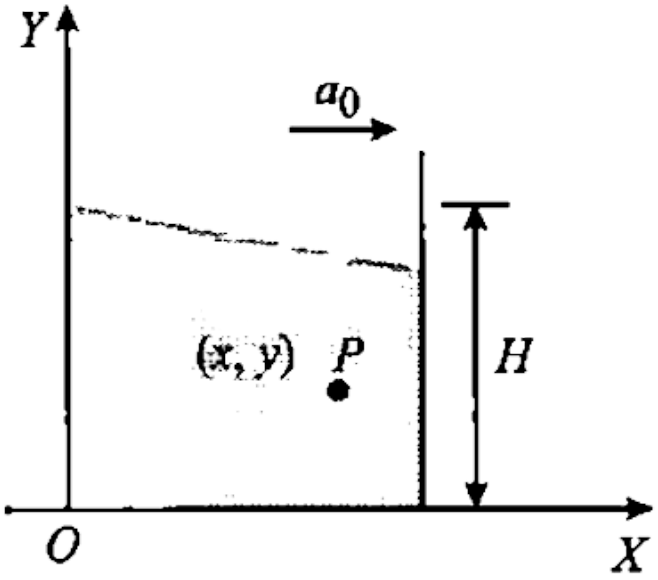
D. Both are wrong

Answer: D

Watch Video Solution

14. A container contains liquid upto height H and kept on a horizontal frictionless surface .At t=0, the container is given a constant acceleration a_0 along positive x-axis.the pressure at point P

depends upon :



A. Only on the x-co-ordinate of the point P

B. Only on the y-co-ordinate of the point P

C. On both x and y co-ordinate of the point P

D. None

Answer: A

View Text Solution

15. The weight of an aeroplane flying in air is balanced by

A. Up thrust of the air which will be equal to the weight of the air having the same volume as the plane

B. Force due to the pressure difference between the upper and lower surfaces of

the wings, created by different air speed on the surface

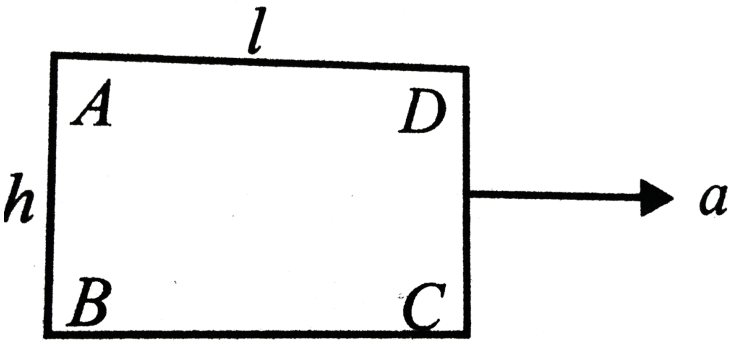
C. Vertical component of the thrust created by air currents strinking the lower surface of the wings

D. Force due to the reaction of gases ejected by the revolving propeller

Answer: A

Watch Video Solution

16. A closed rectangular tank is completely filled with water and is accelerated horizontally with an acceleration towards the right. Pressure is i. maximum and ii. minimum at



A. (i)B(ii)C

B. (i)C(ii)D

C. (i)B(ii)C

D. (i)B(ii)A

Answer: C

Watch Video Solution

17. A beaker containing a liquid is kept inside a big closed jar. If the air inside the jar is continuously pumped out, the pressure in the liquid near the bottom of the liquid will

A. Increases

B. Decreases

C. Remain constant

D. First decrease and then increase

Answer: A

Watch Video Solution

Numberical Mcq Single

1. 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. $\frac{L}{\sqrt{2r}}$

B. $2\pi L$

C. $\sqrt{\frac{2}{r}}.L$

D. $\frac{L}{2\pi}$

Answer: D

Watch Video Solution

2. A cubical block of copper of side $10cm$ is floating in a vessel containing mercury. Water is poured into the vessel so that the copper block just gets submerged. The height of water column is

(

$\rho_{Hg} = 13.6g/cc, \rho_{Cu} = 7.3g/cc, \rho_{water} = 1gm/cc)$

A. 1.25 cm

B. 2.5 cm

C. 5 cm

D. 7.5 cm

Answer: D

3. A block of silver of mass $4kg$ hanging from a string is immersed in a liquid of relative density 0.72. If relative density of silver is 10, then tension in the string will be

A. 37.12 N

B. 42.34 N

C. 73 N

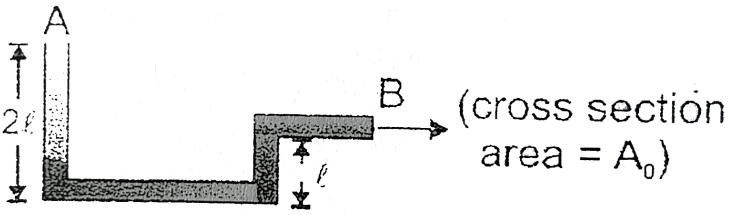
D. 21.15 N

Answer: A

Watch Video Solution

4. A tube in vertical plane is shown in figure. It is filled with a liquid of density ρ and its end B is closed. Then the force exerted by the fluid on the tube at end B will be : [Neglect atmospheric pressure and assume the radius of the tube to

be negligible in comparison to l]



A. $P_{atm}A_0$

B. $(P_{atm} + \rho gl)A_0$

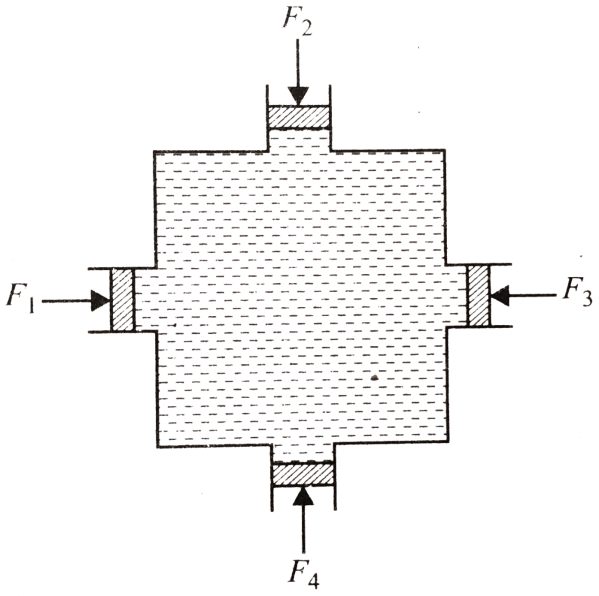
C. $(P_{atm} + 2\rho gl)A_0$

D. $(P_{atm} + 4\rho gl)A_0$

Answer: C

Watch Video Solution

5. Figure shows water filled in a symmetrical container. Four pistons of equal area A are used at the four openings to keep the water in equilibrium. Now an additional force F is applied at each piston. The increase in the pressure at the centre of the container due to this addition is



A. $\frac{F}{A}$

B. $\frac{2F}{A}$

C. $\frac{4F}{A}$

D. 0

Answer: B

Watch Video Solution

6. A block of iron is kept at the bottom of a bucket full of water at $2^{\circ}C$. The water exerts bouyant force on the block. If the temperature of

water is increased by $1^{\circ}C$ the temperature of iron block also increases by $1^{\circ}C$. The bouyant force on the block by water

A. will increase

B. will decrease

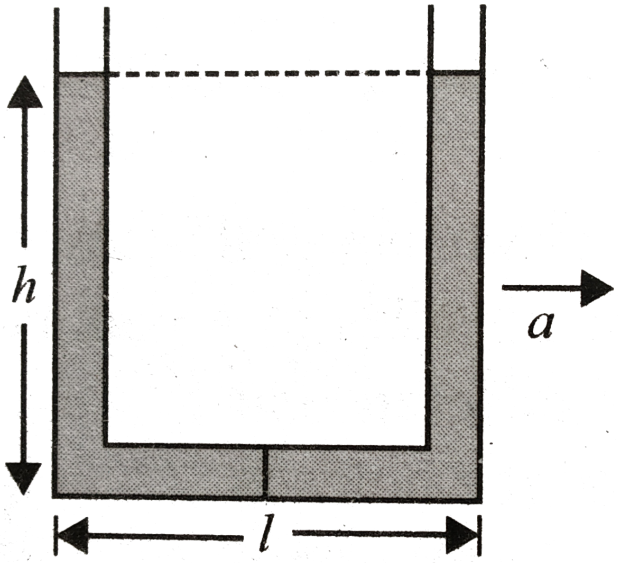
C. will not change

D. may decrease or increase depending on the values of their coefficient of expansion

Answer: C

 Watch Video Solution

7. A U-tube of base length l filled with the same volume of two liquids of densities ρ and 2ρ is moving with an acceleration $'a'$ on the horizontal plane. If the height difference between the two surfaces (open to atmosphere) becomes zero, then the height h is given by



A. $\frac{a}{2g}l$

B. $\frac{3a}{2g}l$

C. $\frac{a}{g}l$

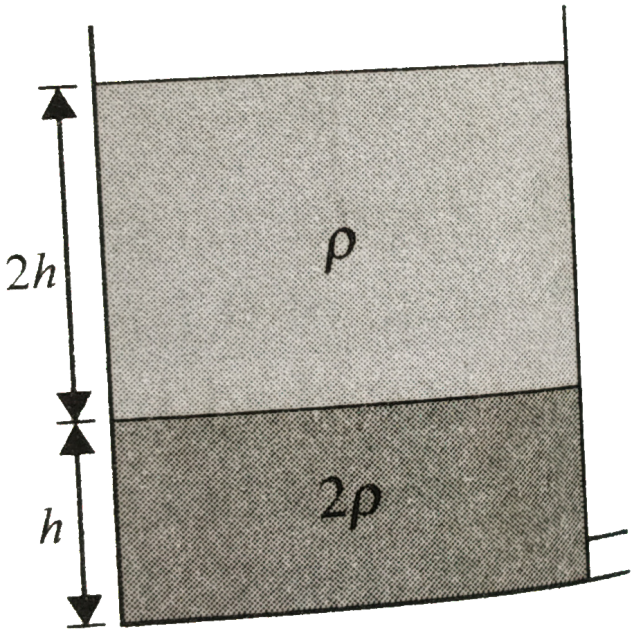
D. $\frac{2a}{3g}l$

Answer: D

 Watch Video Solution

8. The velocity of the liquid coming out of a small hole of a vessel containing two different liquids

of densities 2ρ and ρ as shown in the figure is



A. $\sqrt{6gh}$

B. $2\sqrt{gh}$

C. $2\sqrt{2gh}$

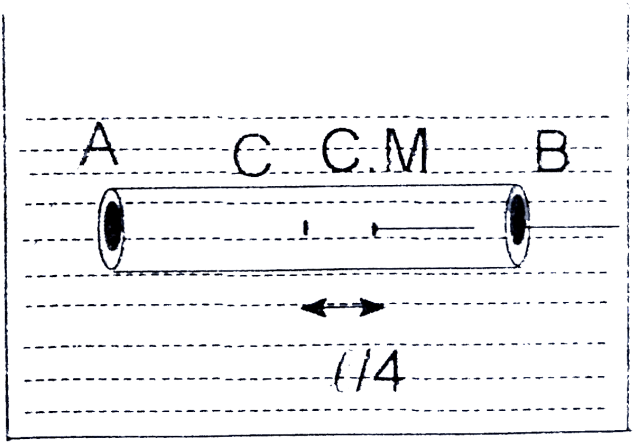
D. $\sqrt{gh}$

Answer: B

Watch Video Solution

9. A non uniform cylinder of mass m, length l and radius r having its C.O.M at a distance $\frac{l}{4}$ from centre and lying on axis of cylinder . The cylinder is kept in a liquid of uniform density ρ. The moment of inertia of the rod about C.O.M is I. The angular acceleration of point A relative to point B just after the rod is released from

position shown in figure is .



A. $\frac{\pi\rho gl^2r^2}{I}$

B. $\frac{\pi\rho gl^2r^2}{4I}$

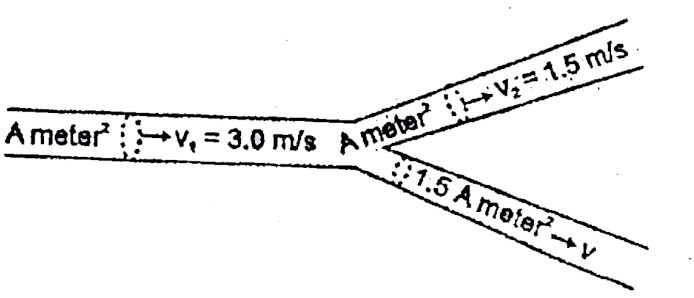
C. $\frac{\pi\rho gl^2r^2}{2I}$

D. $\frac{3\pi\rho gl^2r^2}{4I}$

Answer: C

Watch Video Solution

10. An incompressible liquid flows through a horizontal tube as shown in the figure. Then the velocity 'v' of the fluid is:



A. 3.0 m/s

B. 1.5 m/s

C. 1.0 m/s

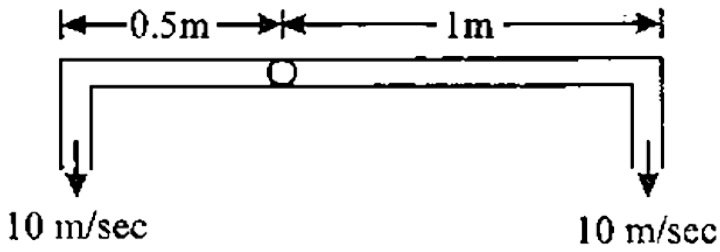
D. 2.25 m/s

Answer: D

Watch Video Solution

11. An unsymmetrical sprinkler the top view of the setup has frictionless shaft and equal fluid flows through each nozzle with a velocity of 10 m/sec relative to nozzle. If the shaft is rotating

at constant angular speed then its angular speed of rotation is :



A. 3 rad/s

B. 4 rad/s

C. 2 rad/s

D. 10 rad/s

Answer: D

View Text Solution

12. The centre of buoyancy of a floating object is :

A. At the centre of gravity of the object

B. At the centre of gravity of the submerged part of the object

C. At the centre of gravity of the remaining part outside the fluid of the object

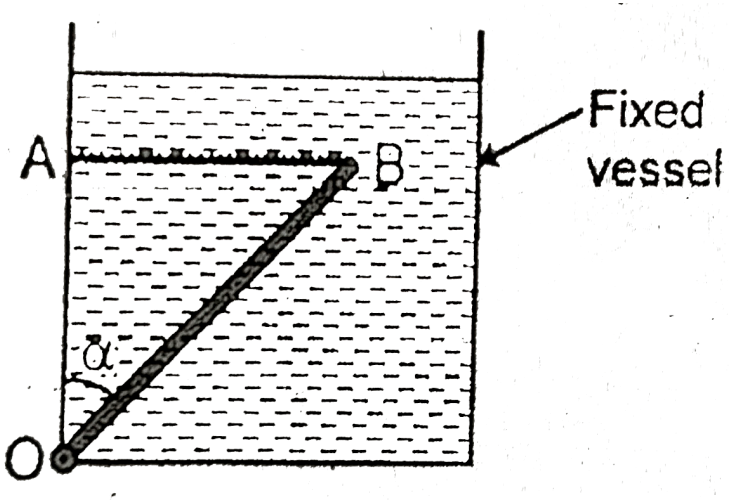
D. At the centre of gravity of the fluid displaced by the submerged part of the object.

