PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

MECHANICAL PROPERTIES OF FLUIDS

Examples

1. The pressure at the bottom of a lake due to water is $4.9 \times 10^6 N/m^2$. What is the depth of the lake?

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2. What is force on the base of a tank of base area $1.5m^2$ when it is filled with water upto a height of 1m

$\left(\rho_{\text{water}} = 10^3 kg/m^3, P_0 = 10^5 Pa \text{ and } g = 10m/s^2\right)$

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3. When equal volumes of two metals are mixed together the specific gravity of alloy is 4. When equal masses of the same two metals are mixed together the specific gravity of the alloy not becomes 3. find specific gravity of each metal?

(specific gravity $= \frac{\text{density of substance}}{\text{density of water}}$)

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4. When a polar bear jumps on an iceberg, its weight 240 kg.wt is just sufficient to sink the iceberg. What is the mass of the iceberg? (specific gravity of ice is 0.9 and that of sea water is 1.02)

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5. Four-fifths of a cylindrical block of wood, floats in a liquid. Assuming the relative density of wood be 0.8 find the density of the liquid.

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6. Two bodies are in equilibrium when suspended in water from the arms of a balance.The mass of one body is $28g$ and its density is $5.66 g/cm^3$. If the mass of the other body is $36g$, what is its density ?

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7. 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.

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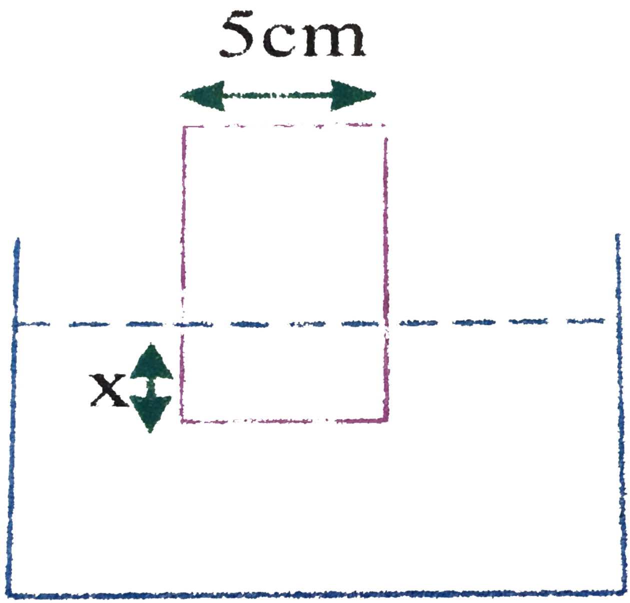
8. 

A cubical block of iron of side 5 cm is floating in mercury taken in a vessel. What is the height of the block above mercuery level.

$\left(\rho_{Hg} = 13.6 g / cm^3, \rho_{Fe} = 7.2 g / cm^3\right)$

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9. A solid sphere of radius R has a concentric cavity of radius $\frac{R}{3}$ inside it. The sphere is found to just float in water with the highest point of it touching the water surface. Find the specific gravity of the material of the sphere.

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

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11. A small ball of density ρ is immersed in a liquid of density $\sigma(> \rho)$ to a depth h and released. The height above the surface of water up to which the ball will jump is

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12. Two spheres of volume 250 cc each but of relative densities 0.8 an d 1.2 are connected by a string and the combination is immersed in a liquid. Find the tension I the string. $\left(g = 10m/s^2\right)$

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13. A uniform cylinder of length L and mass M having cross-sectional area A is suspended, with its length vertical, from a fixed point by a massless spring such that it is half submerged in a liquid of density σ at equilibrium position. The extension x_0 of the spring when it is in equlibrium is:

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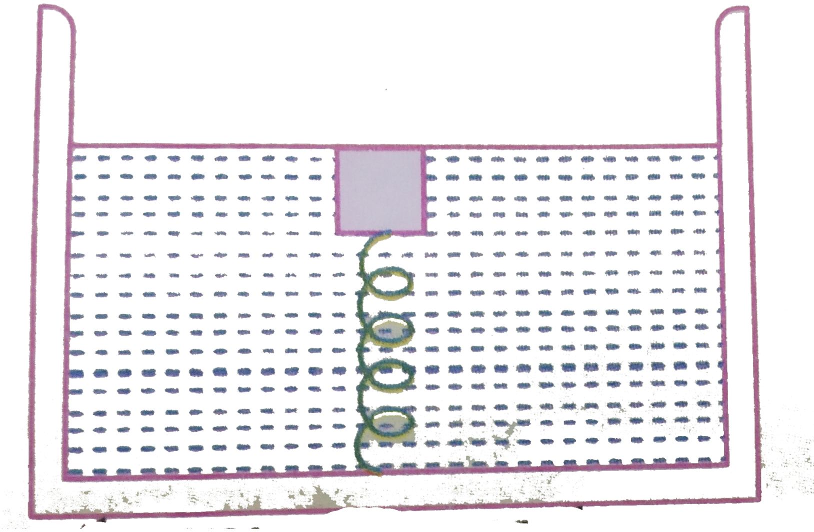
14. A block is fully submerged in a vessel filled with water by a spring attached to the bottom of the vessel. In equilibrium position spring is compressed. If the vessel now moves downwards with an acceleration

$a(< g)$. What happens to the length of the spring.?



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15. What are the dimensions of Reynolds number ?

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16. What should be the average velocity of water in a tube of diameter 2 cm so that the flow is (i) laminar (ii) turbulent? The viscosity of water is

0.001 Pa-s. (for water pipes $R < 2000$ stream line flow, $R > 3000$ turbulent flow)

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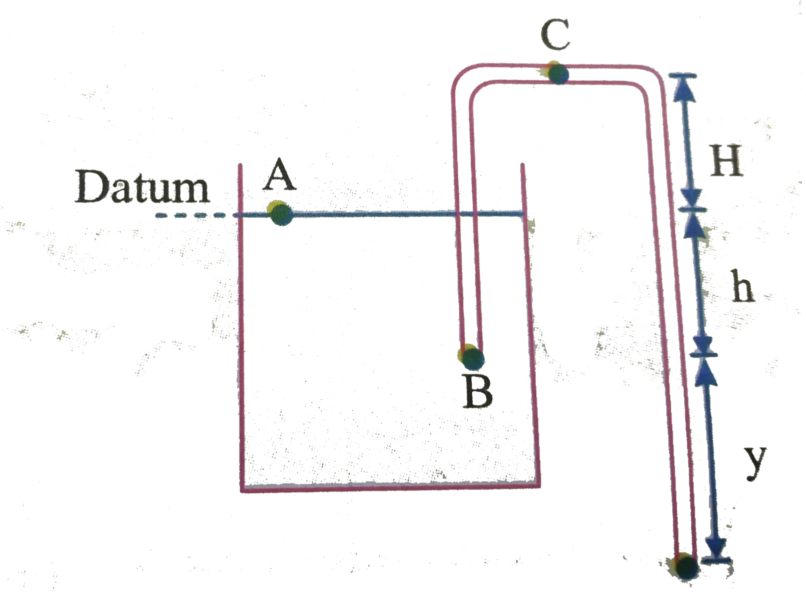
17. A siphon tube is used to remove liquid from a container as shown in fig. In order to operate the siphon tube, it must initially be filled with the liquid.

(i). Determine the pseed of the liquid through the siphon.

(ii). Determine the pressure at the point C.



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18. A pipe having an internal diameter D is connected to another pipe of same size. Water flows into the second pipe through n holes, each of diameter d. if the water in the first pipe has speed v, the speed of water leaving the second pipe is

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19. A syringe of diameter 1 cm having a nozzle of diameter 1 mm is placed horizontally at a height 5 m from the ground an incompressible non-viscous liquid is filled in the syringe and the liquid is compressed by moving the piston at a speed of $0.5ms^{-1}$ the horizontal distance travelled by the liquid jet is $\left(g = 10ms^{-2}\right)$

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20. 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.

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21. 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 $= 10^3kg.m^{-3}$)

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22. Calculate the rate of flow of glycerine of density. $1.25 \times 10^3kg/m^3$ through the conical section of a pipe. If the radii of its ends are $1.0m$ and

$0.04m$ and the pressure drop across its length is $10N/m^2$.

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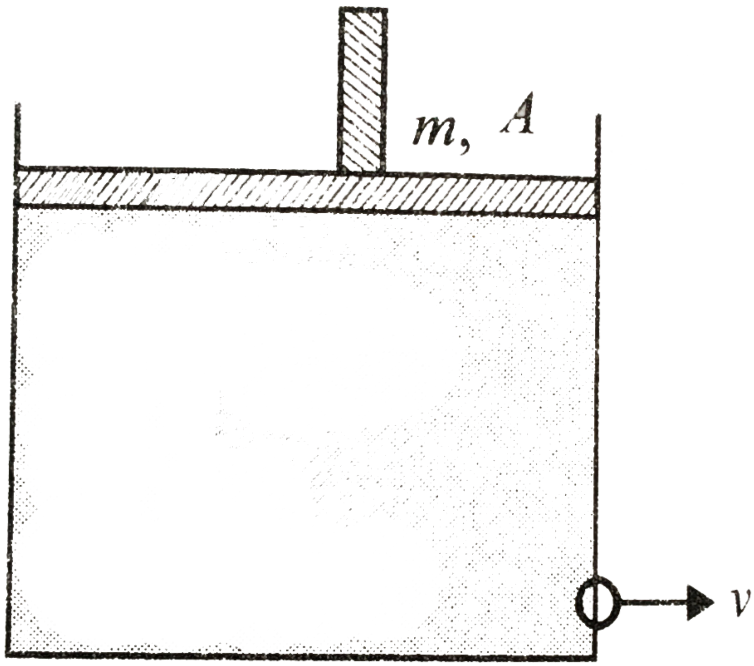
23. A cylindrical vessel contains a liquid of density ρ up to height h. The liquid is closed by a piston of mass m and area of cross section A. There is a small hole at the bottom of the vessel. The speed v with which the liquid comes out of the hole is



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24. A pump draws water from a reservoir and sends it through a horizontal pipe with speed v. Find the relation between power of the pump and velocity of liquid.

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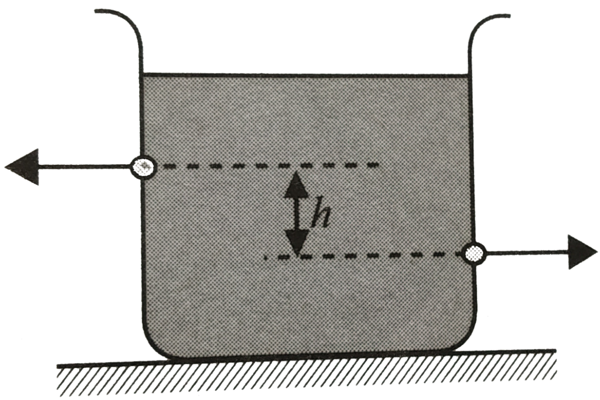
25. There are two identical small holes of area of cross section a on the opposite sides of a tank containing liquid of density ρ. The differences in height between the holes is h. The tank is resting on a smooth horizontal surface. The horizontal force which will have to be applied on the tank to keep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



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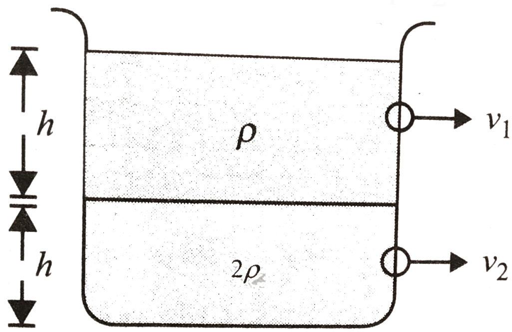
26. Equal volume of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in the figure. Two small holes are punched at depths $h/2$ and $3h/2$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then v_1/v_2 is



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27. A hose shoots water straight up to a height of 2.5 m. The opening end of the hose has an area of $0.75cm^2$. What is the speed of the water as it leaves the hose? How much water will come out in one minute?

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28. 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

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29. A large wooden plate of area $10m^2$ floating on the surface of river is made to move horizontally wilth a speed of $2ms^{-1}$ by applying a tangential force. If the river is 1m deep and the water contact with the bed is stationary, find the tangential force needed to keep the plate moving. Coefficient of viscosity of water at the temperature of the river $= 10^{-2} poise.$

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30. A $16cm^3$ of water flows per second through a capillary tube of radius r cm and of length 1 cm, when connected to a pressure head of h cm of water. If a tube of the same length and radius $r/2$ is connected to the same pressure head, find the mass of watear flowing per minute through the tube.

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31. Water flows in a streamline manner through a cappilary tube of radius a. The pressure difference being P and the rate of flow is Q . If the radius is reduced to $a/2$ and the pressure difference is increased to 2P, then find the rate of flow.

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32. Capillary tubes of length l and $2l$ are connected in series, their radii are r and $2r$ respectively. If stream line flow is maintained and pressure difference across first and second capillary tubes are P_1 and P_2 respectively then find the ratio $\frac{P_1}{P_2}$.

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33. Three capillary tubes of same radius 1 cm but of length 1 m 2 m and 3 m are fitted horizontally to the bottom of a long vessel containing a liquid at constant pressure and flowing through these. Whatis the length of a single tube which can replace the three capillaries.

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34. Two equal drops of water are falling through air with a steady velocity v. If the drops coalesced, what will be the new velocity?

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35. A spherical steel ball released at the top of along column of glycerin of length l falls through a distance $l/2$ with accelerated motion and the remaining distance $l/2$ with uniform velocity let t_1 and t_2 denote the times taken to cover the first and second half and w_1 and w_2 are the work done against gravity in the two halves, then compare times and work done.

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36. A small steel ball falls through a syrup at a constant speed of $10cms^{-1}$. If the steel ball is pulled upwards with a force equal to twice its effective weight, how fast will it move upwards?

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37. A small piece of wire of length 4 cm is floating on the surface of water. If a force of 560 dynes in excess of itss apparent weight is requried to pull it up from the surface find the surface tension of water.

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38. An annular metal ring of inner radius 7 cm and outer radius 14 cm and negligible weight is floating on the surface of a liquid if surface tensiton of liquid is $0.08Nm^{-1}$ calculate the force required to detach it it from liquid surface.

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39. A wire is bent in the form of a U-shape and a slider of negligible mass is connecting the two vertical sides of the U-shape. This arrangement is dipped in a soap solution and lifted a thin soap film is formed in t he frame it supports a wegith of 2.0×10^{-2} if the length of the slider is 40 cm whta is the surface tension of the film?

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40. When a wire o length $l(l < < r)$ and ceoss sectional radius r is kept floating on surface of a liquid. Maximum radius of wire such that it may not sink. Is

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41. If the surface tension of soap solution is $35\text{dynes}/cm$, calculate the work done to form an air bubble of diameter 14 mm with that solution.

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42. A soap bubble is blown to a radius of 3 cm. if it is to be further blown to a radius of 4 cm what is the work done? (surface tension of soap solution $= 3.06 \times 10^{-2}Nm^{-1}\big)$

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43. A water drop of diameter 2 mm is split up into 10^9 identical water drops. Calculate the work done in this process. (the surface tension of water is $7.3 \times 10^{-2} Nm^{-1}$)

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44. 1000 drps of a liquid each of diameter 4 mm coalesce to form a single large drop. If surface tension of liquid is 35 dyne cm^{-1} calculate the energy evolved by the system in the process.

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45. A large number of liquid drops each of radius 'a' coalesce to form a single spherical drop of radish b. The energy released in the process is converted into kinetic energy of the big drops formed. The speed of big drop will be

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46. A drop of radius R is split under isothermal condition into into n droplets each of radius r the ratio of surface energies of big and each small drop is

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47. Number of droplets (n) are combined isothermally to form a big drop the ratio of initial and final surface energies of the system is

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48. When a big drop of water is formed from n small drops of water, the energy oss is 3E, where, E is the energy of the bigger drop. If R is the radius of the bigger drop and r is the radius of the smaller drop then number of smaller drops (n) is?

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49. Find the weight of water supported by surface tension in a capillary tube with a radius of 0.2 mm. Surface tension of water is $0.072Mn^{-1}$ and angle of contact of water is 0^0.

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50. A capillary tube of radius r is immersed in water and water rises to a height of h mass of water in the capillary tube is 5×10^{-3} kg the same capillary tube is now immersed in a liquid whose surface tension in $\sqrt{2}$ times the surface tension of water. The angle of contact between the capillary tu8be and this liquid is 45° the mass of liquid which rises into the capillary tube now is (in kg)

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51. A U tube is supported with its limbs vertical and is partly filled with water. If the inner diameter of the limbs are 1cm,and 0.01 cm , respectively, what will be the difference in height of water in the two limbs? S.T. or water $70 \times 10^{-3} Nm^{-1}$. Angle of contact , $\theta = 0°$.

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52. What should be the pressure inside a small air bubble of $0.1 mm$ radius situated just below the surface of water? Surface tension of water $= 72 \times 10^{-3} N/m$ and atmospheric pressure $= 1.013 \times 10^5 N/m^2$

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53. Two separate air bubbles (radii $0.002 cm$ and 0.004) formed of the same liquid (surface tension $0.07 N/m$) come together to form a double bubble. Find the radius and the sense of curvature of the internal film surface common to both the bubbles.

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54. Two soap bubble of radii R_1 and R_2 are kept in vacuum at constant temperature, the ratio of masses of air inside them, is

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55. Two soap bubble of radii R_1 and R_2 are in atmosphere of pressure P_0 at constant temperature. Ratio of masses of air inside them is

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56. Two spherical soap bubble coalesce. If V is the consequent change in volume of the contained air and S the change in total surface area, show that

$3PV + 4ST = 0$

where T is the surface tension of soap bubble and P is

Atmospheric pressure

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57. When air bubble comes from bottom to the top of a lake its radius becomes n times. If temprerature remains constant through out the lake the depth of the lake will be.

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58. The lower end of a capillary tube of diameter 2.0 mm is dipped 8.00cm below the surface of water in a beaker. What is the pressure required in the tube in order to blow a hemispherical bubble at its end in water? The surface tension of water at temperature of the experiments is $7.30 \times 10^{-2} Nm^{-1}$. 1 atmospheric pressure $=1.01 \times 10^{5} Pa$, density of water $= 1000 kg/m^{3}, g = 9.80 ms^{-2}$. also calculate the excess pressure.

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59. A glass U-tube is such that the diameter of one limb is $3.0 mm$ and that of the other is 6.0mm. The tube is inverted vertically with the open ends below the surface of water in a beaker. What is the difference between the height to which water rises in the two limbs? Surface tension of water is $0.07 Nm^{-1}$. Assume that the angle of contact between water and glass is 0°.

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C.U.Q

1. The force of buoyncy is equal to

A. weight of the body

B. weight of the liquid displaced by the body

C. apparent weight of the body

D. viscous force

Answer: B

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2. The weight of the body is maximum in

A. air

B. hydrogen

C. water

D. vacuum

Answer: D

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3. When a boat in a river enters the sea water, then it

A. sinks a little

B. rises a little

C. remains same

D. will drown

Answer: B

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4. When a body is fully immersed in a liquid the loss of weight of the body is equal to

A. apparent weight of the body

B. force of buoyancy

C. half the force of buoyancy

D. twice the force of buoyancy

Answer: B

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5. A boat carrying steel balls is floating on the surface of water in a tank. If the balls are thrown into the tank one by one, how will it affect the level of water ?

A. go up

B. for down

C. remain the same

D. can not be decided

Answer: B

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6. A large block of ice floats in a liquid. Whe ice melts the liquid level rises. The density of liquid is

A. greater than that of water

B. less than that of water

C. equal to that of water

D. half of that of water

Answer: A

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7. Identify the correct choice: (A) when a body floats in a liquid, it displaces the liquid whose weight is equal to its own weight.

(B). When a body sinks in a liquid, it displaces the liquid whose volume is equal to its own volume.

A. A is true but B is false.

B. A is false but B is true.

C. Both A and B are true.

D. Both A and B are false.

Answer: C

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8. 100 kg of iron and cotton are weghed by using a spring balance on the surface of the earth if R_1 and R_2 are the reading shown by the balance, then

A. $R_1 < R_2$

B. $R_1 = R_2$

C. $R_1 > R_2$

D. $R_1 = R_2 = 0$

Answer: C

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9. A swimmer goes from the surface of water to a depth of 20m the change in the pressure on his body is nearly

A. 3 atmospheres

B. 1 atmosphere

C. 2 atmospheres

D. zero

Answer: C

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10. A bucket of water contain a wooden block floating in water with $(4/5)$ th of its volume sub merged in the water. The bucket is placed on the floor of a lift and the lift now starts moving down with uniform acceleration. The block of wood now

A. moves upward

B. moves downward

C. remains at same place

D. moves horizontally

Answer: C

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11. Clouds appear to float in air due to

A. low density air currect

B. air current

C. viscosity of air

D. buoyancy

Answer: D

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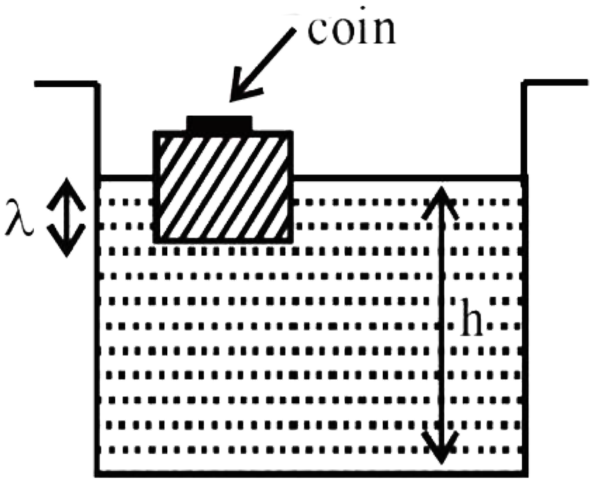
12. A wooden block, with a coin placed on its top, floats in water as shown in figure. The distance l and h are shown here. After some time the coin falls into water. Then



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: D

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13. In order that a floating object be in a stable equilibrium its centre of buoyancy should be

A. vertical below its centre of gravity

B. horizontally inline with its centre of gravity

C. vertically above its centre of gravity

D. may be anywhere

Answer: C

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14. A piece of ice floats in a liquid denser than water. The liquid fills the vessel upto the edge. If ice melts completely then

A. water level remain unchanged

B. water level decreases

C. water overflows

D. data is unsufficient.

Answer: C

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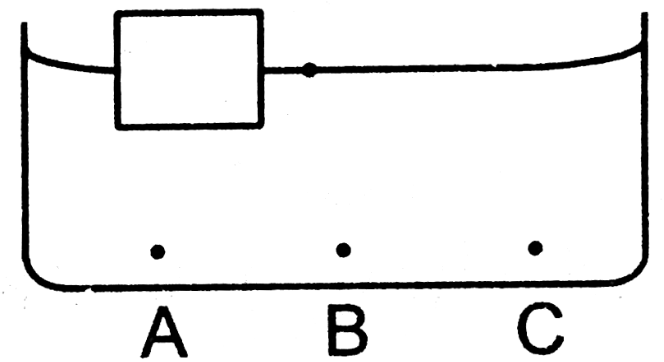
15. A wooden object floats in water kept in as beaker. The object is near a side of the beaker figure. Let P_1, P_2, P_3 be the pressure at the three points A,B and C of the bottom as shown in the figure.



A. $P_A > P_B > P_C$

B. $P_A > P_B < P_C$

C. $P_A = P_B = P_C$

D. $P_A = P_C < P_B$

Answer: C

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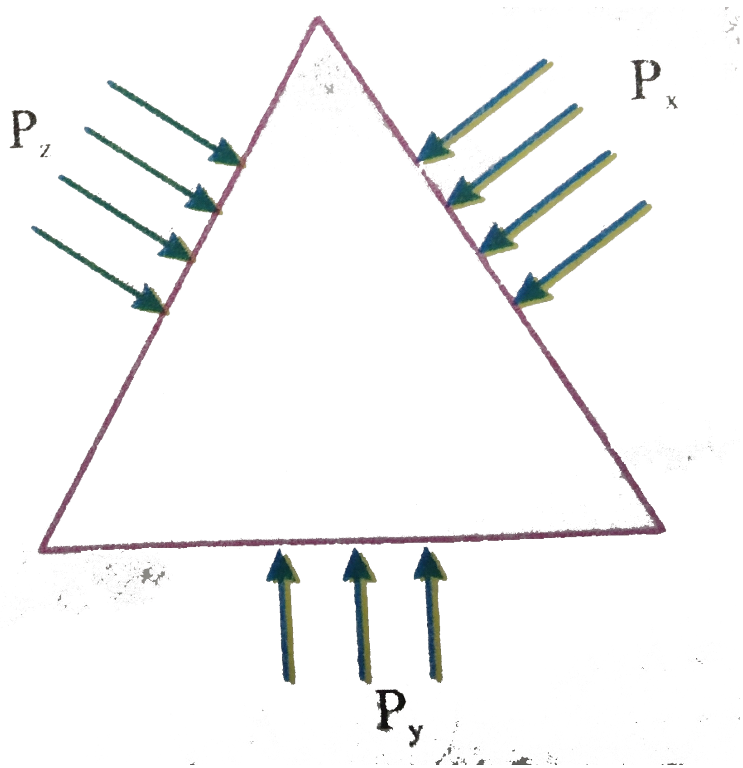
16. 

A triangular element of the liquid is shown in the fig. P_x, P_y and P_z represent the pressures on the element of the liquid then:

A. $P_x = P_y \neq P_z$

B. $P_x = P_y = P_z$

C. $P_x \neq P_y \neq P_z$

D. $P_x^2 + P_y^2 + P_z^2 =$ constant

Answer: B

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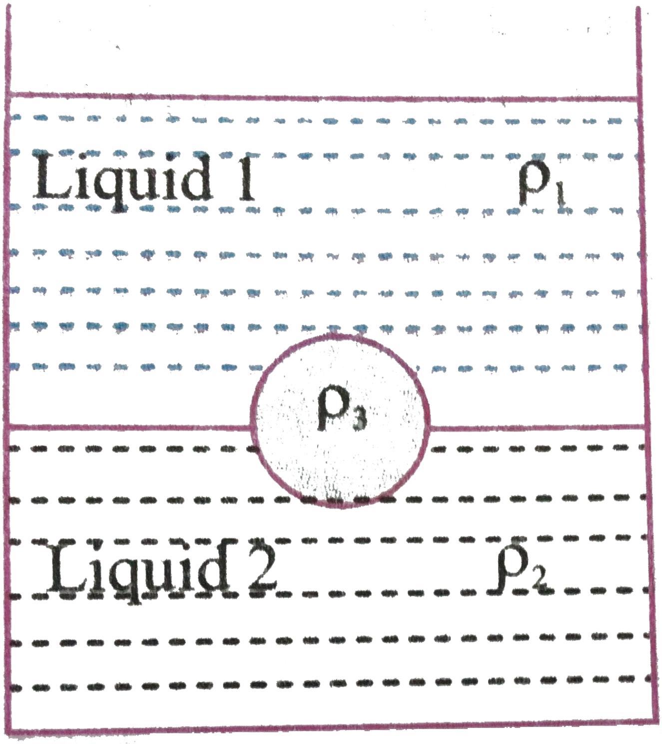

17.

A jar filled with two non-mixing liquid 1 and 2 having densities ρ_1 and ρ_2 respectively. A solid ball, made of a material of density ρ_3 is dropped in the jar. It come to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_2 and ρ_3?

A. $\rho_1 < \rho < \rho_3$

B. $\rho_1 < \rho_3 < \rho_2$

C. $\rho_3 < \rho_1 < \rho_2$

D. $\rho_1 < \rho_3 < \rho_2$

Answer: B

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18. Stream line motion becomes turbulent motion when the velocity of the liquid is

A. beyond critical velocity

B. critical velocity

C. below critical velocity

D. variable velocity

Answer: A

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19. In turbulent flow the velocity of the liquid molecules in contact with the walls of the tube.

A. is zero

B. is maximum

C. is equal to critical velocity

D. may have any value

Answer: A

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20. Which of the following is a characteristic of turbulent now?

A. velocity more than critical velocity

B. irregular flow

C. molecule crossing from one layer to the other

D. 1,2,3

Answer: D

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21. When the value of Reynilds number is less, the predominant forces are

A. viscous forces

B. inertial forces

C. surface tension forces

D. gravitational forces.

Answer: A

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22. In a laminar flow at a given point the magnitude and direction of the velocity of the fluid

A. both are constant

B. magnitude is only constant

C. direction is only constant

D. both are not constant

Answer: A

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23. The liquid flow is most stream lined when

A. liquid of high viscosity and high density flowing through a tube of small radius.

B. liquid of high viscosity and low density flowing through a tube of small radius

C. liquid of low viscosity and low density flowing through a tube of large radius

D. liquid of low viscosity and high density flowing through a tube of large radius.

Answer: B

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24. If the flow is stream lined then Reynolds number is less than

A. 2000

B. 3000

C. 1000

D. 4000

Answer: C

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25. The rate of flow of the liquid is the product of

A. area of cross section of the liquid and velocity of the liquid.

B. length of the tube of the flow and velocity of the liquid.

C. volume of the tube of the flow and velocity of the liquid.

D. viscous force acting on the liquid layer and velcoity of the liquid.

Answer: A

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26. The equation of continuity leads to

A. law of conservation of moments of liquid flow

B. law of conservation of energy

C. law of equipartition of energy

D. law of conservation of mass.

Answer: D

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27. The volume of a liquid flowing per second out of an orifice at the bottom of a tank does not depend upon

A. the density of the liquid

B. acceleration due to gravity

C. the height of the liquid above orifice

D. the area of the orifice

Answer: A

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28. Water is flowing in a pipe of uniform cross section under constant pressure difference At some place the pipe becomes narrow. The pressure of at water at this place

A. remains same

B. may increase or decrease

C. increases

D. decreases

Answer: D

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29. What flows through a horizontal pipe of radius r at a speed V. if the radius of the pipe is doubled, the speed of flow of water under similar conditions is

A. 2V

B. $\frac{V}{2}$

C. $\frac{V}{4}$

D. $4V$

Answer: C

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30. A liquid is under stream lined motion through a horizontal pipe of non uniform cross section. If the volume rate of flow at cross section a is V, the volume rate of flow at cross section $\frac{a}{2}$ is

A. $\frac{V}{2}$

B. $2V$

C. $\frac{V}{4}$

D. V

Answer: D

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31. A liquid is under stream lined motion through a horizontal pipe of non uniform cross section. If the volume rate of flow at cross section a is V, the volume rate of flow at cross section $\frac{a}{2}$ is

A. $\frac{V}{2}$

B. $2V$

C. $\frac{V}{4}$

D. V

Answer: B

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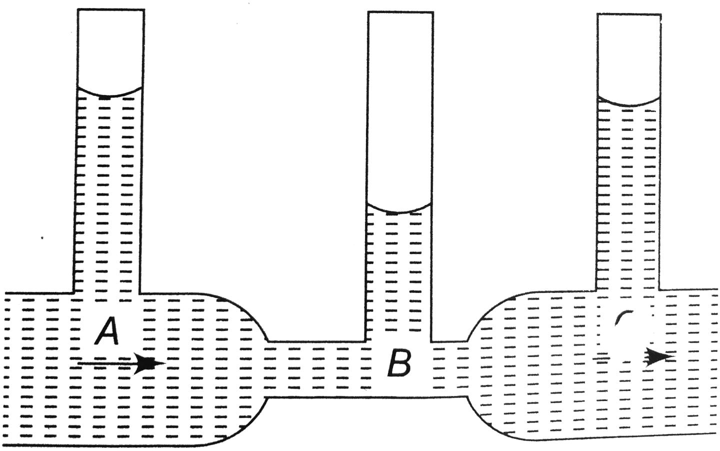
32. In the following fig., the flow of liquid through a horizontal pipe is shown. Three tubes A, B and C are connected to the pipe. The radii of the tubes A, B and C at the junction are respectively $2cm, 1cm$ and $2cm$. It can be said that the



A. in A is maximum

B. in A and C is equal

C. is same in all the three

D. in A and B is same

Answer: C

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33. Bernoulli's theorem is applicable in the case of

A. compressible liquid in stream lined flow

B. compressible liquid in turbulent flow

C. incompressible liquid in stream lined flow

D. incompressible liquid in turbulent flow.

Answer: C

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34. If air blown through the space between a calendar suspended from a nail on wall and the wall, then

A. the calendar moves close to the wall.

B. the calendar moves farther from the wall.

C. the position of the calendar does not change.

D. the position of the calendar may or may not change.

Answer: A

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35. A spinning ball is moving in a direction opposite to the direction of the wind. The ball moves in a curved path as

A. the pressure at the top and the bottom of the ball are equal.

B. the pressure at the top $>$ thre pressure at the bottom

C. the pressure at the top $<$ the pressure at the bottom

D. there is no relation between the pressures.

Answer: B

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36. The dynamic lift of an aeroplane is based on

A. Torricelli theorem

B. Bernoulli's theorem

C. conservation of angular momentum

D. priciple of continuity.

Answer: B

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37. A gale is on a house. The force on the roof due to the gale is

A. directed downward

B. zero

C. directed upward

D. information insufficient

Answer: C

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38. A train goes past a person standing at the edge of a platform at high speed. Then the person will be

A. attracted towaeds the train

B. unaffected by the train

C. pushed away by the train

D. affected only if its speed is greater than critical velocity.

Answer: A

Watch Video Solution

39. The velocity distribution curve of the stream line flow of a liquid advancing through a capillary tube is

A. circular

B. elliptical

C. parabolic

D. a straight line

Answer: C

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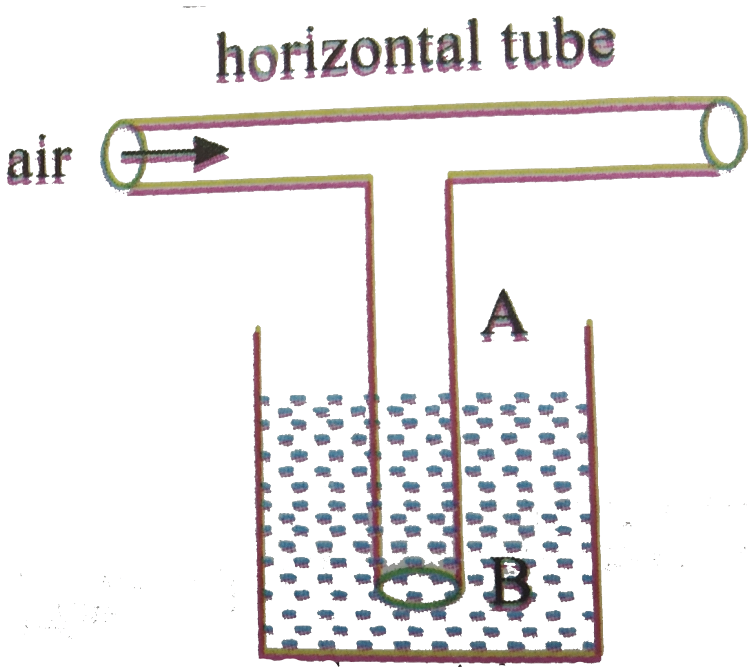
40. 

Water stands at level A in the arrangement shown in figure. If a jet of air is gently blown into the horizontal tube in the direction shown in figure, then

A. water will fall below A in the capillary tube

B. water will rise above A in the capillary tube

C. there will be no effect on the level of water in the capillary tube

D. air will emerge from end B in the form of bubbles.

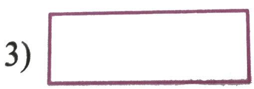
Answer: B

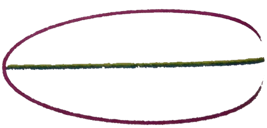
Watch Video Solution

41. The vertical sections of the wing of a fan are shown. Maximum upthrust is in

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

42. A car moving on a road when overtaken by a bus

A. is pulled towards the bus

B. is pushed away from the bus

C. is not affected by the bus

D. information is insufficient.

Answer: A

Watch Video Solution

43. When the temperature increases the viscosity of

A. a and c are true

B. b and c are true

C. b and d are true

D. a and d are true

Answer: A

Watch Video Solution

44. A water barrel stands on a table of height h. If a small holes is punched in the side of the barrel at its base, it is found that the resultant stream of water strikes the ground at a horizontal distance R from the table. What is the depth of water in the barrel?

A. $\frac{4h}{R^2}$

B. $4hR^2$

C. $\frac{R^2}{4h}$

D. $\frac{h}{4R^2}$

Answer: C

Watch Video Solution

45. The main cause of viscosity is

A. force of repulsion between molecules

B. cohesive forces

C. adhesive forces

D. both cohesive and adhesive force.

Answer: B

Watch Video Solution

46. As the depth of the river increases, the velocity of flow

A. increases

B. decreases

C. remains unchanged

D. may increase or decrease

Answer: B

Watch Video Solution

47. Viscosity is the property by virtue of which a liquid.

A. occupies minimum surface area

B. offers resistance for the relative motion between its layers.

C. becomes spherical in shape.

D. tends to gain its deformed position.

Answer: B

Watch Video Solution

48. Which of the following substances has the greatest viscosity?

A. Mercury

B. Water

C. Kerosene

D. Glycerin

Answer: D

Watch Video Solution

49. Machine parts are jammed in winter due to

A. increase in viscosity of libricant

B. decrease in viscosity of libricant

C. increase in surface tension of lubricant

D. decrease in surface tension of lubricant

Answer: A

Watch Video Solution

50. Viscosity is most closely related to

A. density

B. velocity

C. friction

D. energy

Answer: C

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51. Rain drops fall with terminal velocity due to

A. buoyancy

B. viscosity

C. low weight

D. surface tension

Answer: B

Watch Video Solution

52. The force which tends to destroy the relative motion between liquid layers is known as

A. force due to surface tension

B. viscous force

C. gravitational force

D. force of cohesion

Answer: B

Watch Video Solution

53. Two identical lead shots are dropped at the same time in two glass jars containing water and glycerin. The glass jars containing water and gycerin. The lead shot dropped in glycerin descends slowly because

A. viscous force is more in water than in glycerin

B. viscous force is more in glycerin than in water

C. surface tension is more is water

D. surface tension is more in glycerin

Answer: B

Watch Video Solution

54. After the storm, the sea water waves subside due to

A. surface tension of sea-water

B. disappearance of heavy currects

C. The vicosity of sea water

D. gravitational pull of the storm

Answer: C

Watch Video Solution

55. When a metallic sphere is dropped in a long column of a liquid, the motion of the sphere is opposed by the viscous force of the liquid. If the apparent weight of the sphere equals to the retardation forces on it, the sphere moves down with a velocity called.

A. critical velocity

B. terminal velcoity

C. velocity gradient

D. constant velocity

Answer: B

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56. The tangential forces per unit area of the liquid layer required to maintain unit velocity gradient is known as

A. coefficient of gravitation of liquid layer

B. coefficient of friction between layers

C. coefficient of viscosity of the liquid

D. temperature coefficient of viscosity

Answer: C

Watch Video Solution

57. The quality of fountain-pen ink depends largely on

A. surface tension of the liquid.

B. viscosity of ink

C. impurities in ink

D. density of ink

Answer: B

Watch Video Solution

58. The tangential force or viscous force on any layer of the liquid is directly proportional to the velcoity gradient $d\upsilon/dx$. Then the direction of velcoity gradient is

A. perpendicular to the direction of flow of liquid.

B. parallel to the direction of flow of liquid.

C. opposite to the direction of flow of the liquid.

D. independent of the direction of flow of liquid.

Answer: A

Watch Video Solution

59. Viscosity of the fluids is analogous to

A. random motion of the gas molecules

B. friction between the solid surfaces

C. integral motion

D. non uniform motion of solids

Answer: B

Watch Video Solution

60. The viscous drag is

A. inversely proporional to the velocity gradient

B. directly proportional to the surface area of layers in contact

C. independent of nature of liquid

D. perpendicular to the directional liquid flow

Answer: B

Watch Video Solution

61. For an ideal fluid viscosity is

A. zero

B. infinity

C. finite but small

D. unity

Answer: A

Watch Video Solution

62. When stirring of a liquid is stopped, the liquid comes to rest due to

A. surface tension

B. gravity

C. viscosity

D. buoyancy

Answer: C

Watch Video Solution

63. Viscosity is exhibited by

A. solids liquids and gases

B. liquids andd gases

C. solids and gases

D. solids and liquids

Answer: B

Watch Video Solution

64. A good lubricant must have

A. high viscosity

B. low viscosity

C. high density

D. low surface tension

Answer: A

Watch Video Solution

65. With the increase of temperature

A. the viscosity of a liquid increases.

B. the viscosity of a gas decreases

C. the viscosity of a gas increases

D. the viscosity of a gas remains unchaged.

Answer: B

Watch Video Solution

66. Coefficient of viscosity of a gas

A. increases with increase of temperature

B. decreases with increase of temperature

C. remains constant with increase of temprature

D. may increase or decrease with increase of temprature.

Answer: A

Watch Video Solution

67. Viscosity of water at constant temperature is

A. more in deep water

B. more in shallow waters

C. less in deep water

D. same in both dep water and shallow waters

Answer: A

Watch Video Solution

68. Hot syrup flows faster because

A. surface tension increases with temperature

B. viscosity decreases with temeprature

C. viscosity increases with temperature

D. surface tensiondecreases with temperature

Answer: B

Watch Video Solution

69. The pressure at a depth h in a liquid of density ρ is plotted on the Y-axis and the value of h on the X-axis the graph is a strainght line. The slope of the straight line is ($g =$ acceleration due to gravity)

A. ρg

B. $\frac{1}{\rho g}$

C. $\frac{\rho}{g}$

D. $\frac{g}{\rho}$

Answer: A

Watch Video Solution

70. A drop of water of radius r is falling rhough the air of coefficient of viscosity η with a constant velocity of v the resultant force on the drop is

A. $\frac{1}{6\pi\eta rv}$

B. $6\pi\eta rv$

C. $\sqrt{6\pi\eta rv}$

D. zero

Answer: D

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71. The paint-gun works on the principle of

A. Boyle's law

B. Bernoulli's principle

C. Archimedis principle

D. Newton's laws of motion.

Answer: B

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72. The rate of flow of a liquid through a capillary tube is

A. directly proportional to the length of tube.

B. inversely proportional to the difference of pressure between the ends of the tube.

C. directly proportional to the 4^{th} power of the radius of the tube.

D. independent of the nature of the liquid.

Answer: C

Watch Video Solution

73. Poiseuille's equation holds good when

A. the flow is steady and stream line

B. the pressure is constant at every cross section

C. The liquid in contact with the walls is stationary

D. All the above

Answer: D

Watch Video Solution

74. If l is length of the tube and r is the radius of the tube, then the rate of volume flow of a liquid is maximum for the following measurements. Under the same pressure difference.