Answer: B

Watch Video Solution

13. A uniform rod OB of length $1m$, cross-sectional areal $0.012m^2$ and relative density 2.0 is free to rotate about smooth hinge O in vertical plane. The rod is held with a horizontal string AB which can withstand a maximum tension of $45N$. The rod and string system is kept in water as shown in figure. The maximum value of angle α which the rod can make with

vertical without breaking the string is



A. 45°

B. 37°

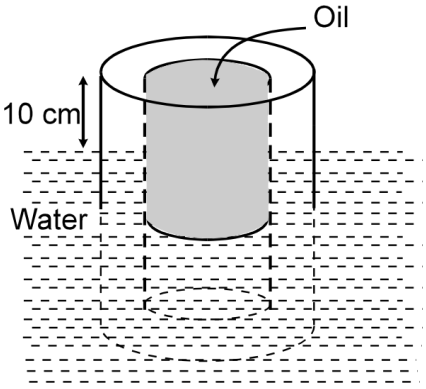
C. 53°

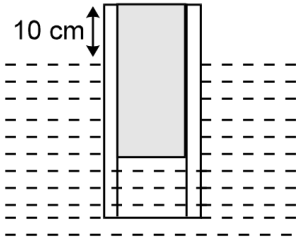
D. 60°

Answer: C

Watch Video Solution

14. A tube with both ends open floats vertically in water. Oil with a density 800 kg/m^3 is poured into the tube. The tube is filled with oil upto the top end while in equilibrium. The portion out of the water is of length 10 cm. The length of oil in the tube is $10\alpha cm$. Find α (assume effect of surface tension is neglible):





A. 50 cm

B. 60 cm

C. 90 cm

D. 100 cm

Answer: A

Watch Video Solution

15. Following are some statements about buoyant force : (Liquid is of uniform density)

(i)Buoyant force depends upon orientation of

the concerned body inside the liquid.

(ii)Buoyant force depends upon the density of the body immersed.

(iii)Buoyant force depends on the fact whether the system is on moon or on the earth.

(iv)Buoyant force depends upon the depth at which the body (fully immersed in the liquid) is placed inside the liquid. Of these statements :

A. Only (i),(ii) and (iii),(iv) are correct

B. Only (ii) is correct

C. Only (iii) and (iv) are correct

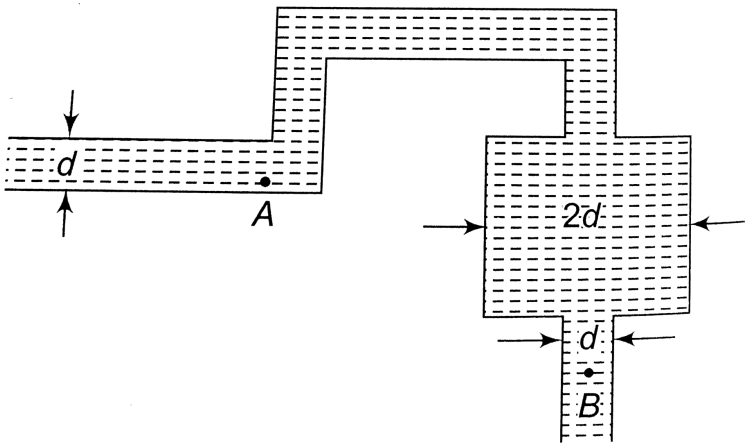
D. (i),(ii) and (iv) are incorrect

Answer: D

Watch Video Solution

16. An ideal fluid is flowing through the given tubes which is placed on a horizontal surface. If the liquid has velocities V_A and V_B and pressure P_A and P_B at point A and B respectively, then the correct relation is (A and B are at same height from ground level. the figure shown is as

in the system is seen from the top):



A. $V_A > V_B, P_A < P_B$

B. $V_A < V_B, P_A > P_B$

C. $V_A = V_B, P_A = P_B$

D. $V_A > V_B, P_A = P_B$

Answer: C

Watch Video Solution

17. There is a small hole in the bottom of a fixed container containing a liquid upto height $'h'$. The top of the liquid as well as the hole at the bottom are exposed to atmosphere. As the liquid come out of the hole. (Area of the hole is $'a'$ and that of the top surface is $'A'$) :

A. The top surface of the liquid accelerates with acceleration =g

B. The top surface of the liquid accelerates with acceleration $=g\frac{a^2}{A^2}$

C. The top surface of the liquid retards with retardation $=g\frac{a}{A}$

D. The top surface of the liquid retards with retardation $=\frac{ga}{A}$

Answer: D

Watch Video Solution

18. A fixed container of height H with large cross-sectional area A is completely filled with water. Two small orifice of cross-sectional area a are made, one at the bottom and the other on the vertical side of the container at a distance H/2 from the top of the container find the time taken by the water level to reach a height of H/2 from the bottom of the container.

A. $\frac{2A}{3a}\sqrt{\frac{2H}{g}}$

B. $\frac{2A}{3a}\left(\sqrt{2}-1\right)\sqrt{\frac{H}{g}}$

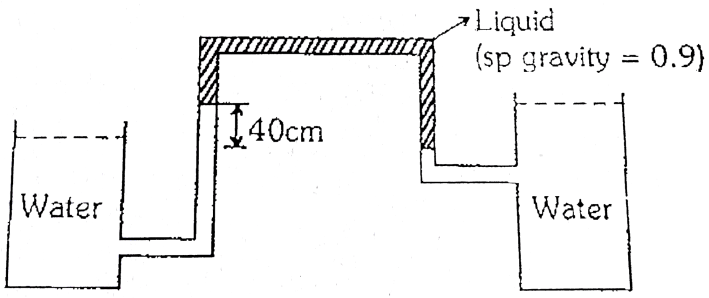
C. $\frac{3A}{2a}\left(\sqrt{2}-1\right)\sqrt{\frac{H}{g}}$

D. $\frac{3A}{2a}\sqrt{\frac{2H}{g}}$

Answer: A

Watch Video Solution

19.



The manometer shown below is used to measure the difference in water level between the two

tanks. Calculate this difference for the conditions indicated.

A. 2 cm

B. 4 cm

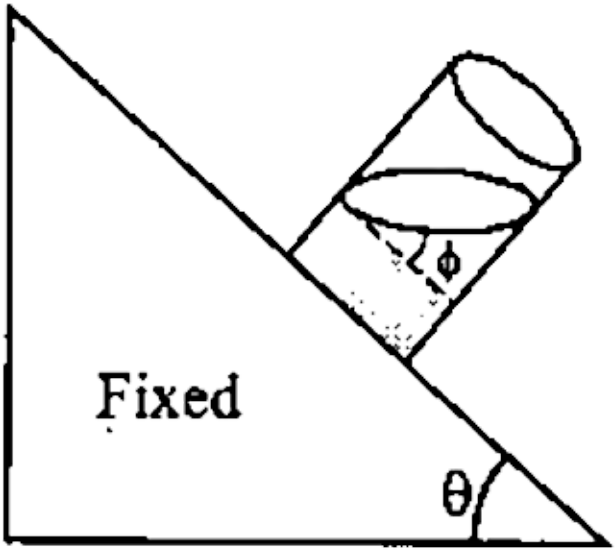
C. 6 cm

D. 8 cm

Answer: A

Watch Video Solution

20. A cylinderical vessel filled with water is released on a fixed inclined surface of angle θ as shown in figure. The friction coefficient of surface with vessel in $\mu(< \tan\theta)$. Then the constant with the incline will be (Neglect the viscosity of liquid)



A. $\tan^{-1}\mu$

B. $\theta - \tan^{-1}\mu$

C. $\theta + \tan^{-1}\mu$

D. $\cot^{-1}\mu$

Answer: D

View Text Solution

21. A copper piece of mass 10 g is suspended by a vertical spring. The sprig elongates 1 cm over its natural length to keep the piece in equilibrium. A

beaker containing water is now placed below the piece so as to immerse the piece completely in water. Find the elongation of the spring. Density of copper =9000 kgm^-3. $Takeg = 10ms^{-2}$

A. 0.45 cm

B. 0.89 cm

C. 1.02 cm

D. 1.86 cm

Answer: B

Watch Video Solution

22. A vessel contains oil (density $= 0.8 gm/cm^3$) over mercury (density $= 13.6 gmcm^3$). A homogeneous sphere floats with half its volume immersed in mercury and the other half in oil. The density of the material of the sphere in gm/cm^3 is

A. 3.3

B. 6.4

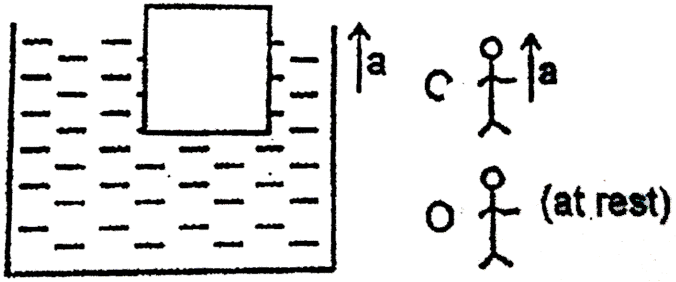
C. 7.2

D. 12.8

Answer: D

Watch Video Solution

23. A block is partially immeresed in a liquid and the vessel is accelerating upwards with an acceleration 'a'. The block is observed by two observers O_1 and O_2, one at rest and the other accelerating with an acceleration 'a' upward. The total buoyant force on the block is :



A. same for O_1 and O_2

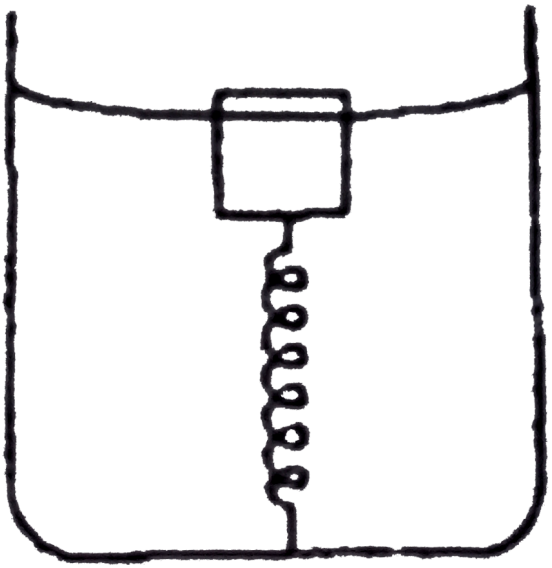
B. greater for O_1 than O_2

C. greater for O_2 than O_1

D. data is not sufficient

Answer: C

 Watch Video Solution



24.

A cubical block of wood of edge 3 cm floats in water. The lower surface of the cube just touches the free end of a vertical spring fixed at the bottom of the pot. Find the maximum weight that can be put on the block without wetting it. Density of wood $= 800kg/m^3$ and spring

constant of the spring $= 50N/m$. Take $g = 10m/s^2$

A. 0.1 N

B. 0.35 N

C. 0.5 N

D. 0.7 N

Answer: D

Watch Video Solution

25. A large block of ice cuboid of edge length 'l' and density $\rho_{ice} - 0.9\rho_w$, has a larger vertical hole along its axis. This block is floating in a lake. Find out length of the rope required to raise a bucket of water through the hole.

A. l/2

B. l/4

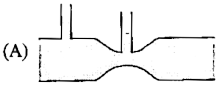
C. l/8

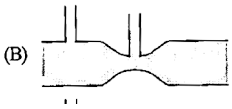
D. l/10

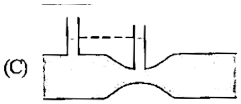
Answer: D

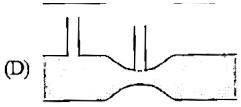
Watch Video Solution

26. For a fluid which is flowing steadily, the level in the vertical tubes is best represented by

A. 

B. 

C. 

D. 

Answer: B

Watch Video Solution

Watch Video Solution

27. A cylindrical wooden float whose base area S and the height H drift on the water surface. Density of wood d and density of water is ρ. What minimum work must be performed to take the float out of the water ?

A. $\frac{S^2gd}{2\rho}$

B. $\frac{Sgd^2H^2}{\rho}$

C. $\frac{Sgd^2H^2}{2\rho}$

D. $\frac{2S^3gd^2}{\rho H^2}$

Answer: C

Watch Video Solution

28. A circular cylinder of height $h_0 = 10cm$ and radius r_0=2 cm is opened at the top and filled with liquid. It is rotated about its vertical axis. Determine the speed of rotation so that half the area of the bottom gets exposed ($g = 10m/s^2$):

A. 25 rad/s

B. 50 rad/s

C. 100 rad/s

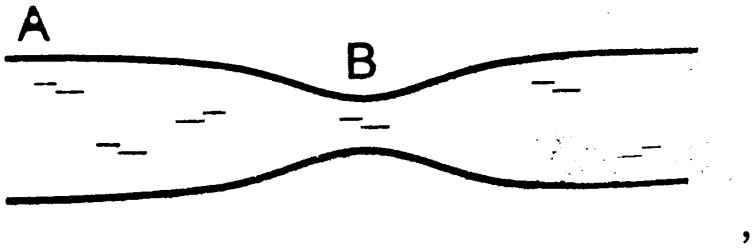
D. 200 rad/s

Answer: D

Watch Video Solution

29. Water flows ina horizontla tube as shown in figure. The pressure of water changes by 600 N m^-2 between A and B whre the areas of cross section asre `30cm^2 and 15cm^2 respectively.

Find the rate of flow of water through the tube.



,

A. $600c\frac{m^3}{s}$

B. $1200cm^3/s$

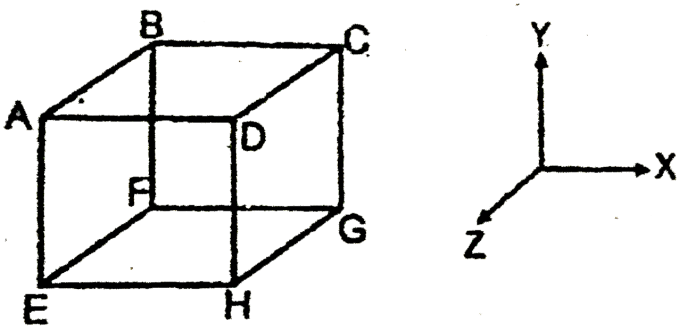
C. $1800cm^3/s$

D. $2400cm^3/s$

Answer: B

Watch Video Solution

30. The cubical container ABCDEFGH which is completely filled with an ideal (nonviscous and incompressible) fluid, moves in a gravity free space with a acceleration of $a = a_0\left(\hat{i} - \hat{j} + \hat{k}\right)$ where a_0 is a positive constant. Then the minimum pressure at the point will be



A. B

B. C

C. E

D. H

Answer: D

Watch Video Solution

31. To measure the atmospheric pressure, four different tubes of length 1m, 2m , 3m and 4m are used. If the height of the mercury column in the tubes is h_1, h_2, h_3, h_4 respectively in the four cases, then $h_1 : h_2 : h_3 : h_4$

A. 1:2:3:4

B. 4:3:2:1

C. 1:2:2:1

D. 1:1:1:1

Answer: B

View Text Solution

32. An open tank $10m$ long and $2m$ deep is filled up to $1.5m$ height of oil of specific gravity 0.82. The tank is uniformly accelerated along its

length from rest to a speed of $20m/s$ horizontally. The shortest time in which the speed may be attained without spilling any oil is

A. 20

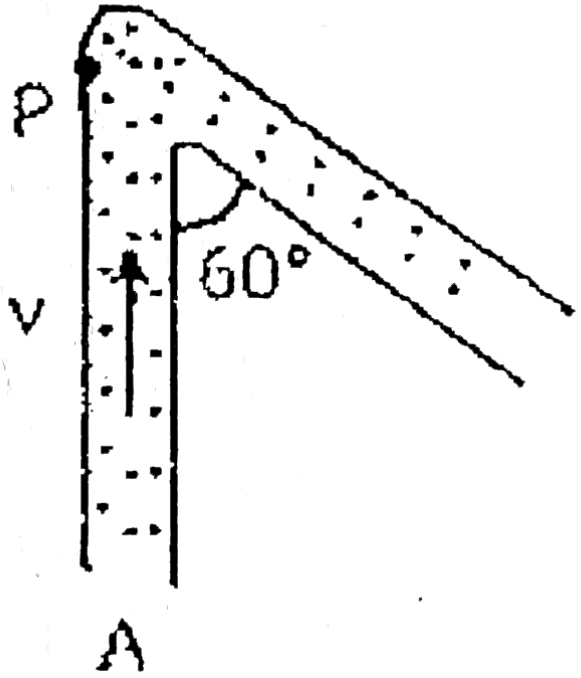
B. 18s

C. 10 s

D. 5s

Answer: B

Watch Video Solution



33.

Water (density ρ) is flowing through the uniform tube of cross-sectional area A with a constant speed v as shown in the figure. Find the magnitude of force exerted by the water on the

curved corner of the tube is (neglect viscous forces)

A. $\sqrt{3}\rho A v^2$

B. $2\rho A v^2$

C. $\sqrt{2}\rho A v^2$

D. $\frac{\rho A v^2}{\sqrt{2}}$

Answer: B

Watch Video Solution

34. An open rectangular tank 1.5 m wide 2m deep ad 2 m long is half filled with water. It is accelerated horizontally at $3.27m/s^2$ in the direction of its length determine the depth of water at each end of tank.

A. 0.9 m

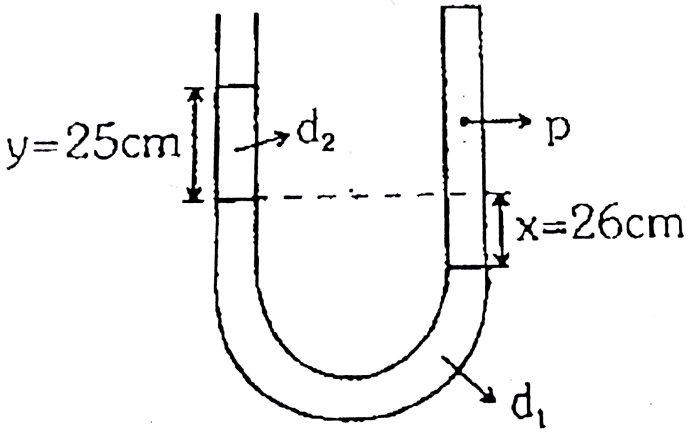
B. 1.2 m

C. 1.5 m

D. 1.7 m

Answer: C

Watch Video Solution



35.

In a given U-tube (open at one-end) find out relation between p and p_a

Given

$d_2 = 2 \times 13.6 gm/cm^3, d_1 = 13.6 gm/cm^3$

A. $p_{atm} = p$

B. $p_{atm} = 2p$

C. $p_{atm} = p/2$

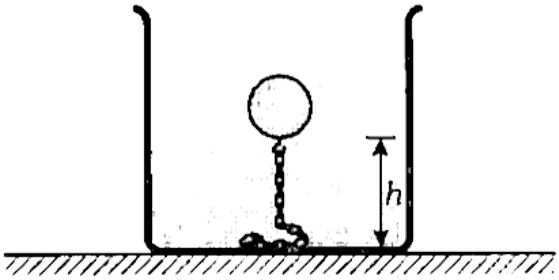
D. $p_{atm} = p/4$

Answer: B

Watch Video Solution

36. One end of a long iron chain of linear mass density λ is fixed to a sphere of mass m and specific density 1/3 while the other end is free. The sphere along with the chain is immersed in a

deep lake. If specific density of iron is 7 , the height h above the bed of the lake at which the sphere will float in equilibrium is (assume that the part of the chain lying on the bottom of the lake exerts negligible force on the upper part of the the chain)



A. $\frac{16}{7}\frac{m}{\lambda}$

B. $\frac{7m}{3\lambda}$

C. $\frac{5m}{2\lambda}$

D. $\frac{8m}{3\lambda}$

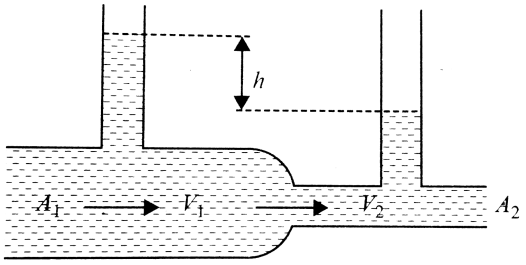
Answer: B

Watch Video Solution

Advanced Mcq With One Or More Options Correct

1. A liquid flows through a horizontal tube. The velocities of the liquid in the two sections, which have areas of cross section A_1 and A_2 are v_1 and v_2 respectively. The difference in the levels of the

liquid in the two vertical tubes is h. Then



A. The volume of the liquid flowing through the tube in unit time is $A_1 v_1$

B. $v_2 - v_1 = \sqrt{2gh}$

C. $v_2^2 - v_1^2 = 2gh$

D. The energy per unit mass of the liquid is the same in both sections of the tube

Answer: A

Watch Video Solution

2. An object is weighted at the North Pole by a beam balance and a spring balance, giving readings of W_B and W_S respectively. It is again weighed in the same manner at the equator, giving readings of W'_B and W'_S respectively. Assume that the acceleration due to gravity is the same everywhere and that the balance are quite sensitive, Choose the wrong option

A. $W_B = W_S$

B. $W'_B = W'_S$

C. $W_B = W'_B$

D. $W'_S < W_S$

Answer: A::B::C

Watch Video Solution

3. A spring balance reads W_1 when a ball is suspended from it. A weighing machine reads W_2 when a tank of liquid is kept on it. When the ball is immersed in the liquid, the spring balance

reads W_3 and the weighing machine reads W_4.

Then, which of the following are not correct?

A. $W_1 > W_3$

B. $W_1 < W_3$

C. $W_2 < W_4$

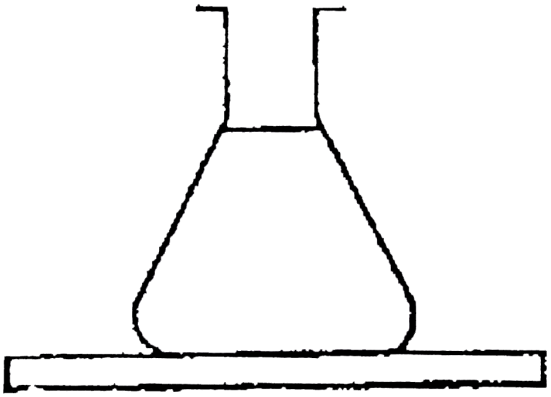
D. $W_2 > W_4$

Answer: B::D

Watch Video Solution

4. A spring balance reads W_1 when a ball is suspended from it. A weighing machine reads W_2 when a tank of liquid is kept on it. When the ball is immersed in the liquid, the spring balance reads W_3 and the weighing machine reads W_4. Then, which of the following are not correct?

Watch Video Solution



5.

A massless conical flask filled with a liquid is kepth on t a table in a vacuum the force exerted by the liquid on the bse of the flask is W_1. Th force exerted by the flask on the table is W_2

A. $W_1 = W_2$

B. $W_1 > W_2$

C. $W_1 < W_2$

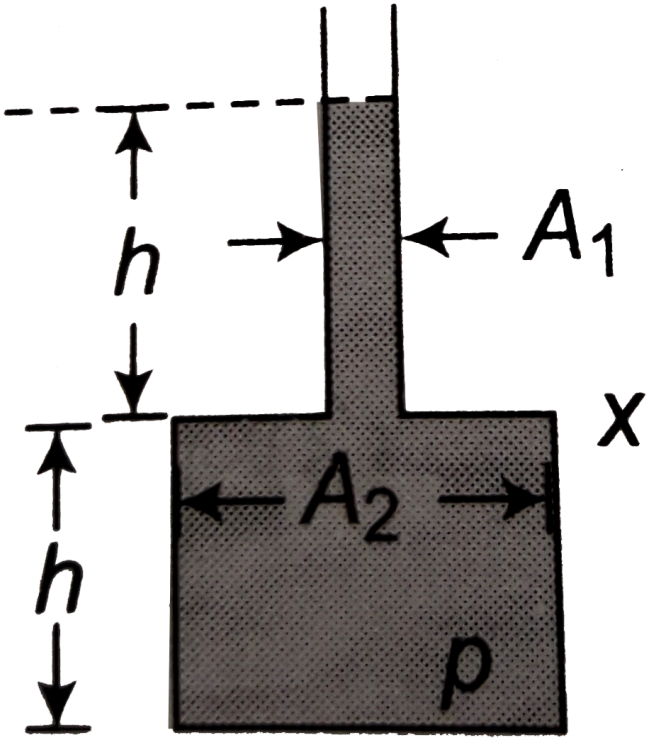
D. The force exerted by the liquid on the walls of the flask is $(W_1 - W_2)$

Answer: B::C

Watch Video Solution

6. The vessel shown in the figure has a two sections of areas of cross-section A_1 and A_2. A liquid of density ρ fills both th sections, up to a height h in each Neglect atmospheric pressure.

Choose the wrong option.