A. l, r

B. $\frac{l}{2}, 2r$

C. $l, \frac{r}{2}$

D. $2l, 2r$

Answer: B

Watch Video Solution

75. Which factor better controls the flow rate of a liquid throught the syringe?

A. the pressure exerted by the thumb

B. the length of the needle

C. the nature of the liquid

D. the radius of the syringe bore.

Answer: D

Watch Video Solution

76. After terminal velocity is reached the acceleration of a body falling thorugh a viscous fluid is:

A. zero

B. g

C. less than g

D. greater than g

Answer: A

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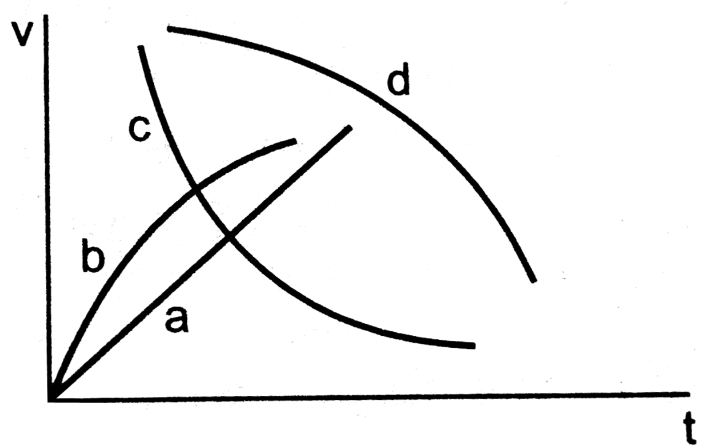
77. A spherical bal is dropped in a long column of a viscous liquid. The speed of the ball as a function of time may be best represented by the graph



A. curve A

B. curve B

C. curve C

D. curve S

Answer: C

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78. A solid rubber ball orf density d and radius R falls vertically through air. Assume that the air resistance acting on the ball is $F = KRV$ where K is constant and V is its velocity. Because of this air resistance the ball attains a constant velocity called terminal velocity v_T after some time. Then V_T

A. $\frac{4\pi R^2 dg}{3K}$

B. $\frac{3K}{4\pi R^2 dg}$

C. $\frac{4}{3}\frac{\pi r^3 dg}{K}$

D. $\pi r d g k$

Answer: A

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Watch Video Solution

79. A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity η. After some time the velocity of the ball attains a constant value known as terminal velocity υ_T. The terminal velocity depends on (i) the mass of the ball m (ii) η, (iii) r and (iv) acceleration due to gravity g . Which of the following relations is dimensionally correct?

A. $V = \frac{Kmg}{\eta r}$

B. $V = \frac{Kmgr}{\eta}$

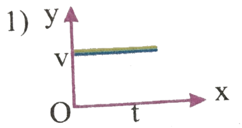
C. $V = \frac{Kmg\eta}{r}$

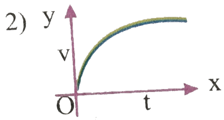
D. $V = \frac{Kr\eta}{mg}$

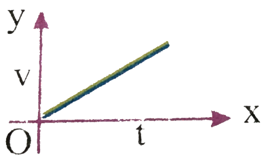
Answer: A

Watch Video Solution

80. A ball is dropped into coaltar. Its velocity time curve will be

A. 

B. 

C. 

D. 

Answer: B

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81. Two needles are floating on the surface of water. A hot needle when touches wate $3r$ surface between the needles then they move

A. closer

B. away

C. out of the liquid

D. into the liquid.

Answer: B

Watch Video Solution

82. When there are no external forces, shape of the liquid is determined by

A. density of liquid

B. temperature only

C. surface tension

D. viscosity

Answer: C

Watch Video Solution

83. In a gravity free space, shape of a large drop of liquid is

A. spherical

B. ellisodial

C. neither spherical nor cylindrical

D. may be spherical or cylindrical

Answer: A

Watch Video Solution

84. Statement I: Small liquid drops assume spherical shape.

Statement II: Due to surface tension liquid drops tend to have minimum surface area.

A. gravity

B. surface tension

C. viscosity

D. intermolecular separation

Answer: B

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85. A capillary tube, made of glass is dipped into mercury. Then

A. mercury rises in the capillary tube

B. mercury descends in capillary tube

C. mercury rises and flows out of capillary tube

D. mercury neither rises nor descends in the capillary tube.

Answer: B

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86. The height upto which water will rise in a capillary tube will be:

A. maximum when water temperature is 4^0C

B. minimum when water temperature is 4^0C

C. minimum when water temperature is 0^0C

D. same at all temperature

Answer: B

Watch Video Solution

87. At critical temperature surface tension becomes

A. 0

B. 1

C. infinite

D. negative

Answer: A

Watch Video Solution

88. The fundametal quantity which has the same power in the dimensional formula of surface tension and coefficient of viscosity is

A. mass

B. length

C. time

D. none

Answer: A

Watch Video Solution

89. Statement I: Droplets of liquid are usually more spherical in shape than large drops of the same liquid.

Statement II: Force of surface tension predominates force of gravity in case of small drops.

A. force of surface tension is equal and opposite to the fore of gravity

B. force of surface tension predominates the force of gravity

C. force of gravity predominates the surface tension

D. force of surface tension and force of gravity act in the same direction and are equal.

Answer: B

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90. Mercury does not wet glass, wood or iron because

A. cohesive force is less than adhesive force

B. cohesive force is greater than adhesive force

C. angle of contact is less than 90^0

D. cohesive force is equal to adhesive force

Answer: B

Watch Video Solution

91. The surface tension of a liquid at its boiling point is

A. maximum

B. zero

C. same as at room temperature

D. minimum but more than zero

Answer: B

Watch Video Solution

92. The addition of soap changes the surface tension of water to T_1 and that of salt solution changes to T_2. Then

A. $T_1 = T_2$

B. $T_1 > T_2$

C. $T_1 < T_2$

D. $T_1 \geq T_2$

Answer: C

Watch Video Solution

93. Surface tension of water is T_1. When oil spreads on water surface tension becomes T_2, then

A. $T_1 > T_2$

B. $T_1 = T_2$

C. $T_1 < T_2$

D. $T_1 = \frac{T_2}{2}$

Answer: A

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94. Two pieces of glass plate one upon the other with a little water between them cannot be separated easily because of

A. inertial

B. pressure

C. viscosity

D. surface tension

Answer: D

Watch Video Solution

95. The quantity on which the rise of liquid in a capillary tube does not depend is

A. density of liquid

B. radius of capillary tube

C. angle of contact

D. atmospheric pressure

Answer: D

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96. The end of a glass tube becomes round on heating due to

A. friction

B. viscosity

C. gravity

D. surface tension

Answer: D

Watch Video Solution

97. The potential energy of molecule on the surface of a liquid as compared to in side the liquid is

A. zero

B. smaller

C. the same

D. greater

Answer: D

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98. A drop of water breaks into two droplets of equal size. In this process which of the following statements is correct? (1). The sum of temperature of the two droplets together is equal to the original temperature of the drop.

(2).the sum of masses of the two droplets is equal to the original mass of the drop.

(3). the sum of the radii of the two droplets is equal to the radius of the original drop.

(4). the sum of the surface areas of the two droplets is equal to the surface area of the original drop.

A. 1 is correct

B. 2 is correct

C. 3 is correct

D. 4 is correct

Answer: B

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99. It is difficult to fill a capillary tube with mercury that with water since

A. angle of contact between glass & mercury is more that 90° and the angle of contact between glass and water is less than 90°

B. angle of contact is between glass and mercury is less that 90° and the angle of contact between glass and water is more than 90°

C. angle of contact is same for both water and mercury.

D. mercury is less dense than water.

Answer: A

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100. A water proofing agent chages the angle of contact from

A. acute to $(\pi/2)$

B. $(\pi/2)$ to obtuse

C. acute to obtuse value

D. obtuse to acute value

Answer: C

Watch Video Solution

101. A liquid will not wet the surface of a solid if the angle of contact is

A. 0°

B. $= 45^{\circ}$

C. $= 90^{\circ}$

D. $> 90^{\circ}$

Answer: D

Watch Video Solution

102. The liquid meniscus in a capillary tube will be convex, if the angle of contact is

A. greater that 90°

B. less than 90°

C. equal to 90°

D. equal to zero

Answer: A

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103. The rise of liquid into capillary tube is h_1. If the apparatus is taken in a lift moving up with acceleration the height is h_2 then

A. $h_1 = h_2$

B. $h_1 > h_2$

C. $h_2 > h_1$

D. $h_2 = 0$

Answer: B

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104. The nature of r-h graph (r is radius of capillary tube and h is capillary rise) is

A. straight line

B. parabola

C. ellipse

D. recangular hyperbola

Answer: D

Watch Video Solution

105. If L is the capillary rise or dip and A the cross sectional area of the tube, other condition being the same, then

A. $LA =$ constant

B. $L\sqrt{A} =$ constant

C. $\frac{L}{A} =$ constant

D. $\frac{L}{\sqrt{A}} =$ constant

Answer: B

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106. Water rises in a capillary tube to a height H, when the capillary tube is vertical. If the same capillary is now inclined to the vertical the length of water column in it will

A. increase

B. decrease

C. will not change

D. may increase or decrease depending on the angle of inclination.

Answer: A

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107. The excess pressure inside a soap bubble is

A. inversely proportional to the surface tension

B. inversely proportional to its radius

C. directly proportional to square of its radius

D. inversely proportional to square of its radius

Answer: B

Watch Video Solution

108. The surface tension of a liquid ___ with rise of temperature.

A. increases

B. decreases

C. remains same

D. first decreased and then increases

Answer: B

Watch Video Solution

109. If two soap bubbles of different radii are connected by a tube

A. air flows from the bigger bubbles to the smaller bubble till the sizes become equal.

B. air flows from bigger bubble to the smaller bubble till the sizes are interchanged

C. air flows from the smaller bubble to the bigger.

D. there is no flow of air.

Answer: C

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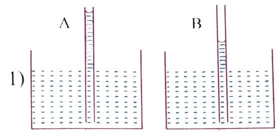
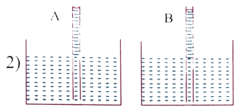
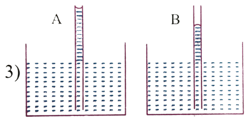
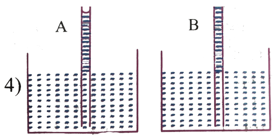
110. A capillary tube (A) is dipped in water. Another identical tube (B) is dipped in a soap-water solution. Which of the following shows the relative nature of the liquid columns in the two tubes?

A. 

B. 

C. 

D. 

Answer: A

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111. If a big shop of liquid at 27° is broken into number of small drops then the termparature of the drplets is

A. $= 27^{\circ} C$

B. $> 27^{\circ} C$

C. $< 27^{\circ} C$

D. $= 54^{\circ} C$

Answer: C

Watch Video Solution

112. With the increase in temperature the angle of contact glass and water

A. decreases

B. increases

C. remains cont

D. some times increases and some times decreases

Answer: A

Watch Video Solution

113. When a capillary tube is dipped into a liquid, the liquid neither rises nor falls in the capillary.

A. 20°

B. 90°

C. 30°

D. 70°

Answer: B

Watch Video Solution

114. The water proofing agents:

A. increase the surface tension T and decrease the angle of contact θ

B. increase both T and θ

C. decrease both T and θ

D. decrease T and increase θ

Answer: B

Watch Video Solution

115. A capillary is dipped in water vessel kept on a freely falling lift, then

A. water will not rise in the tube

B. water will rise to the maximum available height of the tube

C. water will rise to the height observed under normal condition

D. water will rise to the height below that observed under normal condition.

Answer: B

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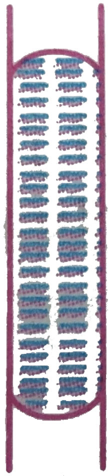
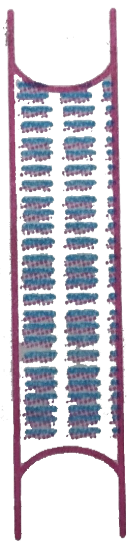
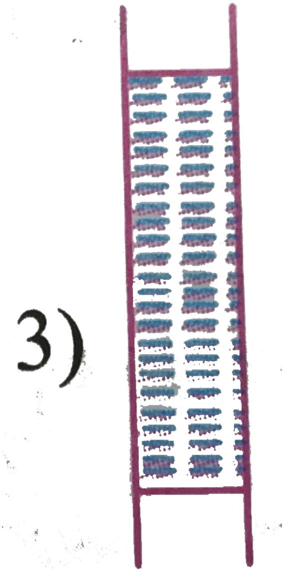
116. A vertical glass capillary tube, open at both ends, contains some water. Which of the following shapes may not be taken by the water in the tube?

1) 

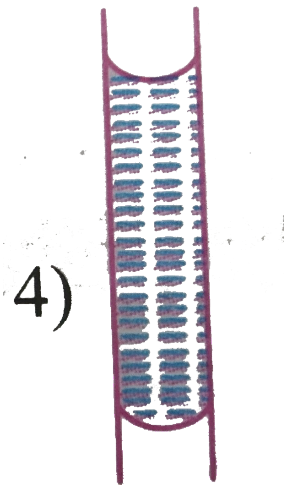
A.

2) 

B.



C.



D.

Answer: B

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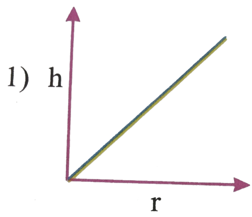
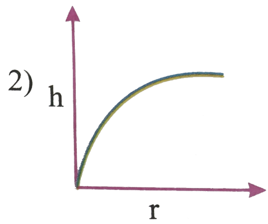
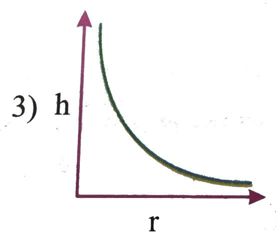
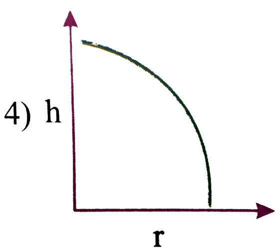
117. Which of the following graphs may represent the relation between capillary rise h and the radius r of the capillary

A. 

B. 

C. 

D. 

Answer: C

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Level 1 (C.W)

1. In car lift compressed air exerts a force F_1 on a small piston having a radius of 5 cm. This pressure is transmitted to a second piston of radius 15 cm. If the mass of the car to be lifted is 1350 kg, what is F_1? What is the pressure necessary to ac complish this task ?

A. $14.7 \times 10^3 N$

B. $1.47 \times 10^3 N$

C. $2.47 \times 10^3 N$

D. 24.7×10^3N

Answer: B

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2. A bucket containing water of depth 15 cm is kept in a lift which is moving vertically upward with an acceleration 2g. Then the pressure on the bottom of the bucket in $kgwt/cm^2$ is

A. 0.45

B. 0.045

C. 0.015

D. 0.15

Answer: B

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3. An inverted u-tube has its two limbs in water and kerosene contained in two beakers. If water rises to a height of 10 cm to what height does kerosene (density $= 0.8gm/cc$) rise in te other limb?

A. 10 cm

B. 12.5 cm

C. 15 cm

D. 20 cm

Answer: B

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4. 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. 14.4

B. 7.2

C. 3.6

D. 12.2

Answer: B

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5. An iar tight container having a lid with negli-gible mass and an area of $8cm^2$ is partially evacuated. If a 48 N forces is required to pull the lig of the container and the atmospheric pressure is $1.0 \times 10^5 Pa$ the pressure in the container before it is opened must be

A. 0.6 atm

B. 0.5 atm

C. 0.4 atm

D. 0.2 atm

Answer: C

Watch Video Solution

6. A brass sphere weighs 100 gm. Wt in air. It is suspended by a thread in a liquid of specific gravity $= 0.8$. If the specific energy gravity of brass is 8, the tension in the thread in newtons is

A. 0.0882

B. 8.82

C. 0.882

D. 0.00882

Answer: C

Watch Video Solution

7. A cube of side 20 cm is floating on a liquid with 5 cm of the cube outside the liquid. If the density of liquid is $0.8 gm / cc$ then the mass of the cube is

A. 4.2 kg

B. 4.8 kg

C. 5 kg

D. 5.2 kg

Answer: B

Watch Video Solution

8. If a body floats with $(m/n)^{th}$ of its volume above the surface of water, then the relative density of the material of the body is

A. $\frac{(n - m)}{n}$

B. $\frac{m}{n}$

C. $\frac{n}{m}$

D. $\frac{(n - m)}{n}$

Answer: A

Watch Video Solution

9. When a body lighter than water is completely submerged in water, the buoyant force acting on it is found to be n times its weight. The specific gravity of the specific gravity of the material of the body is

A. $\frac{1}{1+n}$

B. $\frac{1}{n}$

C. n

D. $n+\frac{1}{n}$

Answer: B

Watch Video Solution

10. A pipe having an internal diameter D is connected to another pipe of same size. Water flows into the second pipe through n holes, each of diameter d. if the water in the first pipe has speed v, the speed of water leaving the second pipe is

A. $\frac{D^2v}{nd^2}$

B. $\frac{nD^2v}{d^2}$

C. $\frac{nd^2v}{D^2}$

D. $\frac{d^2v}{nd^2}$

Answer: A

Watch Video Solution

11. The velocity of the wind over the surface of the wing of an aeroplane is $80ms^{-1}$ and under the wing $60ms^{-1}$. If the area of the wing is $4m^2$, the dynamic lift experienced by the wing is [density of air $= 1.3kg.\,m^{-3}$]

A. 3640 N

B. 7280 N

C. 14560 N

D. 72800 N

Answer: B

Watch Video Solution

12. An aeroplane of mass 5000 kg is flying at an altitude of 3 km. if the area of the wings is $50m^2$ and pressure at the lower surface of wings is $0.6 \times 10^5 Pa$, the pressure on the upper surface of wings is (in pascal) $\left(g = 10ms^{-2}\right)$

A. 59×10^3

B. 2×10^4

C. 6×10^3

D. 59

Answer: A

Watch Video Solution

13. Water flows through a non-uniform tube of area of cross section A, B and C whose values are 25, 15 and $35cm^2$ resprectively. The ratio of the velocities of water at the sections A,B and C is

A. $5:3:7$

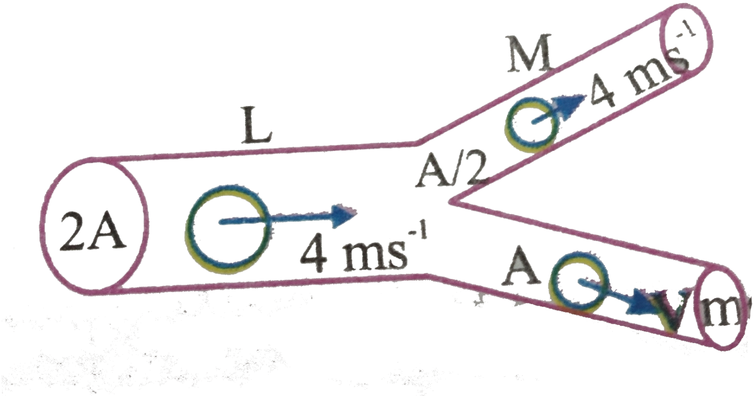
B. $7:3:5$

C. $21:35:15$

D. $1:1:1$

Answer: C

Watch Video Solution



14.

An incompressible liquid flows through a horizontal tube LMN as shown in the figure. Then the velocity V of the liquid throught he tube N is:

A. $1ms^{-1}$

B. $2ms^{-1}$

C. $4.5ms^{-1}$

D. $6ms^{-1}$

Answer: D

Watch Video Solution

15. A liquid is kept in a cylindrical jar, which is rotated about the cylindrical axis. The liquid rises at its sides. The radius of the jar is r and speed of rotation is Ω the difference in height at the centre and the sides of the jar is

A. $\frac{r^2\omega^2}{g}$

B. $\frac{r^2\omega^2}{2g}$

C. $\frac{g}{r^2\omega^2}$

D. $\frac{2g}{r^2\omega^2}$

Answer: B

Watch Video Solution

16. The reading of pressure meter attached with a closed pipe is $3.5 \times 10^5 Nm^{-2}$. On opening the value of the pipe, the reading of the pressure meter is reduced to $3.0 \times 10^5 Nm^{-2}$. Calculate the speed of the water flowing in the pipe.

A. $10cm/s$

B. $10m/s$

C. $0.1m/s$

D. $0.1m/s$

Answer: B

Watch Video Solution

17. At the mount of the tap area of cross-section is $2.0cm^2$ and the speed of water is $3m/s$. The area of cross-section of the water column 80 cm below the tap is (use $g = 10m/s^2$)

A. $0.6cm^2$

B. $1.2cm^2$

C. $1.5cm^2$

D. $2.0cm^2$

Answer: B

Watch Video Solution

18. 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.

A. 10

B. 5

C. $5\sqrt{2}$

D. $10\sqrt{2}$

Answer: A

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19. 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.

A. 10

B. 5

C. $5\sqrt{2}$

D. $10\sqrt{2}$

Answer: D

Watch Video Solution

20. There is a hole at the side-bottom of a big water tank. The area of the hole is $4mm^2$ to it a pipe is connected. The upper surface of water is 5 m above the hole. The rate of flow of water through the pipe is (in $m^3s^{-1}\big)\big(g = 10ms^{-2}\big)$

A. 4×10^{-5}

B. 4×10^5

C. 4×10^{-6}

D. 28×10^{-5}

Answer: A

Watch Video Solution

21. The flow rate from a tap of diameter $1.25cm$ is 3 L//min. The coefficient of viscosity of water is 10^{-3} pa-s. Characterize the flow.

A. Tubulent

B. Laminar

C. neither laminar (or) Turbulent

D. Data inadequate

Answer: A

Watch Video Solution

22. If the shearing stress between the horizontal layers of water in a river is 1.5 milli newton/m^2 and $\eta_{\text{water}} = 1 \times 10^{-3} Pa.s$ The velocity gradient is ... s^{-1}

A. 1.5

B. 3

C. 0.7

D. 1

Answer: A

Watch Video Solution

23. A force of 10 N is requrid to draw rectangular glass plate on the surface of a liquid with some velocity. Force needed to draw another glass plate of 3 times length and 2 times width is

A. $\frac{5}{3}N$

B. $10N$

C. $60N$

D. $30N$

Answer: C

Watch Video Solution

24. Water is flowing through a capillary tube at the rate of $20 \times 10^{-6} m^3/s$. Another tube of same radius and double the length is connected in series to the first tube. Now the rate of flow of water in $m^3 s^{-1}$ is

A. 10×10^{-6}

B. 3.33×10^{-6}

C. 6.67×10^{-6}

D. 20×10^{-6}

Answer: C

Watch Video Solution

25. An artery in a certain person has been widened $1\frac{1}{2}$ times the original diamter. If the pressure difference across the artery is maintaned constant, the blood flow through the artery will be increased to

A. $(3/2)$ times

B. $(9/4)$ times

C. no change

D. $(81/16)$ times

Answer: D

Watch Video Solution

26. Water flowing from a hose pipe fills a 15 litre container in one minute. The speed of water from the free opening fo radius 1 cm is (in ms^{-1})

A. 2.5

B. $\frac{\pi}{2.5}$

C. $\frac{2.5}{\pi}$

D. 5π

Answer: C

Watch Video Solution

27. Two liquids are allowed to flow through two capillary tubes of length in the ratio $1:2$ and radii in the ratio $2:3$ under the same pressure difference. If the volume rates of flow of the liquids are in the ratio $8:9$ the ratio fo their coefficients of viscosity is

A. $1:3$

B. $3:1$

C. $4:9$

D. $9:4$

Answer: C

Watch Video Solution

28. The viscous resistance of a tube to liquid flow is R. its resistance for a narrow tube of same length and $\frac{1}{3}$ times radius is

A. $\frac{R}{3}$

B. $3R$

C. $27R$

D. $81R$

Answer: D

Watch Video Solution

29. Eight spherical rain drops of the same mass and radius are falling down with a terminal speed of $6cms^{-1}$. If they coalesce to form one big drop, what will be its terminal speed? Neglect the buoyancy due to air

A. $1.5cms^{-1}$

B. $6cms^{-1}$

C. $24cms^{-1}$

D. $32cms^{-1}$

Answer: C

Watch Video Solution

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

A. $mg\left(\frac{d_1}{d_2}\right)$

B. $mg\left(1 - \frac{d_2}{d_1}\right)$

C. $mg\left(\frac{d_1 + d_2}{d_1}\right)$

D. $mg\left(\frac{d_1 + d_2}{d_2}\right)$

Answer: B

Watch Video Solution

31. The length of a rubber cord floating on water is 5 cm. The force needed to pull the cord out of water is ....N (surface tension of water is $7.2 \times 10^{-4} Nm^{-1}$).

A. 7.2×10^{-3}

B. 7.2×10^{-4}

C. 7.2×10^{-5}

D. 7.2×10^{-2}

Answer: C

Watch Video Solution

32. Calculate the force required to separate the galss plates of area $10^{-2}m^2$ with a film of water 0.05 mm thickness between them (surface tension of waer $= 70 \times 10^{-3}N/m\Big)$)

A. $28N$

B. $112N$

C. $5.6N$

D. $11.2N$

Answer: A

Watch Video Solution

33. A thin wire ring of 3 cm radius float on the surface of liquid. The pull required to raise the ring before the film breaks is $30.14 \times 10^3 N$ more than its weight. The surface tension of the liquid (in Nm^{-1}) is

A. 80×10^{-3}

B. 87×10^{-3}

C. 90×10^{-3}

D. 98×10^{-3}

Answer: A

Watch Video Solution

34. A wire is bent in the form of a U-shape and a slider of negligible mass is connecting the two vertical sides of the U-shape. This arrangement is dipped in a soap solution and lifted a thin soap film is formed in t he frame it supports a weight of $2.0 \times 10^{-2} N$ if the length of the slider is 40 cm what is the surface tension of the film?

A. $25Nm^{-1}$

B. $2.5Nm^{-1}$

C. $2.5 \times 10^{-2}Nm^{-1}$

D. $2.5 \times 10^{-3}Nm^{-1}$

Answer: C

Watch Video Solution

35. A ring of inner and outer radii 8 and 9 cm is pulled out of water surface with a force of [S.T of water $(T) = 70\text{dyne}/cm$]

A. $26 \times 10^{-2}N$

B. $12.6 \times 10^{-2}N$

C. 7.48×10^{-2}

D. 3.08×10^{-2}

Answer: C

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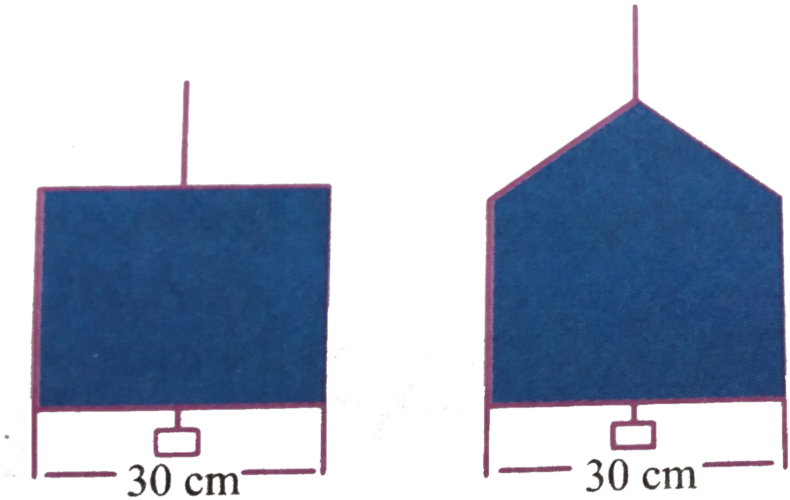

Fig (i) Fig (ii)

36. In Fig(i) a thin film supports a small weight $3.5 \times 10^{-2} N$ The weight supported by a film of the same liquid at the same temperature in fig.(ii) is

A. $3.5 \times 10^{-2} N$

B. $3.5 \times 10^{-3} N$

C. $3.5 \times 10^{-1} N$

D. $3.5 \times 10^{-4} N$

Answer: A

Watch Video Solution

37. Work of 6.0×10^{-4}N joule is required to the done in increasing the size of soap film form $10cm \times 6cm$ to $10cm \times 11cm$. The surface tension of the film is (in N/m)

A. 5×10^{-2}

B. 6×10^{-2}

C. 1.5×10^{-2}

D. 1.2×10^{-2}

Answer: B

Watch Video Solution

38. The work done in increasing the radius of a soap bubble from 4 cm to 5 cm is Joule (given surface tension of soap water to be $25 \times 10^{-3} N/m$)

A. 0.5657×10^{-3}

B. 5.657×10^{-3}

C. 56.5×10^{-3}

D. 565×10^{-3}

Answer: A

Watch Video Solution

39. A mercury drop of radius 1 cm is sprayed into 10^{6} drops of equil size. The energy expended in joule is (surface tension of mercury is $\left(460 \times 10^{-3} N/m\right)$

A. 0.057

B. 5.7

C. 5.7×10^{-4}

D. 5.7×10^{-6}

Answer: A

Watch Video Solution

40. 8000 identical water drops combine together to form a big drop. Then the ratio of the initial surface enrgy of all the initial surface energy of all the drops together is

A. $1:10$

B. $1:15$

C. $1:20$

D. $1:25$

Answer: C

Watch Video Solution

41. When two capillary tubes A and B are immersed in water , the heights of water columns are found to be in the ratio $2:3$ the ratio of the radii of tubes A and B is

A. $2:3$

B. $4:9$

C. $9:4$

D. $3:2$

Answer: D

Watch Video Solution

42. A capillary tube of radius 0.25 mm is dipped vertically in a liquid of density $800kgm^{-3}$ and of surface tension $3 \times 10^{-2}Nm^{-2}$. The angle of contact of liquid -glass is given by $\cos\theta = 0.3$ If $g = 10ms^{-2}$ the rise of liquid in the capillary tube is.. Cm

A. 9

B. 0.9

C. 9×10^{-3}

D. 0.09

Answer: B

Watch Video Solution

43. When a clean lengthy capillary tube is dipped vertically in a beaker containing water, the water rises to a height of 8 cm. What will happen if another capillary tube of length 4 cm and same radius is dipped vertically in the same beaker containing water. (angle of contact of water is 0°)

A. Water will flow out like a fountain.

B. water will rise to a height of 4 cm only and the angle of contact will be zero

C. water will rise to the a height of 4 cm only and the angle of contact will be 60°

D. water will not rise at all

Answer: C

Watch Video Solution

44. Capillary tubes of diameters 1,1.5,2 mm are are dipped vertically in the same liquid. The capillary ascents of the liquid in the tube are in the ratio

A. $2:3:4$

B. $6:4:3$

C. $3:4:6$

D. $4:3:2$

Answer: B

Watch Video Solution

45. A capillary tube is taken from the Earth to the surface of the moon. The rise of the liquid column on the Moon (acceleration due to gravity on the Earth is 6 times that of the Moon) is

A. six times that on the earth surface

B. $\frac{1}{6}$ that on the Earth's surface

C. equal to that on the Earth's surface

D. zero

Answer: A

Watch Video Solution

46. When a capillary tube is lowerd into water the mass of the water raised above the outside level is 5 gm. If the radius of the tube is doubled the mass of water that raises in the tube above the outside level is

A. 1.25 gm

B. 5 gm

C. 10 gm

D. 20 gm

Answer: C

Watch Video Solution

47. A vessel has a small hole at its bottom. If water can be poured into it upto a height of 7 cm without leakage $\left(g = 10ms^{-2}\right)$ the radius of the hole is (surface tension of water is $0.7Nm^{-1}$)

A. 2 mm

B. 0.2 mm

C. 0.1 mm

D. 0.4 mm

Answer: B

Watch Video Solution

48. A 20 cm long capillary tube is dipped in water. The water rises up to 8 cm. If the entire arrangement is put in a freely falling elevator, the length of water column in the capillary tube will be

A. 4 cm

B. 20 cm

C. 8 cm

D. 10 cm

Answer: B

Watch Video Solution

49. When a cylindrical tube is dipped vertically into a liquid the angle of contact is 140°. When the tube is dipped with an inclination of 40° the angle of contact is

A. 100°

B. 140°

C. 180°

D. 60°

Answer: B

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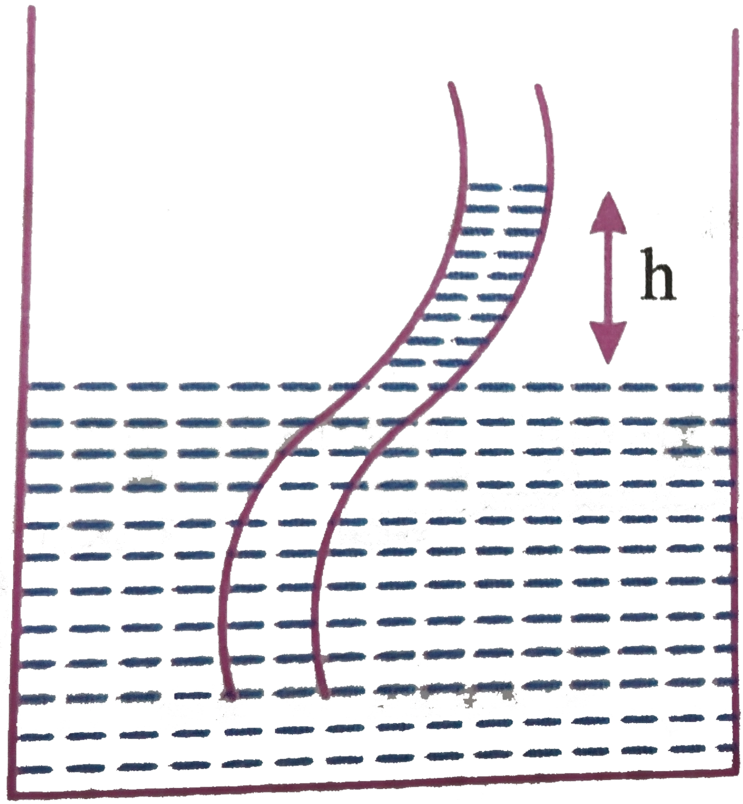


50.

Water rises in a straight capillary tube upto a height of 5 cm when held vertical in water. If the tube is bent as shown figure then the height of water column in it will be

A. 5 cm

B. less than than 5cm

C. more than 5 cm

D. $5\cos\alpha$

Answer: A

Watch Video Solution

51. Two liquid drops have their diameters as 1 mm and 2 mm. The ratio of excess pressures in them is

A. $1:2$

B. $2:1$

C. $4:1$

D. $1:4$

Answer: B

Watch Video Solution

52. Pressure inside two soap bubbles are 1.01 and 1.02 atmospheres. Ratio between their volumes is

A. $102 : 101$

B. $(102)^3 : (101)^3$

C. $8 : 1$

D. $2 : 1$

Answer: C

Watch Video Solution

53. Excess pressure one soap bubble is four times that of other. Then the ratio of volume of first bubble to second one is

A. $1 : 64$

B. $64 : 1$

C. $4 : 1$

D. $1:2$

Answer: A

Watch Video Solution

54. If a soap bubble of radius 3 cm coalesce with another soap bubble of radius 4 cm under isothermal conditions the radius of the redultant bubble formed is in cm

A. 7

B. 1

C. 5

D. 12

Answer: C

Watch Video Solution

Level 2 (C.W)

1. A bird of mass 1.23 kg is able to haver by imparting a downward velocity of $10m/s$ uniformly to air of density $\rho kg/m^3$ over an effective area $0.1m^2$ the acceleration due to gravity is $10m/s^2$ then the magnitude of ρ in kg/m^3

A. 0.34

B. 0.89

C. 1.23

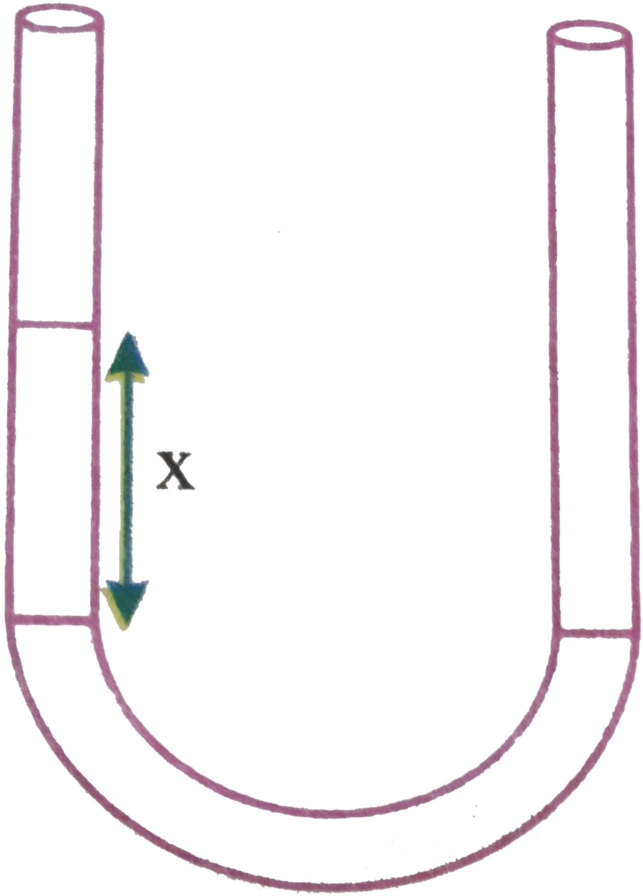
D. 4.8

Answer: C

Watch Video Solution

2. one end of a U-tube of uniform bore (area A) containing mercury is connected to a suction pump. Because of it the level of liquid of density ρ

falls in one limb. When the pump is removed, the restoring force in the other limb is:



A. $2x\rho Ag$

B. $x\rho g$

C. $A\rho g$

D. $x\rho Ag$

Answer: A

Watch Video Solution

3. A boat having length 2 m and width 1 m is floating in a lake. When a man stands on the boat, it is depressed by 3 cm. The mass of the man is

A. 50 kg

B. 55 kg

C. 60 kg

D. 70 kg

Answer: C

Watch Video Solution

4. A cube of wood supporting 200 g mass just floats in water. When the mass is removed, the cube rises by 1 cm, the linear dimesion of cube is

A. 10 cm

B. 20 cm

C. $10\sqrt{2}cm$

D. $5\sqrt{2}cm$

Answer: C

Watch Video Solution

5. A large block of ice 4 m thick has a vertical hole drilled through it and is floating in the middle of water in a lake. The minimum length of rope required to scoop up a bucket full of the through the hole is (density of ice $= 0.9CGS$ unit, density of water $= 1CGS$ unit)

A. 40 cm

B. 24 cm

C. 20 cm

D. 360 cm

Answer: A

Watch Video Solution

6. A hollow metal sphere is found to float in water with the highest point just touching the free surface of water. If d is the density of the metal in cgs units, the fraction that represents the volume of the hollow in terms of the volume of the sphere is

A. $\frac{1}{d}$

B. $\left(1 - \frac{1}{d}\right)$

C. $\frac{d}{(d - 1)}$

D. $\left(1 + \frac{1}{d}\right)$

Answer: B

Watch Video Solution

7. A solid body is found floating in water with $\left(\frac{\alpha}{\beta}\right)^{th}$ of its volume submerged. The same solid is found floating in a liquid with $\left(\frac{\alpha}{\beta}\right)^{th}$ of its volume above the liquid surface. The specific gravity of the liquid is

A. $\frac{\beta - \alpha}{\alpha}$

B. $\frac{\alpha - \beta}{\beta}$

C. $\frac{\alpha}{\beta - \alpha}$

D. $\frac{\beta}{\alpha - \beta}$

Answer: C

Watch Video Solution

8. A wooden cube is found to float in water with $\frac{1}{2}cm$ of its vertical side above the water. On keeping a weight of 50 gm over its top, it is just submerged in the water. The specific gravity of wood is

A. 0.8

B. 0.9

C. 0.85

D. 0.95

Answer: D

Watch Video Solution

9. A solid sphere of radius R has a concentric cavity of radius '$R/2$' inside it. The sphere is found to just float in water with the highest point of it touching the water surface. The specific gravity of the material of the sphere is

A. 1

B. $\frac{7}{8}$

C. $\frac{8}{7}$

D. $\frac{8}{9}$

Answer: C

Watch Video Solution

10. Water from a tap emerges vertically downwards with iitial velocity $4ms^{-1}$. The cross-sectional area of the tap is A. The flow is steady and pressure is constant thoroughout the stream of water. The distance h vertically below the tap, where the cross-sectional area of the stream becomes $\left(\frac{2}{3}\right)A$ is $\left(g = 10m/s^2\right)$

A. 0.5 m

B. 1 m

C. 1.5 m

D. 2.2 m

Answer: B

Watch Video Solution

11. Two identical tall jars are filled with water to the brim. The first jar has a small hole on the side wall at a depth $h/3$ and the second jar has a small holw on the side wall at a depth of $2h/3$, where h is the height of the jar. The water issuing out from the first jar falls at a distance R_1 from the base and the water issuing out from the second jar falls at a distance R_2 From the base. The correct relation between R_1 and R_2 is

A. $R_1 > R_2$

B. $R_1 < R_2$

C. $R_2 = 2 \times R_1$

D. $R_1 = R_2$

Answer: D

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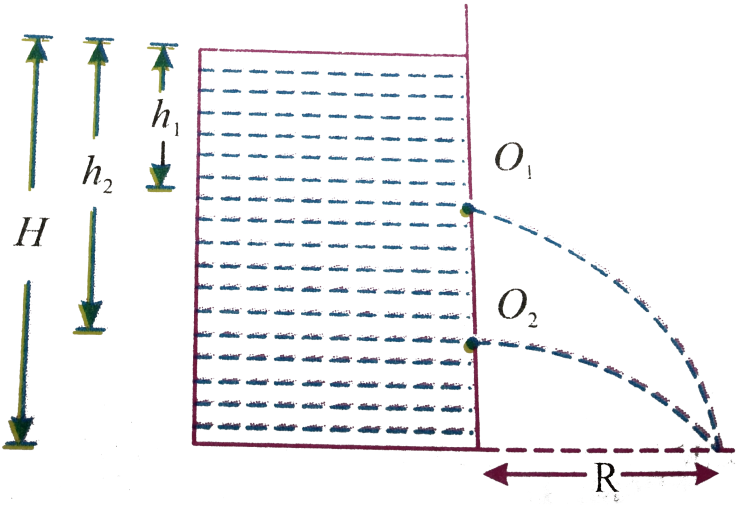
12. 

There are two holes O_1 and O_2 in a tank of height H. The water emerging from O_1 and O_2 strikes the ground at the same points as shows in fig. Then:

A. $H = h_1 + h_2$

B. $H = h_2 - h_1$

C. $H = h_1 h_2$

D. $H = \frac{h_2}{h_1}$

Answer: A

Watch Video Solution

13. A tube is mounted so that it's base is at height h above the horizontal ground. The tank is filed with water to a depth h. A hole is punched in the side of the tank at depth y below water surface. Then the value of y so that the range of emerging stream be maximum is

A. h

B. $h/2$

C. $h/4$

D. $3h/4$

Answer: A

Watch Video Solution

14. A tank full of water has a small hole at the bottom. If one-fourth of the tank is emptied in t_1 seconds and the remaining three-fourths of the tank is emptied in t_2 seconds. Then the ratio $\frac{t_1}{t_2}$ is

A. $\sqrt{3}$

B. $\sqrt{2}$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{2}{\sqrt{3}}$ - 1

Answer: D

Watch Video Solution

15. There are two holes one each along the opposite sides of a wide rectangular tak. The cross section of each hole is $0.01m^2$ and the vertical distance between the holes is one meter. The tak is filled with water. The net force on the tak in newton when water flows out of the holes is (density of water $1000kg/m^3$)

A. 100

B. 200

C. 300

D. 400

Answer: B

Watch Video Solution

16. A tank with vertical walls is mounted so that its base is at a height H above the horizontal ground. The tak is filled with water to a depth h. A hole is puched in the side wall of the tank at a depth x below the water surface. To have maximum range of the emerging stream, the value of x is

A. $\frac{H+h}{4}$

B. $\frac{H+h}{2}$

C. $\frac{H+h}{3}$

D. $\frac{3(H+h)}{4}$

Answer: B

Watch Video Solution

17. There is a small hole at the bottom of tank filled with water. If total pressure at the bottom is $3atm\left(1atm = 10^5 Nm^{-2}\right)$, then find the velocity of water flowing from hole.

A. $\sqrt{400}m/s$

B. $\sqrt{200}m/s$

C. $\sqrt{600}m/s$

D. $\sqrt{500}m/s$

Answer: A

Watch Video Solution

18. The level of a liquid in a vessel kept constant at 50 cm. it has three identical horizontal tubes each of length 60 cm coming out at heights 5,10 and 15 cm respectively. If a single tube of the same radius as that of the three tubes can replace the three tubes when placed horizontaly at the bottom of the vessel length of that tube is

A. 25 cm

B. 40 cm

C. 12.5 cm

D. 50 cm

Answer: A

Watch Video Solution

19. A tube of radius R and length L is connected in series with another tube of radius $\frac{R}{2}$ and length $\frac{L}{8}$ if the pressure across the tubes taken together is P, the pressure across the two tubes separately are:

A. $\frac{P}{2}$ and $\frac{P}{2}$

B. $\frac{P}{3}$ and $\frac{3P}{2}$

C. $\frac{P}{4}$ and $\frac{3P}{2}$

D. $\frac{P}{3}$ and $\frac{2P}{3}$

Answer: D

Watch Video Solution

20. A capillary tube is attached horizontally to a constant pressure head arrangement. If the radius of the capillary tube is increased by 10%, then the rate of flow of the liquid shall change nearly by

A. -40%

B. $+40\%$

C. $+21\%$

D. $+46\%$

Answer: D

Watch Video Solution

21. Three horizontal capillary tubes of same radii and length L_1, L_2 and L_3 are fitted side by side a little above the bottom, to the wall of a tank that is filled with water. The length of a single capillary tube of same radius that can replace the three tubes such that thwe rate of flow of water through the single tube equals the combined rate of flow through the three tubes is

A. $\frac{L_1L_2L_3}{L_1+L_2+L_3}$

B. $\frac{L_1L_2L_3}{L_1L_2+L_2L_3+L_3L_1}$

C. $\frac{L_1+L_2+L_3}{L_1L_2L_3}$

D. $\frac{L_1L_2+L_2L_3+L_3L_1}{L_1L_2L_3}$

Answer: B

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22. One spherical ball of radius R, density of released in liquid of density $d/2$ attains a terminal velocity V. Another ball of radius 2R and density 1.5 d released in the liquid will attain a terminal velocity

A. 2 V

B. 4 V

C. 6 V

D. 8 V

Answer: D

Watch Video Solution

23. When a solid ball of volume V is falling through a viscous liquid, a viscous force F acts of it. If another ball of volume 2 V of the same meterial is falling through the same liquid then the viscous force experienced by it will be (when both fall with terminal velocities).

A. F

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

C. $2F$

D. $\frac{F}{4}$

Answer: C

Watch Video Solution

24. A metalic wire of diameter d is lying horizontally o the surface of water. The maximum length of wire so that is may not sink will be

A. $\sqrt{\frac{2T}{\pi dg}}$

B. $\sqrt{\frac{2Tg}{\pi d}}$

C. $\sqrt{\frac{2\pi d}{Tg}}$

D. any length

Answer: D

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25. A liquid is filled into a semi eliiptical cross section with a as semi major axis and b as semi minor axis. The rato of surface tension forces on the curved part and the plane part of the tube in vertical position will be

A. $\frac{\pi(a+b)}{4b}$

B. $\frac{2\pi a}{b}$

C. $\frac{\pi a}{4b}$

D. $\frac{\pi(a-b)}{4b}$

Answer: A

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26. A liquid drop of diameter D breaks up into 27 drops. Find the resultant change in energy.

A. $2\pi TD^2$

B. πTD^2

C. $\frac{\pi TD^2}{2}$

D. $4\pi TD^2$

Answer: A

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27. A film of water is formed between two straight parallel wires of length 10 cm each separated by $0.5cm$ If their separation is increased by $1mm$ while still maintaining their parallelism, how much work will have to be done (Surface tension of water $= 7.2 \times 10^{-2}\frac{N}{m})$

A. $7.22 \times 10^{-6}J$

B. $1.44 \times 10^{-5}J$

C. $2.88 \times 10^{-5}J$

D. $5.76 \times 10^{-5}J$

Answer: B

Watch Video Solution

28. A soap film in formed on a frame of area $4 \times 10^{-3} m^2$. If the area of the film in reduced to half, then the change in the potential energy of the film is (surface tension of soap solution $= 40 \times 10^{-3} N/m\Big)$

A. $32 \times 10^{-5} J$

B. $16 \times 10^{-5} J$

C. $8 \times 10^{-5} J$

D. $16 \times 10^{5} J$

Answer: B

Watch Video Solution

29. The work done is blowing a soap bubble of volume V is W. The work done in blowing a soap bubble of volume $2V$ is

A. W

B. $2^{\frac{2}{3}}W$

C. $3^{\frac{2}{3}}W$

D. $2W$

Answer: B

Watch Video Solution

30. The lower end of a capillary tube of radius r is placed vertically in water of density ρ , surface tension S. The rice of water in the capillary tube is upto height h, then heat evolved is

A. $+\dfrac{\pi r^2 h^2 dg}{2J}$

B. $+\dfrac{\pi r^2 h^2 dg}{J}$

C. - $\frac{\pi r^2 h^2 dg}{2J}$

D. - $\frac{\pi r^2 h^2 dg}{J}$

Answer: A

Watch Video Solution

31. Four identical capillary tubes a,b,c and d are dipped in four beakers containing water with tube a vertically, tube b at 30° tube c at 45° and tube d at 60° inclination with the vertical. Arrange the lengths of water column in the tubes in descending order.

A. d,c,b,a

B. d,a,b,c

C. a,c,d,b

D. a,b,c,d

Answer: A

Watch Video Solution

32. A vessel whose bottom has round holes with diameter of 1 mm is filled with water Assuming that surface tenstion acts only at holes, then the maximum height to which the water can be filled in vessel without leakage is (given surface tension of water is $75 \times 10^{-3} N/m\Big)$ and $g = 10 m/s^2$

A. 3 cm

B. 0.3 cm

C. 3 mm

D. 3 m

Answer: A

Watch Video Solution

33. Water rises to a height h_1 in a capillary tube in a stationary lift. If the lift moves up with uniform acceleration it rises to a height h_2, then acceleration of the lift is

A. $\left[\frac{h_2 - h_2}{h_2}\right]g$

B. $\left[\frac{h_2 - h_1}{h_1}\right]g$

C. $\frac{\left(h_1 - h_2\right)}{h_1}\Big]g$

D. $\left[\frac{h_1 - h_2}{h_2}\right]g$

Answer: D

Watch Video Solution

34. The radii of the two columne is U-tube are r_1 and $r_2\left(> r_1\right)$. When a liquid of density ρ (angle of contact is 0°)) is filled in it, the level different of liquid in two arms is h. The surface tension of liquid is

($g =$ acceleration due to gravity)

A. $\dfrac{\rho g h r_1 r_2}{2(r_2 - r_1)}$

B. $\dfrac{\rho g h(r_2 - r_1)}{2 r_2 r_1}$

C. $\dfrac{2(r_1 - r_2)}{\rho g h r_2 r_1}$

D. $\dfrac{2(r_1 - r_2)}{\rho g h}$

Answer: A

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35. The potential energy of the liquid of surface tension T and density ρ that rises into the capillary tube is

A. $\pi^2 T^2 \rho^2 g$

B. $4\pi T^2 \rho^2 g$

C. $\frac{2\pi T^2}{\rho g}$

D. $\frac{\pi T^2}{\rho g}$

Answer: C

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36. A small air bubble of 0.1 mm diameter is formed just below the surface of water. If surface tension tension of water is 0.072 Nm^{-1}, the pressure inside the air bubble in kilo pascal is (Atmospheric pressure $= 1.01 \times 10^5 Pa$)

A. 28.9

B. 0.289

C. 0.0289

D. 103.88

Answer: D

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37. A spherical soap bubble of radius 1 cm is formed inside another of radius 4 cm. The radius of single soap bubble which maintains the same pressure difference as inside the smaller and outside the larger soap bubble is_____cm.

A. 1

B. 0.8

C. 0.5

D. 0.25

Answer: B

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38. The depth of water at which air bubble of radius 0.4 mm remains in equilibrium is $\left(T_{\text{water}} = 72 \times 10^{-3} N/m\right)$

A. $3.67cm$

B. $3.67m$

C. $6.37cm$

D. $5.32cm$

Answer: A

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39. Two separate air bubbles (radii $0.002cm$ and 0.004) formed of the same liquid (surface tension $0.07N/m$) come together to form a double bubble. Find the radius and the sense of curvature of the internal film surface common to both the bubbles.

A. 0.001 cm

B. 0.002 cm

C. 0.004 cm

D. 0.003 cm

Answer: C

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40. The excess pressure inside a spherical soap bubble of radius 1 cm is balanced by a column of oil (specific gravity $= 0.8$), 2 mm high, the surface tension of the bubble is

A. $3.92 N/m$

B. $0.0392 N/m$

C. $0.392 N/m$

D. $0.00392 N/m$

Answer: B

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Level 3

1. A hydraulic press with the larger piston of diameter 35 cm at a heigth of 1.5 m relative to the smaller piston of diameter 10 cm. The mass on the smaller piston is 20 kg. What is the force exerted on the load placed. On the larger piston ? The density of oil in the press is $750 kgm^{-3}$

A. $5 \times 10^3 N$

B. $1.3 \times 10^3 N$

C. $3.7 \times 10^3 N$

D. $4.8 \times 10^3 N$

Answer: B

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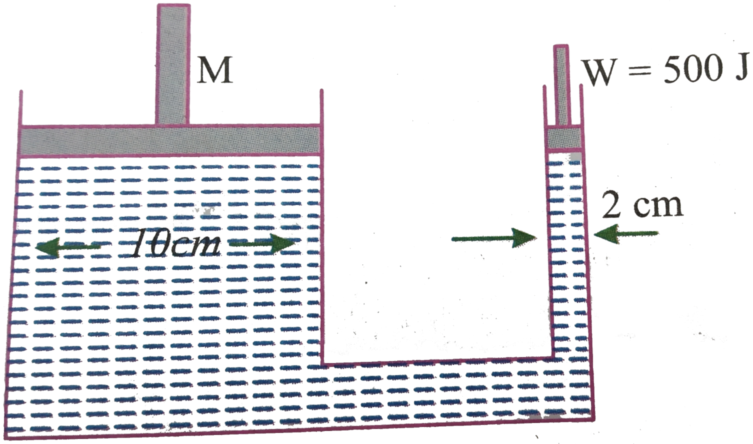
2.



The hydraulic press shown in the figure is used to raise the mass M through a height of 5.0 mm by performing 500 J of work at the small piston. The diameter of the large piston is 10 cm while that of the smaller one is 2 cm. The mass M is

A. $10^4 kg$

B. $10^3 kg$

C. $100 kg$

D. $10^5 kg$

Answer: A

Watch Video Solution

3. A small ball of density ρ is immersed in a liquid of density $\sigma(> \rho)$ to a depth h and released. The height above the surface of water up to which the ball will jump is

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

B. $\left(\frac{\rho}{\sigma} + 1\right)h$

C. $\left(\frac{\sigma}{\rho} - 1\right)h$

D. $\left(\frac{\sigma}{\rho} + 1\right)h$

Answer: C

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4. A bowl of soap water is at rest on a table in the dining compartment of a train, if the acceleration of the train is $g/4$ in forward direction the angle made by its surface withh horizontal is

A. $\tan^{-1}\left(\frac{1}{2}\right)$

B. $\tan^{-1}\left(\frac{1}{4}\right)$

C. $\tan^{-1}\left(\frac{1}{5}\right)$

D. $\tan^{-1}\left(\frac{1}{3}\right)$

Answer: B

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5. A metallic sphere with an internal cavity weighs $40gwt$ in air and $20gwt$ in water. If the density of the material with cavity be $8gpercm^3$ then the volume of cavity is :

A. zero

B. $15cm^3$

C. $5cm^3$

D. $20cm^3$

Answer: B

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6. A cylindrical tank has a hole of $2cm^2$ at its bottom if the water is allowed to flow into tank from a tube above it at the rate of $100cm^3/s$ then find the maximum height upto which water can rise in the tank (take $= g = 10ms^{-2}$)

A. $2.5 \times 10^{-2}m$

B. $1.25 \times 10^{-2}m$

C. $5.5 \times 10^{-2}m$

D. $3.5 \times 10^{-2}m$

Answer: B

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7. A vessel has water to height of 40 cm. it has three horizontal capillary tubes of same diameter each of length 15 cm coming out at height 10 cm, 15 cm, 20 cm .The length of a single tube of same diameter as that of the three tubes which can replace them when placed horizontally at the bottom of the vessel is:

A. 45 cm

B. 5 cm

C. 8 cm

D. 16 cm

Answer: C

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8. A spherical solild of volume V is made of a material of density ρ_1. It is falling through a liquid of density $\rho_2 \left(\rho_2 < \rho_1\right)$. Assume that the liquid applies a viscous froce on the ball that is proportional ti the its speed v, i.e., $F_{viscous} = -kv^2(k > 0)$. The terminal speed of the ball is

A. $\sqrt{\frac{Vg\rho_1}{k}}$

B. $\frac{Vg(\rho_1 - \rho_2)}{k}$

C. $\sqrt{\frac{Vg(\rho_1 - \rho_2)}{k}}$

D. $\frac{Vg\rho_1}{k}$

Answer: C

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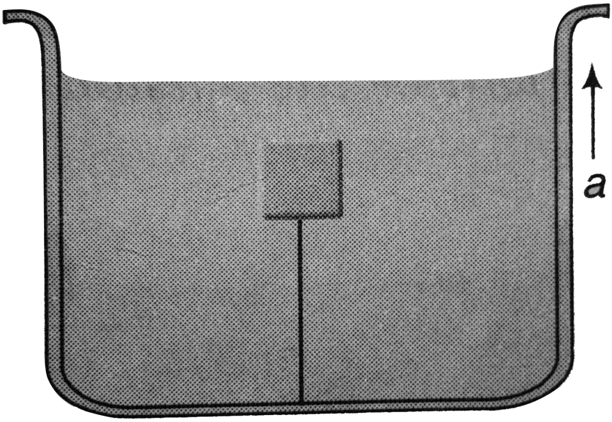
9. A block of mass 1 kg and density $0.8g/cm^3$ is held stationary with the help of a string as shown in figure. The tank is accelerating vertically upwards with an acceleration a $= 1.0m/s^2$. Find



(a) the tension in the string,

(b) if the string is now cut find the acceleration of block.

(Take $g = 10 m/s^2$ and density of water $= 10^3 kg/m^3$).

A. $T = 2.2N$

B. $T = 2.75N$

C. $T = 3N$

D. $T = 2.4N$

Answer: B

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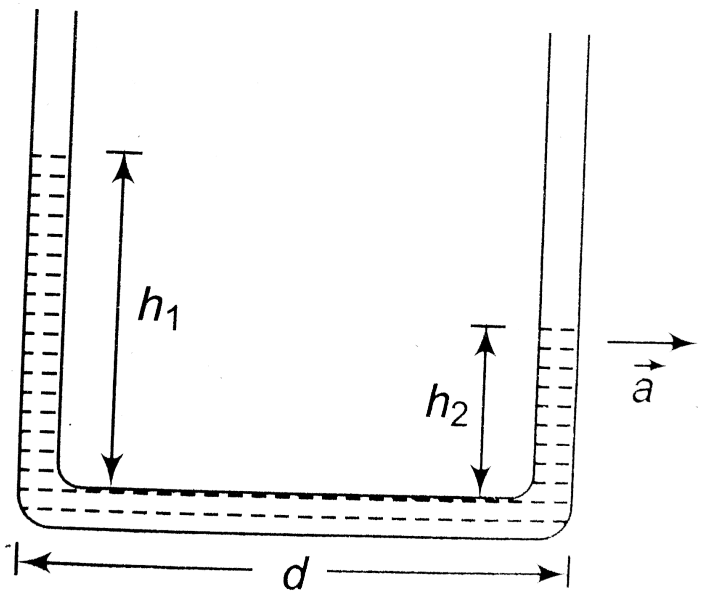
10. Fig, shows a U-tube of uniform cross-sectional area A accelerated with acceleration a as shown. If d is the separation between the limbs. Then the difference in the levels of the liquid in the U - $tube$ is



A. $\frac{ad}{g}$

B. $\frac{g}{ad}$

C. adg

D. $ad + g$

Answer: A

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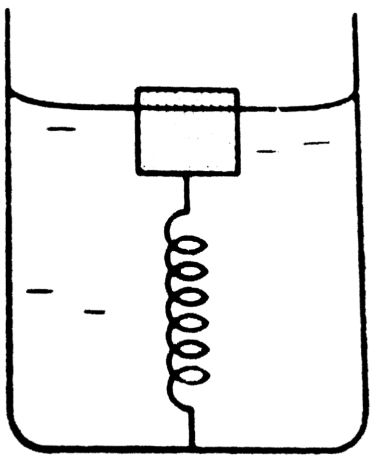
11. A cubical block of wood of edge 3 cm floats in water. The lower surface of the cube just touches the free end of a vertical spring fixed at the bottom of the pot. Find the maximum weight that can be put on the block without wetting it. Density of wood $=800 kgm^{-3}$ and spring constant of the spring $= 50 Nm^{-1} Take g = 10 ms^{-2}$.



,

A. $1.35N$

B. $1.55N$

C. $1.65N$

D. $1.75N$

Answer: A

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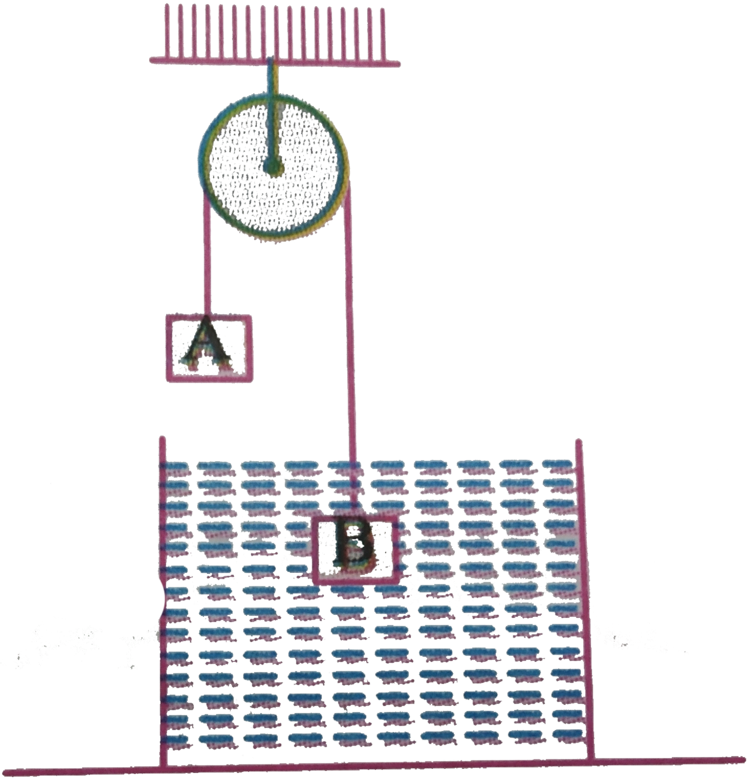
12.



In the arrangement shown in the figure $\frac{m_A}{m_B} = \frac{2}{3}$ and the ratio of density of block B and the liquid is $2:1$ The system is released from rest. Then

A. block B will oscillate but not simple harmonically

B. block B will oscillate simple harmonically

C. the system will remain in equilibarium

D. None of the above

Answer: A

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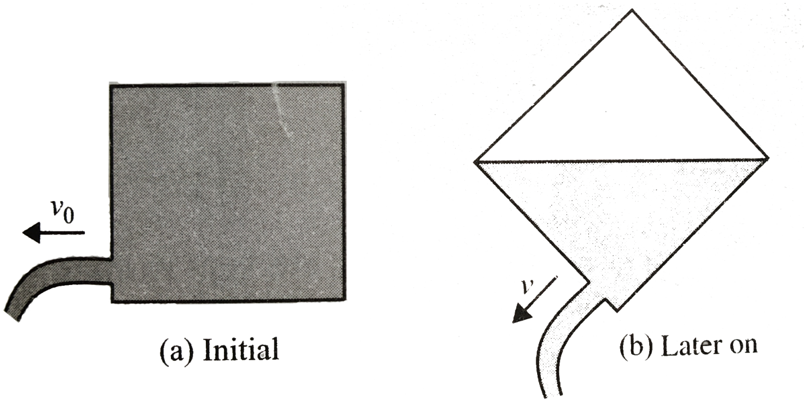
13. A square box of water has a small hole located the bottom corners. When the box is full and sitting on a level surface, complete opening of the hole results in a flow of water with a speed v_0 as shown in Fig. (a). when the box is still half empty, it is tilted by 45° so that hole is at the lowest point. Now the water will flow out with a speed of



(a) Initial (b) Later on

A. v_0

B. $\frac{v_0}{2}$

C. $\frac{v_0}{\sqrt{2}}$

D. $\frac{v_0}{4\sqrt{2}}$

Answer: D

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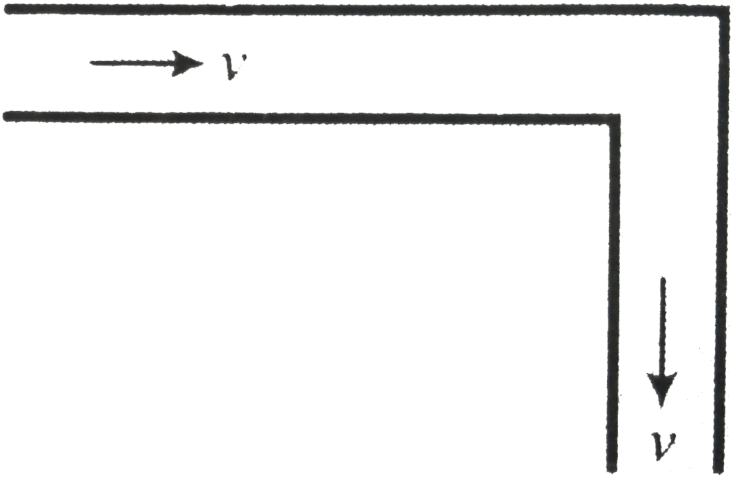
14. A liquid of density ρ is flowing with a speed v through a pipe of cross sectional area A. The pipe is bent in the shape of a right angles as shown.

What force should be exerted on the pipe at the corner to keep it fixed?



A. $\frac{\sqrt{2}SV}{\rho}$

B. $\sqrt{2}SV^2\rho$

C. $\sqrt{3}\frac{SV(2)\rho}{2}$

D. $\sqrt{3}SV^2\rho$

Answer: B

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15. A light cylindrical vessel is kept on a horizontal surface it's base area is A. A hole of cross-sectional area a is made just at it's bottom side. The minimum coefficient of friction necessary for not sliding of vessel dueto the impact force of the emerging liquid.

A. varying

B. $\frac{a}{A}$

C. $\frac{2a}{A}$

D. none

Answer: C

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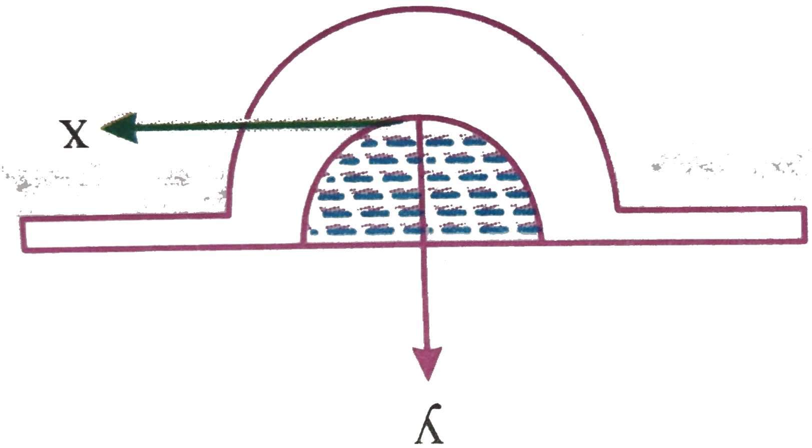
16. A small hole is made at the bottom of a symmetrical jar as shown in figure. A liquid is filled in to the jar up to a certain height. The rate of dissension of liquid is independent of level of the liquid in the jar. Then the surface of jar is a surface of revolution of curve



A. $y = kx^4$

B. $y = kx^2$

C. $y = kx^3$

D. $y = kx^5$

Answer: A

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17. A drop of water of mass m and density ρ is placed between two weill cleaned glass plates, the distance between which is d. What is the force of attraction between the plates?

($T =$ surface tension)

A. $\frac{Tm}{2\rho d^2}$

B. $\frac{4Tm}{\rho d^2}$

C. $\frac{2Tm}{\rho d^2}$

D. $\frac{Tm}{\rho d^2}$

Answer: C

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18. A drop of liquid of density ρ is floating half-immersed in a liquid of density d. If σ is the surface tension the diameter of the drop of the liquid is

A. $\sqrt{\frac{3\sigma}{t(2\rho - d)}}$

B. $\sqrt{\frac{6\sigma}{g(2\rho - d)}}$

C. $\sqrt{\frac{4\sigma}{g(2\rho - d)}}$

D. $\sqrt{\frac{12\sigma}{g(2\rho - d)}}$

Answer: D

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19. A straw $6cm$ long floats on water. The water film on one side has surface tension of $50dyn/cm$. On the other side, camphor reduces the surface tension to $40dyn/cm$. The resultant force acting on the straw is

A. 60 dyne

B. 10 dyne

C. 30 dyne

D. 0 dyne

Answer: A

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20. A capillary tube is immersed vertically in water such that the height of liquid column is found to be x on the surface of the earth. When it is taken to mine the capillary rise is y if R is the radius of the earth. Then the depth of mine is

A. $d = R\frac{(y - x)}{x}$

B. $d = R\frac{(y - x)}{y}$

C. $d = R\left(\frac{x}{y - x}\right)$

D. $d = R\left(\frac{y}{y - x}\right)$

Answer: B

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21. Eight spherical droplets, each of radius r of a liquid of density ρ and surface ternsion T coalesce to form one big drop. If s is the specific heat of the liquid then the rise in the temperature of the liquid in this process is

A. $\frac{2T}{3r\rho s}$

B. $\frac{3T}{r\rho s}$

C. $\frac{3T}{2r\rho s}$

D. $\frac{T}{r\rho r}$

Answer: C

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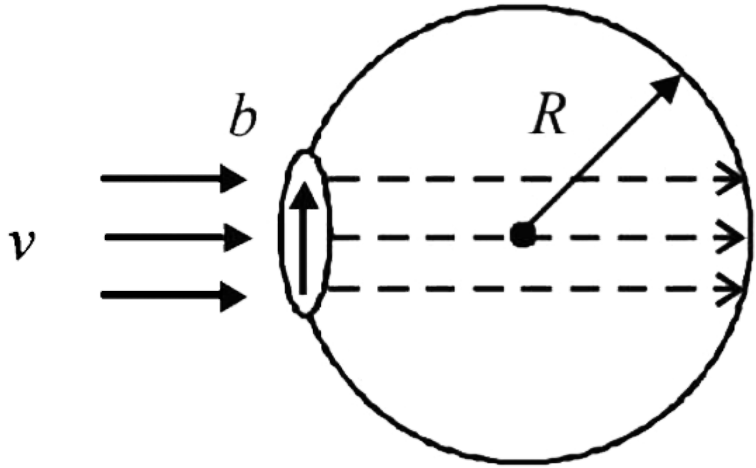
22. A bubble having surface tension T and radius R is formed on a ring of radius $b(b < < R)$. Air is blown inside the tube with velocity v as shown. The air molecule collides perpendicularly with the wall of the bubble and stops. Calculate the radius at which the bubble separates from the ring.



A. $\frac{4T}{\rho v^3}$

B. $\frac{4T}{\rho v}$

C. $\frac{2T}{\rho v^2}$

D. $\frac{4T}{\rho v^2}$

Answer: D

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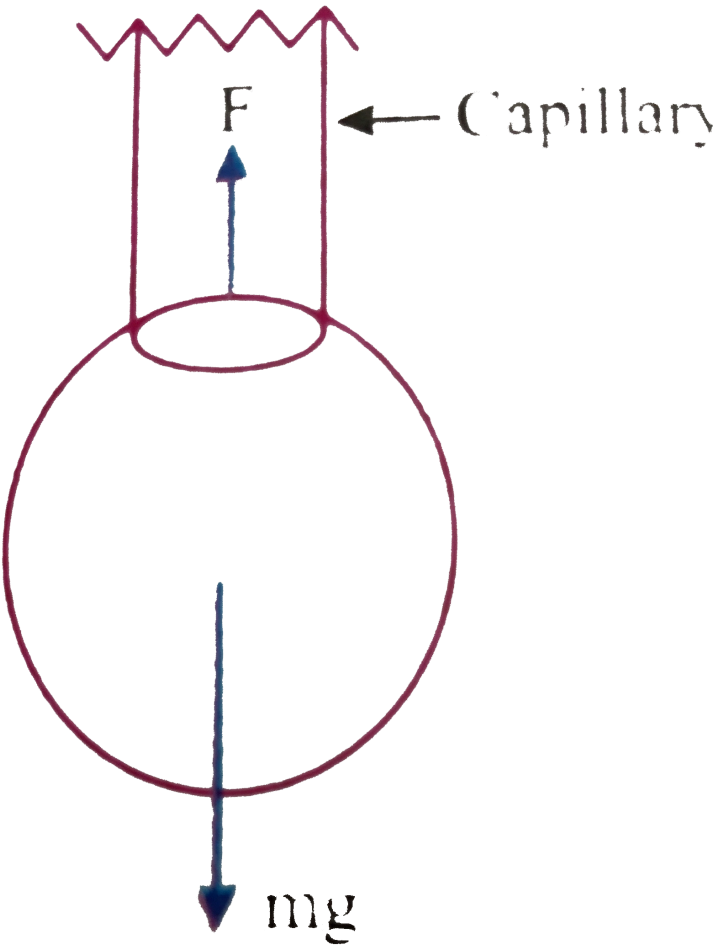

23.

Soapy water drips from a capillary tube. When the drop breaks away, the diameter of its neck is D. The mass of the drop is m. Find the surface tension of soapy? Water?

A. $\frac{mg}{\pi^2 D}$

B. $\frac{mg}{\pi D^2}$

C. $\frac{mg}{\pi D}$

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

Answer: C

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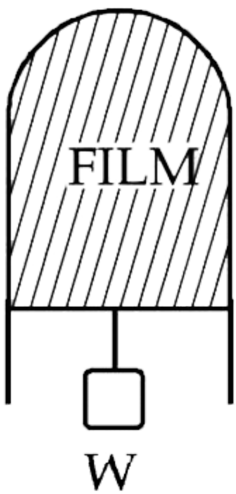
24. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of $1.5 \times 10^{-2} N$ (see figure). The length of the slider is 30cm and its weight negligible. The surface tension of the liquid film is



A. $0.0125 Nm^{-1}$

B. $0.1Nm^{-1}$

C. $0.05Nm^{-1}$

D. $0.025Nm^{-1}$

Answer: D

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25. Two mercury drops (each of radius r) merge to form a bigger drop. The surface energy of the bigger drop, if T is the surface tension is

A. $2^{5/3}\pi r^2$

B. $4\pi r^2 T$

C. $2\pi r^2 T$

D. $2^{8/3}\pi r^2$

Answer: D

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26. if a ball of steel (density $\rho = 7.8 g/cm^3$) attains a terminal velocity of $10 cm/s$ when falling in a tank of water (coefficient of viscosity, $\eta_{water} = 8.5 \times 10^{-4}$Ps s), then its terminal velocity in glycerine $\left(\rho = 1.2 g/cm^2, \eta = 13.2 Pas\right)$ would be nearly

A. $1.6 \times 10^{-5} cms^{-1}$

B. $6.25 \times 10^{-4} cms^{-1}$

C. $6.45 \times 10^{-4} cms^{-1}$

D. $1.5 \times 10^{-5} cms^{-1}$

Answer: B

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27. Work done in increasing the size of a soap bubble from a radius of 3cm to 5cm is nearly (Surface tension of soap solution $= 0.03 Nm^{-1}$)

A. $0.2\pi mJ$

B. $2\pi mJ$

C. $0.4\pi mJ$

D. $4\pi mJ$

Answer: C

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28. Water is flowing continuously from a tap having an internal diameter $8 \times 10^{-3}m$. The water velocity as it leaves the tap is $0.4ms^{-1}$. The diameter of the water stream at a distance $2 \times 10^{-1}m$ below the tap is close to:

A. $7.5 \times 10^{-3}m$

B. $9.6 \times 10^{-3}m$

C. $3.6 \times 10^{-3}m$

D. $5.0 \times 10^{-3}m$

Answer: C

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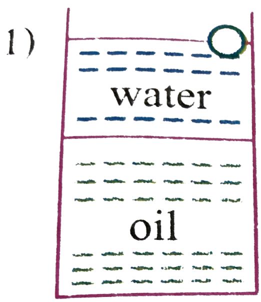
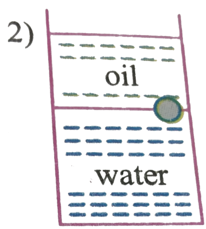
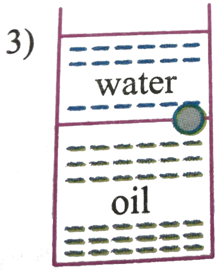
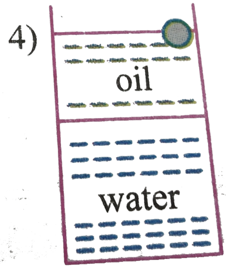
29. A ball is made of a material of density ρ where $\rho_{oil} < \rho < \rho_{water}$ with ρ_{oil} and ρ_{water} representing the densities of oil and water, respectively. The oil and water are immiscible. If the above ball is in equilibrium in a mixture of this oil and water, which of the following pictures represents its equilibrium position?

A. 

B. 

C. 

D. 

Answer: B

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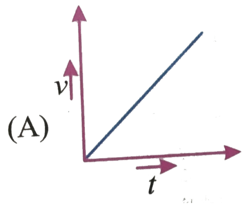
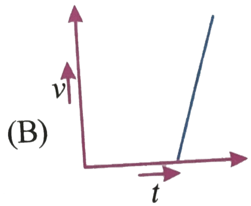
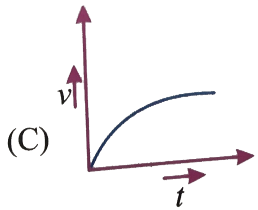
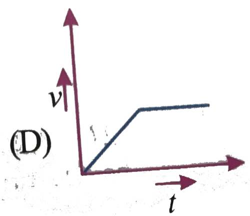
Single Answer Questions

1. A tall cylinder is filled with viscous oil. A round pebble is dropped from the top with zero initial velocity. From the plot shown in figure, indicate the one that represents the velocity (v) of the pebble as a function of time (t)

A. 

B. 

C. 

D. 

Answer: C

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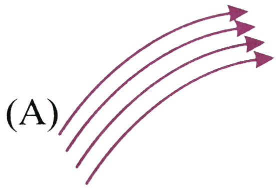
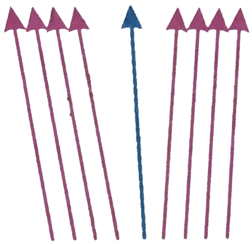
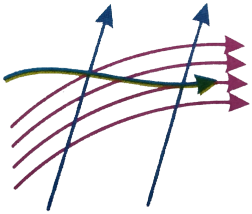
2. Which of the following diagrams does not represent a streamline flow?

A. 

B. 

C. 

D. 