A. The pressure at the base of the vessel is

$2h\rho g$

B. The force exerted by the liquid on the base of the vessel is $2h\rho gA_2$

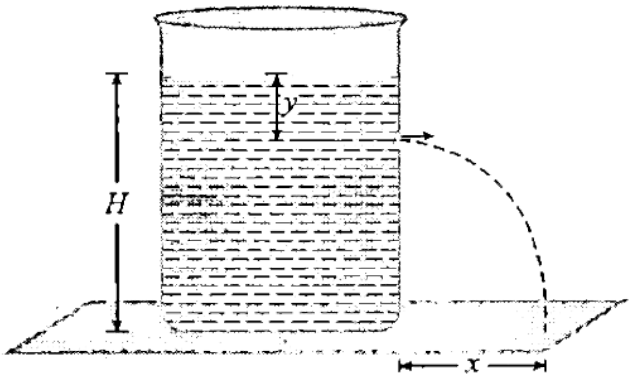
C. The weight of the liquid is $< 2h\rho gA_2$

D. The walls of the vessel at the level X exert a downward force $h\rho g(A_2 - A_1)$ on the liquid

Answer: B::D

Watch Video Solution

7. A tank, which is open at the top, contains a liquid up to a height H. A small hole is made in the side of the tank at a distance y below the liquid surface. The liquid emerging from the hole lands at a distance x from the tank :



A. IF y is increased from zero to H, x will first increase and then decrease

B. x is maximum for $y = H/2$

C. The maximum value of x is H

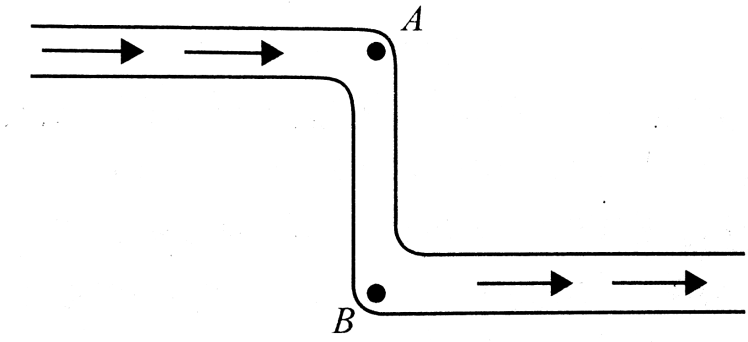
D. The maximum value of x will depend on the density of the liquid

Answer: B::C

Watch Video Solution

8. In the figure, an ideal liquid flows through the tube, which is of uniform cross section. The liquid has velocities v_A and v_B, and pressures P_A

and P_B at the points A and B, respectively. Then



A. $v_A = v_B$

B. $v_B > v_A$

C. $p_A = p_B$

D. $p_B > p_A$

Answer: A::C

Watch Video Solution

9. A liquid of density ρ comes out with a velocity v from a horizontal tube of area of cross-section A. The reaction force exerted by the liquid on the tube is F :

A. $F \propto v$

B. $F \propto v^2$

C. $F \propto A$

D. $F \propto \rho$

Answer: A::B::C

Watch Video Solution

10. A piece of ice is floating in water. What will happen to the level of water when all ice melts? What will happen if the beaker is filled not with water but with liquid

a. denser than water,

b. lighter than water?

A. level remains same if liquid is water

B. level fallls if liquid is water

C. level will rise if liquid is denser than water

D. level will rise if liquid is lighter than water

Answer: B::C::D

Watch Video Solution

11. A beaker exactly full of water has an ice piece floating on it. As the cube melts what happens to the water level if

(a) the cube contains an air bubble,

(b) lead piece and

(c) a cork piece.

A. it remains unchanged if the tube contains an air bubble

B. the level falls if the cube contains some lead pieces inside it

C. the level will rise if the cube contains some cork pieces inside

D. the level remains the same if the cube contains some cork pieces inside it

Answer: B::C

Watch Video Solution

12. An iron casting weighs 27kg in air 18kg in water. What is the volume of the covities in the casting ? (Density of iron $= 7800kgm^{-3}$)

A. outer volume of casting is $6000cm^3$

B. outer volume of casting is $9000cm^3$

C. volume of cavity inside the casting is $780cm^3$

D. volume of cavity inside the casting is $5538cm^3$

Answer: A::B::C

Watch Video Solution

13. A ball of density d is dropped on to a horizontal solid surface. It bounces elastically from the surface and returns to its original position in a time t_1. Next, the ball is released and it falls through the same height before striking the surface of a liquid of density of d_L

(a) If $d < d_L$, obtain an expression (in terms of d, t_1 and d_L) for the time t_2 the ball takes to come back to the position from which it was released.

(b) Is the motion of the ball simple harmonic?

(c) If $d = d_L$, how does the speed of the ball depend on its depth inside the liquid? Neglect all frictional and other dissipative forces. Assume the depth of the liquid to be large.

A. $t_2 > t_1$

B. $t_2 > t_1$

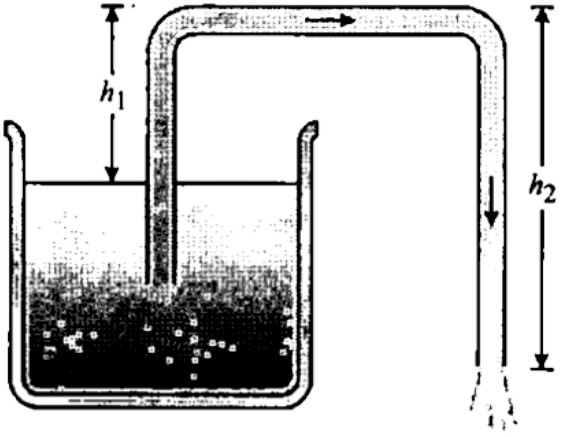
C. the motion of the ball is not simple harmonic

D. If $\rho = \rho_L$, then the speed of the ball inside the liquid will be independent of its depth

Answer: A::C::D

Watch Video Solution

14. Siphon is a device to transfer liquid from a higher level to a lower level. The condition of working of a siphon is :



A. $h_2 > h_1$

B. $h_2 = 2h_1$

C. h_1 should be less the height of corresponding liauid barometer

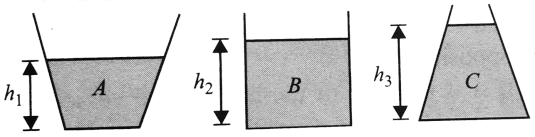
D. h_1 should be greater than the height of corresponding liquid barometer

Answer: A::C

Watch Video Solution

15. Equal volumes of a liquid are poured in the three vessels A, B and $C(h_1 < h_2 < h_3)$. All the vessels have the same base area. Select the

correct alternatives.



A. The force on the base will maximum in vessel A

B. The force on the base will be maximum in vessel C

C. Net force exerted by liquid in all the three vessels is equal

D. Net force exerted by liquid in vessel A is maximum

Answer: A::D

16. Water is flowign is streamline motion through a tube with its axis horizontal. Consider two points A and B in the tube at the same horizontal level

A. the pressure at A and B are equal for any shape of the tube

B. the pressure can never be equal

C. the pressure are equal if the tube hs a uniform cross-section

D. the pressure may be equal even if the tube has a non-uniform cross-section

Answer: B::C::D

Watch Video Solution

17. A vessel is fileld with mercury to a height of $0.9m$. Barometric height is $0.7m$. mercury :

A. the vessel can be completely emptied with the aid of a siphon.

B. the vessel cannot be emptied completely with the aid of a siphon

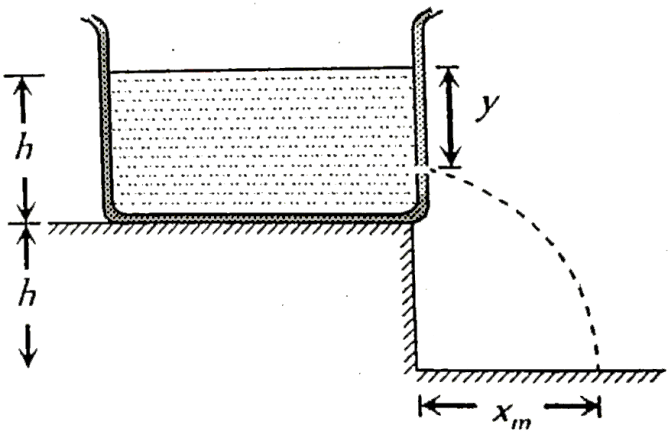
C. the vessel can be emptied with at least $0.7m$ height of mercury remaining in the vessel

D. none of these

Answer: C::D

Watch Video Solution

18. A tank is filled upto a height h with a liquid and is placed on a platform of height h from the ground. To get maximum range x_m a small hole is punched at a distance of y from the free surface of the liquid. Then



A. $x_m = 2h$

B. $x_m = 1.5h$

C. $y = h$

D. $y = 0.75h$

Answer: A

Watch Video Solution

Unsolved Numerical Problems

1. A block of wood floats in water two-thirds of its volume submerged. In oil the block of floats with

0.90 of its volume submerged. Find the density of (a) wood and (b) oil, if density of water I $10^3 kg/m^3$.

Watch Video Solution

2. A balloon filled with hydrogen has a volume of $1m^3$ and its mass is $1kg$. What would be the volume of the block of a very light material which it can just lift ?

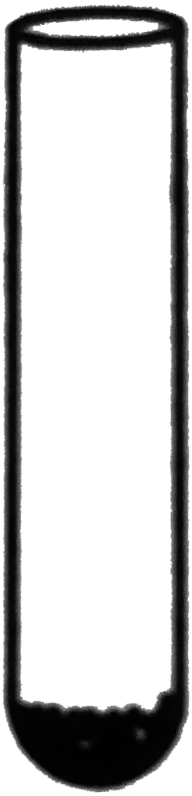
Watch Video Solution

3. A horizontal pipeline carries water in a streamline flow. At a point along the pipe, where the cross- sectional area is $10cm^2$, the water velocity is $1ms^{-1}$ and the pressure is 2000 Pa. The pressure of water at another point where the cross-sectional area is $5cm^2$, is.....Pa. (Density of water $= 10^3 kg.\, m^{-3}$)

Watch Video Solution

4. A glass tube of radius $0.8cm$ floats vertical in water, as shown in figure. What mass of lead pellets would cause the tube to sink a further

$3cm$?



Watch Video Solution

5. When equal volumes of two substances are mixed together, the specific gravity of the mixture is 5. But when equal weights of the same substance are mixed together, the specific gravity of the two is 3. Find the specific gravity of two substances.

Watch Video Solution

6. Water from a tap emerges vertically downwards with an initial spped of $1.0ms^{-1}$. The cross-sectional area of the tap is $10^{-4}m^2$.

Assume that the pressure is constant throughout the stream of water, and that the flow is steady. The cross-sectional area of the stream 0.15 m below the tap is

Watch Video Solution

7. A piece of metal floats on mercury. The coefficient of volume expansion of metal and mercury are γ_1 and γ_2, respectively. if the temperature of both mercury and metal are increased by an amount ΔT, by what factor does

the fraction of the volume of the metal submerged in mercury changes ?

Watch Video Solution

8. 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

Watch Video Solution

9. A tank 5 m high is half filled with water and then is filled to top with oil of density $0.85g/cm^3$ The pressure at the bottom of the tank, due to these liquids is

Watch Video Solution

10. A stone of density $2.5g/cm^3$ completely immersed in sea water is allowed to sink from rest. Calculate the depth to which the stone would sink in two seconds. Neglect the effect of

friction. Specific gravity of sea water is 1.025 and acceleration due to gravity is $9.8m / s^2$.

Watch Video Solution

11. A cube of wood supporting 200gm mass just floats in water. When the mass is removed, the cube ruses by 2cm. What is the size of the cube?

Watch Video Solution

12. Water is flowing continuously from a tap having an internal diameter 8×10^{-3}m. The water velocity as it leves the tap is $0.4ms^{-1}$. The diameter of the water stream at a distance 2×10^{-1}m below the tap is close to $(g = 10m/s^2)$

Watch Video Solution

13. A certain block weighs 15 N in air. But is weighs only 12 N when completely immersed in water. When immersed completely in another

liquid, it weighs 13 N. Calculate the relative density of (i) the block and (ii) the liquid.

Watch Video Solution

14. A cylindrical tank $1m$ in radius rests on a platform $5m$ high. Initially the tank is filled with water to a height of $5m$. A plug whose area is $10^{-4}m^2$, is removed from an orifice on the side of the tank at the bottom. Calculate the following :

(a) Initial speed with which the water flows from the orifice.

(b) Initial speed with which the water strikes the ground,

(c) Time taken to empty the tank to half its original value.

Watch Video Solution

15. A vertical uniform U tube open at both ends contains mercury. Water is poured in one limb until the level of mercury is depressed $2cm$ in that limb. What is the length of water column when this happens.

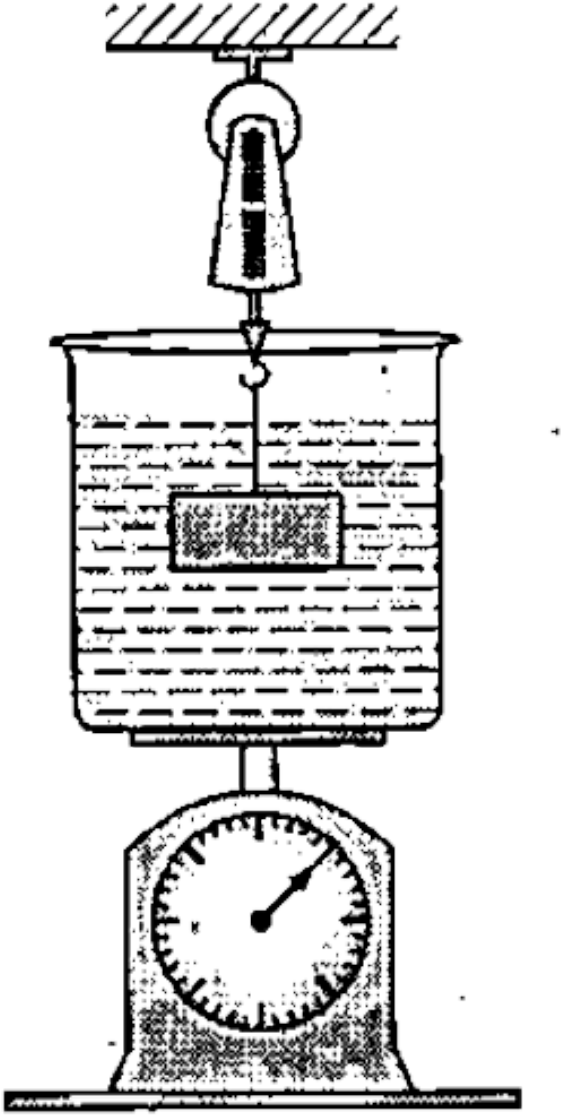
Watch Video Solution

16. A piece of copper having an internal cavity weights 264 g in air and 221 g in water. Find the volume of the cavity. Density of copper is $8.8g/cm^3$

Watch Video Solution

17. A beaker of mass 1 kg contains 2 kg of water and rests on a scale. A 2kg block of aluminum (specific gravity 2.70) suspended from a spring scale is suspended from a spring scale is

submerged in water, as shown in figure. Find the readings of both scales.