Answer: D

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3. Along a streamline,

A. the velocity of a fluid particle remains constant

B. the velocity of all fluid particles crossing a given position is constant

C. the velocity of all fluid particles at a given instant is constant

D. the speed of a fluid particle remains constant.

Answer: B

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4. An ideal fluid flows through a pipe of circular cross-section made of two sections with diameters $2.5cm$ and $3.75cm$. The ratio of the velocities in the two pipes is

A. $9:4$

B. $3:2$

C. $\sqrt{3}:\sqrt{2}$

D. $\sqrt{2}:\sqrt{3}$

Answer: A

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5. The angle of contact at the interface of water glass is 0° ethylalcohol-glass is 0° mercury glas is 140° and methyliodide-glass is 30° A glass capillary is put in a through containing one of these four liquids. It is observed that the meniscus is convex. The liquid in the through is

A. water

B. ethylalcohol

C. mercury

D. methyliodide

Answer: C

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6. For a surface molecule,

A. the net force on it is zero

B. there is a net upward force

C. the potential energy is less than that of a molecule inside

D. the potential energy is more than the of a molecule inside.

Answer: D

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7. Pressure is a scalar quantity, because

A. it is the ratio of force to area and both force and area are vectors.

B. it is the ratio of the magnitude of the force to area parallel to surface.

C. it is the ratio of the component of the force normal to the area.

D. it does not depend on the size of the area chosen.

Answer: C

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8. The force required to take away flat plate of radius $4cm$ from the surface of water is (surface tension os water $= 70\text{dyne}/cm$)

A. 1221.2dyne

B. 1589.2dyne

C. $1645.3 dyne$

D. $1758.4 dyne$

Answer: D

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9. The surface tension of a soap solution is 0.05 Nm^{-1} How much work is done to produce a soap bubble of radius 0.03 m?

A. $1.8 \times 10^{-2} J$

B. $2.1 \times 10^{-3} J$

C. $1.5 \times 10^{-2} J$

D. $1.1 \times 10^{-3} J$

Answer: D

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10. Water rises in a capillary tube to a height of 2.0cm. In another capillary tube whose radius is one third of it, how much the water will rise?

A. 60 mm

B. 80 mm

C. 40 mm

D. 30 mm

Answer: A

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11. Water is flowing through a horizontal tube. The pressure of the liquid in the portion where velocity is $2m/s$ is 2 m of Hg. What will be the pressure in the portion where velocity is $4m/s$

A. $2.66 \times 10^5 Pa$

B. $2.78 \times 10^5 Pa$

C. $2.84 \times 10^5 Pa$

D. $2.60 \times 10^5 Pa$

Answer: A

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12. Air is streaming past a horizontal airplane wing such that its speed is $90ms^{-1}$ at the lower surface and $120ms^{-1}$ over the upper surface. The wing is $10m$ long and has an average width of $2m$, the difference of pressure on the two sides and the gross lift on the wing respectively, are (density of air $= 1.3kgm^{-3}$)

A. $4.095Pa$

B. $409.5Pa$

C. $4095.0Pa$

D. $40.95Pa$

Answer: C

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13. In which of the following types of flows is the Bernoulli's theorem strictly applicable:

A. Streamlines and rotational

B. Turbulent and rotational

C. Turbulent and irrotational

D. Streamlines and irrotational

Answer: D

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14. A U tube contains water and methylated spirts separated by mercury columns in the two arms are in level with 10.0cm of water in one arm and 12.5 cm of spirit in the other. What is the relative density of spirit?

A. $5/4$

B. $1/2$

C. $2/5$

D. $4/5$

Answer: D

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15. Ice berg floats in water with part of it submerged. What is the fraction of the volume of iceberg suberged, if the density of ice is $\rho_l = 0.917 g/cm^3$?

A. 0.917

B. $\frac{1000}{917}$

C. $\frac{83}{1000}$

D. $\frac{1000}{83}$

Answer: A

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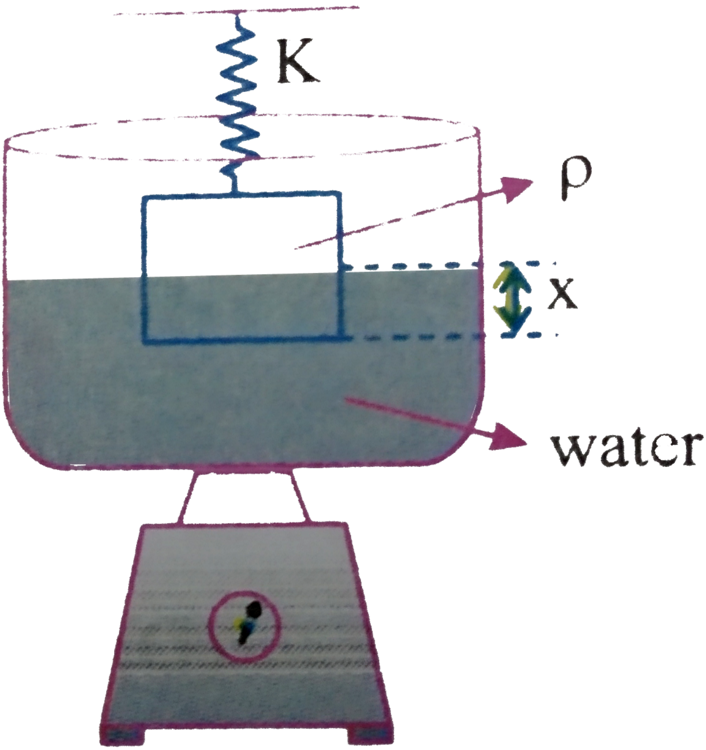

16.

A vessel filled with water is kept on a weighing pan and the scale adjusted to zero. A block of mass 10 kg is suspended by a massless spring of spring constant $k = 100 N/m$. This block is submerged inside into the water in the vessel such that elongation i spring is $x = 10cm$. What is the reading of the scale?

A. 100 N

B. 10 N

C. 110 N

D. 90 N

Answer: D

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17. Two mercury droplets radii 0.1 cm and 0.2 cm collapse into one single drop. What amount of energy is released/absorbed? The sur4face tension of mercury $T = 435.5 \times 10^{-3} Nm^{-1}$

A. 32.23×10^{-7} (Released)

B. 32.23×10^{-7} (Absorbed)

C. 64.46×10^{-7} (Absorbed)

D. 64.46×10^{-7} (released)

Answer: B

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18. The surface tension and vapour pressure of water at $20^{\circ} C$ is $7.28 \times 10^{-2} Nm^{-1}$ and $2.33 \times 10^{3} Pa$, respectively. What is the radius of the smalalest spherical water droplet which can form without evaporating at $20^{\circ} C$?

A. $3.125 \times 10^{-5} m$

B. $12.5 \times 10^{-5} m$

C. $6.25 \times 10^{-5} m$

D. none of these

Answer: C

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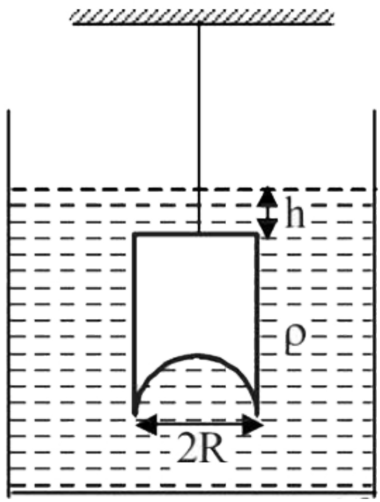
19. A hemispherical portion of radius R is removed from the bottom of a cylinder of radius R. The volume of the remaining cylinder is V and its mass M. It is suspended by a string in a liquid of density ρ where it stays vertical. The upper surface of the cylinder is at a depth h below the liquid surface. The force on the bottom of the cylinder by the liquid is



A. $\rho g\left(V + \pi R^2 h\right)$

B. Mg

C. Mg - $V\rho g$

D. $Mg + \pi R^2 h\rho g$

Answer: A

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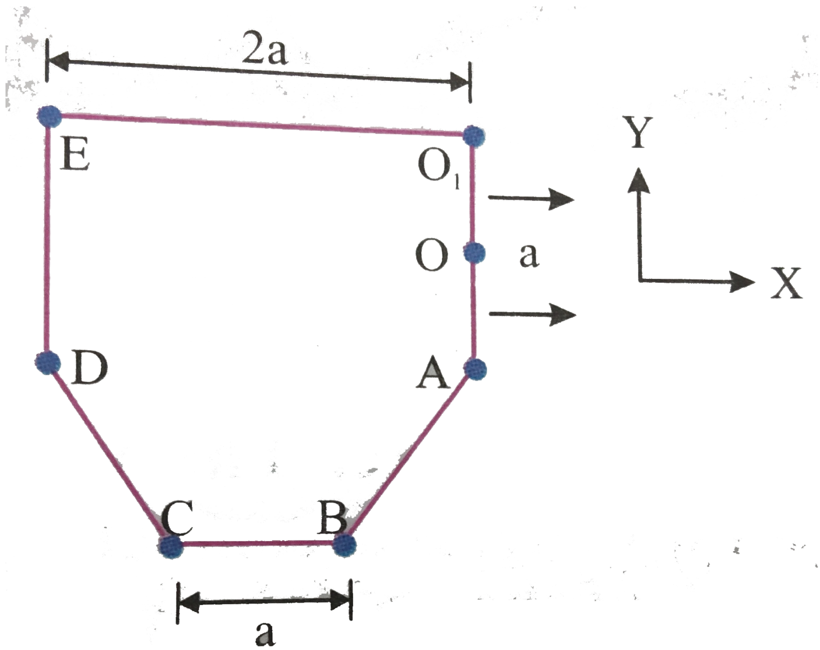
20.



The top view of closed compartment containing liquid is moving with an acceleration along x-axis as shown. Find the incorrect statement

A. The pressure at A and O is same

B. The pressure at O and O_1 is same

C. The pressure at B and C is same

D. The pressure at D and E is same

Answer: C

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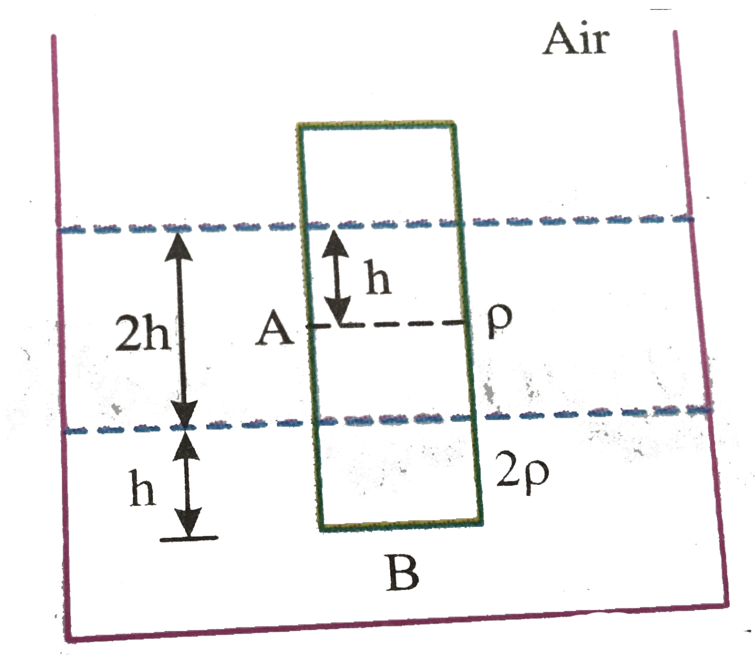

21.

A cylinder stands vertical in two immiscible liquids of densities ρ and 2ρ as shown. Find the difference in pressure at point A and B:

A. $2\pi gh$

B. $3\rho gh$

C. $4\rho gh$

D. none

Answer: B

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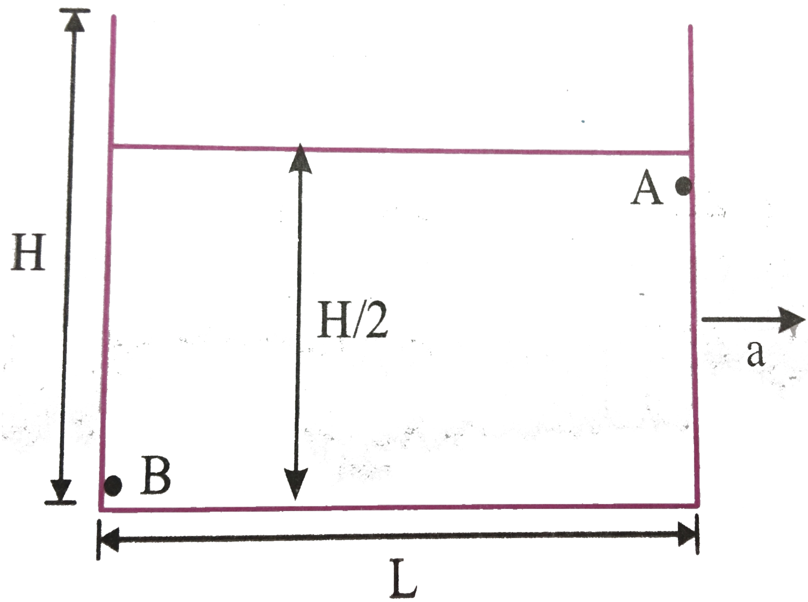

22.

A vessel of height H and length L contains a liquid of density ρ upto height $H/2$ The vessel start accelerating horizontally with acceleration a towards right. If A is the point at the surface of the liquid at right . If A is the point at the surface of the liquid at right end while the vessel is accelerating and B is the point at bottom of the vessel on the other end, the difference of pressures at B and A will be

A. $\frac{\rho}{2}(gH + aL)$

B. $\frac{\rho}{2}(gH - aL)$

C. $2\rho(gH - aL)$

D. $\frac{3\rho}{2}(gH + aL)$

Answer: A

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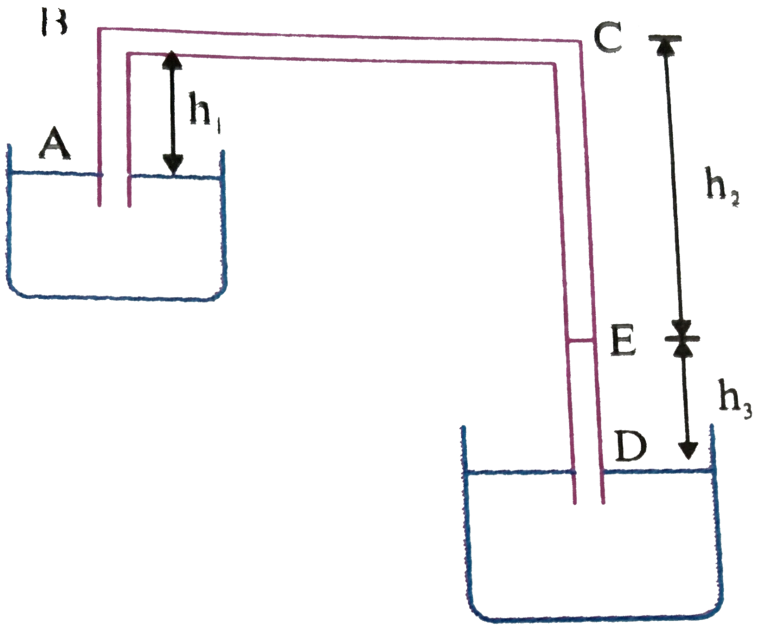

23.

In the syphon as shown which of the option is not correct, if $h_2 > h_1$ and $h_3 < h_1$?

A. $p_E < p_D$

B. $p_E > p_C$

C. $p_B = p_C$

D. $p_E < p_B$

Answer: D

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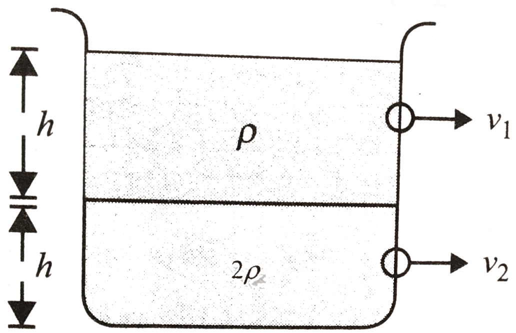
24. Equal volume of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in the figure. Two small holes are punched at depths $h/2$ and $3h/2$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then v_1/v_2 is



A. $\frac{1}{2\sqrt{2}}$

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. $\frac{1}{\sqrt{2}}$

Answer: D

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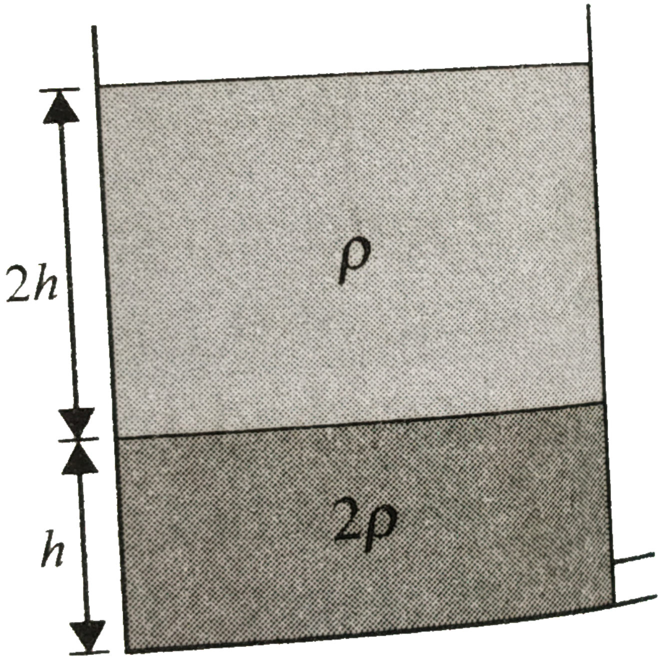
25. The velocity of the liquid coming out of a small hole of a vessel containing two different liquids of densities 2ρ and ρ as shown in the figure is



A. $\sqrt{gh}$

B. $2\sqrt{gh}$

C. $2\sqrt{2gh}$

D. $\sqrt{6gh}$

Answer: B

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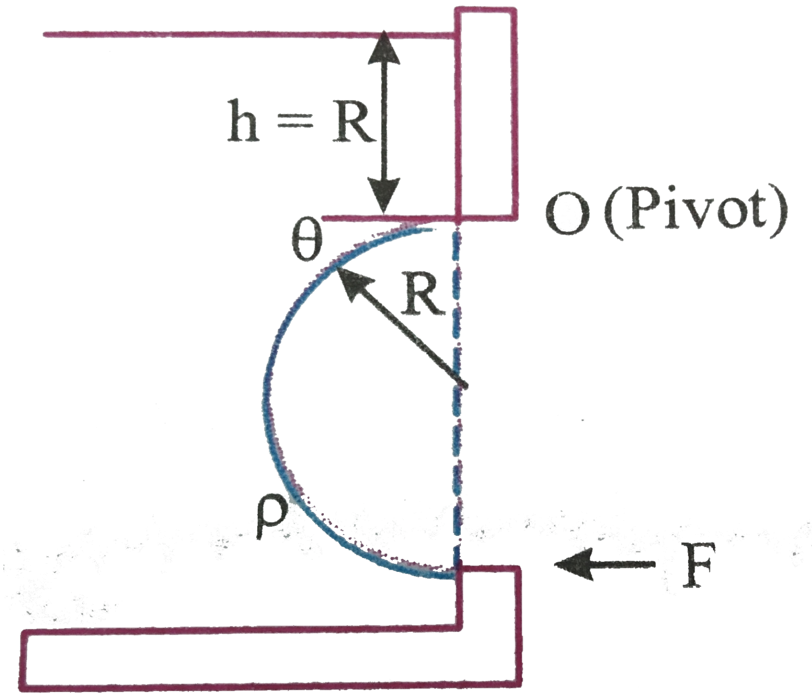

26.

The fig shows a semo-cylinderical massless gate of unit length perpendicular to the plane of the page and is pivoted at the point O holding a stationary liquid of density ρ. A horizontal foce F is applied at its lowest position to keep it stationary. The magnitude of the force is:

A. $\frac{3}{2}\rho g R^2$

B. $\frac{9}{2}\rho g R^2$

C. $\rho g R^2$

D. $2\rho g R^2$

Answer: D

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27. A wooden block is floating in a water tank. The block is pressed to its bottom. During this process, work done is equal to :

A. work done against upthrust exerted by the water

B. Work done against upthrust plus loss of gravitational potential energy of the block

C. Work done against upthrust minus loss of ravitational potential energy of the block

D. all the above

Answer: C

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28. A sphere of solid material of specific gravity 8 has a concentric spherical cavity and just sinks in water. The ratio of radius of cavity to that of outer radius of the sphere must be

A. $\frac{7^{1/3}}{2}$

B. $\frac{5^{1/3}}{2}$

C. $\frac{9^{1/3}}{2}$

D. $\frac{3^{1/3}}{2}$

Answer: A

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29. A cylindrical tank of height H is open at the top end and it has a radius r. Water is filled in it up to a height of h. The time taken to empty the tank through a hole of radius r' in its bottom is

A. $\sqrt{\frac{2h}{g}}\left(\frac{R^2}{r^2}\right)$

B. $\sqrt{\frac{2H}{g}}\left(\frac{R^2}{r^2}\right)$

C. $\sqrt{h}(H)$

D. $\sqrt{\frac{2H}{g}}\left(\frac{R}{r}\right)$

Answer: A

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30. Two unequal blocks placed over each other of densities σ_1 and σ_2 are immersed in a fluid of density of σ. The block of density σ_1 is fully submerged so that ratio of their masses is $\frac{1}{2}$ and $\sigma/\sigma_1 = 2$ and $\sigma/\sigma_2 = 0.5$

. Find the degree of submergence of the upper block of density σ_2.

A. 50% submerged

B. 25% submerged

C. 75% submerged

D. full submerged

Answer: D

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31. A thin uniform cylindrical shell, closed at both ends, is partially filled with water. It is floating vertically in water in half-submerged state. If ρ_c is the relative density of the material of the shell with respect to water, then the correct statement is that the shell is

A. more than half-filled if ρ_c is less than 0.5

B. more than half-filled if ρ_c is more than 1.0

C. half-filled if ρ_c is more than 0.5

D. less than half-filled if ρ_c is less than 0.5

Answer: A

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32. Two balls of same size but different masses m_1 and $m_2(m_2 > m_1)$ are attached to the two ends of a thin light thread and dropped from a certain height. It is known that the ciscous drag of air depends on the size and velocities of the balls. other than the gravitational pull from the earth and the viscous drag, the buoyant force from air also act on the balls, the buoyant force on a ball equals to the wweight of air displaced by the ball. After sufficiently long time from the instant the balls were dropped both of them acquire uniform velocity known as terminal velocity. When the balls have acquired terminal velocity, the tension in the thread is

A. zero

B. $(m_2 - m_1)g$

C. $0.5(m_2 + m_1)g$

D. $0.5(m_2 - m_1)g$

Answer: D

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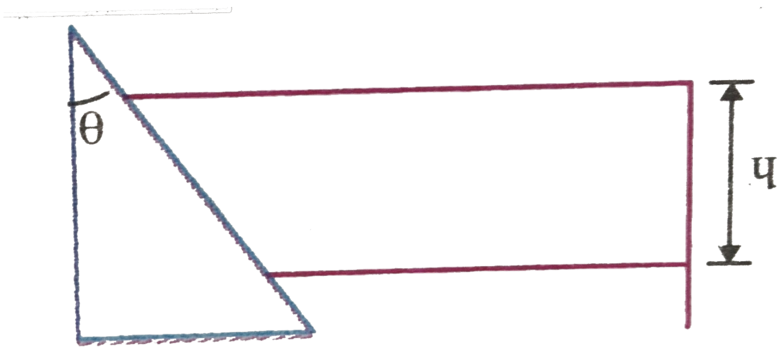

33.

A silt is cut at the bottom, along the right bottom edge of a rectangular tank. The slit is closed by a wooden wedge of mass m and apex angle θ as shown in figure. The vertical plane surface of the wedge is in contact with the right vertical wall of the container. coefficient of static friction between these two surfaces is μ. To what maximum height can water be filled in the tank without leakage from the slit ? The width of tank is b and density of water is ρ.

A. $\sqrt{\dfrac{2m}{\rho b(\tan\theta - \mu)}}$

B. $\sqrt{\dfrac{4m}{\rho b(\tan\theta - \mu)}}$

C. $\sqrt{\dfrac{2m}{\rho b(\sin\theta - \mu\cos\theta)}}$

D. $\sqrt{\dfrac{2m\cos\theta}{\rho b(\tan\theta - \mu\cos\theta)}}$

Answer: A

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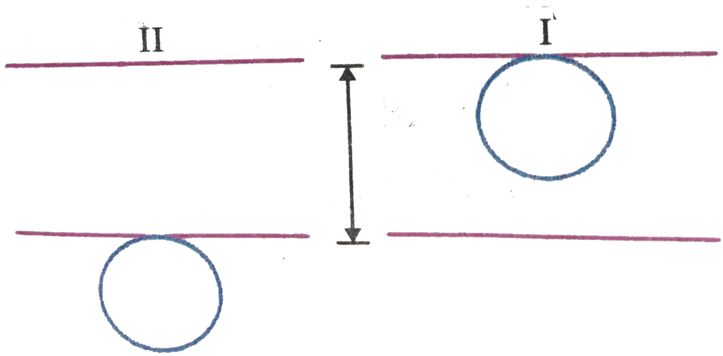
34.



In figure-I is shown a sphere of mass m and radius r resting at the bottom of a large container filled with water. Depth of the container is h. Density of material of the sphere is the same as that of water. Now hte whole sphere is slowly pulled out of water as shown in figure-II Work done by the agent in pulling the sphere is equal to

A. mgr

B. $0.5mgr$

C. $mg(5r+h)$

D. $mg(r+h)$

Answer: A

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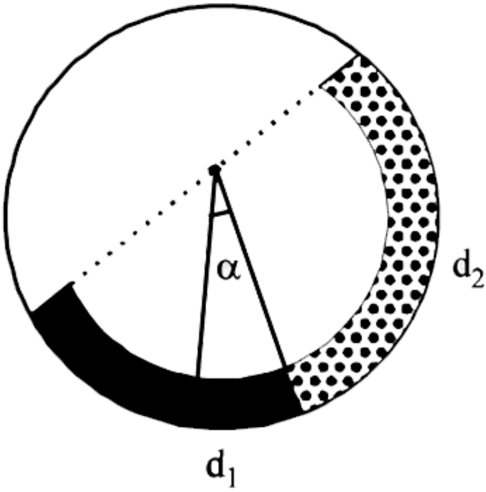
35. There is a circular tube in a vertical plane. Two liquids which do not mix and of densities d_1 and d_2 are filled in the tube. Each liquid subtends 90° angle at centre. Radius joining their interface make an angle α with vertical. Ratio $\frac{d_1}{d_2}$ is :



A. $\frac{1 + \sin\alpha}{1 - \sin\alpha}$

B. $\frac{1 + \cos\alpha}{1 - \cos\alpha}$

C. $\frac{1 + \tan\alpha}{1 - \tan\alpha}$

D. $\frac{1 + \sin\alpha}{1 - \cos\alpha}$

Answer: C

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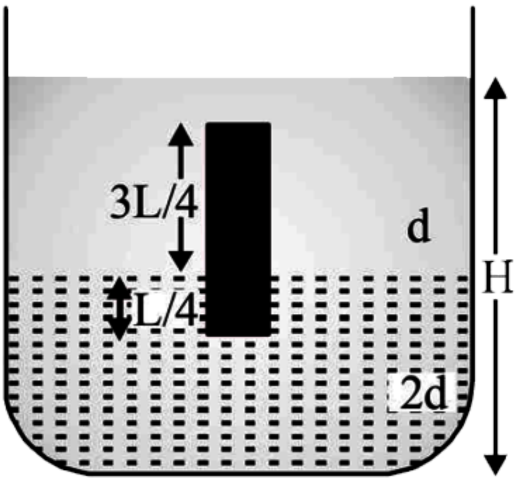
36. A homogeneous solid cylinder of length L(LltH/2), cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with length L/4 in the denser liquid as shown in the figure. The lower density liquid is open to atmosphere having pressure P_0. Then density D of solid is given by



A. $\frac{5}{4}d$

B. $\frac{4}{5}d$

C. $4d$

D. $\frac{d}{5}$

Answer: A

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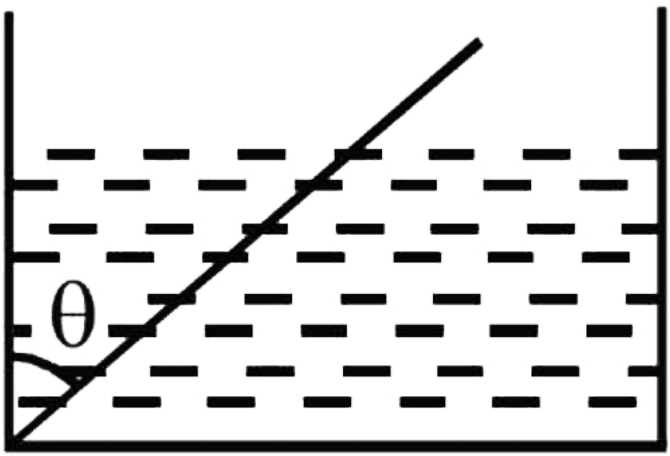
37. A wooden plank of length 1m and uniform cross-section is hinged at one end to the bottom of a tank as shown in fig. The tank is filled with water upto a hight 0.5m. The specific gravity of the plank is 0.5. Find the angle θ that the plank makes with the vertical in the equilibrium position. (Exclude the case $\theta = \theta^\circ$)



A. 45°

B. 60°

C. 30°

D. 37°

Answer: A

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38. 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. fall

B. rise

C. remains same

D. cannot be determined

Answer: A

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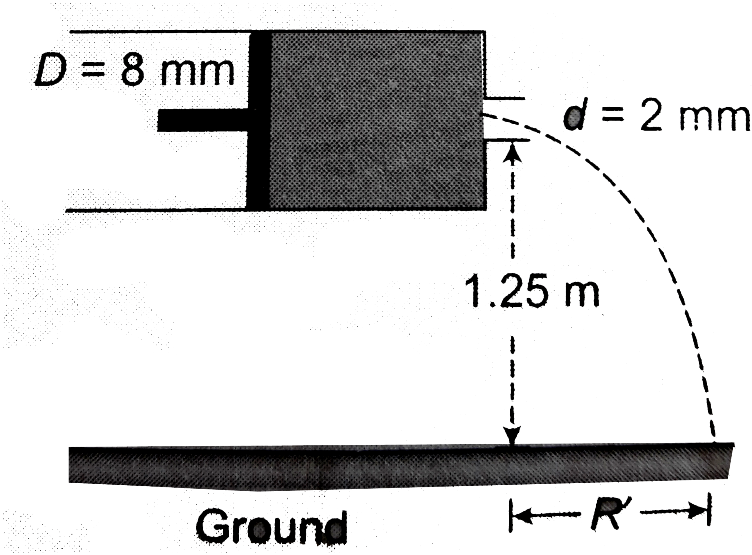
39. Consider a horizontally oriented syringe containing water located of a height of $1.25m$ above the ground. The diameter of plunger is $8mm$ and the diameter if the nozzle is $2mm.$ The plunger is pushed with a constant speed of $0.25m/s.$ Find the horizontal range of water stream on the ground. Take $g = 10m/s^2$.



A. 4 m

B. 6 m

C. 2 m

D. 8 m

Answer: C

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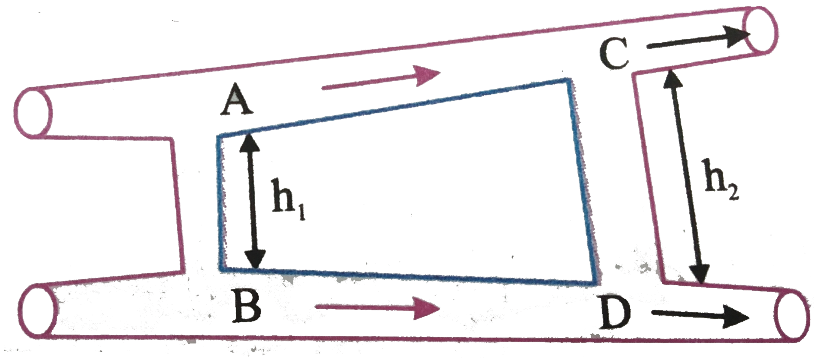

40.

An ideal liquid is flowing in two pipes, AC is inclined and BD is horizontal. Both the pipes are connected by two vertical tubes of length h_1 and h_2 as shown in the fig. The flow is streamline in both the pipes. if velocity of liquid at A, B and C are $2m/s$, $4m/s$ and $4m/s$ respectively, the velocity at D will be

A. $4m/s$

B. $\sqrt{14}m/s$

C. $\sqrt{28}m/s$

D. none

Answer: C

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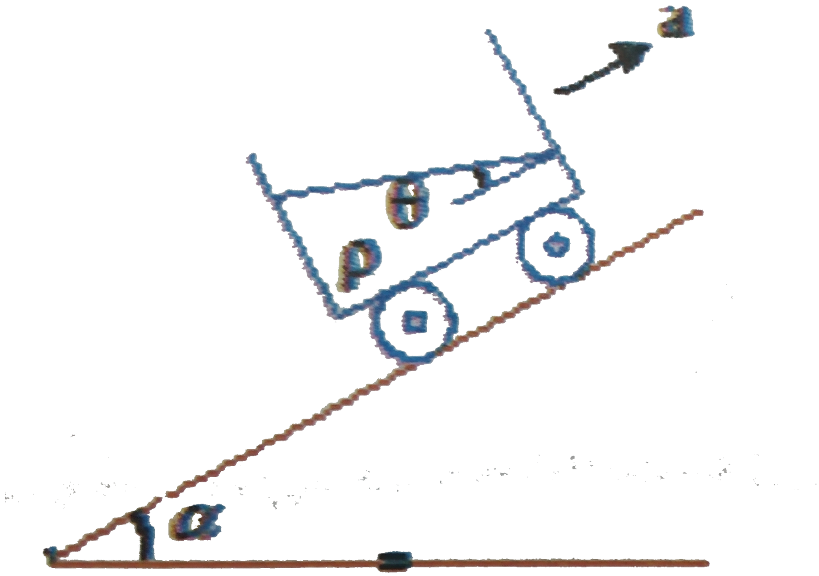

41.

A fluid container is containing a liquid of density ρ is accelerating upward with acceleration a along the inclined plane of inclination α as shown in the figure. Then the angle of inclination θ of free surface is

A. $\tan^{-1}\left[\frac{a}{g\cos\alpha}\right]$

B. $\tan^{-1}\left[\frac{a + g\sin\alpha}{g\cos\alpha}\right]$

C. $\tan^{-1}\left[\frac{a - g\sin\alpha}{g(1 + \cos\alpha)}\right]$

D. $\tan^{-1}\left[\frac{a - g\sin\alpha}{g(1 - \cos\alpha)}\right]$

Answer: B

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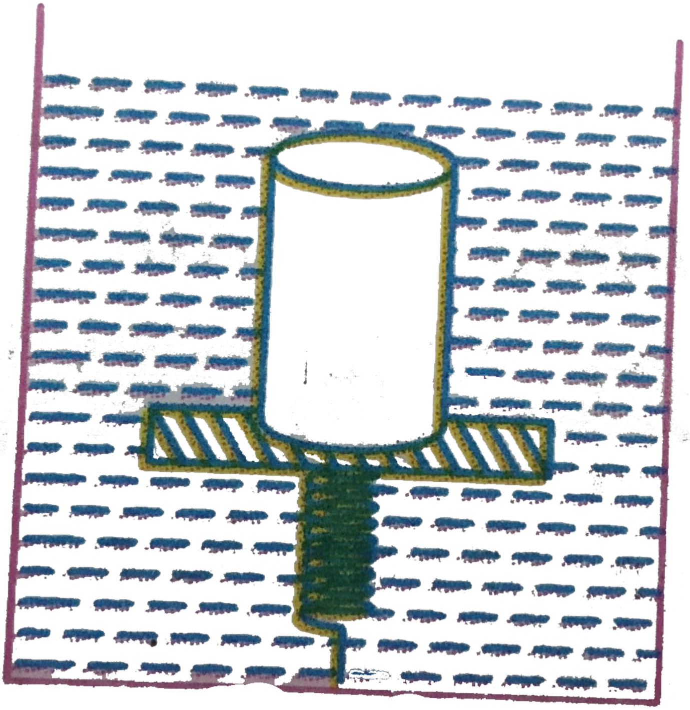
42.



Cylindrical block of area of cross-section A and of material of density ρ is placed in a liquid of density one third of density of block. The block compress in the spring is one-third of te length of the block. if acceleration due to gravity is g, the spring constant of the spring is

A. ρAg

B. $2\rho Ag$

C. $2\rho Ag/3$

D. $\rho Ag/3$

Answer: B

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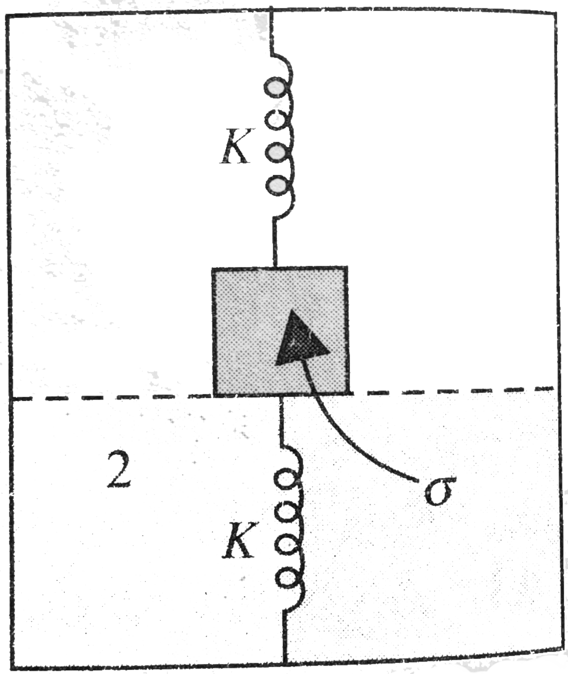
43. A cubic block of side a is connected with two similar vertical springs as shown. Initially, bottom surface of the block of density σ touches the surface of the fluid of density 2σ while floating. A weight is placed on the block so that it is immersed half in the fluid, find the weight.



A. $a\left(\frac{K}{2}+a^2\sigma g\right)$

B. $a\left(K+a^2\sigma g\right)$

C. $a\left(K+\frac{a^2}{2}\sigma g\right)$

D. $\frac{a}{2}\left(K+a^2\sigma g\right)$

Answer: B

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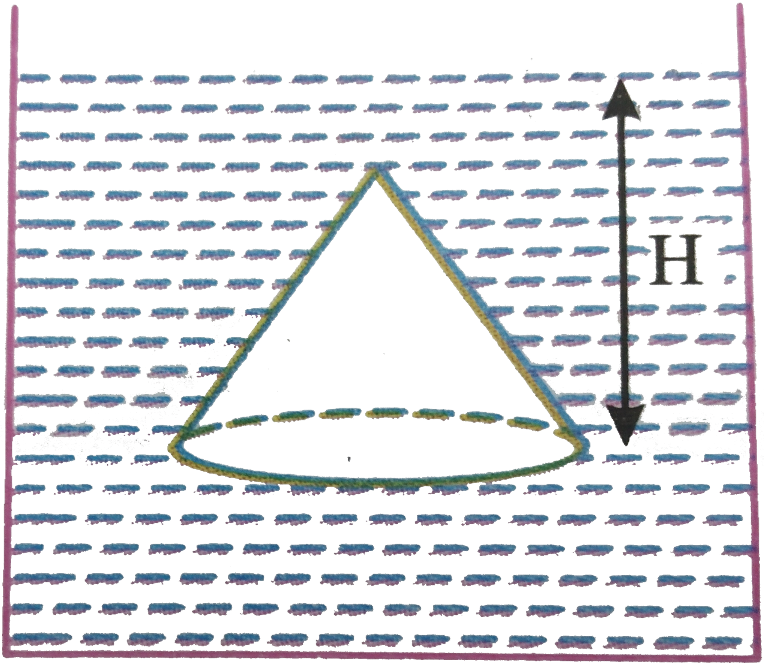

44.

A cone of radius r and height r is under a liquid of density d.its base is parallel to the free surface of the liquid at a depth H from it as shown.What is the net force due to liquid on its curved surface? (neglect atmospheric pressure)

A. $\pi r^2 dg\left(H - \frac{r}{3}\right)$

B. $2\pi r^2 dg\left(H - \frac{2r}{3}\right)$

C. $\pi r^2 dg\left(2H - \frac{r}{3}\right)$

D. $\pi r^2 dg\left(2H - \frac{2r}{3}\right)$

Answer: A

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45. 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 $\sigma(> \rho)$.

A. $2\pi R^2 L\rho\left(\sqrt{\frac{\sigma}{\rho}} - 1\right)$

B. $\pi R^2 L\rho\left(\sqrt{\frac{2\sigma}{\rho}} - 1\right)$

C. $\pi R^2 L\rho\left(\sqrt{\frac{\sigma}{\rho}} - 1\right)$

D. $\pi R^2 L\rho\left(\sqrt{\frac{\sigma}{\rho}} - 1\right)$

Answer: C

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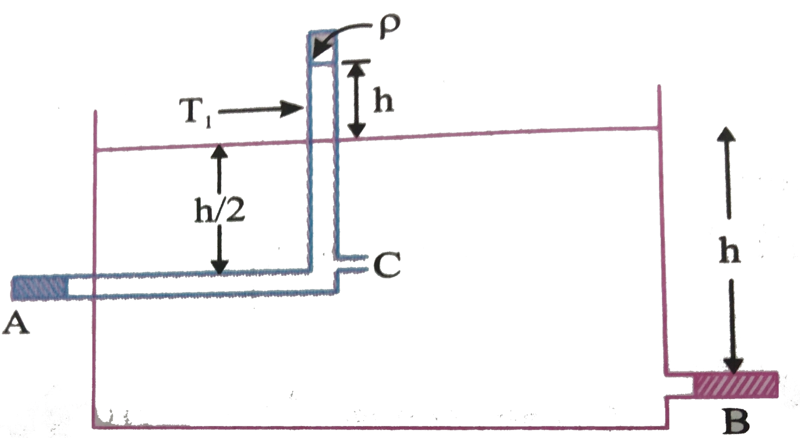
46.



The cross-sectional areas of a tube T_1 and the hole in the vessel at B are a and $a/2$ respectively. There is a hole in the tube at C (at the level of A) through which liquid in the vessel rises by a height h in the tube. The other liquid heights are shown in the diagram. The plugs at A and B are removed simultaneously. How much horizontal force is required to keep vessel in equilibrium if p is the pressure in the tube and p_0 is the atmospheric pressure? Hole C is closed when plugs are removed.

A. $a(p_0 - p)$

B. $\frac{a}{2}(p_0 - p)$

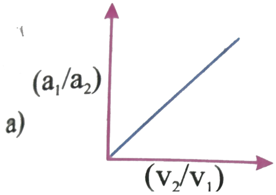
C. $2a(p_0 - p)$

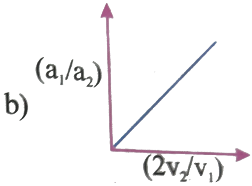
D. $4a(p_0 - p)$

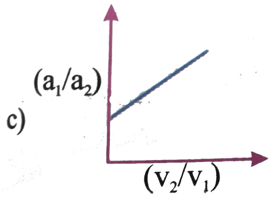
Answer: C

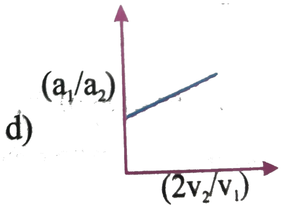
Watch Video Solution

47. A large open tank has two holes in the wall. The top hole is a square hole of side L at a depth y from the surface of water. The bottom hole is a circular hole of radius R at a depth 4y from surface of water . If $R = L/2\sqrt{\pi}$, find the correct graph. V_1 and V_2 are the velocities in top and bottom holes. Area of the square & curcular holes are a_1 and a_2

A. 

B. 

C. 

D. 

Answer: B

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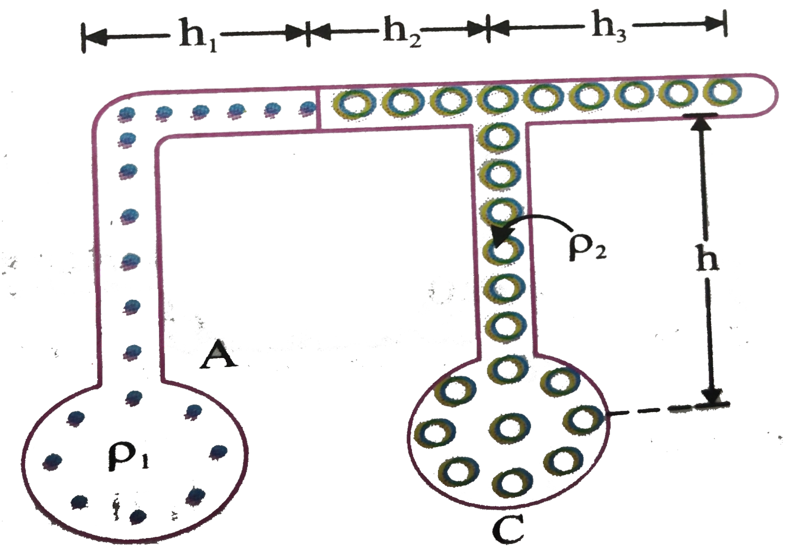
48.



The difference in pressures in bulbs A and C having fluids of densities ρ_1 and ρ_2 when tube B is horizontal will be

A. $\left(\rho_2 - \rho_1\right)gh$

B. $\rho_2 g\left(h_2 + h_3\right) - \rho_1 g h_1$

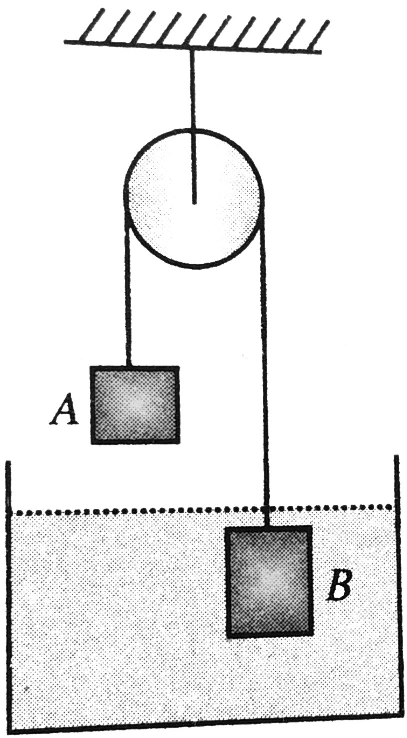
C. $\rho_2 g\left(h + h_2\right) - \, - \rho - (1) g\left(h + h_1\right)$

D. $\left(\rho_1 - \rho_2\right)gh$

Answer: D

Watch Video Solution

49. In the arrangement as shown, $m_B = 3m$, density of liquid is ρ and density of block B is 2ρ. The system is released from rest so that block B moves up when in liquid and moves down when out of liquid with the same acceleration. Find the mass of block A.



A. $\frac{7}{4}m$

B. $2m$

C. $\frac{9}{2}m$

D. $\frac{9}{4}m$

Answer: D

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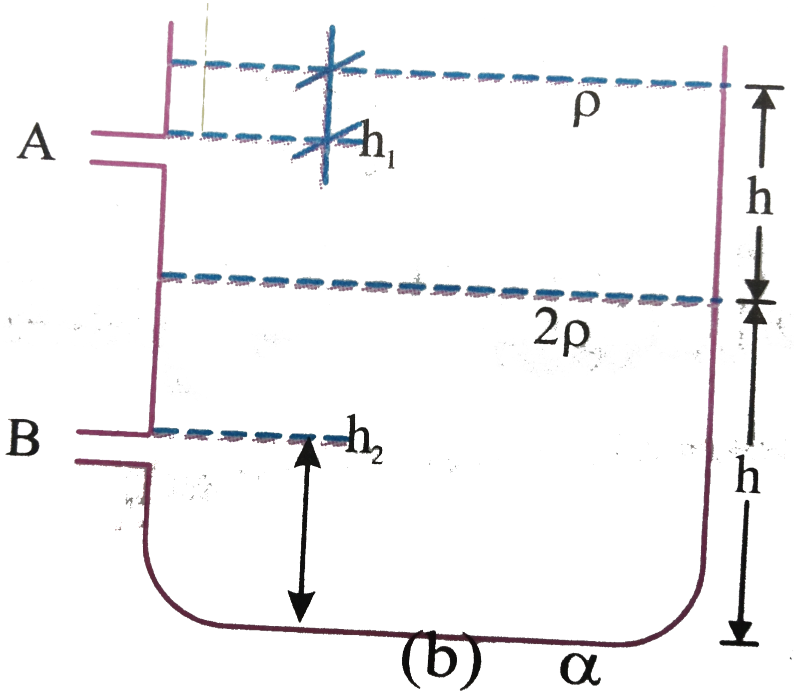
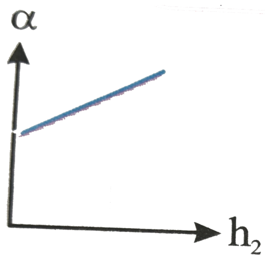
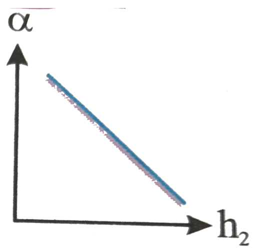
50.

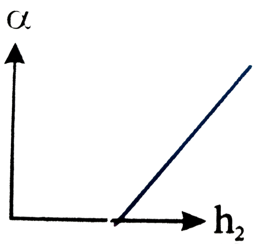


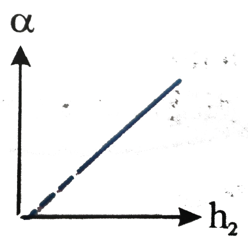
In the arrangement shown two liquids of density ρ and 2ρ are filled in a container the height of both liquids is h. there are two holes A and B at heights h_1 and h_2 from top liquid surface and bottom of the vessel. if V_1 and V_2 are the velocities of efflux at the two holes A and B respectively, find the correct graph.

Take $= \alpha\left(\frac{V_2}{V_1}\right)^2$

A. 

B. 

C. 

D. 

Answer: B

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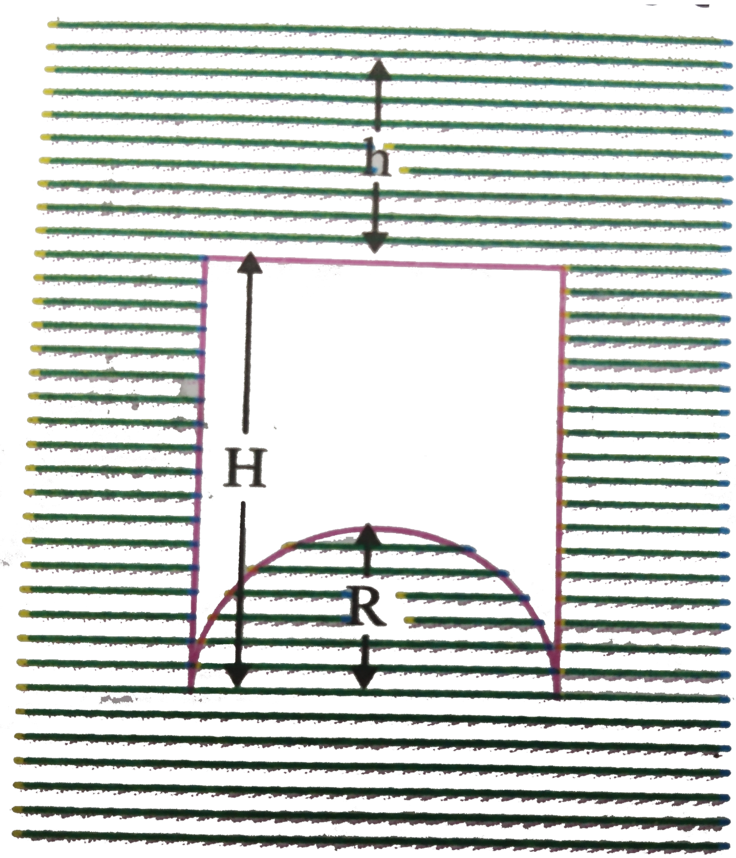


51.

A cylinder of radius R, height H and density *simga* has a hemispherical cut at its bottom. The top of the cyliner is kept at depth h from the liquid surface. If the density of liquid is ρ, find the hydrostatic force acting on the hemispherical surface of the cylinder.

A. $F_2 = \pi R^2 \rho g\left(H + h - \frac{2}{3}R\right)$

B. $F_2 = \pi R^2 \rho g\left(H - h + \frac{2}{3}R\right)$

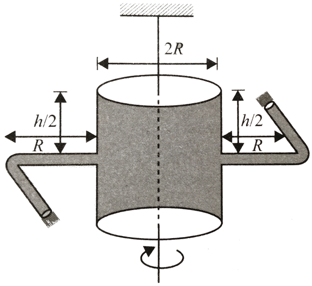
C. $F_2 = \pi R^2 \rho g\left(H - h - \frac{2}{3}R\right)$

D. $F_2 = \pi R^2 \rho g\left(H + h + \frac{2}{3}R\right)$

Answer: A

Watch Video Solution

52. A cylindrical container of radius $'R'$ and height $'h'$ is completely filled with a liquid. Two horizontal L-shaped pipes of small cross-sectional area $'a'$ are connected to the cylinder as shown in the figure. Now the two pipes are opened and fluid starts coming out of the pipes horizontally in opposite directions. Then the torque due to ejected liquid on the system is



A. $4agh\rho R$

B. $8agh\rho R$

C. $2agh\rho R$

D. $6agh\rho R$

Answer: A

Watch Video Solution

53. A marble of mass x and diameter $2r$ is gently released in a tall cylinder containing honey. If the marble displaces mass $y(< x)$of the liquid, then the terminal velocity is proportional to

A. $x + y$

B. $x - y$

C. $\frac{x + y}{r}$

D. $\frac{x - y}{r}$

Answer: D

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54. A small metal ball of diameter $4mm$ and density $10.5g/cm^3$ in dropped in glycerine of density $1.5g/cm^3$. The ball attains a terminal velocity of $8cms^{-1}$. The coefficient of viscosity of glycerine is

A. 4.9 poise

B. 9.8 poise

C. 98 poise

D. 980 poise

Answer: B

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55. A sphere of brass released in a long liquid column attains a terminal speed v_0. If the terminal speed attained by a sphere of marble of the same radius and released in the same liquid is nv_0, then the value of n will be (Given: The specific gravities of brass, marble and liquid are $8.5, 2.5$ and 0.8, respectively)

A. $\frac{5}{17}$

B. $\frac{17}{77}$

C. $\frac{11}{31}$

D. $\frac{17}{5}$

Answer: A

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56. Between a plate of area $100cm^2$ and another plate of area $100m^2$ there is a $1mm$, thick layer of water, if the coefficient of viscosity of water is 0.01 poise, then the force required to move the smaller plate with a velocity $10cms^{-1}$ with reference to large plate is

A. 100 dyne

B. 10^4dyne

C. 10^6 dyne

D. 10^9 dyne

Answer: A

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57. A spherical ball falls through a viscous medium with terminal velocity v. If this ball is replaced by another ball of the same mass but half the radius, then the terminal velocity will be (neglect the effect of buoyancy.)

A. velocity of flow through pipe is $6\sqrt{2}\frac{m}{s}$

B. 2v

C. 4v

D. 8v

Answer: D

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58. Neglecting the density of air, the terminal velocity obtained by a raindrop of radius $0.3mm$ falling through the air of viscosity $1.8 \times 10^{-5} N/m^2$ will be

A. $10.9\frac{m}{s}$

B. $8.3\frac{m}{s}$

C. $9.2\frac{m}{s}$

D. $7.6\frac{m}{s}$

Answer: B

Watch Video Solution

59. Water is flowing in a river. If the velocity of a layer at a distance of 10 cm from the bottom is $20\frac{cm}{s}$. Find the velocity of layer at a height of $40cm$ from the bottom

A. $10\frac{cm}{s}$

B. $20\frac{cm}{s}$

C. $30\frac{cm}{s}$

D. $80\frac{cm}{s}$

Answer: A

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60. A horizontal plate $(10cm \times 10cm)$ moves on a layer of oil of thickness 4 mm with constant speed of $10\frac{cm}{s}$. The coefficient of viscosity of oil is 4 poise. The tangential force applied on the plate to maintain the constant speed of the plate is

A. 10^3dyne

B. 10^4 dyne

C. 10^5 dyne

D. none of these

Answer: B

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61. A liquid is flowing through a narrow tube. The coefficient of viscosity of liquid is 0.1308 poise. The length and inner radius of tube are 50 cm and 1 mm respectively. The rate of flow of liquid is $360\frac{cm^3}{\min}$. Find the pressure difference between ends of tube.

A. $10^{6}\frac{\text{dyne}}{cm^2}$

B. $10^{4}\frac{\text{dyne}}{cm^2}$

C. $10\frac{\text{dyne}}{cm^2}$

D. none of these

Answer: A

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62. Find the terminal velocity of solid sphere of radius 0.1 m moving in air in vertically downward direction. $\left(\eta = 1.8 \times 10^{-5}\frac{Ns}{m^2}\right.$, density of sphere $\left. = 1000\frac{kg}{m^3} \text{ and } g = 10\frac{m}{s^2}\right)$

A. $2\frac{m}{s}$

B. $1.2\frac{cm}{s}$

C. $4\frac{cm}{s}$

D. none of these

Answer: B

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63. Eight equal drops of water each of radius $r = 2mm$ are falling through air with a terminal velocity of $16\frac{cm}{s}$. The eight drops combine to form a big drop. Calculate the terminal velocity of big drop.

A. $16\frac{cm}{s}$

B. $32\frac{cm}{s}$

C. $64\frac{cm}{s}$

D. none of these

Answer: C

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64. At $20\ ^\circ C$ to attain the terminal velocity how fast will an aluminium sphere of radil 1 mm fall through water. Assume flow to be laminar flow and specific gravity of $Al = 2.5$

A. $5\frac{m}{s}$

B. $6\frac{m}{s}$

C. $4\frac{m}{s}$

D. $2\frac{m}{s}$

Answer: B

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65. Water flows at a speed of 6 cms^{-1} through a tube of radius 1 cm. coefficient of viscosity of water at room temperature is 0.01 poise. Calculate the Reynolds number. Is it a steady flow.

A. 100

B. 110

C. 120

D. 140

Answer: C

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66. A metal sphere of radius 1 mm and mass 50 mg falls vertically in glycerine. Find (a) the viscous force exerted by the glycerine on the sphere when the speed of the sphere is 1 cm s-1, (b) the hydrostatic force exerted by the glycerine on the sphere and (c) the terminal velocity with which the sphere will move down without acceleration. Density of glycerine $= 1260 kgm^{-3}$ and its coefficient of viscosity at room temperature = 8.0 poise.

A. $3 \times 10^{-4} N$

B. $1.5 \times 10^{-4} N$

C. $4.5 \times 10^{-4} N$

D. $0.5 \times 10^{-4} N$

Answer: B

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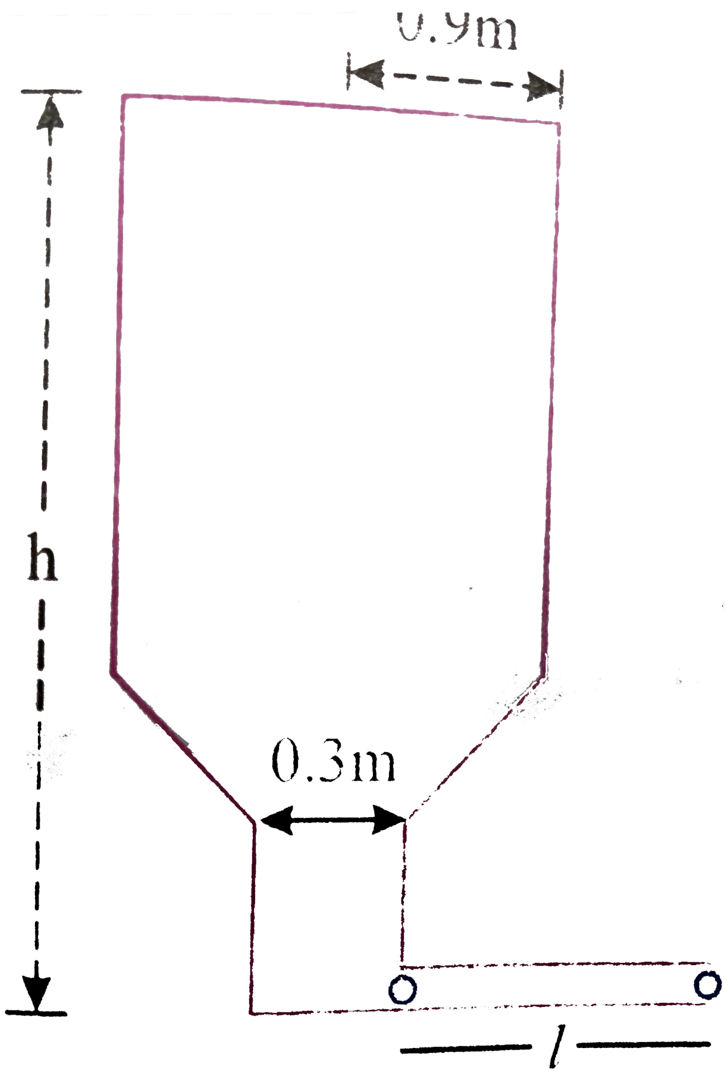

67.

A liquid of density $900 \frac{kg}{m^3}$ is filled in a cylindrical tank of upper radius 0.9 m and lower radius 0.3 m A capillary tube of length 1 is attached at the bottom of the tank as shown in fig. The capillary has outer radius 0.002 m and inner radius a. When pressure P is applied at the top of the tank volume flow rate of liquid is $8 \times 10^{-6} \frac{m^3}{s}$ and if capillary tube is detached, the liquid comes out from the tank with a velocity $10 \frac{m}{s}$. then the coefficient viscosity of liquid is $\frac{\pi a^2 = 10^{-6} m^2 a^2}{l = 2 \times 10^{-6} m}$.

A. $\eta = 1.25 \times 10^{-3} N - \frac{s}{m^2}$

B. $\eta = 2.50 \times 10^{-3} N - \frac{s}{m^2}$

C. $\eta = 5.00 \times 10^{-3} N - \frac{s}{m^2}$

D. $\eta = 7.25 \times 10^{-3} N - \frac{s}{m^2}$

Answer: A

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68. If the terminal speed of a sphere of gold (density $= 19.5 kg/m^3$) is $0.2 m/s$ in a viscous liquid (density $= 1.5 kg/m^3$), find the terminal speed of a sphere of silver (density $= 10.5 kg/m^3$) of the same size in the same liquid

A. $0.2 \frac{m}{s}$

B. $0.4\frac{m}{s}$

C. $0.133\frac{m}{s}$

D. $0.1\frac{m}{s}$

Answer: D

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69. A cylindrical vessel of area of cross-section A and filled with liquid to a height of h_1 has a capillary tube of length l and radius r protuding horizontally at its bottom. If the viscosity of liquyid is η and density ρ. Find the time in which the level of water in the vessel falls to h_2.

A. $\frac{8\eta lA}{\pi\rho gr^4}$ ln $\frac{h_1}{h_2}$

B. $\frac{8\eta lA}{\pi\rho gr^4}$

C. $\frac{\eta A}{g}\left(\sqrt{h_1} - \sqrt{h_2}\right)$

D. $\frac{8\eta lA}{\pi\rho gr^4}$ ln $\frac{h_2}{h_1}$

Answer: A

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70. When water flows through a tube of radius r placed horizontally, a pressure difference p develops across the ends of the tube. If the radius fo the tube is doubled and the rate fo flow halved, the pressure differnece will be

A. $8p$

B. p

C. $\frac{p}{8}$

D. $\frac{p}{32}$

Answer: D

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71. A spherical solild of volume V is made of a material of density ρ_1. It is falling through a liquid of density $\rho_2 \left(\rho_2 < \rho_1\right)$. Assume that the liquid applies a viscous froce on the ball that is proportional ti the its speed v, i.e., $F_{viscous} = -kv^2 (k > 0)$. The terminal speed of the ball is

A. $\sqrt{\dfrac{Vg\left(\rho_1 - \rho_2\right)}{k}}$

B. $\dfrac{Vg\rho_1}{k}$

C. $\sqrt{\dfrac{Vg\rho_1}{k}}$

D. $\dfrac{Vg\left(\rho_1 - \rho_2\right)}{k}$

Answer: A

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72. A volume V of a viscous liquid flows per unit time due to a pressure head ΔP along a pipe of diameter d and length l. instead of this pipe a set of four pipes each of diameter $\frac{d}{2}$ and length 2l is connected to the same pressure head ΔP. Now the volume of liquid flowing per unit time is:

A. $\frac{V}{16}$

B. $\frac{V}{8}$

C. $\frac{V}{4}$

D. V

Answer: B

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73. Two capillary tubes of same radius r but of lengths l_1 and l_2 are fitted in parallel to the bottom of a vessel. The pressure to the bottom of a vessel. The pressure head is P. What should be the length of a singl tube of same radius that can replace the two tubes so that the rate of flow is same as before?

A. $l_1 + l_2$

B. $\frac{1}{l_1} + \frac{1}{l_2}$

C. $\frac{l_1 l_2}{l_1 + l_2}$

D. $\frac{1}{l_1 + l_2}$

Answer: C

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74. $L, \frac{L}{2}$ and $\frac{L}{3}$ are connected in series. Their radii are r, $\frac{r}{2}$ and $\frac{r}{3}$ respectively. Then, if stream-line flow is to be maintained and the pressure across the first capillary is P, then:

A. the pressure difference across the ends of second capillary is $8P$

B. the pressure difference across the third capillary is 43 P

C. the pressure difference across the ends of second capillary is 16 P

D. the pressure difference across the third capillary is 59 P

Answer: A

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75. Find the maximum possible mass of a greased needle floating on water surface.

A. $m_{\max} = \frac{2Tl}{g}$

B. $m_{\max} = \frac{g}{2Tl}$

C. $m_{\max} = \frac{2Tg}{l}$

D. $m_{\max} = \frac{Tl}{g}$

Answer: A

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76. A vertical capillary tube with inside diameter $0.50mm$ is submerged into water so that the length of its part emerging outside the water surface is equal to $25mm$. Find the radius of curvature of the meniscus. Surface tension of water is $73 \times 10^{-3} N/m$.

A. $R = 0.6m$

B. $R = 6mm$

C. $R = 0.6mm$

D. $R = 0.6Km$

Answer: C

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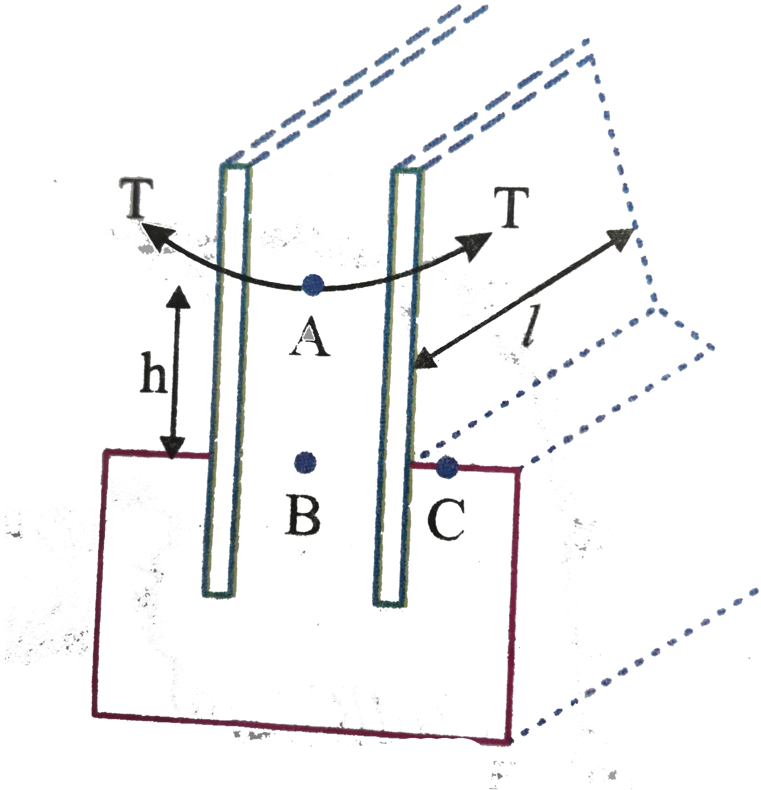

77.

Expression for the height of capillary rise between two parallel plates dipping liquid of density σ separated by a distance d. The surface tension of the liquid is T. [Take angle of contact to be zero]

A. $h = \frac{2T}{\sigma d g}$

B. $h = \frac{2d}{\sigma T}$

C. $h = \frac{\sigma T}{d}$

D. $h = \frac{2T^2}{\sigma d}$

Answer: A

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78. A glass capillary sealed at the upper end is of length $0.11m$ and internal diameter 2×10^{5}m. The tube is immersed vertically into a liquid of surface tension $5.06 \times 10^{-2} N/m$. To what length the capillary has to be immersed so that the liquid level inside and outside the capillary becomes the same. What will happen to water level inside the capillary if the seal is now broken?

A. 5 cm

B. 3 cm

C. 1 cm

D. 7 cm

Answer: C

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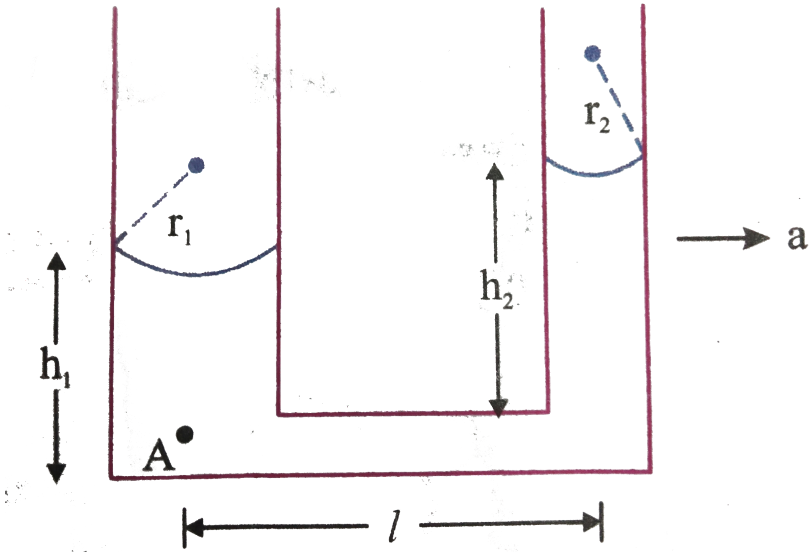

79.

A vertical communicating tube contains a liquid of density ρ. If it moves with a horizontal acceleration a, pressure at A is equal to :

A. $\rho g h_2 + P_0 + \dfrac{2T}{r_2} + \rho a l$

B. $\rho g h_2 + \rho a l + P_0 - \dfrac{2T}{r_2}$

C. $\rho g h_1 + P_0 - \dfrac{2T}{r_1}$

D. $\rho g h_1 - P_0 - \dfrac{2T}{r_1}$

Answer: C

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80. A glass rod of diameter $d = 2mm$ is inserted symmetrically into a glass capillary tube of radius $r = 2mm$. Then the whole arrangement is vertically dipped into liquid having surface tension 0.072 Nm. The height to which liquid will rise on capillary is (Take $g = 10\frac{m}{s^2}$, $\text{density}_{\text{liq}} = 1000\frac{kg}{m^3}\Big)$.

Assume contact angle to be zero, capillary tube to be long enough

A. 1.44 cm

B. 6 cm

C. 4.86 cm

D. 5.26 cm

Answer: A

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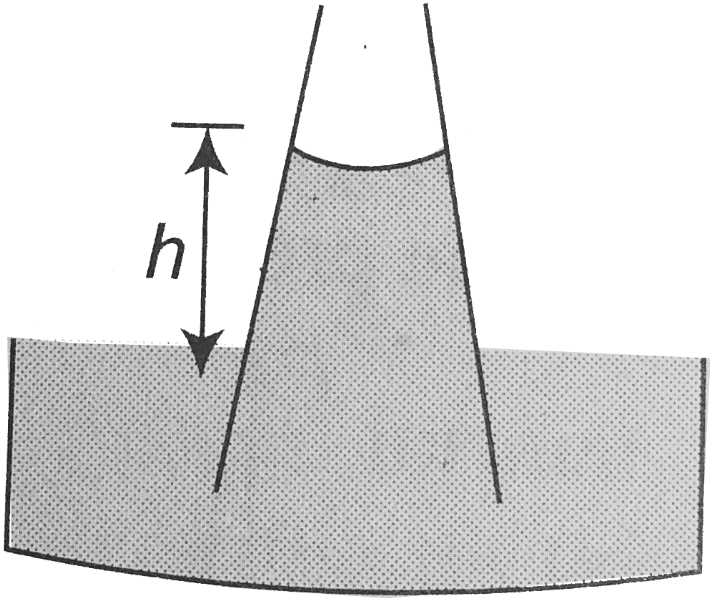

81.

A capillary of the shape as shown is dipped in a liquid. Contact angle between the liquid and the capillary is 0° and effect of liquid inside the mexiscus is to be neglected. T is surface tension of the liquid, r is radius of the meniscus, g is acceleration due to gravity and ρ is density of the liquid then height h in equilibrium is:

A. Greater than $\frac{2T}{r\rho g}$

B. Equal to $\frac{2T}{r\rho g}$

C. less than $\frac{2T}{r\rho g}$

D. of any value depending upon actual values

Answer: C

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82. In the bottom of a vessel with mercury there is a round hole of diameter $d = 70\mu m$. At what maximum thickness of the mercury Layer will the liquid still not flow out through this hole ? $\left[\rho_{\text{mercury}} = 13600\frac{kg}{m^3}\right]$

A. 11 cm

B. 21 cm

C. 42 cm

D. 32 cm

Answer: B

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83. An air bubble of diameter $d = 4\mu m$ is located in water at a depth $h = 5.0m$ considering standard atmospheric pressure at 1 atm, find the pressure in the air-bubble?

A. 2.2 atm

B. 1.2 atm

C. 3.2 atm

D. 1.6 atm

Answer: A

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84. Water rises to a height of $10cm$ in a capillary tube and mercury falls to a depth of $3.42cm$ in the same capillary tube. If the density of mercury is $13.6g/c.c.$ and the angles of contact for mercury and for water are 135° and 0°, respectively, the ratio of surface tension for water and mercury is

A. $1 : 0.15$

B. $1 : 3$

C. $1 : 6.5$

D. $1.5 : 1$

Answer: C

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85. A glass rod of radius r_1 is inserted symmetrically into a vertical capillary tube of radius r_2 such that their lower ends are at the same level. The arrangement is now dipped in water. The height to which water will rise into the tube will be ($\sigma =$ surface tension of water, $\rho =$ density of water)

A. $\dfrac{2\sigma}{(r_2 - r_1)\rho g}$

B. $\dfrac{2\sigma}{(r_2 - r_1)\rho g}$

C. $\dfrac{2\sigma}{(r_2 - r_1)\rho g}$

D. $\dfrac{2\sigma}{(r_2^2 + r_1^2)\rho g}$

Answer: A

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86. A large number of droplets, each of radius a, coalesce to form a bigger drop of radius b. Assume that the energy released in the process is converted into the kinetic energy of the drop. The velocity of the drop is $\sigma =$ surface tension, $\rho =$ density)

A. $\dfrac{\left[\frac{\sigma}{\rho}\left(\frac{1}{a} - \frac{1}{b}\right)\right]^1}{2}$

B. $\left[\frac{2\sigma}{\rho}\left(\frac{1}{a} - \frac{1}{b}\right)\right]^{\frac{1}{2}}$

C. $\left[\frac{3\sigma}{\rho}\left(\frac{1}{a} - \frac{1}{b}\right)\right]^{\frac{1}{2}}$

D. $\left[\frac{6\sigma}{\rho}\left(\frac{1}{a} - \frac{1}{b}\right)\right]^{\frac{1}{2}}$

Answer: D

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87. Two glass plates are separated by water. If surface tension of water is $75 dyn/cm$ and the area of each plate wetted by water is $8 cm^2$ and the distance between the plates is $0.12 mm$, then the force applied to separate the two plates is

A. 10^2dyne

B. 10^4 dyne

C. 10^5 dyne

D. 10^6 dyne

Answer: C

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88. The lower end of a capillary tube is at a depth of $12cm$ and water rises $3cm$ in it. The mouth pressure required to blow an air bubble at the lower end will be xcm of water column, where x is

A. 12

B. 15

C. 3

D. 9

Answer: B

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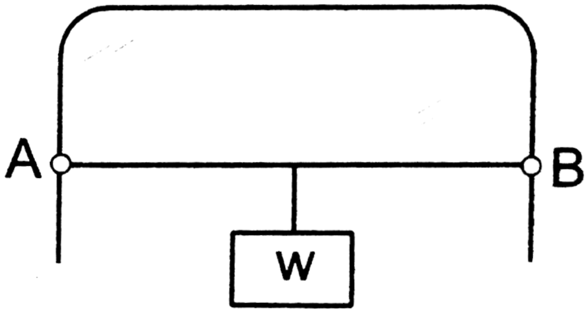
89. A light wire AB of length 10 cm can slide on a vertical frame as shown in figure. There is a film of soap solution trapped between the frame and the wire. Find the load W that should be suspended from the wire to keep it in equilibrium. Neglect friction. Surface tension of soat solution

$= 25 dyncm^{-1}$. Take g=10 ms^-2`



A. 0.2 g

B. 0.3 g

C. 0.4 g

D. 0.5 g

Answer: D

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90. The angle of contact between glass and water is 0° and surface tension is $70 dyn/cm$. Water rises in a glass capillary up to $6 cm$. Another liquid of surface tension $140 dyn/cm$, angle of contact 60° and relative density 2 will rise in the same capillary up to

A. 12 cm

B. 24 cm

C. 3 cm

D. 6 cm

Answer: C

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91. Work W is required to form a bubble of volume V from a given solution. What amount of work is required to be done to form a bubble of volume $2V$?

A. W

B. 2W

C. $2^{\frac{1}{3}}W$

D. $4\frac{1}{3}W$

Answer: D

Watch Video Solution

92. Two vertical parallel glass plates are partially submerged in water. The distance between the plates is d and the length is l. Assume that the water between the plates does not reach the upper edges of the plates and the wetting is complete. The water will rise to height ($\rho =$ density of water and $\alpha =$ surface tension of water)

A. $\frac{2\sigma}{\rho gh}$

B. $\frac{\sigma}{2\rho gd}$

C. $\frac{4\sigma}{\rho gd}$

D. $\frac{5\sigma}{\rho gd}$

Answer: A

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93. A drop of Volume V is pressed between the two glass plates so as to spread to an area of A. If T is the surface tension, the normal force required to separate the glass plates is

A. $\sqrt{\frac{\sigma}{g(2\rho - d)}}$

B. $\sqrt{\frac{2\sigma}{g(2\rho - d)}}$

C. $\sqrt{\frac{6\sigma}{g(2\rho - d)}}$

D. $\sqrt{\frac{12\sigma}{g(2\rho - d)}}$

Answer: D

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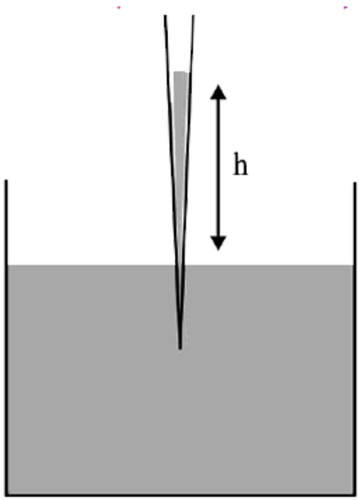
94. A glass capillary tube is of the shape of a truncated cone with an apex angle α so that its two ends have cross sections of different radii. When dipped in water vertically, water rises in it to a high h, where the radius of its cross section is b. If the surface tension of water is S, its density if ρ, and its contact angle with glass is θ, the value of h will be (g is the acceleration due to gravity)



A. $\frac{2S}{b\rho g}\cos(\theta - \alpha)$

B. $\frac{2S}{b\rho g}\cos(\theta + \alpha)$

C. $\frac{2S}{b\rho g}\cos\left(\theta - \frac{\alpha}{2}\right)$

D. $\frac{2S}{b\rho g}\cos\left(\theta + \frac{\alpha}{2}\right)$

Answer: D

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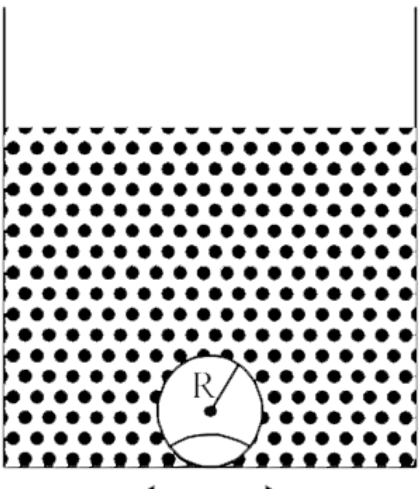
95. On heating water, bubbles being formed at the bottom of the vessel detach and rise. Take the bubbles to be spheres of radius R and making a circular contact of radius r with the bottom of the vessel. If $r < < R$ and the surface tension of water is T, value of r just before bubbles detach is: (density of water is ρ_w)



A. $R^2\sqrt{\frac{2\rho_w g}{2T}}$

B. $R^2\sqrt{\frac{\rho_w g}{6T}}$

C. $R^2\sqrt{\frac{\rho_w g}{T}}$

D. $R^2\sqrt{\frac{3\rho_w g}{T}}$

Answer: A

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96. Assume that a drop of liquid evaporates by decreases in its surface energy, so that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible? The surface tension is T, density of liquid is ρ and L is its latent heat of vaporization.