Watch Video Solution

18. A Piece of brass (alloy of zinc and copper) weighs 12.9 g in air. When completely immersed in water it weighs 11.3 g . What is the mass of copper contained in the alloy ? Specific gravity of zinc and copper are 7.1 and 8.9 respectively.

Watch Video Solution

19. Shows a hydraulic press with the larger piston of diameter $35cm$ at a height of $1.5m$

relative to the smaller piston of diameter $10cm$. The mass on the smaller piston is $20gk$. What is the force exerted on the load by the lerger piston ? The density of oil in the press is 750kgm^{-3}.

Watch Video Solution

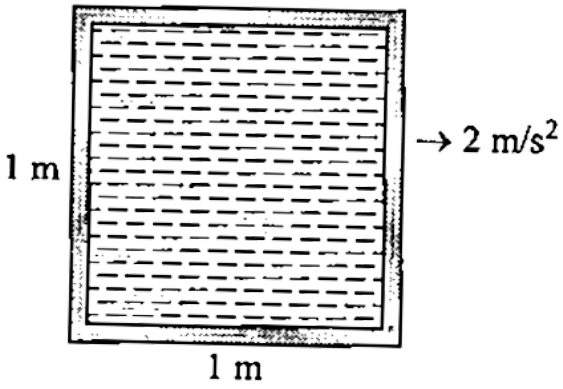
20. Two identical cyclindrical vessels (area of cross section $3.5 \times 10^{-3}m^2$) with their bases at the same level contain liquid of density $800kg/m^3$. The height of liquid in one vessel is 0.3 m and in the other it is $0.1m$. Assuming

$g = 10m/s^2$, find the workdone by gravity in equalising levels when the vessels are interconnected at bottom.

View Text Solution

21. An open cubical tank completely filled with water is kept on a horizontal surface. Its acceleration is then slowly increasesd to $2m/s^2$ as shown in the figure. The side of the tank is 1m. Find the mass of water that would spill out of

the tank.



Watch Video Solution

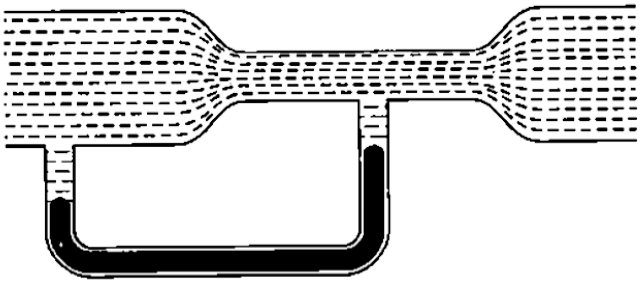
22. A vertical U-tube of uniform inner cross-section contains mercury in both of its arms. A glycerine $\left(\text{density} 1.3 \text{gcm}^{-3}\right)$ column of length $10 cm$ is introduced into one of the arms Oil of

density $0.8 \mathrm{gcm}^{-3}$ is poured in the other arm until the upper surface of the oil and glycerine are in the same horizontal level. Find the length of the oil column.

Watch Video Solution

23. Water flows through the tubes shown in figure. The areas of cross-section of the wide and the narrow portions of the tube are $5cm^2$ and $2cm^2$ respectively. The rate of flow of water through the tube is $500cm^3/s$. Find the

difference of mercury levels in the U-tube.



Watch Video Solution

24. A person can change the volume of his body by taking air into his lungs. The amount of change can be determined by weighing the person under water. Suppose that under water a person weighs 20.0 N with partially full lungs

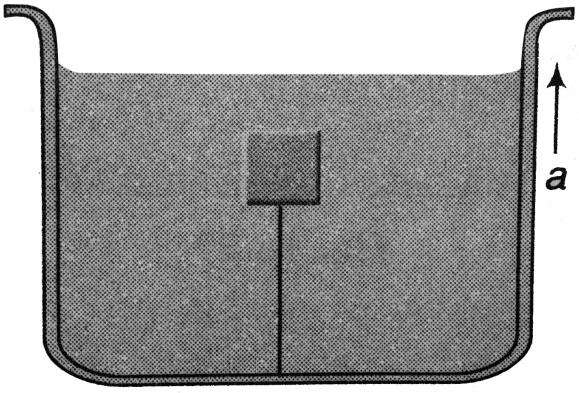
and 40.0 N with empty lungs. Find the change in body volume.

Watch Video Solution

25. A vessel contains oil (density $= 13.6 gm/cm^3$). A uniform sphere floats with half its volume immersed in mercury and the other half in oil. The density of the material of sphere in gm/cm^3 is:

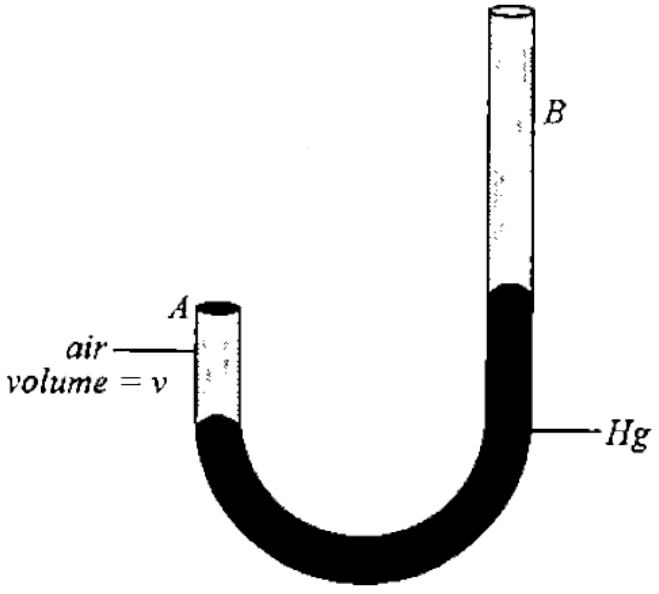
Watch Video Solution

26. The tension in a string holding a solid block below the surface of a liquid (of density greater than that of solid) as shown in figure is T_0 when the system is at rest. What will be the tension in the string if the system has an upward acceleration a?



Watch Video Solution

27. A J-tube, shown in figure, contains a volume V of dry air trapped in arm A of the tube. The atmoshpere pressure is H cm of mercury. When more mercury is poured in arm B, the volume of the enclosed air and its pressure changes. What should be the difference in mercury levels in the two arms so as to reduce the volume of air 1/2.



Watch Video Solution

28. A block of ice with an area A and a height h floats in water of density ρ_0. What work should be performed to submerge the ice block completely into water if density of ice is ρ_1 ?

Watch Video Solution

29. A solid ball of density half that of water falls freely under gravity from a height of 19.6 m and then enters water. Upto what depth will the ball

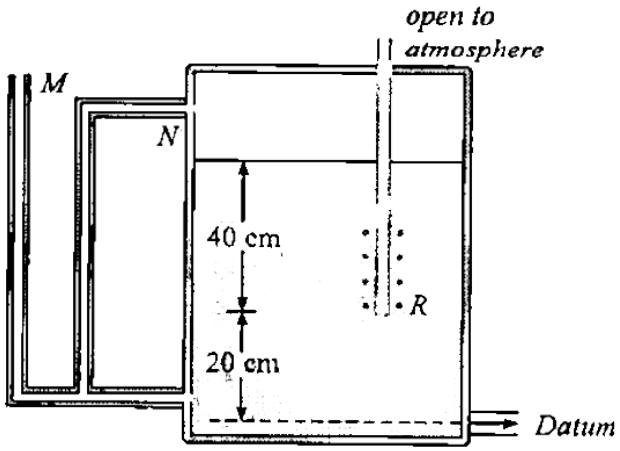
go? How much time will take to come again to the water surface? Neglect air resistance and viscosity effects in water $\left(g = 9.8m / s^2\right)$

Watch Video Solution

30. A U-tube containing a liquid is accelerated horizontally with a constant acceleration a_0. If the separation between the vertical limbs is l find the difference in the heights of the liquid in the two arms.

Watch Video Solution

31. The tank in figure discharges water at constant rate for all water levels above the air inlet R. Find the height above datum to which water would rise in the manometer tubes M and N.



View Text Solution

32. The time period of a sample pendulum is T. Now the bob is immersed in a liquid of density σ. If density of material of bob is ρ, what will be the time period of the pendulum.

Watch Video Solution

33. A rubber ball of mass m and radius r is submerged in water to a depth h and released. What height will the ball jump up to above the surface of the water? Neglect ther resistance of water and air. Take water density ρ.

Watch Video Solution

34. A cubical vessel of height 1 m is full of water. What is the workdone in pumping water out of the vessel?

Watch Video Solution

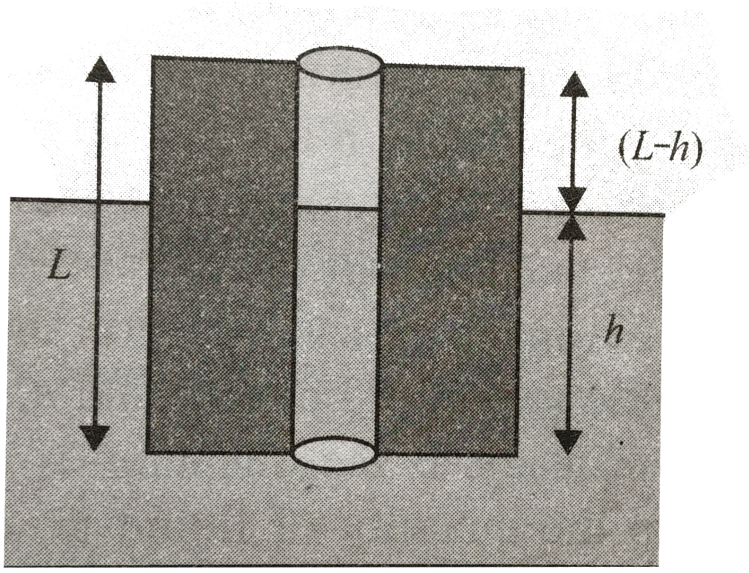
35. A tank is filled with water to a height H. A hole is punched in the wall at a depth h below the water surface. Find the distance x from the wall at which the stream strikes the floor. Could a

hole be punched at another depth so that this second stream would have the same range? If so at what depth? For what value of h is range maximum?

Watch Video Solution

36. A large block of ice $5m$ thick has a vertical hole drilled through it and is floating in the middle of a lake. What is the minimum length of a rope required to scoop up a bucket full of water through the hole? Relative density of ice

$= 0.9.$

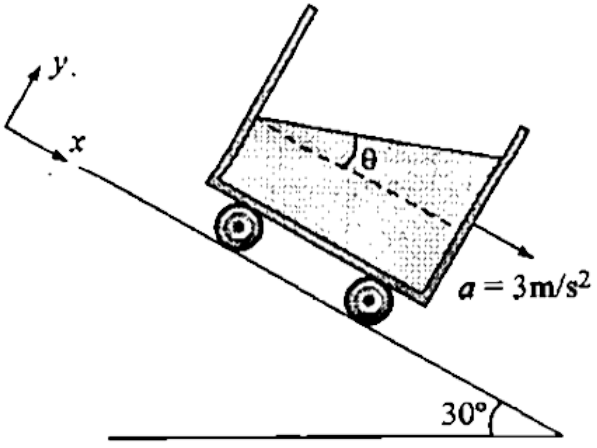


Watch Video Solution

37. A rectangular container of water undergoes constant acceleration down an incline as shown in figure. Determine the slope $\tan\theta$ of the free

surface using the coordinate system shown. Take

$g = 10m/s^2$



Watch Video Solution

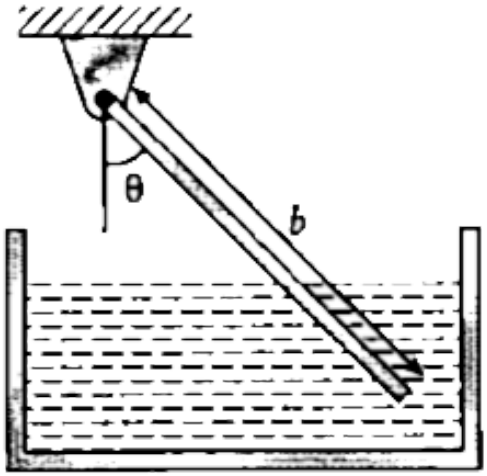
38. An iron casting containing a number of cavities weight $6000N$ in air and $4000N$ in water. What is the volume of the cavities in the casting?

Density of iron is $7.87g/cm^3$. Take $g = 9.8m/s^2$ and density of water $= 10^3 kg/m^3$.

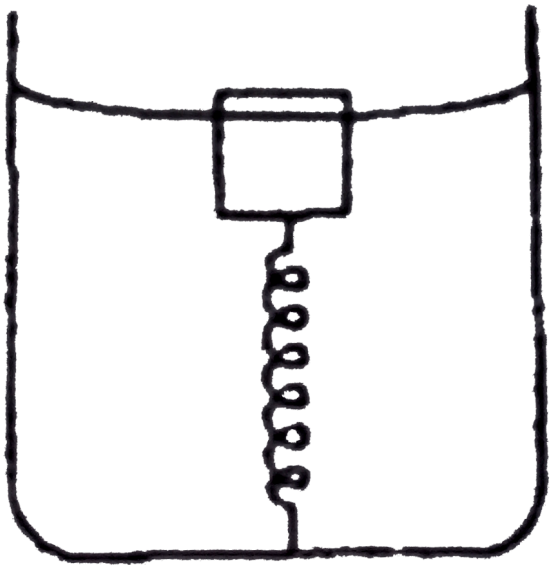
Watch Video Solution

39. A uniform rod of length b capable of tuning about its end which is out of water, rests inclined to the vertical. If its specific gravity is 5/9, find

the length immersed in water.



Watch Video Solution



40.

A cubical block of wood of edge 3 cm floats in water. The lower surface of the cube just touches the free end of a vertical spring fixed at the bottom of the pot. Find the maximum weight that can be put on the block without wetting it. Density of wood $= 800kg/m^3$ and spring

constant of the spring $= 50N/m$. Take $g = 10m/s^2$

Watch Video Solution

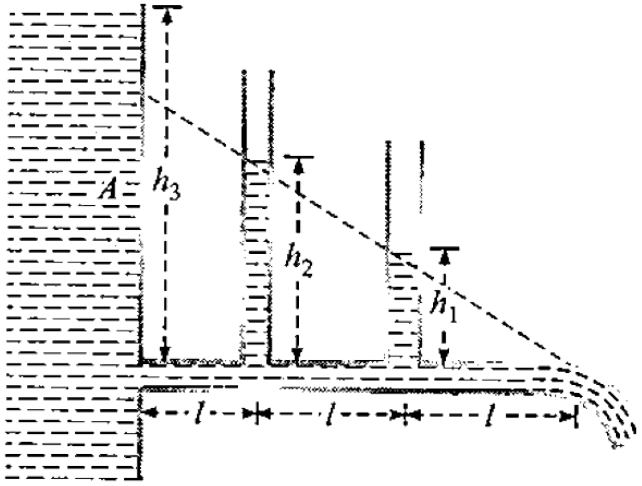
41. A tank is filled with a liquid upto a height H, A small hole is made at the bottom of this tank Let t_1 be the time taken to empty first half of the tank and t_2 time taken to empty rest half of the tank then find $\frac{t_1}{t_2}$

Watch Video Solution

42. A container of large uniform cross-sectional area A resting on a horizontal surface, holds two-immiscible, non-viscous & incompressible liquids of densities d & 2d, each of height $H/2$. The lower density liquid is open to the atmoshpere having pressure P_0. A homogeneous solid cylinder of length $L(L < H/2)$ corss-sectional area $A/5$ is immersed such that it floats with its axis vertical at the liquid interface with the length $L/4$ in the denser liquid. Determine : (i) The density D of the solid & (ii) The total pressure at the bottom of the container.

View Text Solution

43. In the arrangement shown in figure a viscous liquid whose density is $1gm/cm^3$ flows along a tube out of a wide tank A. Find the velocity of the liquid flow if $h_1 = 10cm, h_2 = 20cm, h_3 = 35cm.$ All the distances l are equal.



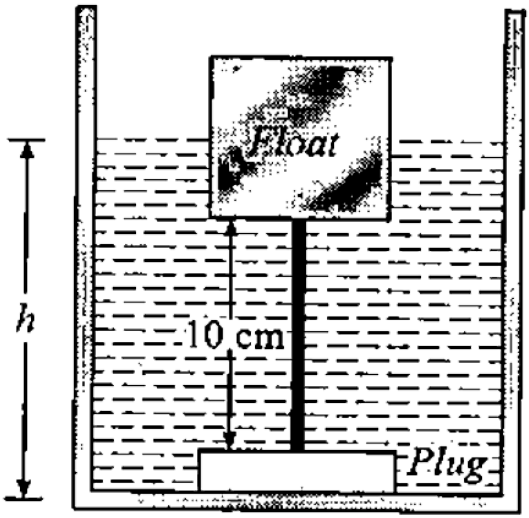
Watch Video Solution

44. A block of wood weighs 12 kg and has a relative density 0.6. It is to be in water with 0.9 of its volume immersed. What weight of a metal is needed (a) if the metal is on the top of wood, (b) if the metal is attached below the wood? [RD of metal =14]

View Text Solution

45. A level controller is shown in the figure it contains of a thin circular plug of diameter 10 cm and a cyclindrical plug of diameter 20 cm tied together with a light rigid rod of length 10 cm. The plug fits in smoothly in a dram hole at the bottom of the tank which opens into atmosphere. As water fills up and the level reaches height h, the plug opens. Find h. Determine the level of water in the tank when the plug closes again. The float has a mass 3kg

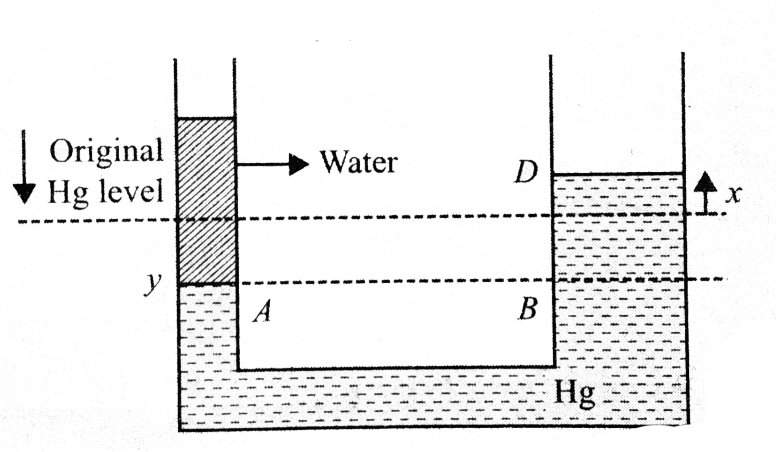
and the plug may be assumed as massless.



View Text Solution

46. Two communicating cylindrical tubes contain mercury. The diametr of one vessel is four times large than the diameter of the outer. A column

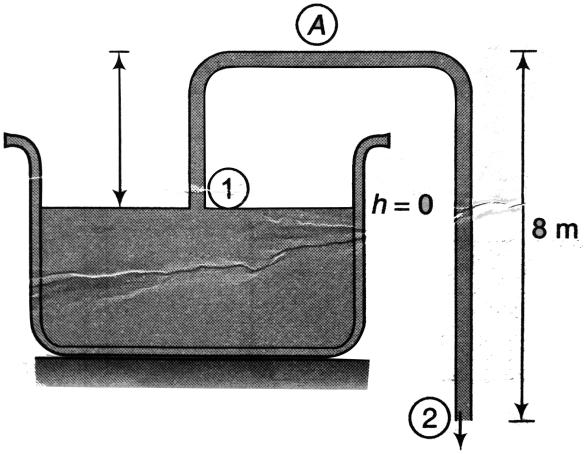
of water of heigt $70cm$ is poured into the narrow vessel. How much wil the mercury level rise in the other vessel and how much will it sink in the narow one? How much will the mercury level rise in the narrow vessel, if a column of water of the same height is pured into the broad vessel?



Watch Video Solution

47. The U-tube acts as a water siphon. The bend in the tube is 1m above the water surface. The tube outlet is 7m below the water surface. The water issues from the bottom of the siphon as a free jet at atmospheric pressure. Determine the speed of the free jet and the minimum absolute pressure of the water in the bend. Given atmospheric pressure $= 1.01 \times 10^5 N/m^2, g = 9.8 m/s^2$ and density

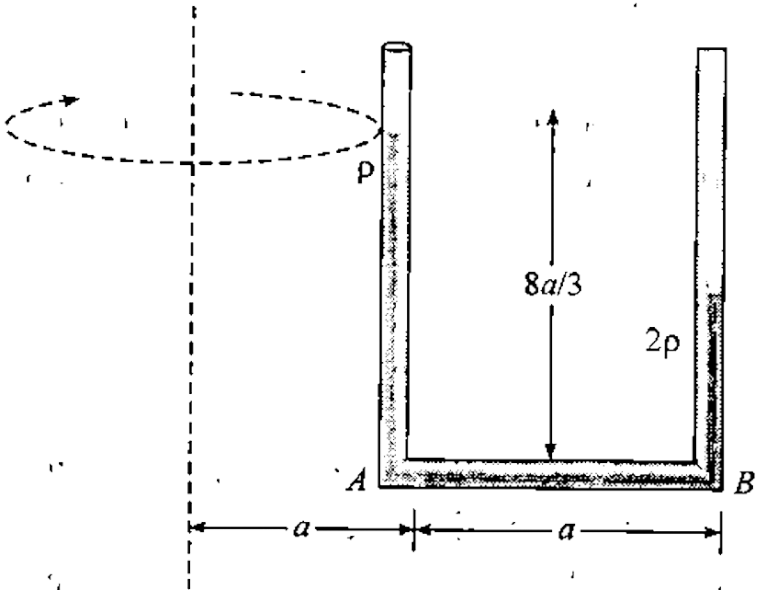
of water $= 10^3 kg/m^3$



Watch Video Solution

48. The interface of two liauids of densities ρ and 2ρ respectively lies at the point A in a U tube at

rest. The height of liquid columb above A is $8a/3$ where AB = a. The cross-sectional area of the tube is S. With what angular velocity the tube must be whirled about a vertical axis at a distance 'a' such that the interface of the liquids shifts towards B by $2a/3$.

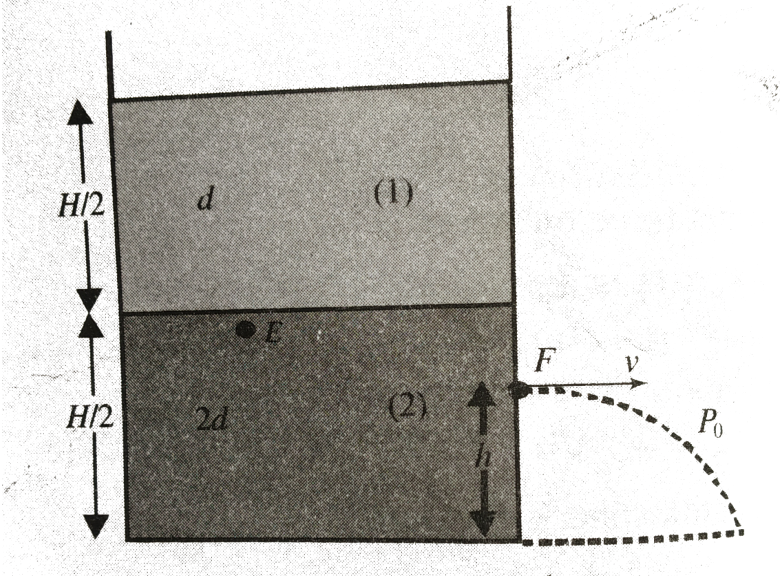


View Text Solution

49. A wooden stick of length L, radius R and density ρ has a small metal piece of mass m (of negligible volume) attached to its one end. Find the minimum value for the mass m (in terms of given parameters) that would make the stick float vertically in equilibrium in a liquid of density $\sigma(>\rho)$.

Watch Video Solution

50. A container of large uniform cross sectional area A, resting on horizontal surface, holds two immiscible non viscous and incompressible liquids of density d and $2d$, each of height $\frac{H}{2}$ as shown in the figure. The lower density liquid is open to the atmosphere having pressure P_0. A tiny hole of area $(s(s << A)$ is punched on the vertical side of the container at a height $h\left(h < \frac{H}{2}\right)$. Determine



a.the initial speed of efflux of the liquid at the hole

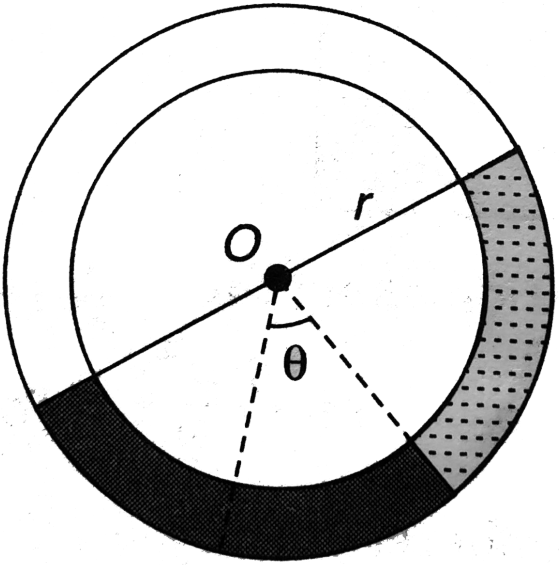
b. the horizontal disance x travelled by the liquid initially

c. the height h_m at which at the hole should be punched so that the liquid travels the maximum distance x_m initially. also calculate x_m (neglect air resistance in calculations).

Watch Video Solution

51. A small uniform tube is bent into a circle of radius r whose plane is vertical. Equal volumes of two fluids whose densities areρ and $\sigma(\rho > \sigma)$ fill half the circle. Find the angle that the radius passing through the interface makes with the

vertical.