A. $\frac{\rho L}{T}$

B. $\sqrt{\frac{T}{\rho L}}$

C. $\frac{T}{\rho L}$

D. $\frac{2T}{\rho L}$

Answer: D

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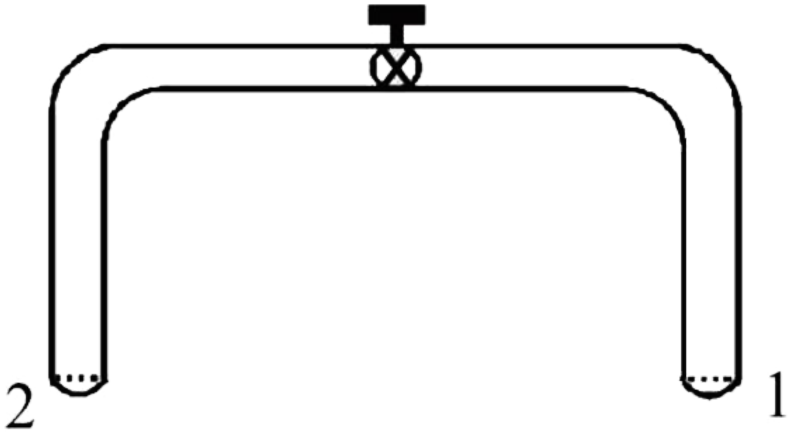
97. A glass tube of uniform internal radius(r) has a valve separating the two identical ends. Intially, the valve is in a tightly closed position. End 1 has a hemispherical soap bubble or radius r. End 2 has sub-hemispherical soap bubble as shown in figure. Just after opening the valve,



A. air from end 1 flows towards end 2. no change in the volume of the soap bubble

B. air from end 1 flows towards end 2. volume of the soap bubble at end 1 decreases

C. no change occurs

D. air from end 2 flows towards end 1. volume of the soap bubble at end 1 increases

Answer: B

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98. A vessel filled with air under pressure p_0 contains a soap bubble of diameter d. The air pressure have been reduced n-fold, and the bubble diameter increased r-fold is isothermally. Find the surface tension of the soap water solution.

A. $T = \frac{1}{2}p_0 d \times \frac{1 - \frac{r^3}{n}}{r^2 - 1}$

B. $T = \frac{1}{8}p_0 d \times \frac{1 - \frac{r^3}{n}}{r^2 - 1}$

C. $T = \frac{1}{4}p_0 d \times \frac{1 - \frac{r^3}{n}}{r^2 - 1}$

D. $T = \frac{1}{6}p_0 d \times \frac{1 - \frac{r^3}{n}}{r^2 - 1}$

Answer: B

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99. The high domes of ancient buildings have structural value (besides beauty). It arises from pressure difference on the 2 faces due to curvature (as in soap bubbles). There is a dome of radius 5 m and uniform (but small) thickness. The surface tension of its masonry structure is about 500 N/m. Treated as hemispherical, the maximum load that the dome can support is nearest to

A. $1500kg - Wt$

B. $3000kg - Wt$

C. $6000kg - Wt$

D. $12000kg - Wt$

Answer: B

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100. A barometer contains two uniform capillaries of radii $1.4 \times 10^{-3}m$ and $7.2 \times 10^{-4}m$. If the height of liquid in narrow tube is $0.2m$ more than that in wide tube, calculate the true pressure difference. Density of liquid $= 10^3 kg/m^3$, surface tension $= 72 \times 10^{-3} N/m$ and $g = 9.8ms^{-12}$.

A. $1360\frac{N}{m^2}$

B. $1260mm$

C. $860\frac{N}{m^2}$

D. $1860\frac{N}{m^2}$

Answer: D

Watch Video Solution

101. In a capillary rise, find the heat developed taking all standard notations as described in the foregoing section.

A. $Q = \frac{2\pi T\cos^2\theta}{\rho g}$

B. $Q = \dfrac{2\pi r^2 T\cos^2\theta}{\rho g}$

C. $Q = \dfrac{2\pi T^2 \sin^2\theta}{\rho g}$

D. $Q = \dfrac{2\pi T^2 \cos^2\theta}{\rho g}$

Answer: D

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102. A vertical U-tube contains a liquid of densityρ and surface tension T. if the radius of the meniscus of liquid in the limbs of the U-tube are R_1 and R_2 find the difference in the liquid column in the limbs.

A. $\Delta h = \dfrac{T(R_1 - R_2)}{\rho g R_1 R_2}$

B. $\Delta h = \dfrac{2T(R_1 - R_2)}{\rho g R_1 R_2}$

C. $\Delta h = \dfrac{2T(R_1 + R_2)}{\rho g R_1 R_2}$

D. $\Delta h = \dfrac{4T(R_1 - R_2)}{\rho g R_1 R_2}$

Answer: B

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103. A mercury drop shape as a round tablet of radius R and thickness h is located between two horizontal glass plates. Assuming that $h < \ < R$, find the mass m of a weight which has to be placed on the copper plate to diminish the distance between the plates by n-times the contact angle is equal to θ. calculate m if T is surface tension of the liquid.

A. $m = \frac{2\pi RT^2|\cos\theta|}{gh}\left(n^2 - 1\right)$

B. $m = \frac{2\pi R^2T|\sin\theta|}{gh}\left(n^2 - 1\right)$

C. $m = \frac{2\pi R^2T|\cos\theta|}{gh}\left(n^2 + 1\right)$

D. $m = \frac{2\pi R^2T|\cos\theta|}{gh}\left(n^2 - 1\right)$

Answer: D

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104. A pair of thin plates partially submerged in water. The distance between the plates is d and their width is l. Assuming that the water between the plates does not reach the upper edges of the plates and that the wetting is complete, find the force of their mutual attraction.

A. $F = \frac{2T^2 l}{\rho g d^2}$

B. $F = \frac{4Tl^2}{\rho g d^2}$

C. $F = \frac{2T^2 l}{\rho g d}$

D. $F = \frac{8T^2 l}{\rho g d^2}$

Answer: A

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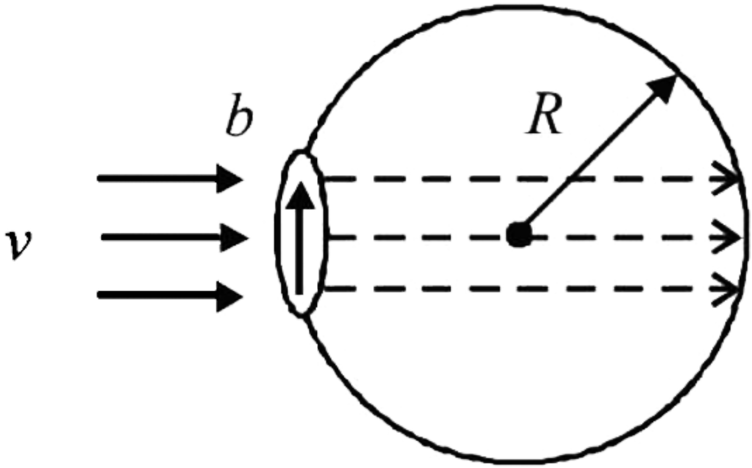
105. A bubble having surface tension T and radius R is formed on a ring of radius $b(b < < R)$. Air is blown inside the tube with velocity v as shown. The air molecule collides perpendicularly with the wall of the bubble and stops. Calculate the radius at which the bubble separates from the ring.



A. $\frac{4T}{\rho V^2}$

B. $\frac{2T}{\rho V^2}$

C. $\frac{T}{\rho V^2}$

D. $\frac{2T}{\rho V}$

Answer: A

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106. The diameter of an air-bubble formed at the bottom of a pond is $d = 4\mu m$, when the bubble rises to the surface, its diameter increases $n = 1.1$ times. If expansion of air bubble is assumed to be isothermal and atmospheric pressure to be standard. How deep the pond at the spot is [surface tension of water $0.075\frac{N}{m}$]

A. 2.5 m

B. 10 m

C. 7.5 m

D. 5 m

Answer: D

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107. A galss capillary length $l = 11\text{cm}$ and inside diameter $d = 20\mu m$ is submerged vertically into water. The upper end of the capillary is sealed. The outside pressure is considered to be $1 \times 10^5 \frac{N}{m^2}$. To what length has the capillary to be submerged to make the water levels inside and outside the capillary coincide?

A. 1.2 cm

B. 2.4 cm

C. 1.4 cm

D. 2.8 cm

Answer: C

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108. Two vertical parallel glass plates are partically submerged in water. The distance between the plates is $d = 0.10mm$, and their width is $l = 12cm$ assuming that the water between the plates does not reach the upper edges of the plates and the wetting is complete. Find the force of their mutual attraction

A. 13 N

B. 26 N

C. 39 N

D. 6.5 N

Answer: A

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More Than One Alternative Type Question

1. Viscous force is similar to friction in solids but viscous force

(a) is independent of area but friction depends on area

(b). Is temperature dependent while friction force between solids depends upon normal reaction.

(c). is velocity dependent while friction is velocity independent

A. a,b,c are correct

B. a,c are correct

C. b,c are correct

D. a,b are correct

Answer: A

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2. With the increase of temperature

A. gases decreases

B. liquid increases

C. gases increases

D. liquid decreases

Answer: C::D

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3. Stream line flow is more likely for liquids with

A. low density air currect

B. high viscosity

C. low density

D. low viscosity

Answer: B::C

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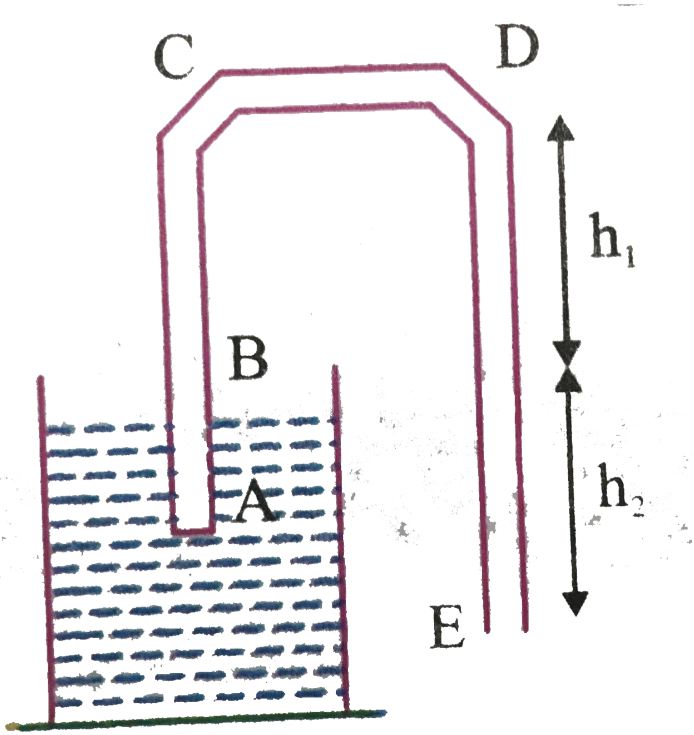
4.



In the siphon system shown v refers to velocity and Prefers to pressure.

Then :

A. $v_E > v_A$

B. $P_D = P_0 - \rho g(h_1 + h_2)$

C. $v_A = v_B = v_E$

D. $v_E = 5v_A + v_B$

Answer: B::C

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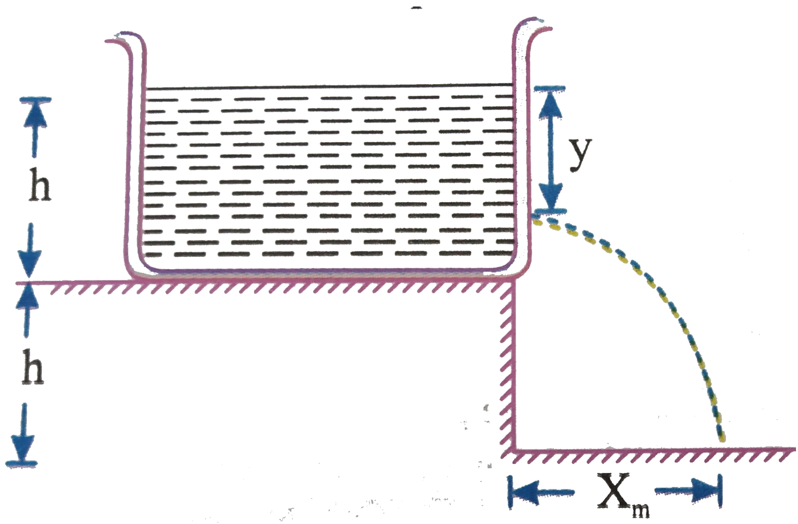

5.

A tank is filled upto a height h with a liquid and is placed on 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

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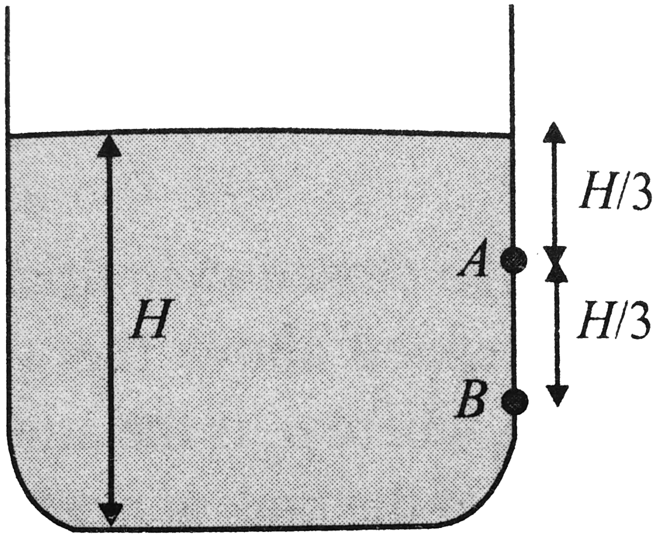
6. The area of two holes A and B are $2a$ and a, respectively, The holes are at height $(H/3)$ and $(2H/3)$ from the surface of water. Find the correct option(s):



A. the velocity of efflux at hole B is 2 times the velocity of efflux at hole

A

B. The velocity of efflux at hole B is $\sqrt{2}$ times the velocity of efflux at

hole A

C. the discharge is same through both the holes

D. the discharge through hole A is $\sqrt{2}$ times the discharge through

hole B.

Answer: B::D

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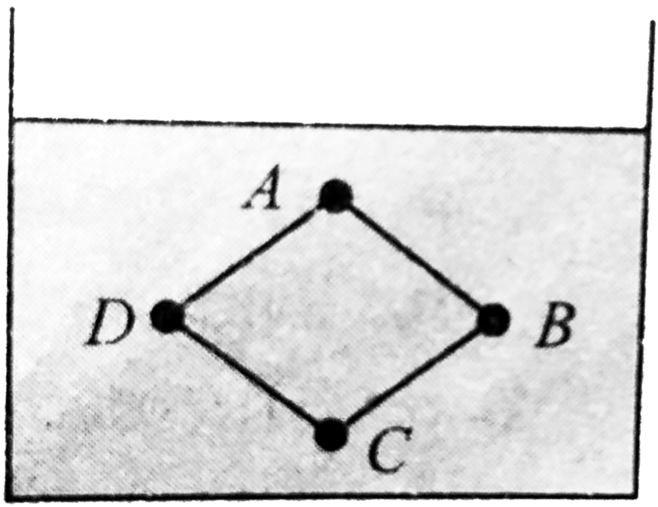
7. Figure shows a container filled with a liquid of density ρ. Four points A, B, C and D lie on the vertices of a vertical square. Points A and C lie on a vertical line and points B and D lies on a horizontal line. Choose the correct statement(s) about the pressure at the four points.



A. $P_D = P_B$

B. $P_A < P_B = P_D < P_C$

C. $P_D = P_B = \dfrac{P_C - P_A}{2}$

D. $P_D = P_B = \dfrac{P_C + P_A}{2}$

Answer: A::B::D

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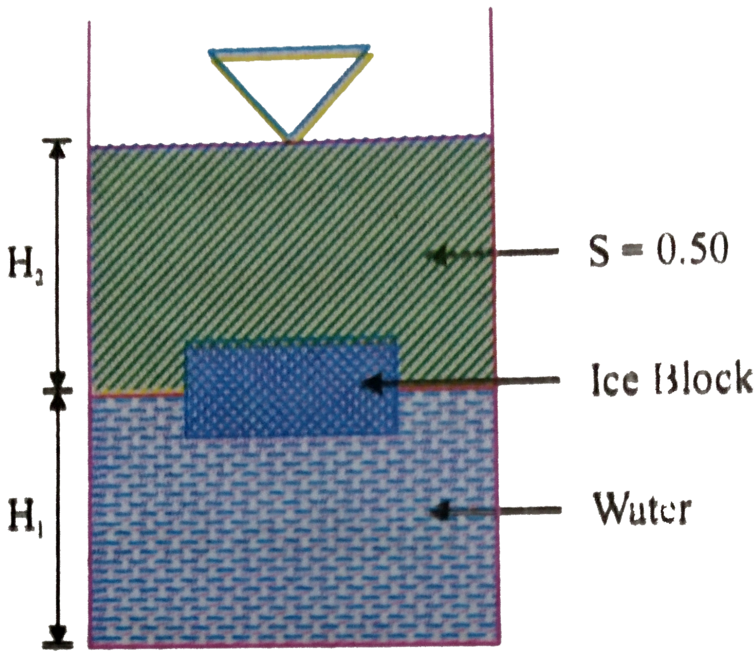
8. 

A block of ice (specified gravity $S_{i-} = 0.90$) is floating in a container having two immiscible liquids (one of specific gravity $S = 0.50$ and other is water) as shown in the figure. (H,H_2 are height of water other liquid columns respectively). Now the ice block melts completely,then

A. H_2 will decrease

B. H_1 will increase

C. $H_1 + H_2$ will remains unchanged

D. $H_1 + H_2$ decreases

Answer: A::B::D

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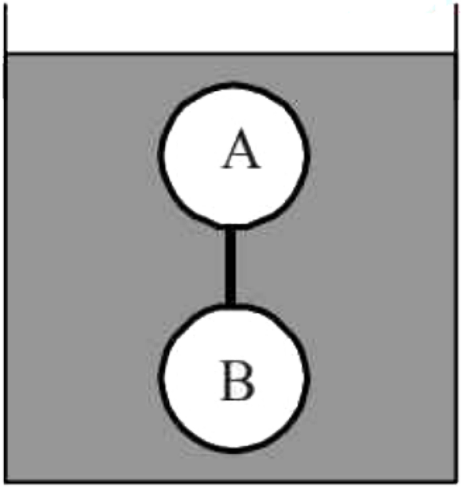
9. Two solid spheres A and B of equal volumes but of different densities d_A and d_B are connected by a string. They are fully immersed in a fluid of density d_F. They get arranged into an equilibrium state as shown in the figure with a tension in the string. The arrangement is possible only if



A. $d_A < d_F$

B. $d_B > d_F$

C. $d_A > d_F$

D. $d_A + d_B = 2d_F$

Answer: A::B::D

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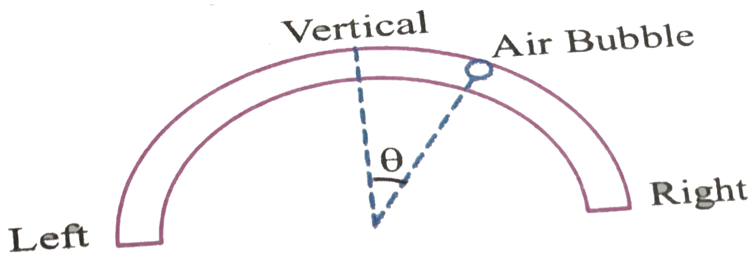
10.



A glass tube filled with colored water, sealed at both the ends is bent into an arc. There is a small air bubble inside. The tube is held with its plane vertical. When the tube moves with constant acceleration either of left or right the bubble shifts and settles at some plane either to the left or right of the highest point. For the situation shown, what can you conclude about acceleration vector of the tube?

A. it points towards the right

B. it points towards the left.

C. its magnitude is $g\tan\theta$

D. its magnitude is $g\cot\theta$

Answer: A::C

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11. A solid sphere of radius R and density ρ is attached to one end of a mass-less spring of force constant k. The other end of the spring is connected to another solid sphere of radius R and density 3ρ. The complete arrangement is placed in a liquid of density 2ρ and is allowed to reach equilibrium. The correct statements(s) is (are)

A. the net elongation of the spring is $\frac{4\pi R^{\circ}\rho g}{3k}$

B. The net elongation of the spring is $\frac{8\pi R^3\rho g}{3k}$

C. the light sphere is partially submerged

D. the light sphere is completely submerged.

Answer: A::D

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12. A container carrying some liquid shown in the diagram is given some acceleration $\vec{a}$.

A. if $\vec{a}$ is directed upwards, P_A - P_B increases

B. if $\vec{a}$ is directed towards right P_A - P_B decreases

C. if $\vec{a}$ is directed downwards, P_A - P_B remains same.

D. if $\vec{a}$ directed towards left P_A - P_B remains same.

Answer: A::B

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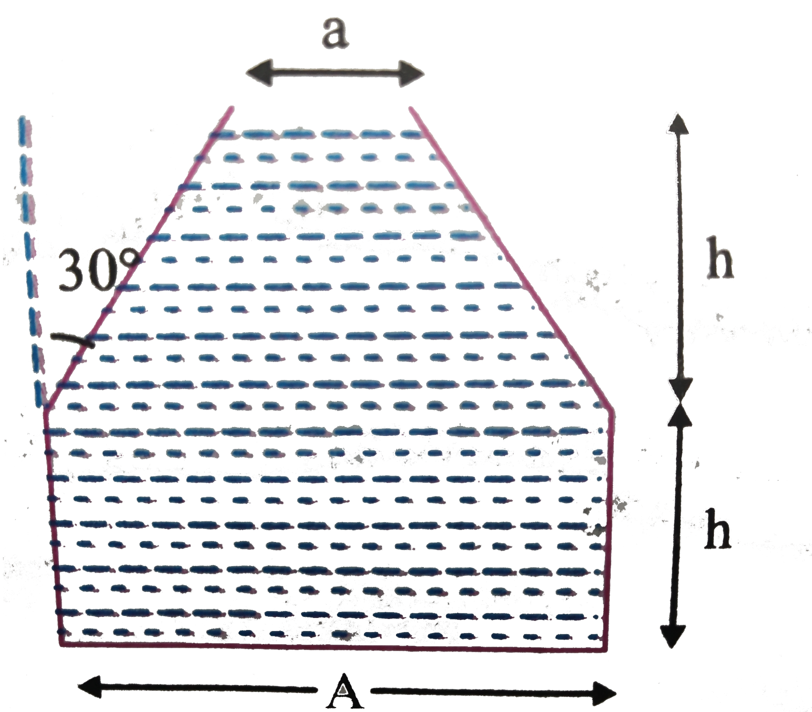
13.



The vessel shown in the figure has two sections. The lower part is a rectangular vessel with area of cross-section A and height h. The upper part is a conical vessel of height h with base area A and top area a and the wals of the vessel are inclined at an angle 30° witht he vertical.A liquid of density ρ fills both the sections upto a height 2h. Neglect atmospheric pressure.

A. The force F exerted by the liquid on the base of the vessel is $2h\rho g.\dfrac{(A+a)}{2}$

B. The pressure P at the base of the vessel is $2h\rho g.\ \frac{A}{a}$

C. The weight of the liquid W is greater than the force exerted by the liquid on the base

D. the walls of the vessel exert a downward force on the liquid.

Answer: D

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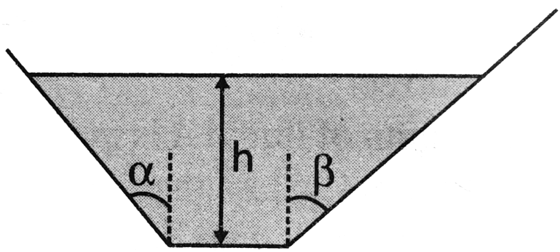
14. A liquid is filled upto height h in a vessel, as shown. Find correct option(s):



A. if $\alpha = \beta$ horizontal component of foces on left and right side of inclined faces will be equal and opposite.

B. if $\alpha \neq \beta$ horizontal component of foces on left ad rifht side of inclined faces will ber equal and opposite.

C. if A is the area of the base of the vessel then force exerted by liquid on walls of the vessel is greater than $\left(P_{\text{atm}} + \rho g h\right)$.

D. As above, the force exerted by liquid on walls is equal to $\left(P_{atm} + \rho g h\right) A$.

Answer: A::B::C

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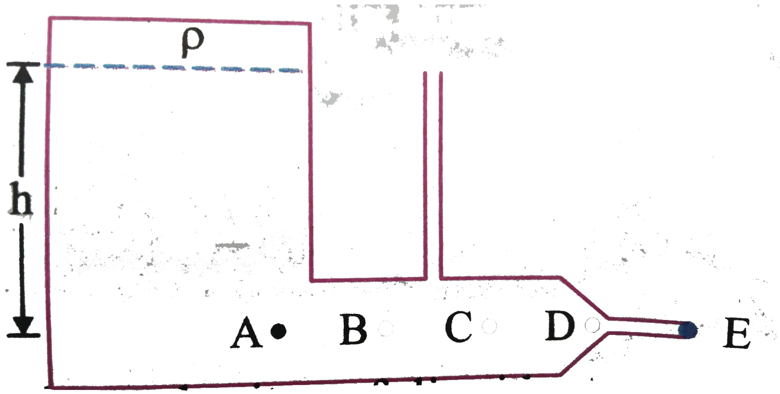

15.

As shown in figure, a liquid of density ρ is standing in sealed container to a height h. The container contains compressed air at a gauge pressure of p.The horizontal outlet pipe has a cross-sectional area A at C and D. The cross-sectional area is $A/2$ at E. Find correct options:

A. The velocity of liquid at C will be $\left[\frac{(P+\rho gh)}{4\rho}\right]^{1/2}$

B. The velocity of liquid at C will be $\left[\frac{2(P+\rho gh)}{\rho}\right]^{1/2}$

C. the discharge rate is given by $\frac{A}{2\rho}(p+\rho gh)^{1/2}$

D. The discharge rate is given by $\frac{A}{2\sqrt{\rho}}(p+\rho gh)^{1/2}$

Answer: A::D

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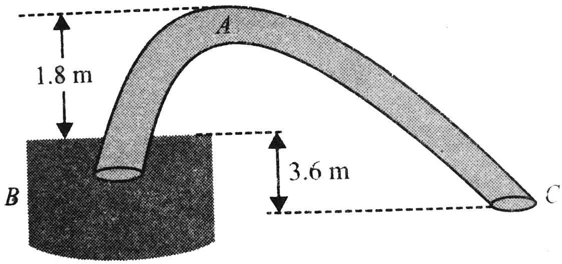
16. A siphon has a uniform circular base of diameter $8/\sqrt{\pi}cm$ with its crest A, $1.8m$ above the water level vessel B is of large cross section ($g = 10m/s^2$ and atmospheric pressure $P_0 = 10^5 N/m^2$).



A. velocity of flow through pipe is $6\sqrt{2}m/s$

B. Discharge rate of flow through pipe is $96\sqrt{2} \times 10^{-4} m^3/s$

C. Velocity of flow through pipe is $6m/s$

D. Pressure of A is $0.46 \times 1^{-5} N/m^2$

Answer: A::B::D

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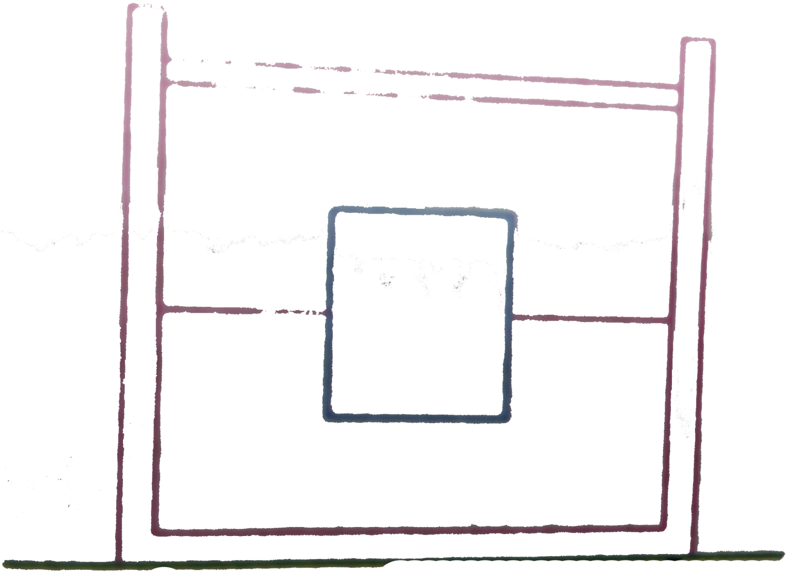
17. 

An incompressible liquid is kept in a long conductying cylindrical cantainer, which is closed at its top by an airtight light piston. A cylinder of length 10 cm made of material of density $0.65 g/cm^3$ floats with half-length submerged in the liquid as shown in the figure. Air trapped in the cylinder has density $1.30 kg/m^3$ On placing extra weight on the piston, pressure of the air in the cylinder is increased to 100 times of the initial pressure.What can you conclude? ($\because$ Use Boyle's law of air i.e., $P_1 V_1 = P_2 V_2$ at constant temperature)

A. Cylinder moves downwards

B. cylinder moves upwards

C. Displacement of the cylinder is 0.55 cm

D. Displacement of the cylinder is 0.6 cm

Answer: B::C

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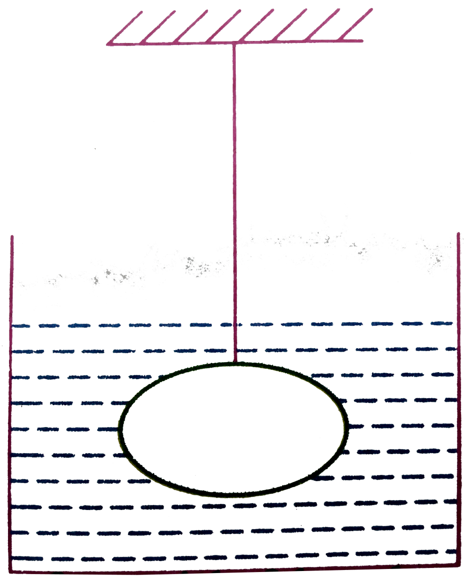

18.

A solid sphere of mass m , is suspended by means of a string in a liquid as shown.The string has some tension. Magnitudes of net force due to liquid on upper hemisphere and that on lower hemisphere are F_A and F_B respectively. Which of the following is/are true.

A. Density of material of the sphere is greater than density of liquid.

B. difference of F_B and F_A is dependent of atmospheric pressure

C. F_B - F_A = mg

D. F_B - F_A = $< mg$

Answer: A::D

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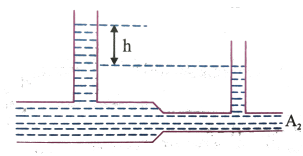
19.



Aliquidflowsthroughah or *izontaltube. Thevelocitiesoftheliquid* ∈ *thetwosectionsw*

A_(1) and A_(2)*are*v_(1),v_(2)` respectively. The difference in the levels of liquid in the two vertical tubes is h.

A. the volume of liquid flowing through the tube in unit time is A_1v_1

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

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

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

Answer: A::C::D

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20. Water flows through a capillary tube of radius r and length at a rate of 40 ml per second, when connected to a pressure difference of h cm of water. Another tube of the3 some length but radius. $\frac{r}{2}$ is connected in series with this tube and the combination is connected to the same pressure head.[density of water is ρ]

A. the pressure difference across each tube is $p_1 = \frac{\rho g h}{17}$ and $p_2 = \frac{16}{17}\rho g h$

B. The pressure difference across each tube is $p_1 = \frac{\rho g h}{16}$ and $P_2 = \frac{17}{16}\rho g h$

C. The rate of flow of the water through the combination is $\frac{40}{17}\frac{c.c}{\sec}$.

D. The rate of flow of water through the combination is $\frac{17}{40}\frac{c.c}{\sec}$.

Answer: A::C

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21. An oil drop falls through air with a terminal velocity of $\frac{5 \times 10^{-4}}{\sec}$ viscosity of air is $1.8 \times 10^{-5}\frac{N\text{-}s}{m^2}$ and density of oil is 900 kg m^3 neglect density of air as compared to that of oil.

A. the radius of is $4.18 \times 10^6 m$

B. The radius of drop is $2.14 \times 10^{-6} m$

C. The terminal velocity of a drop of half of this radius is $1.25 \times 10^{-4}\frac{m}{\sec}$.

D. The terminal velocity of a drop of half of this radius is $2.5 \times 10^{-4}\frac{m}{\sec}$

.

Answer: B::C

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22. A tube of length 1 and radius R carries a steady flow of fluid whose density is ρ and viscosity η. The velocity v of flow is given by $v = v_0\left(1 - r^2/R^2\right)$ Where r is the distance of flowing fluid from the axis.

A. the volume of fluid flowing across the section. Of the tube, in unit time is $2\pi v_0\left(\frac{R^2}{4}\right)$

B. the kinetic energy of the fluid within the volume of the tube is $K.E = \pi\rho l v_0^2\left(\frac{R^2}{6}\right)$

C. the frictional force exerted on the tube by the fluid is $F = 4\pi\eta k v_0$

D. the pressure difference at the ends of tube is $P = \frac{4\eta l v_0}{R^2}$

Answer: A::B::C::D

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23. Viscous force is somewhat like friction as it opposes the motion and is non-conservative but not exactly so because

A. it is velocity dependent while friction not

B. it is velocity independent while friction is

C. it is temperature dependent while friction not

D. it is independent of area like surface tension while friction depends.

Answer: A::C

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24. A solid sphere moves at a terminal velocity of $20ms^{-1}$ in air at a place where $g = 9.8ms^{-2}$. The sphere is taken in a gravity free hall having air at the same pressure and pushed down at a speed of $20ms^{-1}$

A. its initial acceleration will be $9.8ms^{-2}$ downward.

B. its initial acceleration will be $9.8ms^{-2}$ upward

C. The magnitude of acceleration will decrease as the time passes.

D. it will eventually stop.

Answer: B::C::D

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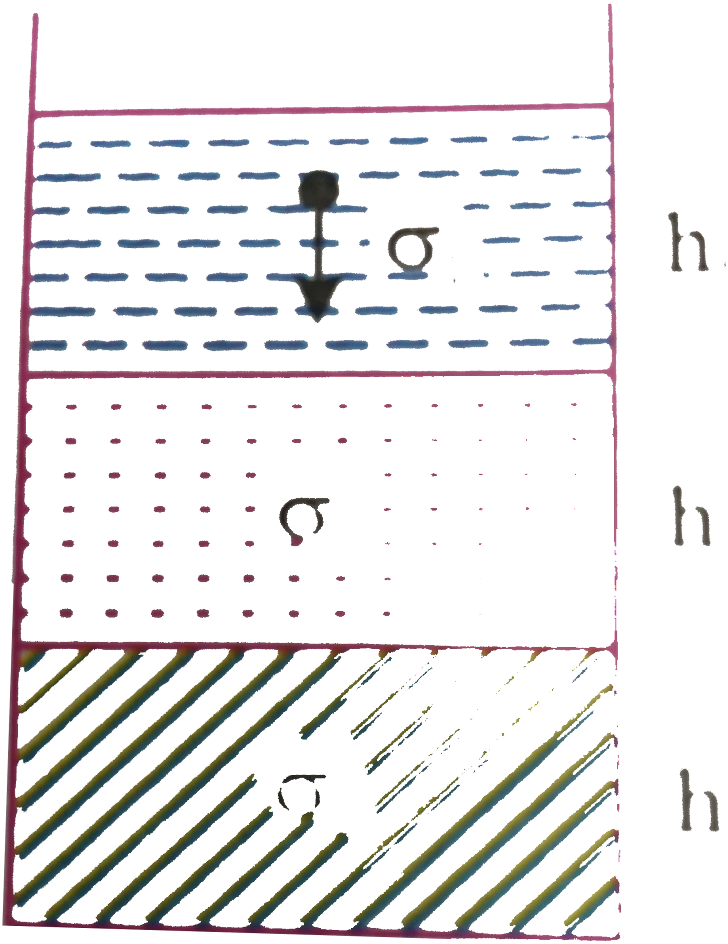

25.

A ball moves successively through three liquids, at rest as shown, of densities σ_1, σ_2 and σ_3 and viscosity coefficient η_1, η_2 and η_3 and respectively with the same terminal velocity then

A. $\eta_3 > \eta_2 > \eta_1$

B. $\frac{\sigma_1}{\eta_1} = \frac{\sigma_2}{\eta_2} = \frac{\sigma_3}{\eta_3}$

C. $\frac{\eta_1}{\eta_3 > \frac{\eta_3}{\eta_2}}$

D. $\frac{\eta_2\sigma_1 - \eta_1\sigma_2}{\eta_3\sigma_1 - \eta_1\sigma_3} = \frac{\eta_2 - \eta_1}{\eta_3 - \eta_1}$

Answer: C::D

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26. A spherical solid body is dropped inside a vast expanse of viscous liquid of large depth and of coefficient of viscosity η. The density of the solid is greater than that of the liquid. The time taken by the body to attain the 90% of the steady state velocity is dependent on

A. density of the liquid

B. density of the solid

C. diameter of the sphere

D. coefficient of viscosity

Answer: B::C::D

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27. A small sphere of mass m is drpped from a height. After it has fallen 100m, it has attained its terminal velocity and continues to fall at that speed. Then the modulus of work done.

A. By viscosity of air is lesser in first 100 m than in the second 100 m

B. by buoyancy of air is in first 100 m is equal to that in the second 100 m

C. by viscosity of air is greater in first 100 m than in the second 100 m

D. by buoyancy of air is lesser in first 100 than that in the second 100 m

Answer: A::B

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28. Pick out the wrong statement from the following

A. viscosity depends upon the nature of the liquids

B. generally viscosity of liquids is more than that of gases

C. in case of gases, viscosity decreases with increase in temperature

D. in case of liquids viscosity decreases with increase in temperature

Answer: C

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29. Excess pressure can be $(2T/R)$ for

A. spherical drop

B. spherical meniscus

C. clindrical bubble in air

D. spherical bubble in water

Answer: A::B::C::D

Watch Video Solution

30. If n drops of a liquid, form a single drop, then

A. some energy will be released in the process

B. some energy will be released in the process

C. the energy released or absorbed will be $E\left(n - n^{\frac{2}{3}}\right)$

D. the enrgy released or absorbed will be $nE\left(2^{\frac{2}{3}} - 1\right)$

Answer: A::C

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31. When a capillary tube is dipped in a liquid, the liquid rises to a height h in the tube. The free liquid surface inside the tube is hemispherical in shape. The tube is now pushed down so that the height of the tube outside the liquid is less than h. Then

A. the liquid will come out of the tube like in a small fountain

B. The liquid will oze out of the tube slowly

C. the liquid will fill the tube but not come out of its upper end

D. the free liquid surface inside the tube will not hemispherical.

Answer: C::D

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32. A cappillary tube of radiue r is lowered into water whose surface tension is α and density d. The liquid rises to a height. Assume that the contact angle is zero. Choose the correct statement (s):

A. Magnitude of work done by force of surface tension is $\frac{4\pi\alpha^2}{dg}$

B. Magnitude of work done by force of surface tension is $\frac{2\pi\alpha^2}{dg}$

C. Potential energy acquired by the water is $\frac{2\pi\alpha^2}{dg}$

D. The amount of heat developed is $\frac{2\pi\alpha^2}{dg}$

Answer: A::C::D

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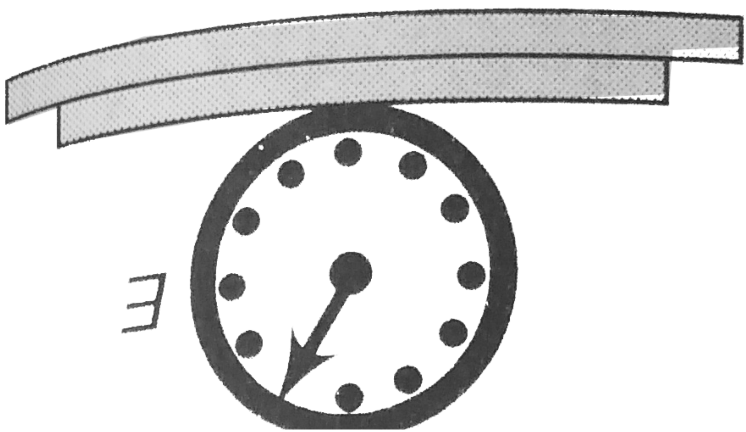
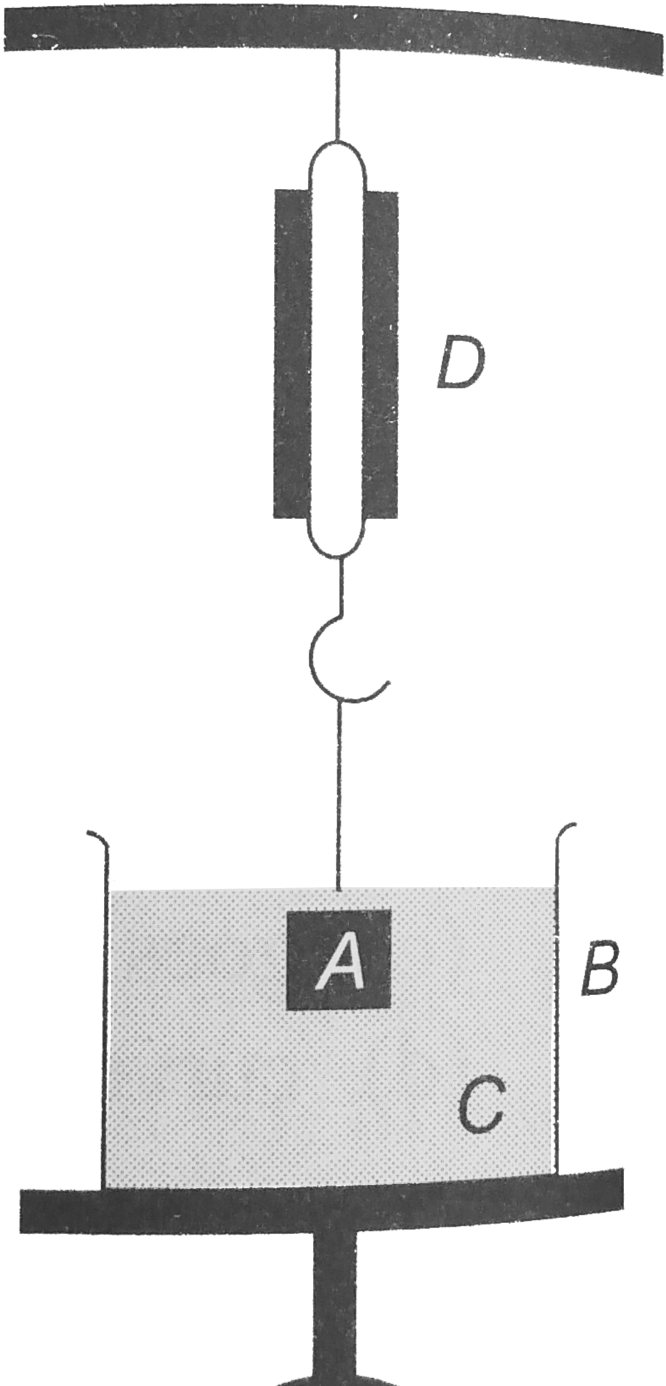
Comprehension Type Questions

1. In figure, block A hangs by a cord form spring balance D and it submerged in a liquid C contained in a beaker B. The mass of the beaker is $1kg$. The mass of the liquid is $1.5kg$. Balance D reads $7.5kg$. The volume of block A is $0.003m^3$. The mass per unit volume of the liquid is




D
A
B
C

A. $1666.7\frac{kg}{m^3}$

B. $1500\frac{kg}{m^3}$

C. $2500\frac{kg}{m^3}$

D. $1750\frac{kg}{m^3}$

Answer: A

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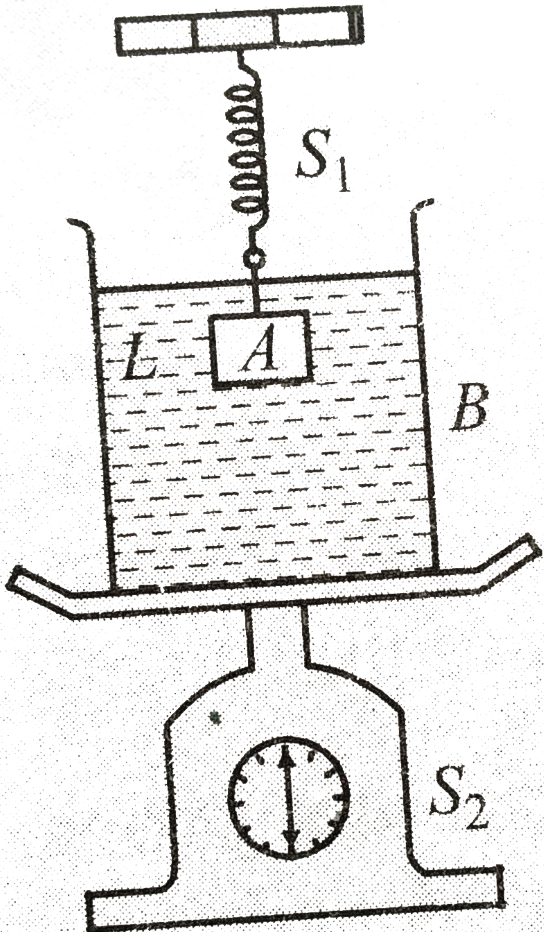
2. As Fig. shows, S_1 and S_2, are spring balances. Block A is hanging from spring balance S_1 and immersed in liquid L which is contained in beaker B. The mass of beaker B is $1kg$ and mass of liquid L is $1.5kg$. Balances S_1 and S_2 reads $2.5kg$ and $7.5kg$, respectively. What will be the readings of S_1 and S_2 when block A is pulled up out of the liquid. Find the reading of S_1

and S_2?



A. 7.5 kg

B. 2 kg

C. 3.5 kg

D. 2.1 kg

Answer: A

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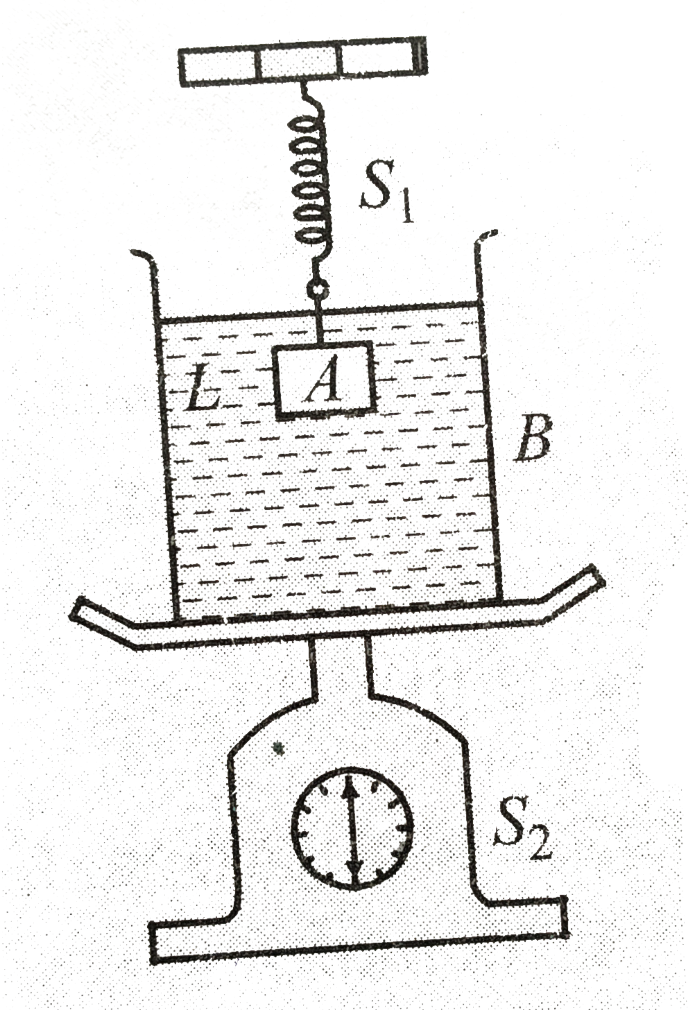
3. As Fig. shows, S_1 and S_2, are spring balances. Block A is hanging from spring balance S_1 and immersed in liquid L which is contained in beaker B. The mass of beaker B is $1kg$ and mass of liquid L is $1.5kg$. Balances S_1 and S_2 reads $2.5kg$ and $7.5kg$, respectively. What will be the readings of S_1 and S_2 when block A is pulled up out of the liquid. Find the reading of S_1

and S_2?



A. 2.5 kg

B. 2 kg

C. 1.5 kg

D. 3 kg

Answer: A

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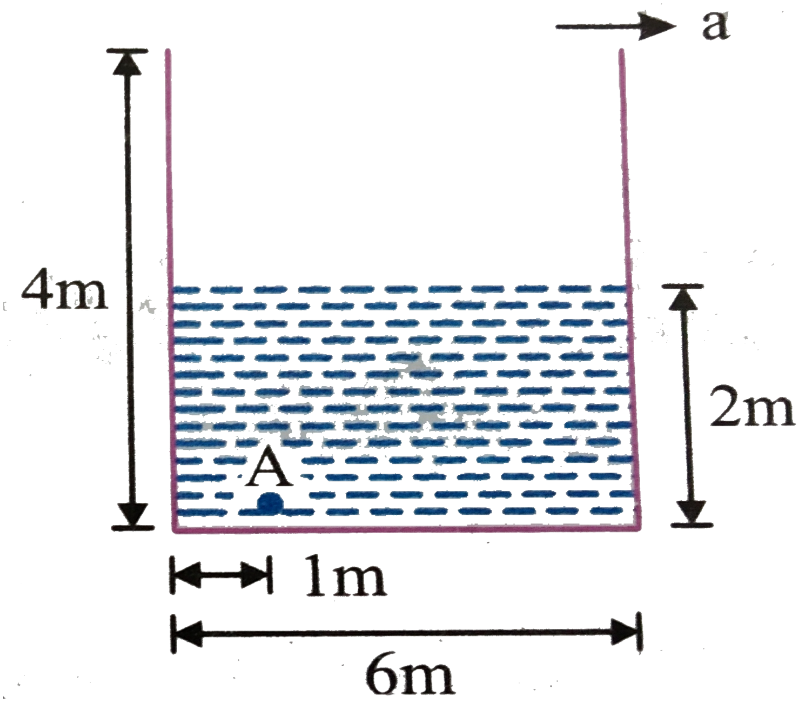
4. 

An open rectangular tank of dimensions $6m \times 5m \times 4m$ contains water upto height of 2m. The vessel is accelerated horizontally with an acceleration of am/s^2 as shown. Take $\rho_{\text{water}} = 10^3 kg/m^3$ $g = 10m/s^2$ atmospheric pressure $= 10^5 N/m^2$. Bese on above information answer the following questions:

Determine the maximum value of a so that no water comes out from tan

k.

A. g

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

C. $\frac{g}{3}$

D. $2g$

Answer: B

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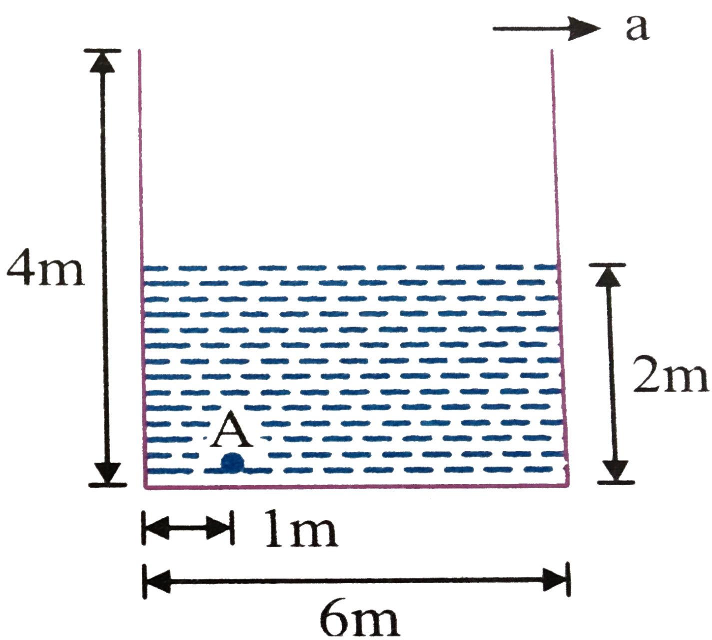
5.



An open rectangular tank of dimensions $6m \times 5m \times 4m$ contains water upto height of 2m. The vessel is accelerated horizontally with an acceleration of am/s^2 as shown. Take $\rho_{\text{water}} = 10^3 kg/m^3$ $g = 10m/s^2$ atmospheric pressure $= 10^5 N/m^2$. Bese on above information answer the following questions:

Determine the height to which the water should be filled in the tank so that when $a = 5m/s^2$ no water comes out from the tank

A. 2 mm

B. 3 m

C. 2.5 m

D. 3.5 m

Answer: C

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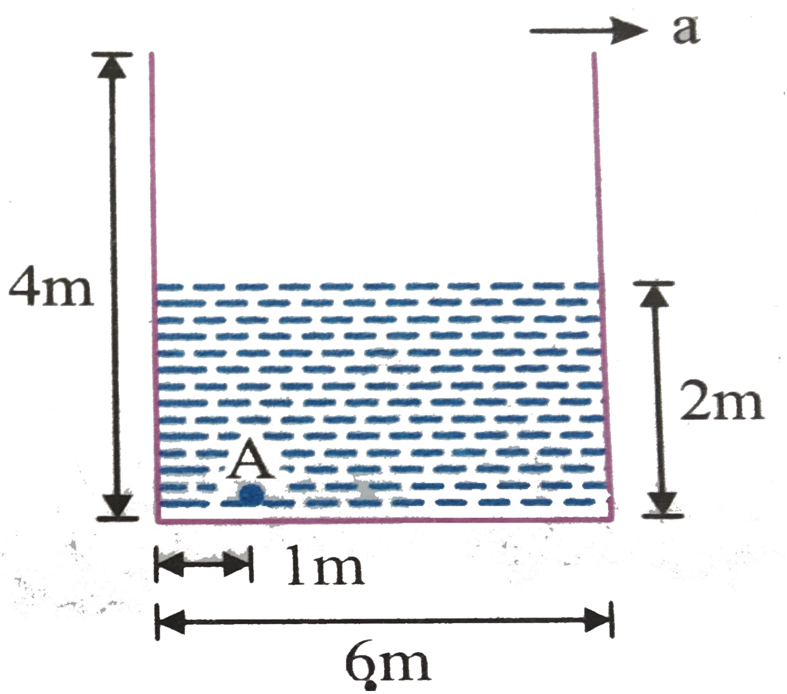

6.

An open rectangular tank of dimensions $6m \times 5m \times 4m$ contains water upto height of 2m. The vessel is accelerated horizontally with an acceleration of am/s^2 as shown. Take $\rho_{\text{water}} = 10^3 kg/m^3$

$g = 10m/s^2$ atmospheric pressure $= 10^5 N/m^2$. Bese on above information answer the following questions:

Instead of open top if the vessel is closed then absolute pressure at point A would be [take $a = \frac{20}{3} m/s^2$ and initially height of water in tank is 2m]

A. $1.33 \times 10^5 N/m^2$

B. $1.0 \times 10^5 N/m^2$

C. $3.33 \times 10^{45} N/m^2$

D. none

Answer: A

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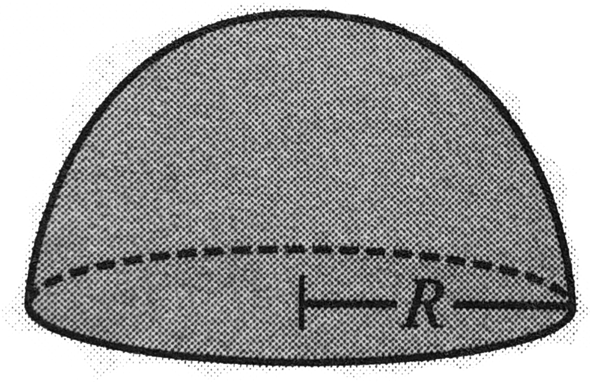
7. A solid hemisphere of radius R is made to just sink in a liquid of density ρ. Find a. the vertical thrust on the curved surface b. the vertical thrust on the flat surface c. the side thrust on the hemisphere. d. the total hydrostatic force acting on the hemisphere.



A. $\frac{\pi R^3 \rho g}{3}$

B. $\frac{\pi R^3 \rho g}{2}$

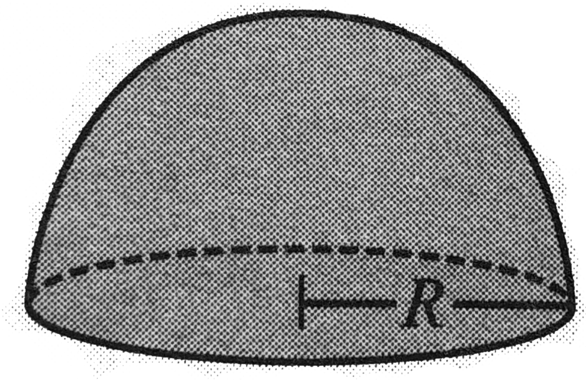
C. 0

D. $\pi R^3 \rho g$

Answer: A

Watch Video Solution

8. A solid hemisphere of radius R is made to just sink in a liquid of density ρ. Find a. the vertical thrust on the curved surface b. the vertical thrust on the flat surface c. the side thrust on the hemisphere. d. the total hydrostatic force acting on the hemisphere.



A. $\frac{\pi R^3 \rho g}{3}$

B. $\frac{\pi R^3 \rho g}{2}$

C. 0

D. $\pi R^3 \rho g$

Answer: D

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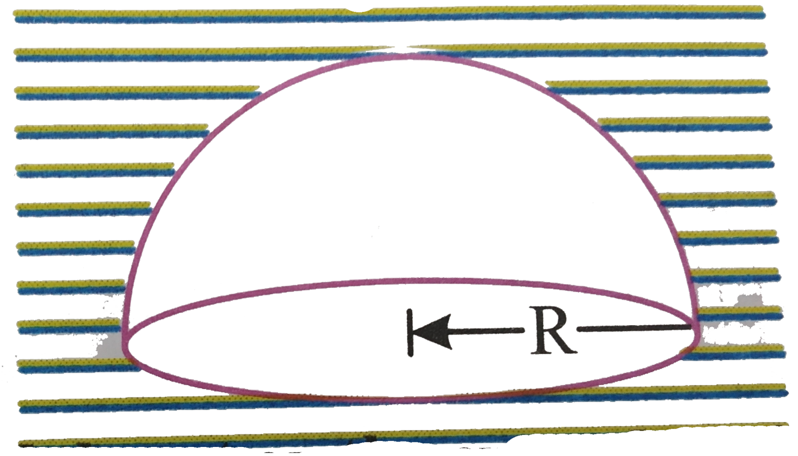
9. 

A solid hemisphere of radius R is made to just sink in a liquid of density ρ find the

A. $\frac{\pi R^3 \rho g}{3}$

B. $\frac{\pi R^3 \rho g}{2}$

C. 0

D. $\pi R^3 \rho g$

Answer: C

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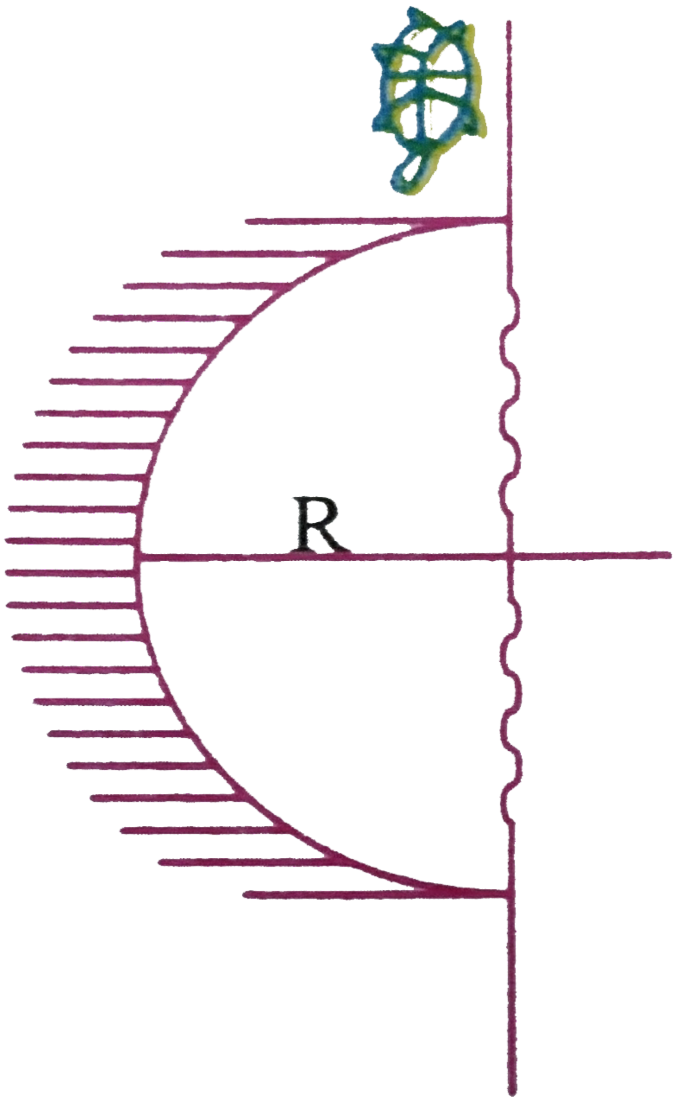

10.

A tortoise is just sinking in water of density ρ The tortoise is assumed to be3 a hemisphere of radius R.

Find vertical thrust

A. $\rho g \pi R^3$

B. $\frac{1}{3}\rho g \pi R^3$

C. $\frac{2}{3}\rho g \pi R^3$

D. 0

Answer: C

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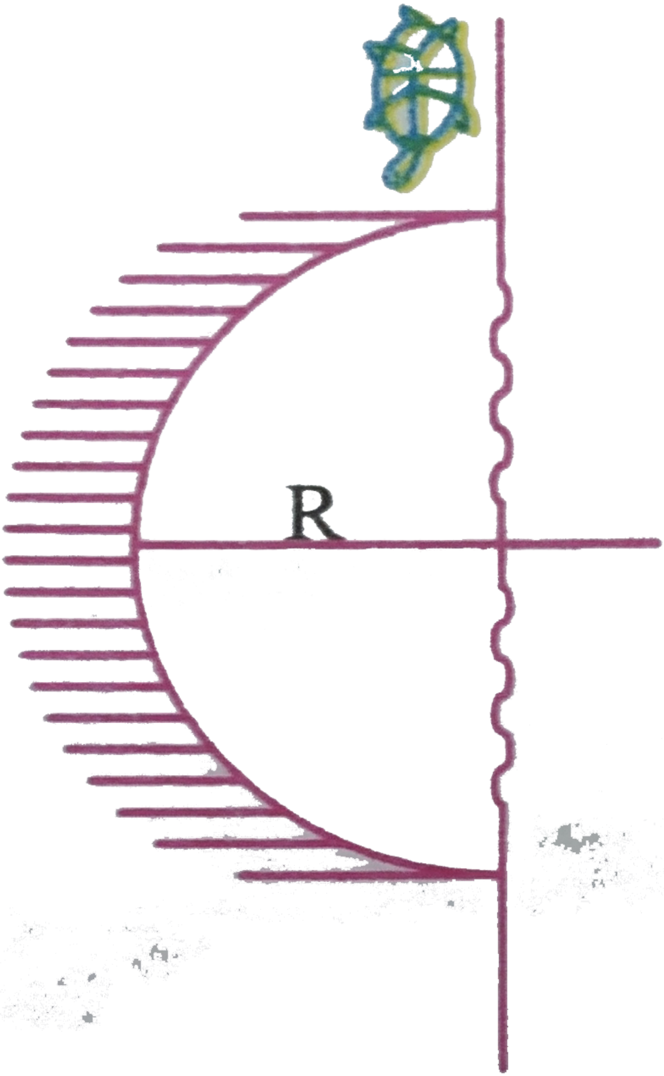

11.

A tortoise is just sinking in water of density ρ The tortoise is assumed to

be3 a hemisphere of radius R.

Q. Find the total hydrostatic force

A. $\rho g\pi R^3$

B. $\sqrt{\frac{13}{3}}\rho g\pi R^3$

C. $\frac{2}{3}\rho g\pi R^3$

D. $\sqrt{\frac{16}{3}}\rho g\pi R^3$

Answer: B

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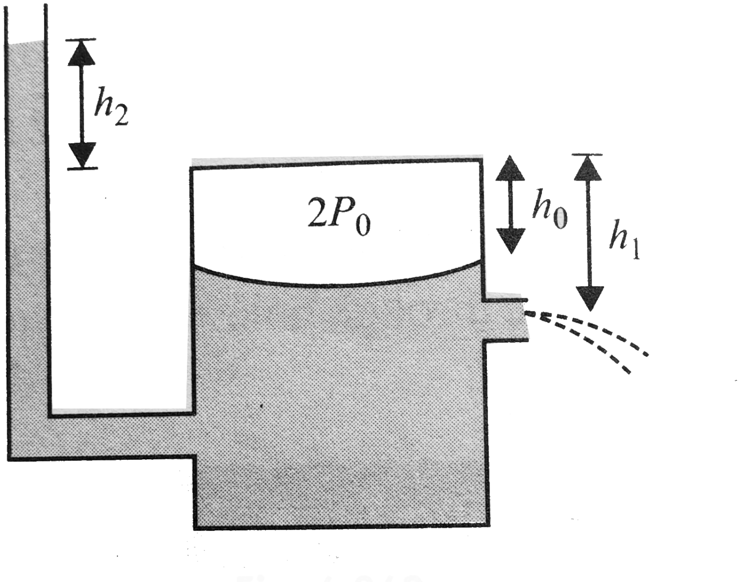
12. Figure shows a large closed cylindrical tank containing water. Initially, the air trapped above the water surface has a height h_0 and pressure $2p_0$ where rh_0 is the atmospheric pressure. There is a hole in the wall of the tank at a depth h_1 below the top from which water comes out. A long vertical tube is connected as shown.



Find the height h_2 of the water in the long tube above top initially.

A. $\frac{3p_0}{\rho g} - \frac{h_0}{3}$

B. $\frac{2p_0}{\rho g} - \frac{h_0}{2}$

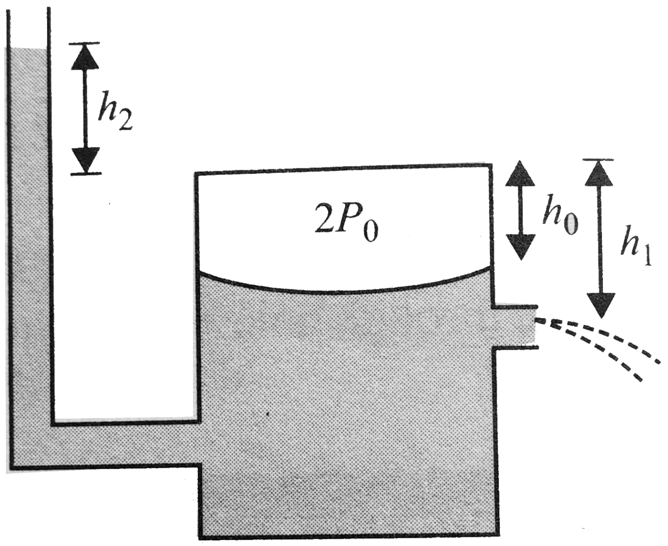
C. $\frac{p_0}{\rho g} - h_0$

D. $\frac{p_0}{2\rho g} - 2h_0$

Answer: C

Watch Video Solution

13. Figure shows a large closed cylindrical tank containing water. Initially, the air trapped above the water surface has a height h_0 and pressure $2p_0$ where rh_0 is the atmospheric pressure. There is a hole in the wall of the tank at a depth h_1 below the top from which water comes out. A long vertical tube is connected as shown.



Find the speed with which water comes out of the hole

A. $\frac{1}{\rho}\left[p_0 - \rho g\left(h_1 - 2h_0\right)\right]^{1/2}$

B. $\left[\frac{2}{\rho}\left[p_0 + \rho g\left(h_1 - h_0\right)\right]\right]^{1/2}$

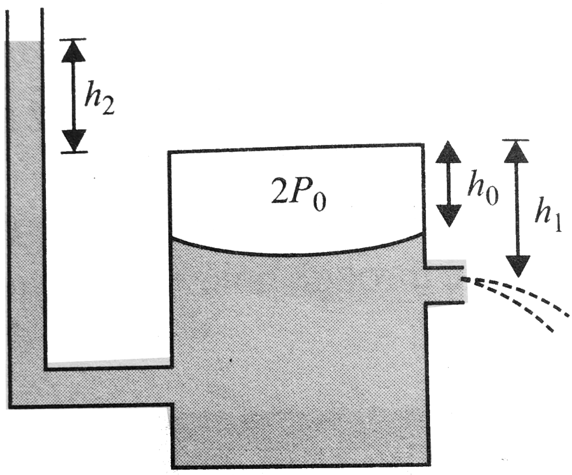
C. $\left[\frac{3}{\rho}\left[p_0 + \rho g\left(h_1 + h_0\right)\right]\right]^{1/2}$

D. $\left[\frac{4}{\rho}\left[p_0 - \rho g\left(h_1 - h_0\right)\right]\right]^{1/2}$

Answer: B

Watch Video Solution

14. Figure shows a large closed cylindrical tank containing water. Initially, the air trapped above the water surface has a height h_0 and pressure $2p_0$ where rh_0 is the atmospheric pressure. There is a hole in the wall of the tank at a depth h_1 below the top from which water comes out. A long vertical tube is connected as shown.



Find the height of the water in the long tube above the top when the water stops coming out of the hole.

A. - $2h_0$

B. h_0

C. h_2

D. - h_1

Answer: D

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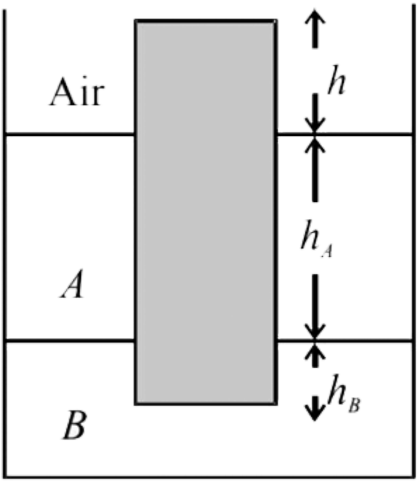
15. A uniform solid cylinder of density $0.8g/cm^3$ floats in equilibrium in a combination of two non-mixing liquids A and B with its axis vertical. The densities of the liquids A and B are $0.7g/cm^3$ and $1.2g/cm^3$, respectively. The height of liquid A is $h_A = 1.2cm$. The length of the part of the cylinder immersed in liquid B is $h_B = 0.8cm$.



(a) Find the total force exerted by liquid A on the cylinder.

(b) Find h, the length of the part of the cylinder in air.

(c) The cylinder is depressed in such a way that its top surface is just below the upper surface of liquid A and is then released. Find the acceleration of the cylinder immediately after it is released.

A. 1.0 N

B. 3 N

C. 5 N

D. 6 N

Answer: A

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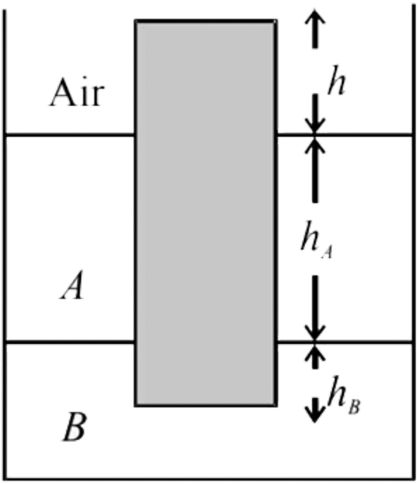
16. A uniform solid cylinder of density $0.8g/cm^3$ floats in equilibrium in a combination of two non-mixing liquids A and B with its axis vertical.

The densities of the liquids A and B are $0.7g/cm^3$ and $1.2g/cm^3$, respectively. The height of liquid A is $h_A = 1.2cm$. The length of the part of the cylinder immersed in liquid B is $h_B = 0.8cm$.



(a) Find the total force exerted by liquid A on the cylinder.

(b) Find h, the length of the part of the cylinder in air.

(c) The cylinder is depressed in such a way that its top surface is just below the upper surface of liquid A and is then released. Find the acceleration of the cylinder immediately after it is released.

A. 0.5 cm

B. 0.2 cm

C. 0.25 cm

D. 0.6 cm

Answer: C

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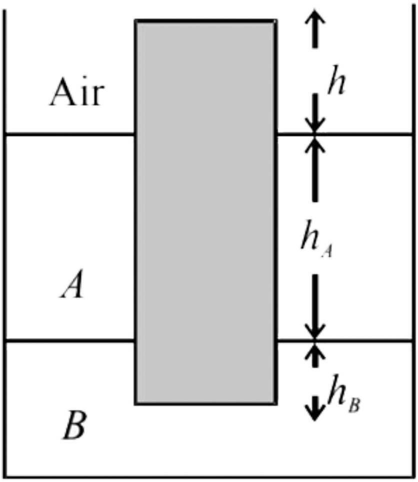
17. A uniform solid cylinder of density $0.8g/cm^3$ floats in equilibrium in a combination of two non-mixing liquids A and B with its axis vertical. The densities of the liquids A and B are $0.7g/cm^3$ and $1.2g/cm^3$, respectively. The height of liquid A is $h_A = 1.2cm$. The length of the part of the cylinder immersed in liquid B is $h_B = 0.8cm$.



(a) Find the total force exerted by liquid A on the cylinder.

(b) Find h, the length of the part of the cylinder in air.

(c) The cylinder is depressed in such a way that its top surface is just below the upper surface of liquid A and is then released. Find the acceleration of the cylinder immediately after it is released.

A. $\frac{g}{8}$

B. $\frac{g}{6}$

C. $\frac{g}{4}$

D. $\frac{g}{3}$

Answer: B

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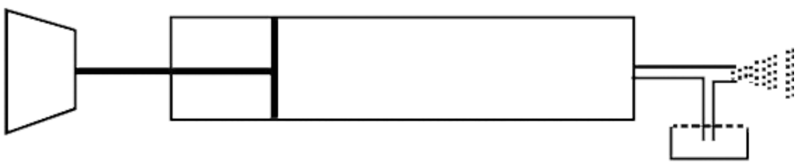
18. A spray gun is shown in the figure where a piston pushes air out of a nozzle. A thin tube of uniform cross section is connected to the nozzle. The other end of the tube is in a small liquid container. As the piston pushes air through the nozzle, the liquid from the container rises into the nozzle and is sprayed out. For the spray gun shown, the radii of the piston and the nozzle are 20mm and 1mm respectively. The upper end of the container is open to the atmosphere.



If the piston is pushed at a speed of $5mms^{-1}$, the air comes out of the nozzle with a speed of

A. $0.1ms^{-1}$

B. $1ms^{-1}$

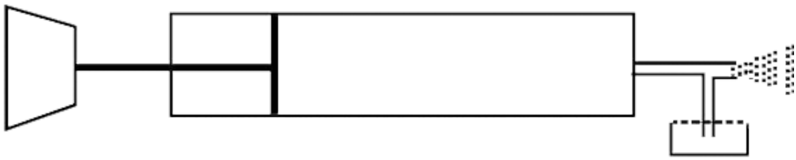
C. $2ms^{-1}$

D. $8ms^{-1}$

Answer: C

Watch Video Solution

19. A spray gun is shown in the figure where a piston pushes air out of a nozzle. A thin tube of uniform cross section is connected to the nozzle. The other end of the tube is in a small liquid container. As the piston pushes air through the nozzle, the liquid from the container rises into the nozzle and is sprayed out. For the spray gun shown, the radii of the piston and the nozzle are 20mm and 1mm respectively. The upper end of the container is open to the atmosphere.



If the density of air is ρ_a, and that of the liquid ρ_l, then for a given piston speed the rate (volume per unit time) at which the liquid is sprayed will be proportional to

A. $\sqrt{\frac{\rho_a}{\rho_l}}$

B. $\sqrt{\rho_a \rho_l}$

C. $\sqrt{\frac{\rho_l}{\rho_a}}$

D. ρ_l

Answer: A

Watch Video Solution

20. A wooden cylinder of length L is partly submerged in a liquid of specific gravity ρ_1 with $n^{th}(n < 1)$ part of it inside the liquid. Another immiscible liquid of density ρ_2 is poured to completely submerge the cylinder. Density of cylinder ρ is the geometric mean of the densities of the two liquid.

Express the density of upper liquid in terms of density of cylinder

A. $\frac{\rho}{n}$

B. ρn

C. $\frac{n}{(n+1)}$

D. none

Answer: B

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21. A wooden cylinder of length L is partly submerged in a liquid of specific gravity ρ_1 with n^{th} $(n < 1)$ part of it inside the liquid. Another immiscible liquid of density ρ_2 is poured to completely submerge the cylinder. Density of cylinder ρ is the geometric mean of the densities of the two liquid.

Calculate the fraction of the cylinder submerged in the lower liquid after the upper liquid is poured in the vessel

A. $\dfrac{n}{(n+1)}$

B. $\dfrac{(n-1)}{(n+1)}$

C. $\dfrac{n(n-1)}{(n+1)}$

D. $\dfrac{n(n-1)}{(n+1)}$

Answer: A

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22. A wooden cylinder of length L is partly submerged in a liquid of specific gravity ρ_1 with n^{th} $(n < 1)$ part of it inside the liquid. Another immiscible liquid of density ρ_2 is poured to completely submerge the cylinder. Density of cylinder ρ is the geometric mean of the densities of the two liquid.

When the cylinder is slightly depressed and released, it oscillates. let there be a mean position. find the time period of small oscillations below thee mean position

A. $\pi\left[\dfrac{(n+a)L}{g(n-1)}\right]^{\frac{1}{2}}$

B. $\pi\left[\dfrac{n^2L}{g(1-n)^2}\right]^{\frac{1}{2}}$

C. $\pi\left[\dfrac{nL}{g\left(n^2-1\right)}\right]^{1/2}$

D. $\pi\left[\dfrac{nL}{g\left(1-n^2\right)}\right]^{\frac{1}{2}}$

Answer: D

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23. A wooden cylinder of length L is partly submerged in a liquid of specific gravity ρ_1 with n^{th} $(n < 1)$ part of it inside the liquid. Another immiscible liquid of density ρ_2 is poured to completely submerge the cylinder. Density of cylinder ρ is the geometric mean of the densities of the two liquid.

Similarly as above, find the time period of small oscillations above the mean position.

A. $\pi\left[\frac{nL}{g}\right]^{\frac{1}{2}}$

B. $\pi\left[\frac{L}{ng}\right]^{\frac{1}{2}}$

C. $\pi\left[\frac{(n-1)L}{g}\right]^{\frac{1}{2}}$

D. $\pi\left[\frac{nL}{(n-1)g}\right]^{\frac{1}{2}}$

Answer: A

Watch Video Solution

24. A tank of height H and base area A is half filled with water and there is a small orifice at the bottom and there is a heavy solid cylinder having base area $\frac{A}{3}$ and height of the cylinder is same as that of the tak. The water is flowing out of the orifice. Here cylinder is put into the tank to increase the speed of water flowing out.

The speed of water flowing out of the orifice after the cylinder is kept inside it is

A. $\sqrt{\frac{gH}{2}}$

B. $\sqrt{\frac{3gH}{2}}$

C. $\sqrt{2gH}$

D. $\sqrt{3gH}$

Answer: B

Watch Video Solution

25. A tank of height H and base area A is half filled with water and there is a small orifice at the bottom and there is a heavy solid cylinder having base area $\frac{A}{3}$ and height of the cylinder is same as that of the tak. The water is flowing out of the orifice. Here cylinder is put into the tank to increase the speed of water flowing out.

After long time, when the height of water inside the tank again becomes equal to $\frac{H}{2}$, the solid cylinder is taken out. then the velocity of liquid flowing out of the orifice (just after removing the cylinder) will be

A. $\sqrt{\frac{gH}{3}}$

B. $\sqrt{\frac{3gH}{2}}$

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

D. $\sqrt{2g\left(\frac{H}{2}\right)}$

Answer: C

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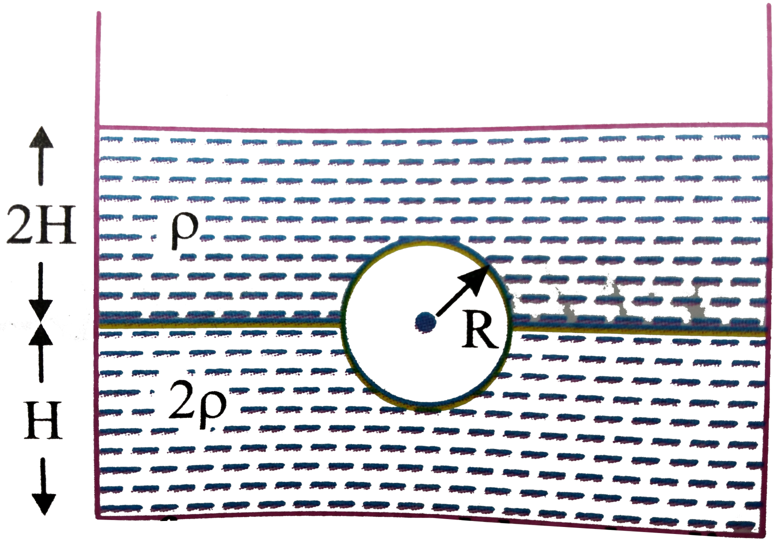
26.