Watch Video Solution

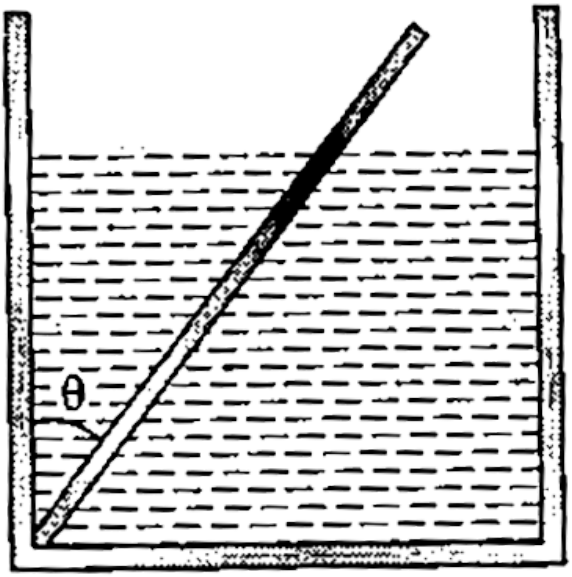
52. A rectangular air mattress has a length 2.0 m, a width 0.50 m and thickness can float on water

if the mass of the mattress is 2.0 kg. what is the density of the mattress ?

Watch Video Solution

53. A wooden plank of length 1m and uniform cross-section is hinged at one end of the bottom of tank as shown in figure. The tank is filled with water upto a height of $0.5m$. Find the angle θ that the plank makes with the vertical in the equilibrium position. [Exclude the case $thea = 0$

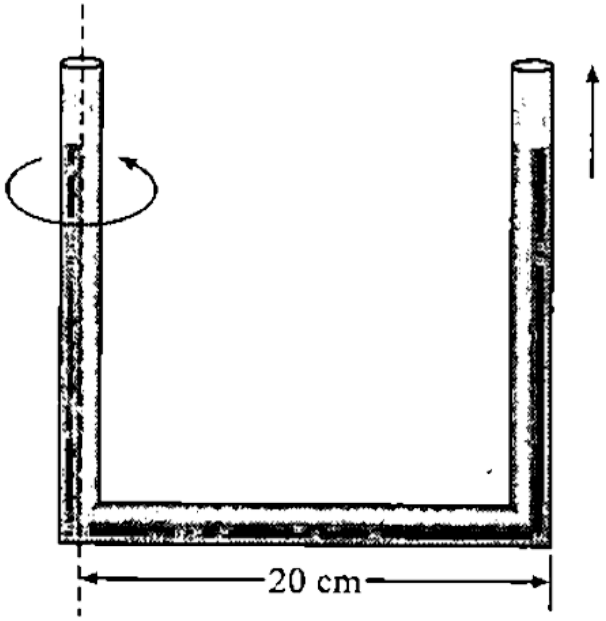
]



View Text Solution

54. The cross-sectional area of the U-tube shown in the figure is everywhere uniform and of value

$1.25 \times 10^{-3} m^2$. The horizontal section of the tube is of length 20 cm. When at rest, the limbs of the tube contain a liquid of density 2.5 up to equal heights. If the tube is rotated with angular velocity of $8.4 rad/s$ about one limb, calculate the volume of liquid that flows from one limb to the other.



View Text Solution

55. Calculate the rate of flow of glycerine of density $1.25 \times 10^3 kg/m^3$ through the conical section of a pipe if the radii of its ends are 0.1m and 0.04 m and the pressure drop across its lengths is $10N/m^2$.

Watch Video Solution

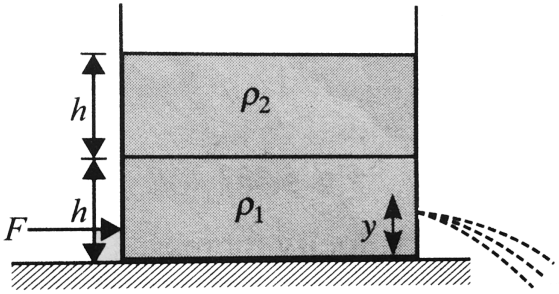
56. An ice cube of edge a is placed in an empty cylindrical vessel of radius 2a. Find the edge (in

cm) of ice cube when it just leaves the contact with the bottom assuming that ice melts uniformly maintaining its cubical shape. Take a = 12 π cm (Ice is lighter than water)

Watch Video Solution

57. A cylindrical tank having cross-sectional area $A = 0.5m^2$ is filled with two liquids of density $\rho_1 = 900kgm^{-3}$ and $\rho_2 = 600kgm^{-3}$, to a height $h = 60cm$ each as shown in the figure. A small hole having area $a = 5cm^2$ is made in right vertical wall at a height $y = 20cm$ from the

bottom. A horizontal force F is applied on the tank to keep it in static equilibrium. The tank is lying on a horizontal surface. Neglect mass of the cylindrical tank in comparison to mass of the liquids ($akeg$ = 10 ms^(-2)`).

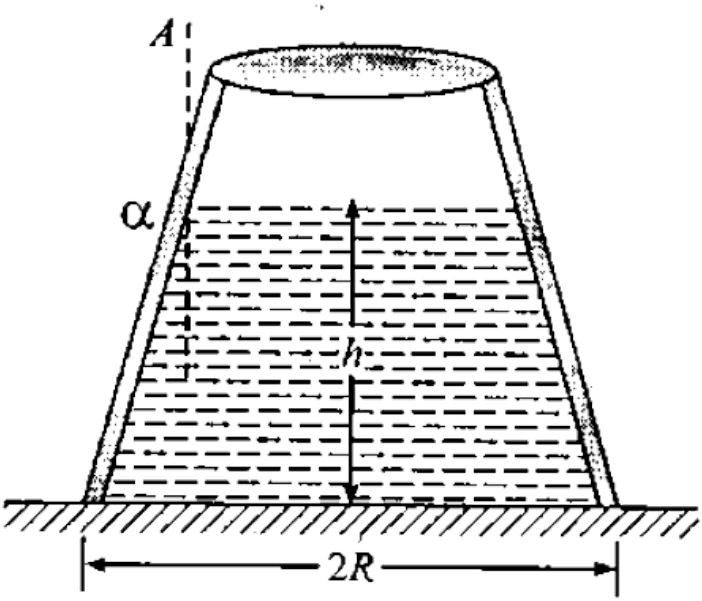


The horizontal force required to keep the cylinder in static equilibrium, on a smooth horizontal plane is

Watch Video Solution

58. A conical vessel wihout a bottom stands on a table. A liquid is poured with the vessel & as soon as the level reaches h, the pressure of the liquid raises the vessel. The radius of the base of the vessel is R and half angle of the cone α and the weight of the vessel is W. What is the density

of the liquid ?



Watch Video Solution

59. Water flows in a horizontal pipe whose one end is closed with a value and the pressure gauge falls to $1 \times 10^5 N/m^2$ when the value is

opend. Calculate the speed of water flowing in the pipe.

View Text Solution

60. A liquid is kept in a cylindrical vessel which is rotated along its axis. The liquid rises at the sides, if the radius of vessel is $0.05m$ and the speed of rotation is $2rev/s$, find difference in the height of the liquid at the centre of the vessel and its sides.

Watch Video Solution

61. A cylinder tank of base area A has a small hole of areal a at the bottom. At time $t = 0$, a tap starts to supply water into the tank at a constant rate $\alpha m^3 / s$.

(a) What is the maximum level of water $h_{\max}$ in the tank?

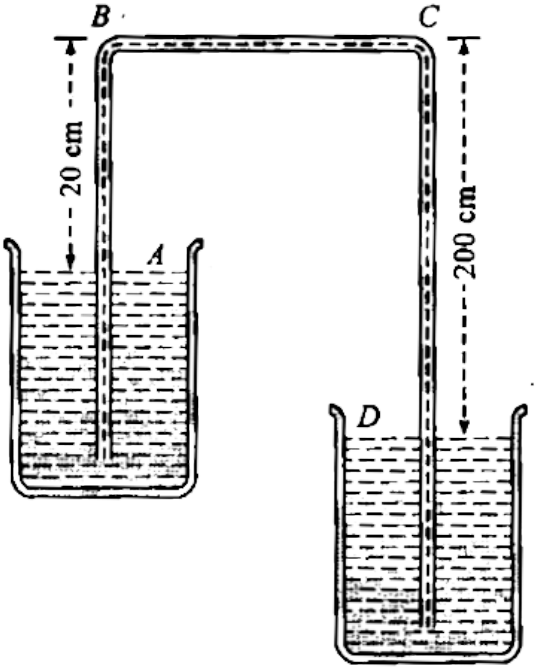
(b) find the time when level of water becomes $h(< h_{\max})$.

Watch Video Solution

62. The figure shows a siphon in action. The liquid flowing through the siphon has a density of $1.5gm/cm^3$. Calculate the pressure difference between

(a) Points A and D,

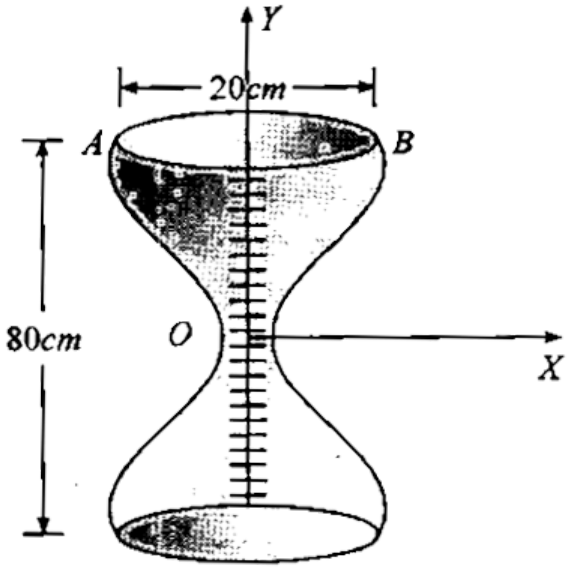
(b) Points B and C



View Text Solution

63. A water clock used in ancient Greek is designed as a closed vessel with a small orifice O. The time is determined accrding to the level of the water in the vessel. What should be the shape of the vessel be for the time scale to be uniform. Find mathemtical equation governing

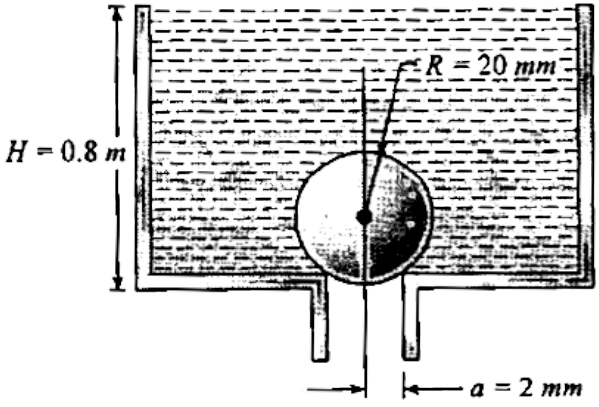
curve AOB.



Watch Video Solution

64. A sphere of radius R, made from material of specific gravity SG, is submerged in a tank of water. The sphere is placed over a hole, of radius

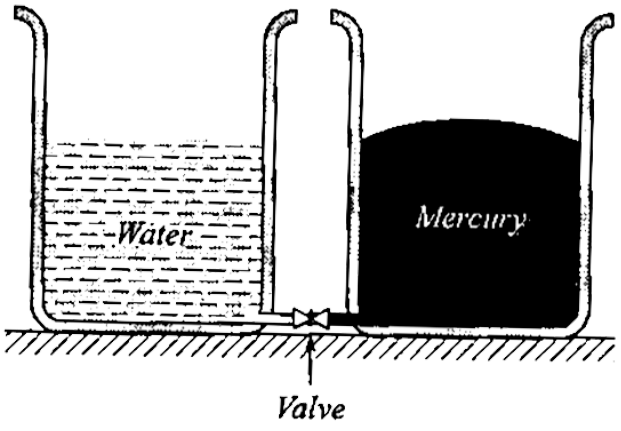
a, in the tank bottom. For the dimensions given, determine the minimum SG required for the sphere to remain in the position shown.



View Text Solution

65. Two identical container are open at the top and are connected at the bottom via a tube of

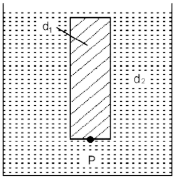
negligible volume and a valve which is closed. Bith containers are filled initially to the same height 1.00m, one with water the other with mercury, as the drawing indicates. The valve is then opened. Water and mercury are immiscible. Determine the fluid level in the left container when equilibrium is re-established.



View Text Solution

66. A thin rod of length (L) and area of cross - section (S) is pivoted at its lowest point (P) inside a stationary, homegeneous and non - viscous liquid. The rod is free to ratate in a vertical plane about a horizontal axis passing through (P). The density (d_1) of the material of the rod is smaller than the density (d_2) of the liquid. The rod is displaced by a small angle (theta) from its equilibrium position and then released. Show that the motion of the rod is simple harmonic and determine its angular

frequency in terms of the given parameters.

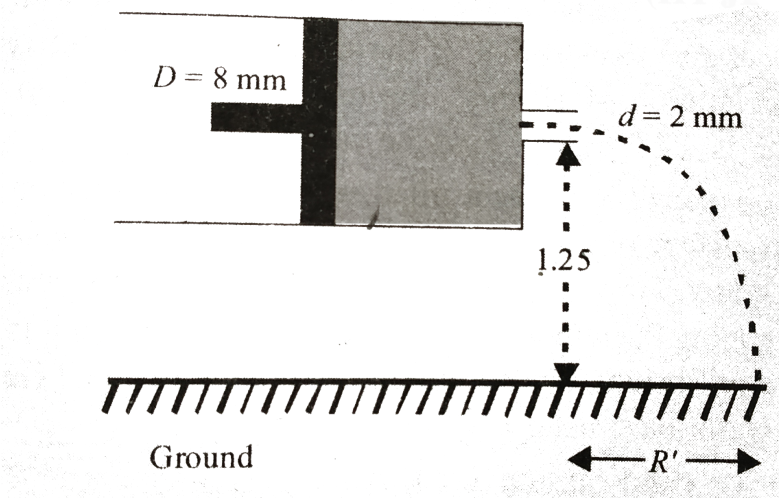


.

Watch Video Solution

67. Consider a horizontally oriented syringe containing water locate at a height of $1.25m$ above the ground. The diameter of the plunger is $8mm$ and the diameter of the nozzle is $2mm$. The plunger is pushed with a constant speed of $0.25m/s$. Find the horizontal range of water

stream on the grond. Take $g = 10m/s^2$



Watch Video Solution

68. A water pipe with interna diameter of 2m carries water at the floor of a house with velocity 2 m/s and at pressure $2 \times 10^5 N/m^2$. Another pipe of internal diameter 1 cm is connected to it

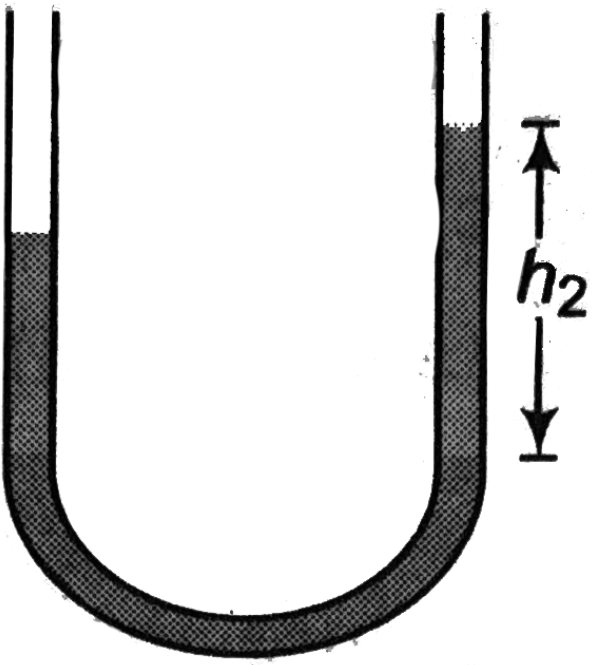
and takes water to 1 st floor, 5m above ground. What is the velocity and water pressure at 1st floor ? (Take $g = 10m/s^2$).

Watch Video Solution

69. Water and oil are poured into the two limbs of a U-tube containig mercury. The interface of the mercury and the liquids are at the same height in both limbs.

Determine the height of the water columnh_1 if that of the oil $h_2 = 20cm$. The density of the oil

is 0.9.



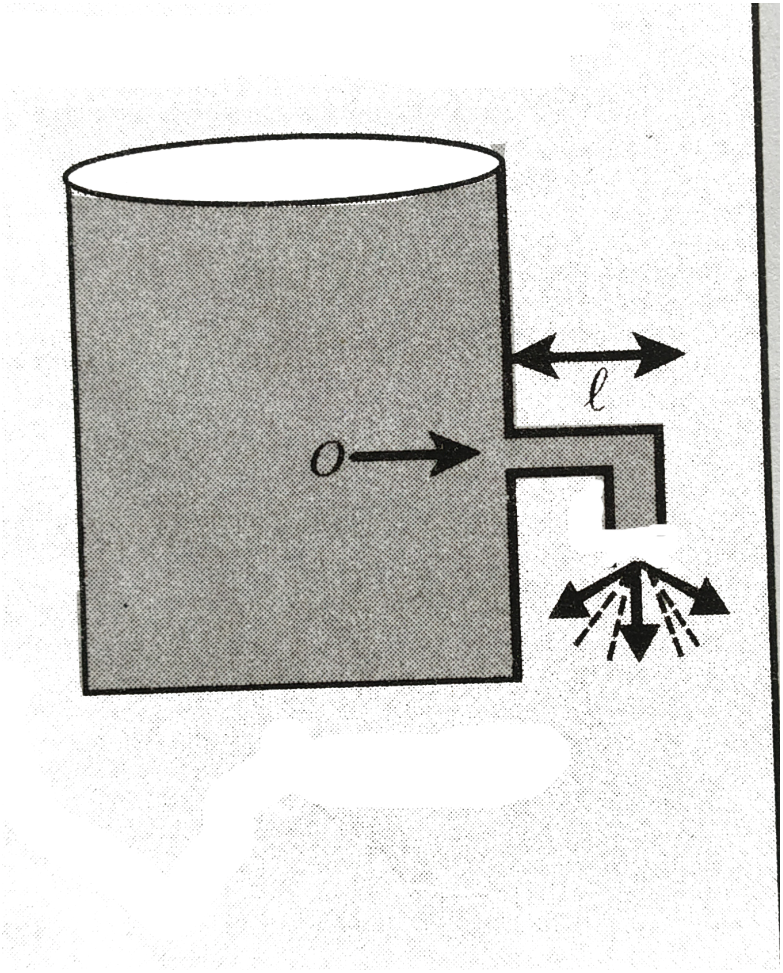
Watch Video Solution

70. Pure water is added drop by drop to a vessel of volume V filled with a salt solution of specific gravity γ which is allowed to overflow. Find the specific gravity of the solution when a volume U of water hs been poured.

Watch Video Solution

71. Water flows out of a big tank along a tube bent at right angles, the inside of the tube is of radius r. The length of the horizontal portion is l . The rate of water flow is Q. Find the moment of

reaction forces of flowing water, acting on the tube walls relative to point O.



Watch Video Solution

72. A cylindrical vessel is filled with water upto a height of 1m. The cross-sectional area of the orifice at the bottom is $(1/400)$ that of the vessel.

(a) What is the tiome required to empty the tank through the orifice at the bottom?

(b) What is the time required for the same amount of water to flow out if the water level in tank is maintained always at a height of 1m from orifice?

Watch Video Solution

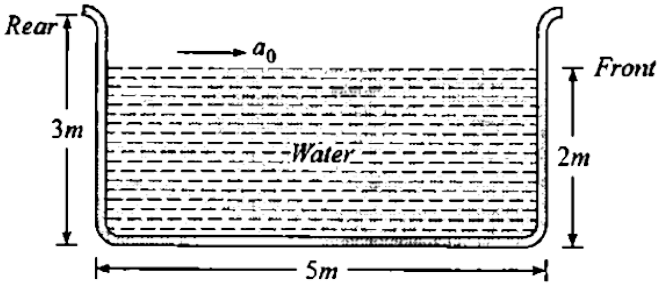
73. An open reactangular tank with tank with dimensions $5 \times 4m \times 3m$ contains water upto a height of 2m is accelerated horizontally along the longer life.

(a) Determine the maximum acceleration that can be given without spilling the water.

(b) If this acceleration is inscreased by $20\,\%$. Calculate the percentage of water spilt over.

(c) If initially,the tank is closed at the top and is accelerated horizontally by $9m/s^2$,find the gauge pressure at the bottom of the front and

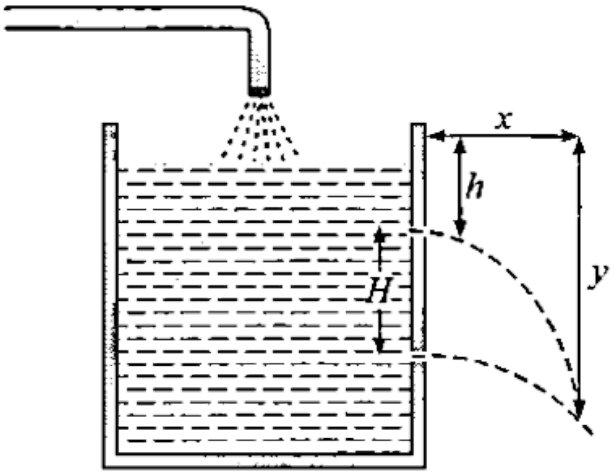
rear walls of the tank. $\left(g = 10m/s^2\right)$



View Text Solution

74. Two holes, each of area $A = 0.2cm^2$ are drilled in the wall of a vessel filled with water. The distances of the holes from the level of water are h and $h + H$. Find the point where the streams flowing out of the holes intersect. The level of water is maintained in the vessel by

regulated supply.



View Text Solution

75. A vertical tube has diameter 0.016 m at its bottom end from which water flows out at the rate of 1.2 kg per minute. The pressure at the end is atmospheric pressure 0.7 m of mercury. If the

diameter of the tube is 0.004 m at a height of 0.3 m from the bottom end, fidn the pressure there.

View Text Solution

76. A cylinderical tank of height 0.4 m is open at the top and has a diameter 0.16m. Water is filled in it up to height of 0.16 m. Find the time taken to empty the tank through a hole of radius $5 \times 10^{-3} m$ in its bottom.

Watch Video Solution

77. A large open top container of negligible mass and uniform cross sectional area A a has a small hole of cross sectional area $A/100$ in its side wall near the bottom. The container is kept on a smooth horizontal floor and contains a liquid of density ρ and mass M_0. Assuming that the liquid starts flowing out horizontally through the hole at $t = 0$, calculate a the acceleration of the container and b its velocity when $75\,\%$ of the liquid has drained out.

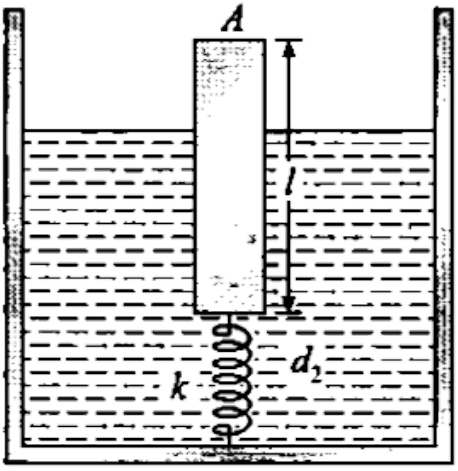
Watch Video Solution

78. A cylindrical bucket, open at the top, is 0.200 m high and 0.100 m in diameter. A circular hole wih cross-section area $1.00cm^2$ is cut in the centre of the bottom of the bucket. Water flows into the bucket from a tube above it at the rate of $1.30 \times 10^{-4} m^3 / s$. How high will the water in the bucket rise?

Watch Video Solution

79. A uniform cylindrical block of length l density d_1 and area of cross section A floats in a liquid of

density d_2 contained in a vessel $(d_2 > d_1)$. The bottom of the cylinder just rests on a spring of contant k. The other end of the spring is fixed to the bottom of the vessel. A weight that may be placed on top of the cylinder such that the cylinder is just submerged in the liquid. find the weight.



Watch Video Solution

80. A ball of density d is dropped on to a horizontal solid surface. It bounces elastically from the surface and returns to its original position in a time t_1. Next, the ball is released and it falls through the same height before striking the surface of a liquid of density of d_L

(a) If $d < d_L$, obtain an expression (in terms of d, t_1 and d_L) for the time t_2 the ball takes to come back to the position from which it was released.

(b) Is the motion of the ball simple harmonic?

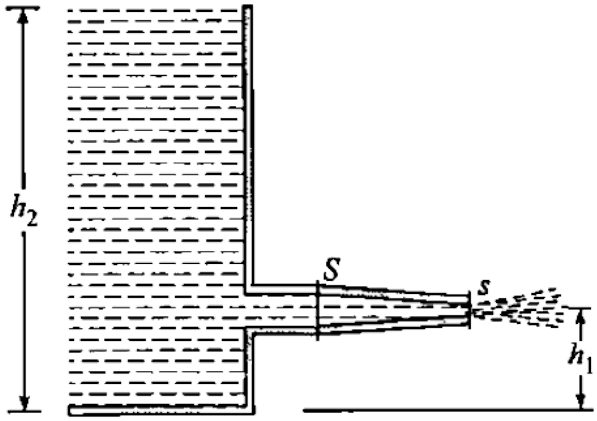
(c) If $d = d_L$, how does the speed of the ball depend on its depth inside the liquid? Neglect

all frictional and other dissipative forces. Assume the depth of the liquid to be large.

Watch Video Solution

81. A side wall of a wide open tank is provided with a narrowing tube through which water flows out. The cross-sectional area of the tube decreases from $S = 3.0cm^2$ to $s = 1.0cm^2$. The water level in the tank is $h = 4.6m$ heigher than in the tube. Neglecting the viscosity of water, find the horizontal component of the force

tending to pull the tube out of the tank.



View Text Solution

82. A ping-pong ball has a volume V and density $(1/10)$ th of water. What force would be required to hold it completely submerged under water?

Watch Video Solution

83. Water leaks out from an open tank through a hole of area $2mm^2$ in the bottom. Suppose water is filled up to a height of 80 cm and the area of cross section of the tankis $0.4m^2$. The pressure at the open surface and the hole are equal to the atmospheric pressure. Neglect the small velocity of the water near the open surface in the tank. a. Find the initial speed of water coming out of the hole. b. Findteh speed of water coming out when half of water has leaked

out. c. Find the volume of water leaked out during a time interval dt after the height remained is h. Thus find the decrease in height dh in term of h and dt.

d. From the result of part c. find the time required for half of the water to leak out.

Watch Video Solution

84. A steel ball floats in a vessel with mercury. How will be volume of the part of the ball submerged in mercury change if a layer of water completely covering the ball is poured above the

mercury? If ρ_w, ρ_s and ρ_m are the densities of water, steel and mercury, find the ratio of these two volumes in terms in of ρ_w, ρ_s and ρ_m.

Watch Video Solution

85. Water flows through a tube shown in figure. The areas of cross section at A and B are $1cm^2$ and $0.5cm^2$ respectively. The height difference between A and B is 5m. If the speed of water at A is 10 cms^{-1} find a the speed at B and

b the difference in pressures at A and B.

Watch Video Solution

86. A jet of water issues vertically at a speed of 0.1 square inch cross-section. A ball weighing one pound is balance in the air by impact of water on its underside. Find the height of the ball above the level of jet. Take $g = 3ft/s^2$

View Text Solution