A spherical ball of radius R is floating at the interface of two liquids with densities ρ and 2ρ. The volumes of the ball immersed in two liquids are equal. Answer the following questions:

Find the force exerted by the liquid with density 2ρ on the ball

A. $\pi R^2 \rho g\left(H+\frac{2R}{3}\right)$

B. $\frac{2}{3}\pi R^2 \rho g$

C. $\frac{4}{3}\pi R^2 \rho g$

D. $2\pi R^2 \rho g\left(H+\frac{2R}{3}\right)$

Answer: D

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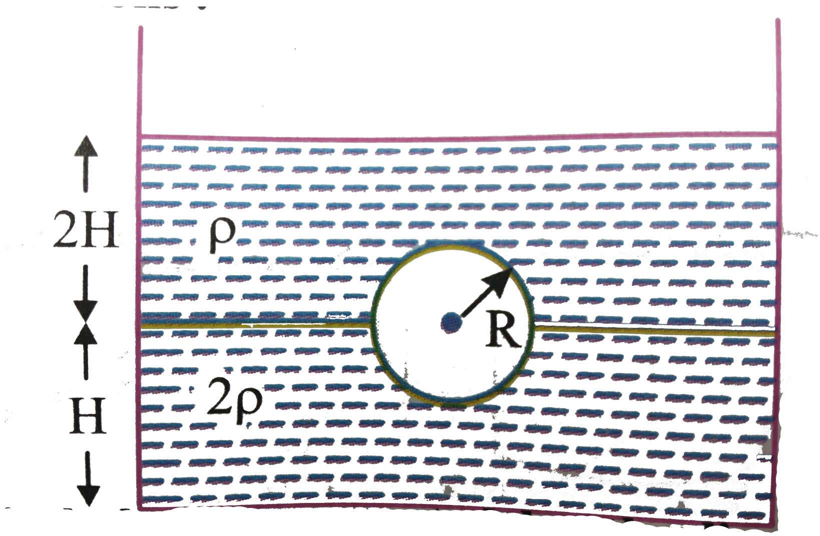

27.

A spherical ball of radius R is floating at the interface of two liquids with densities ρ and 2ρ. The volumes of the ball immersed in two liquids are equal. Answer the following questions:

If a hole is drilled at the bottom of the vessel then volume of the ball immersed inliquid with density ρ will

A. remain same

B. decrease

C. increase

D. decrease first then increase

Answer: A

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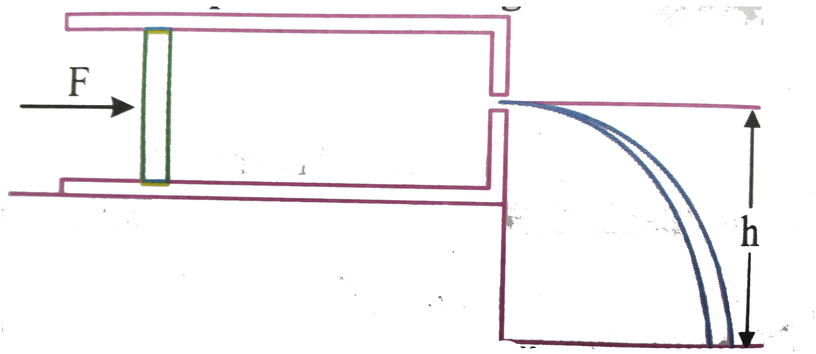
28.



An ideal liquid of density ρ is filled in a horizontally fixed syringe fitted with a piston. There is no friction between the piston and the inner surface of the syringe. Cross-sectional area of the syringe is A. At one end of the syringe, an orifice is made. When the piston is pushed into the syringe, the liquid comes out of the orifice and then following a parabolic path falls on the ground.

With what velocity does the liquid come out of the orifice?

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

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

C. $\sqrt{\frac{F + 2\rho g h A}{\rho A}}$

D. $\sqrt{\frac{F + \rho g h A}{\rho A}}$

Answer: B

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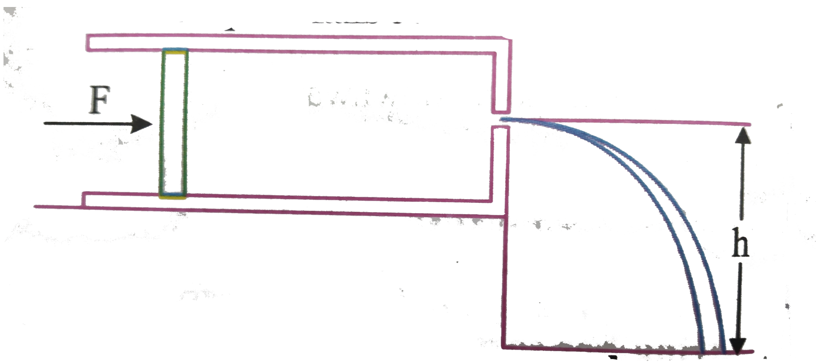

29.

An ideal liquid of density ρ is filled in a horizontally fixed syringe fitted with a piston. There is no friction between the piston and the inner surface of the syringe. Cross-sectional area of the syringe is A. At one end of the syringe, an orifice is made. When the piston is pushed into the syringe, the liquid comes out of the orifice and then following a parabolic path falls on the ground.

With what velocity the liquid strikes the ground?

A. $\sqrt{\frac{F+\rho g h A}{\rho A}}$

B. $\sqrt{\frac{F+2\rho g h A}{\rho A}}$

C. $\sqrt{\frac{2F+\rho g h A}{\rho A}}$

D. $\sqrt{\frac{2(F+\rho g h A)}{\rho A}}$

Answer: D

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30. Molecular forces exist between the molecules of a liquid in a container. The molecules on the surface have unequal force leading to a tension on the surface. If this is not compensated by a force, the equilibrium of the liquid will be a difficult task. This leads to an excess pressure on the surface. The nature of the meniscus can inform us of the direction of the excess pressure. The angle of contact of the liquid decided by the forces between the molecules, air and container can make the angle of contact.

The direction of the excess pressure in the meniscus of a liquid of angle of contact $2\pi/3$ is

A. upward

B. downward

C. horizontal

D. cannot be determined

Answer: A

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31. Molecular forces exist between the molecules of a liquid in a container. The molecules on the surface have unequal force leading to a tension on the surface. If this is not compensated by a force, the equilibrium of the liquid will be a difficult task. This leads to an excess pressure on the surface. The nature of the meniscus can inform us of the direction of the excess pressure. The angle of contact of the liquid decided by the forces between the molecules, air and container can make the angle of contact.

If the excess pressure in a soap bubble is p, the excess pressure in an air bubble is

A. $\frac{p}{2}$

B. p

C. $2p$

D. $4p$

Answer: A

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32. Molecular forces exist between the molecules of a liquid in a container. The molecules on the surface have unequal force leading to a tension on the surface. If this is not compensated by a force, the equilibrium of the liquid will be a difficult task. This leads to an excess pressure on the surface. The nature of the meniscus can inform us of the direction of the excess pressure. The angle of contact of the liquid decided by the forces between the molecules, air and container can make the angle of contact.

In a meniscus of radius r, with excess pressure p in atmospheric pressure p_0, the force experienced is

A. $(p - p_0)\pi r^3$

B. $(p - p_0)2\pi r$

C. $p\pi r^2$

D. $p_0 2\pi r$

Answer: C

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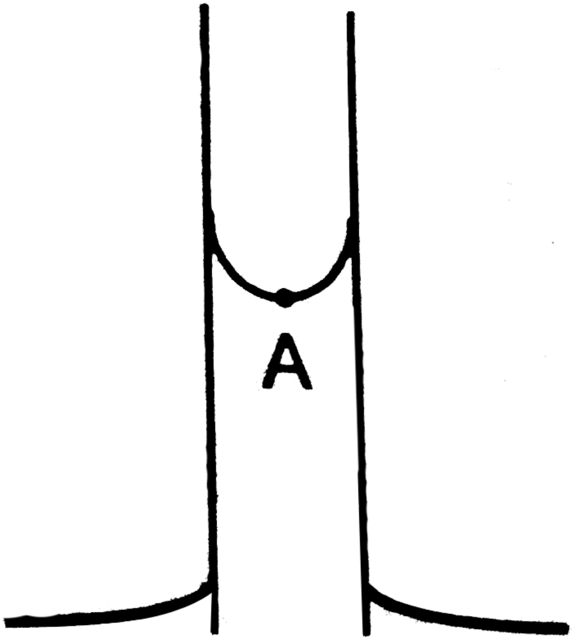
33. Figure shows a capillary tube of radius r dipped into water. If the atmosphere pressure is P_0, the pressure at point A is



A. P_0

B. $P_0 + \frac{2s}{r}$

C. $P_0 - \frac{2s}{r}$

D. $P_0 - \frac{4s}{r}$

Answer: C

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34. Figure shows a capillary tube of radius r dipped into water. The atmospheric pressure is P_0 and the capillary rise of water is h. s is the surface tension for water-glass.

Initially, $h = 10cm$. If the capillary tube is now incline at 45°, the length of water rising in the tube will be

A. 10 cm

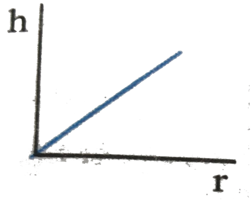
B. $10\sqrt{2}cm$

C. $\frac{10}{\sqrt{2}}$

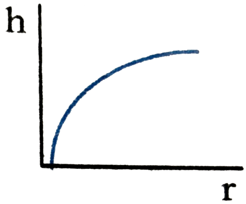
D. $P_0 - \frac{4s}{r}$

Answer: B

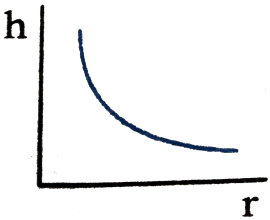
35. Which of the following graphs may represent the relation between capillary rise h and the radius r of the capillary



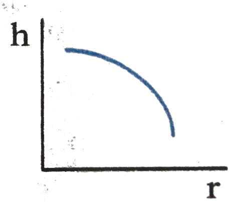
A.



B.



C.



D.

Answer: C

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36. Surface tension arises from the cohesive force between the surface molecules. Interplay between cohesion and adhesion force make the surface inclined at acute or obtuse angle with the contacting solid surfaces. This causes a capillary rise (or fail) given as $h = \frac{2T\cos\theta}{\rho gr}$, where $\theta =$ angle of contact $T =$ surface tension $\rho =$ density of the liquid, $g =$ acceleration due to gravity and $r =$ radius of the capillary tube.

Q. In capillary action θ can be:

A. 0°

B. 90°

C. $90^{\circ} < \theta < 180^{\circ}$

D. all of these

Answer: D

Watch Video Solution

37. Surface tension arises from the cohesive force between the surface molecules. Interplay between cohesion and adhesion force make the surface inclined at acute or obtuse angle with the contacting solid surfaces. This causes a capillary rise (or fail) given as $h = \frac{2T\cos\theta}{\rho gr}$, where $\theta =$ angle of contact $T =$ surface tension $\rho =$ density of the liquid, $g =$ acceleration due to gravity and $r =$ radius of the capillary tube.

In capillary rise:

A. heat is evolved

B. U_{gr} decrease

C. U_{total} increase

D. heat is absorbed

Answer: A

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38. Surface tension arises from the cohesive force between the surface molecules. Interplay between cohesion and adhesion force make the surface inclined at acute or obtuse angle with the contacting solid surfaces. This causes a capillary rise (or fail) given as $h = \frac{2T\cos\theta}{\rho g r}$, where $\theta =$ angle of contact $T =$ surface tension $\rho =$ density of the liquid, $g =$ acceleration due to gravity and $r =$ radius of the capillary tube.

Q. If the vessel accelerates up, capillary rise,

A. increases

B. decreases

C. remains the same

D. becomes zero

Answer: B

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39. When liquid medicine of density ρ is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the dropper. We wish to estimate the size of te drop. We first assume that the drop formed at the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surfacetension T when the radius of the drop is R. When this force becomes smaller than the weight of the drop, the drop gets detached from the dropper.

If the radius of the opening of the dropper is r, the vertical force due to the surface tension on the top of radius R (assuming $r < < R$) is

A. $2\pi rT$

B. $2\pi rRT$

C. $\frac{2\pi r^2 T}{R}$

D. $\frac{2\pi R^2 T}{r}$

Answer: C

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40. When liquid medicine of density ρ is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the dropper. We wish to estimate the size of te drop. We first assume that the drop formed at the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surfacetension T when the radius of the drop is R. When this force becomes smaller than the weight of the drop, the drop gets detached from the dropper.

If $r = 5 \times 10^{-4}$m $\tilde{n} = 10^{3} kgm^{-3}$, $g = 10 ms^{-2}$, $T = 0.11 Nm^{-1}$ the radius of the drop when it detaches from the dropper is approximately

A. $1.4 \times 10^{-3} m$

B. $3.3 \times 10^{-3} m$

C. $2.0 \times 10^{-3} m$

D. $4.1 \times 10^{-3} m$

Answer: A

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Statement Type Questions

1. Statement-1: A light celluloid ball placed in a stream of gas or water issuing at a high velocity from a tube with a narrow neck, the ball floats freely however in this stream (fig)

Statement-2: The gas is the stream has a high velocity, the pressure inside the stream is above atmospheric.

A. Statement-I is true, statement-2 true and statements-2 is a correct explanation for statements-1

B. Statement 1 is true, statement 2 is true, statement-2 is not a correct explanation for statement 1

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: C

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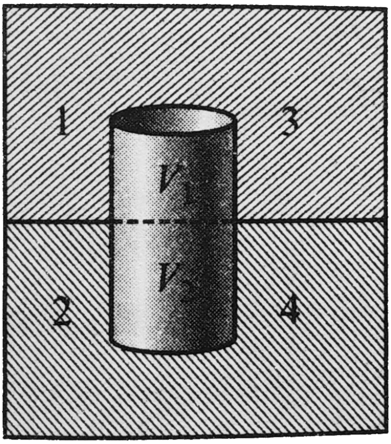
2. Statement I: When a body floats such that its parts are immersed into two immiscible liquids, then force exerted by liquid 1 is of magnitude $\rho_1 v_1 g$.

Statement II: Total buoyant force $= \rho_1 v_1 g + \rho_2 v_2 g$.



A. Statement-I is true, statement-2 true and statements-2 is a correct explanation for statements-2

B. Statement 1 is true, statement 2 is true, statement-2 is not a correct explanation for statement 2

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: D

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3. statement 1 is false, statement 2 is true.

Statement-1: When a soda water bottle fals freely from a height h, the gas bubble rises in water from the bottom.

Statement-2:Air lighter than liquid.

A. Statement-I is true, statement-2 true and statements-2 is a correct explanation for statements-1

B. Statement 1 is true, statement 2 is true, statement-2 is not a correct explanation for statement 1

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: D

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4. statement 1 is false, statement 2 is true.

Statement-1: A soft plastic bag weights the same when empty or when filled with air and measured in vacuum.

Statement-2: The same results will be observed when measured in air.

A. Statement-I is true, statement-2 true and statements-2 is a correct explanation for statements 1

B. Statement 1 is true, statement 2 is true, statement-2 is not a correct explanation for statement 1

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: D

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5. Statement 1 is false, statement 2 is true.

Statement-1: The speed of liquid coming out of the orifice is independent of the nature and quality of liquid in the container.

A. Statement-I is true, statement-2 true and statements-2 is a correct explanation for statements-5

B. Statement 1 is true, statement 2 is true, statement-2 is not a correct explanation for statement 5

C. Statement 1 is true, statement 2 is false

D. Statement 1 is false, statement 2 is true

Answer: C

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6. Statement 1 : If P is the pressure of gas inside the exhaust chamber of a rocket and P_0 is the pressure of the gas outside the chamber. The forward thrust on the rocket is $2a\left(P - P_0\right)$ insteady of a $\left(P - P_0\right)$ where a is the area of orifice.

Statement -2: The formula thrust $= a\left(P - P_0\right)$ holds good for fluids at rest. In the case of rocket the flurids are in motion and we have to use Bernoulli's principle for calculating the thrust.

A. Statement I is true, statement II is true and statement II is correct explanation for statement I

B. Statement I is true, statement II is true and statement II is not the correct explanation for statement I

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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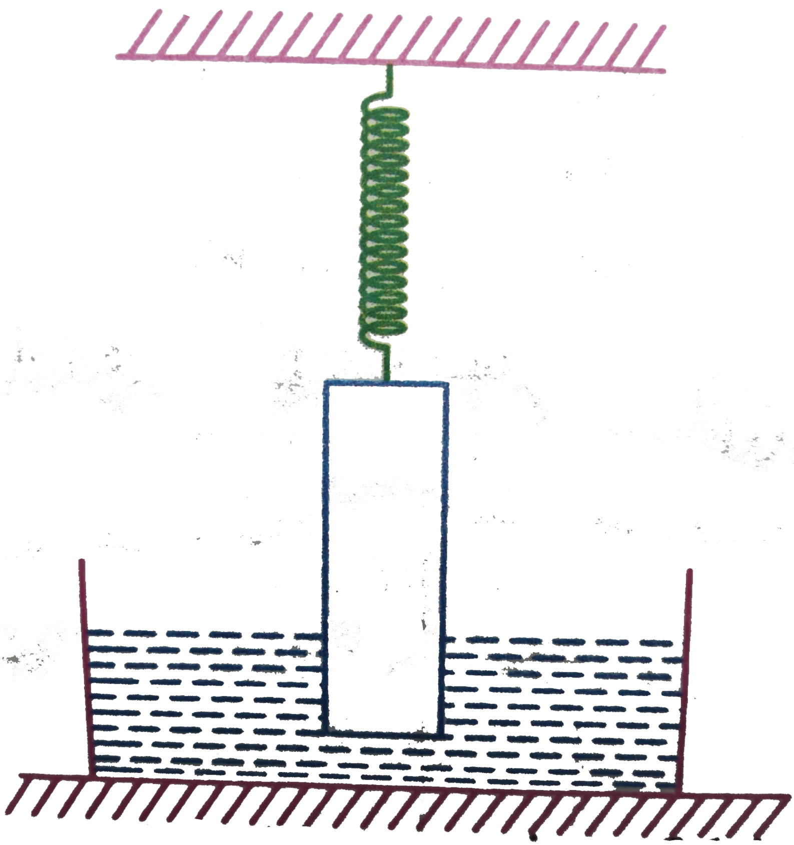
7. Statement -1: A smooth block of mass $2kg$ and specific gravity 2.5 is attached with a spring of force constant $k = 100N/m$ and is half dipped in water. If the extension in the spring is 1cm, the force exteted by the bottom of tank on the block is $19N$.

Statement-2 : In the arrangement shown, the buoyant force acting on the block is equal to weight of liquid displaced.



A. Statement I is true, statement II is true and statement II is correct explanation for statement I

B. Statement I is true, statement II is true and statement II is not the correct explanation for statement I

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: B

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8. Statement-1 A boy carrying a fish in one hand a bucket full of water in the other hand, places the fish in the bucket. He now carries comparatively lesser weight as the weight of the fish will be reduced due to upthrust.

Statement -2: The boy will carry still the same weight.

A. Statement I is true, statement II is true and statement II is correct explanation for statement I

B. Statement I is true, statement II is true and statement II is not the correct explanation for statement I

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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9. Statement-1 : For rotational equilibrium of floating bodies, meta centre must always be lower than centre of gravity of the body

Statement-2 : When a floating body is slightly tilted from equilibrium , centre of buoyance shifts. The vertical line passing through new centre of buoyance and initial vertical line meet at a point, which is called meta centre.

A. Statement I is true, statement II is true and statement II is correct explanation for statement I

B. Statement I is true, statement II is true and statement II is not the correct explanation for statement I

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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10. Statement I: Smaller drops of liquid resist deforming forces better than the larger drops.

Statement II: Excess pressure inside a drop is directly proportional to its surface area.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 1

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: B

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11. Statement I: A needle placed carefully on the surface of water may float, whereas the ball of the same material will always sink.

Statement II: The buoyancy of an object depends both on the material and shape of the object.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 2

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: C

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12. Statement I: Droplets of liquid are usually more spherical in shape than large drops of the same liquid.

Statement II: Force of surface tension predominates force of gravity in case of small drops.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 3

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: A

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13. Statement I: Spraying of water causes cooling.

Statement II: For an isolated system, surface energy increase on the expense of internal energy.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 4

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: A

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14. Statement I: Finer the capillary, greater is the height to which the liquid rises in the tube

Statement II: This is in accordance with the ascent formula.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 5

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: A

Watch Video Solution

15. Statement I: A needle placed carefully on the surface of water may float, whereas the ball of the same material will always sink.

Statement II: The buoyancy of an object depends both on the material and shape of the object.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 6

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: C

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16. Statement I: As radius of soap bubble increases, the insude pressure increases.

Statement II: Excess pressure in soap bubble is inversely propotional to radius.

A. Both statement 1 and statemet 2 are true and statement 2 is the correct explanation of statement 1.

B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanantion of statement 7

C. Statement 1 is true but statement 2 is false.

D. Statement 1 is false but statement 2 is false.

Answer: D

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Integer Type Questions

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

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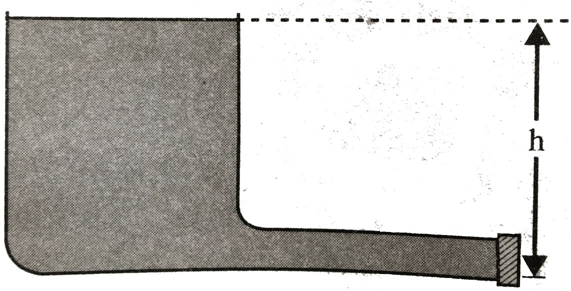
2. The opening near the bottom of the vessel shown in the figure has an area A. A disc is held against the opening keep the liquid from running out. Let F_1 be the net forces on the disc applied by liquid and air in this case. Now the disc is moved away from the opening a short distance. The liquid comes out and strikes the disc in elastically. Let F_2 be the force exerted by the liquid in this condition. The F_1/F_2 is



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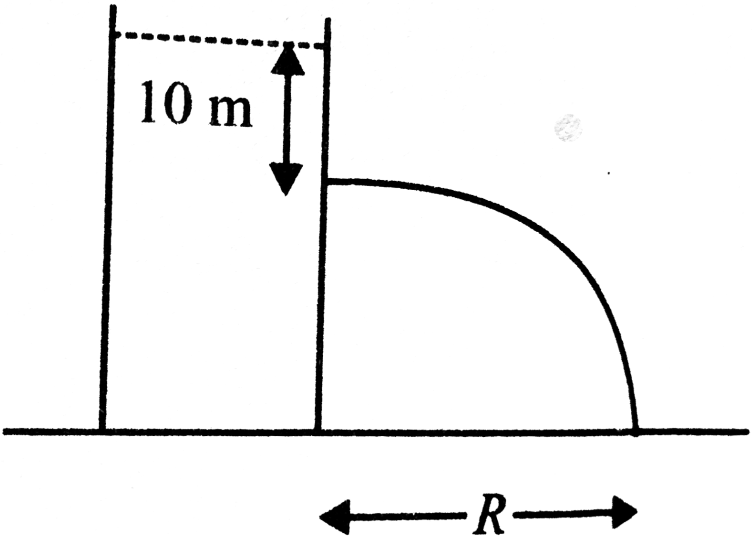
3. The range of water flowing out of a small hole made at a depth $10m$ below water surface in a large tank is R. Find the extra pressure (in atm) applied on the water surface so that range becomes $2R$. Take

$1 atm = 10^5 Pa.$



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4. A vessel with a symmetrical hole in its bottom is fastened on a cart. The mass of the vessel and the cart is $1.5 kg$. With what force F (in $\times 10^2 N$) should the cart be pulled that the maximum amount of water remains in the vessel. The dimensions of the vessel are as shown in the figure. Given that $b = 50 cm$, $c = 10 cm$, area of base $A = 40 cm^2$, $L = 20 cm$, $g = 10 m/s^2$.

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5. A liquid of density $\rho = \rho_0[1 + \alpha y]$ is stored in a container where y is the distance from the liquid surface and $\alpha = \frac{2}{3}m^{-1}$. A small hole is made at the bottom of the container find nearest integer of velocity of efflux (in m/s) when the liquid height is 1 m. Assume flow is laminar $\left(g = 10m/s^2\right)$

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6. A rod of length $6m$ has specific gravity $\rho(= 25/36)$. One end of the rod is tied to a $5m$ long rope, which in turn is tied to the floor of a pool $10m$ deep, as shown. Find the length (in m) of the part of rod which is out of water.

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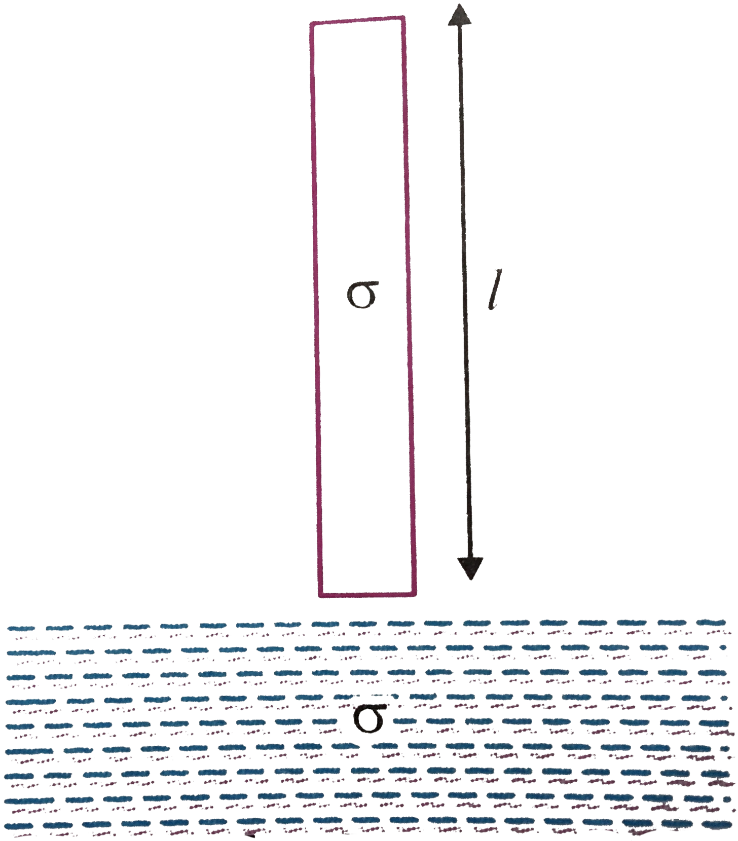
7.



A uniform vertical cylinder is released from rest with its lower end just touching the liquid surface of a deep lake. Calculate the maximum displacement of the cylinder in meters. Take $l = 4m$ and $\frac{\sigma}{\rho} = \frac{1}{2}$

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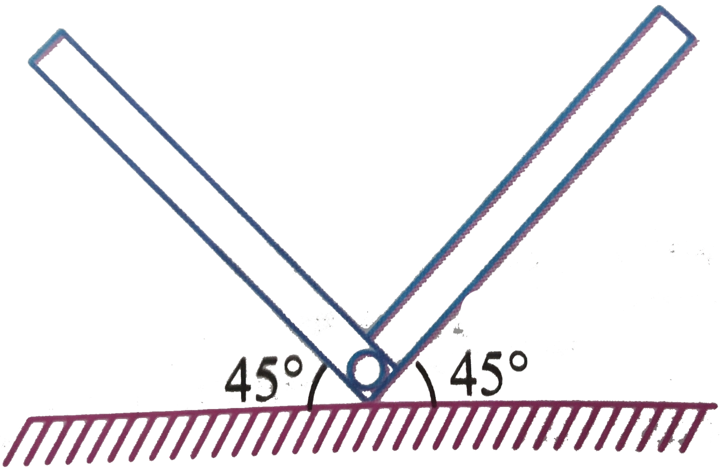

8.

A thin V-shaped glass tube is fixed in the vertical plane as shown. Innitially the left part of the tube contains a column of water of length $d = \sqrt{2}$m. A valve at the bottom of the tube prevents the water from moving to right part. At some time, the valve is quickly opened neglecting friction find the time (in seconds) it takes for the water to move completely into the right part of the tube. (Take $g = \pi^2 m/s^2$)

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9. A cylindrical vessel of height 500mm has an orifice (small hole) at its bottom. The orifice is initially closed and water is filled in it up to height

H. Now the top is completely sealed with a cap and the orifice at the bottom is opened. Some water comes out from the orifice and the water level in the vessel becomes steady with height of water column being 200mm. Find the fall in height(in mm) of water level due to opening of the orifice.

[Take atmospheric pressure $= 1.0 \times 10^5 N/m^2$, density of water=1000kg//m^3 and g=10m//s^2`. Neglect any effect of surface tension.]

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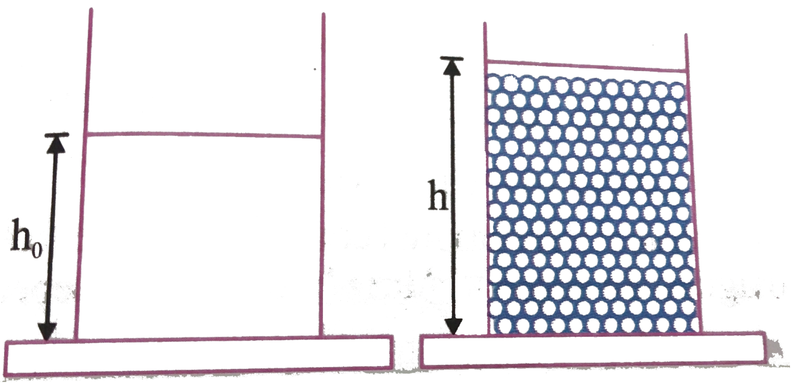
10. 

In a cylindrical container water is filled up to a height of $h_0 = 1.0m$. Now a large number of small iron balls are gently dropped one by one into the container till the upper layer of the balls touches the water surface. if average density of the contents is $\rho = 4070 kg/m^3$, density of iron is $\rho_i = 7140 kg/m^3$ and density of iron is $\rho_0 = 1000 kg/m^3$ find the height h of the water level (in S.I. units) in the container with the iron balls.

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11. When a sphere of radius $r_1 = 1.2$ mm moves in glycerine, the laminar flow is observed if the velocity of the sphere does not exceed $v_1 = 23\frac{cm}{s}$. At what minimum velocity v_2 of a sphere of radius $r_2 = 5.5 cm$ will the flow in water become turbulent? The viscosities of glycerine and water are equal to $\eta_1 = 13.9$ and $\eta_2 = 0.011 P$ respectively. (in $\frac{\mu m}{s}$)

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12. A lead sphere is steadily is steadily sinking in glycerine whose viscosity is equal to $\eta = 13.9$ P.What is the maximum diameter of the sphere at which the flow around that sphere still remains laminar? It is known that the transition to the turbulent flow correspond to reynolds number

$R_e = 0.5$. (here the charactrstic length is taken to be the sphere diameter). (in mm)

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13. The time of survival of a soap bubble of radius of R connected with atmosphere through a capillary of length 1 and radius r. The surface tension is T and the coefficient of viscosity of air is η. In terms of $\frac{\eta l R^4}{T r^4}$ is

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14. An air bubble of radius 1 mm is allowed to rise through a long cylindrical column of a viscous liquid of radius 5 cm and travels at a steady rate of 2.1 cm per sec. if the density of the liquid is $1.47\frac{g}{cc}$. Its viscosity is nearly $\frac{n}{2}$ poise. Then find the value of n. Assume $g = 980\frac{cm}{\sec^2}$ and neglect the density of air.

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15. A spherical ball of radius 3.0×10^{-4} m and density $10^4 \frac{kg}{m^3}$ falls freely under gravity through a distance $H = n \times 500m$ before entering a tank of water. If after enerting the water the velocity of the ball does not change, then find n. viscosity of water is $10 \times 10^{-6} \frac{N\text{-}s}{m^2}, g = 10 \frac{m}{s}$

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16. Estimate the speed of verticaly falingn raindriops from the following data. Radius of the drops=0.02cm, viscosity of ir $= 1.8 \times 10^{-4} poise, g = 9.9 \times 10 ms^2$ and density of water =1000 kg m^-3`.

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17. A small spherical ball falling under gravity in a viscous medium heat the medium due to viscous drage force. The rate of heating is proportional to r^n. $(r =$ radius of the sphere find $)n$.

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18. A conical glass capillary tube of length 0.1 m has diameter 10^{-3} and 5×10^{-4}m respectively at its ends. When it is just immersed in a liquid at $0\,^{\circ}C$ with larger diameter in contact with liquid the liquid rises to 8×10^{-2} m in the tube. if another cylindrical glass capillary tube B is immersed in the same liquid at $0\,^{\circ}C$ the liquid rises to 6×10^{-2} m height. The rise of liquid the tube B is only 5.5×10^{-2}m when the liquid is at $50\,^{\circ}C$. density of the liquid is $\left(\frac{1}{14}\right) \times 10^{4}\frac{kg}{m^{3}}$ and angle of contact is zero. Effect of temperature on the density of the liquid and glass is negligible. The rate at which the surface tension changes with temperatrure considering the change to be linear is given

by $-1.4 \times 10^{-n}\frac{N}{m\,^{\circ}C}$. what is the value of n?

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19. There is a soap bubble of radius $2.4 \times 10^{-4}m$ in air cylinder which is originally at a pressure of $10^{5}\frac{N}{m^{2}}$. The air in the cylinder is now compressed isothermally untill the radius of the bubble is halved. (the surface tension of the soap film is $0.08Nm^{-1}$). The pressure of air in the cylinder is found to be $8.08 \times 10^{n}\frac{N}{m^{2}}$. What is the value of n?

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20. Two vertical parallel glass plates are partically submerged in water. The distance between the plates is $d = 0.10mm$, and their width is $l = 12cm$ assuming that the water between the plates does not reach the upper edges of the plates and the wetting is complete, it is found that the force of their mutual attraction, is $(n + 20)N$. What is the value of n?

$$\left(T = 0.073\frac{N}{m}\right)$$

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21. A vertical water jet flows out of a round hole. One of the horizontal sections of the jet has a diameter $d = 2.0mm$ while the other section located $l = 20cm$ lower has the diameter which is $n = 1.5$ times less. The volume of the water flowing from the hole each second is found to be

$9 \times 10^{-n} \frac{cm^3}{s}$. What is the value of n? (surface tension $T = 0.073 \frac{N}{m}$ and density of water $= 10^3 \frac{kg}{m^3}$.

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22. A glass rod of diameter $d_1 = 1.5mm$ in inserted symmetrically into a glass capillary with inside diameter $d_2 = 2.0$ mm. Then the whole arrangement is vertically oriented and brought in contact with the surface of water. To what height will the liquid rise in the capillary?

Surface tension of water $= 73 \times 10^{-3} N/m$

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23. Find the attractive force is newton between two parallel glass plates, separated by a distance $h = 0.1mm$ after a water drop of mass $m = 70mg$ was introduced between them. Assume wetting to be complete and surface tensin of water, $T = 70$ dyne/cm

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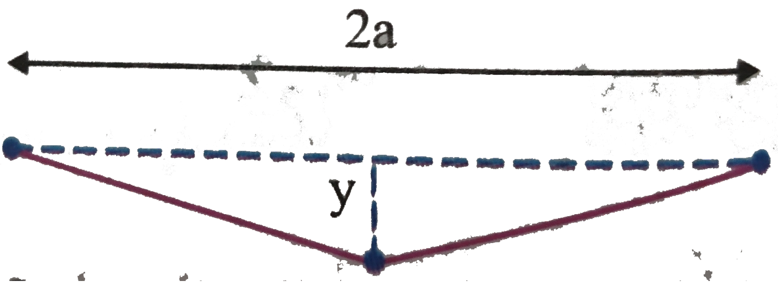
24. 

A thin film of a liquid is maintained between two very long, thin, parallel, horizontal wires separated by a distance 2a. A long wire of mass per unit length λ is gently placed over the liquid film at the middle parallel to the wires. As a result the liquid surface is depressed by a vertical distance $y(y < < a)$ at equilibrium. The surface tension of the liquid is $\frac{\lambda g a}{k y}$ then k is

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25. A soap bubble (surface tension T) is charged to a uniform charged density σ. At equilibrium the radius of the bubble is given by $\frac{N\varepsilon_0 T}{\sigma^2}$. The value of N is [Assume that atmosphere is not present]

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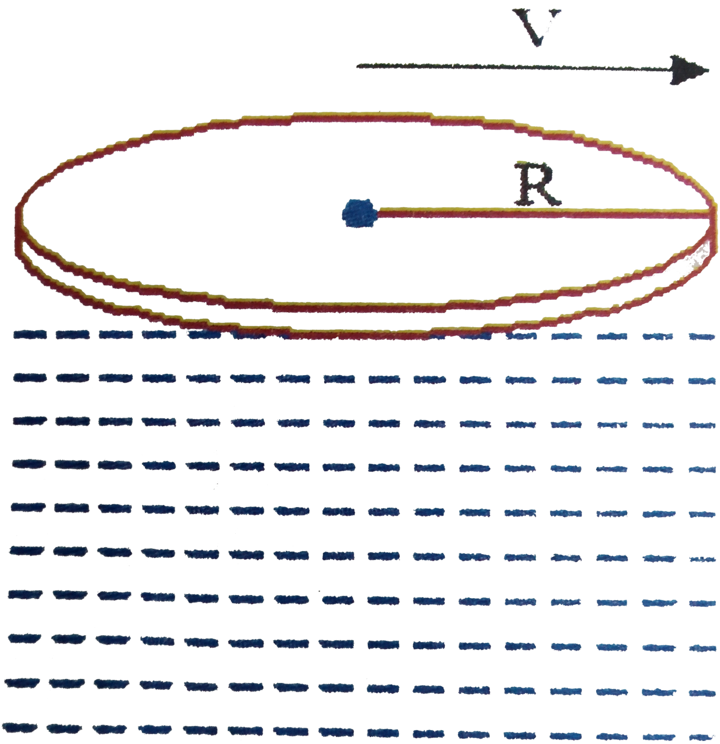
Paragraph Type Questions



1.

Consider a disk of mass m, radius R lying on a liquid layer of thickness T and coefficient of viscosity η as shown in the fig.

The coefficient of viscosity varies as $\eta = \eta_0 x$ (x measured from centre of the disk) at the given instant the disk is floating towards right with a velocity v as shown, find the force required to move the disk slowly at the given instant.

A. $\frac{2\eta_0 R^2 v}{T}$

B. $\frac{8\eta_0 R^2 v}{T}$

C. $\frac{\pi\eta_0 R^2 v}{T}$

D. $\frac{16\eta_0 R^3 v}{T}$

Answer: C

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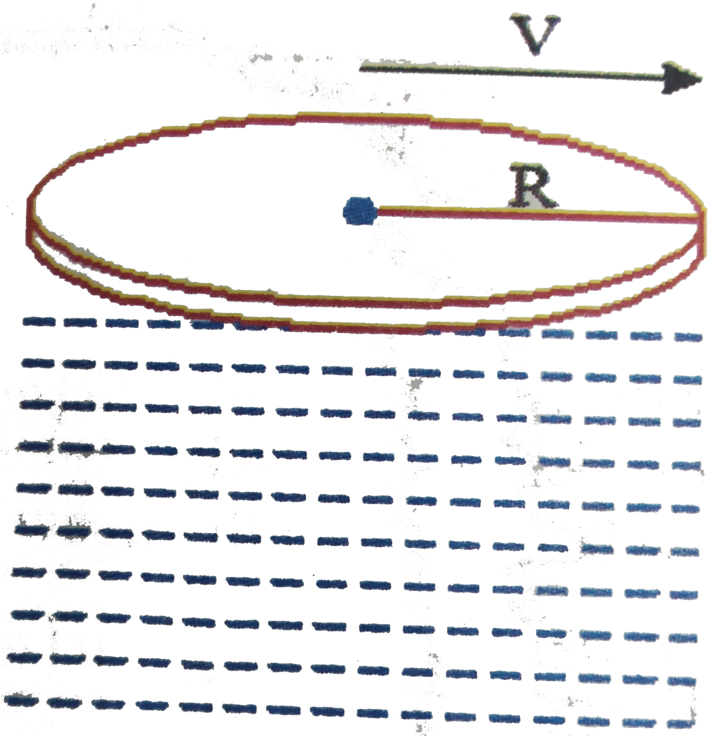
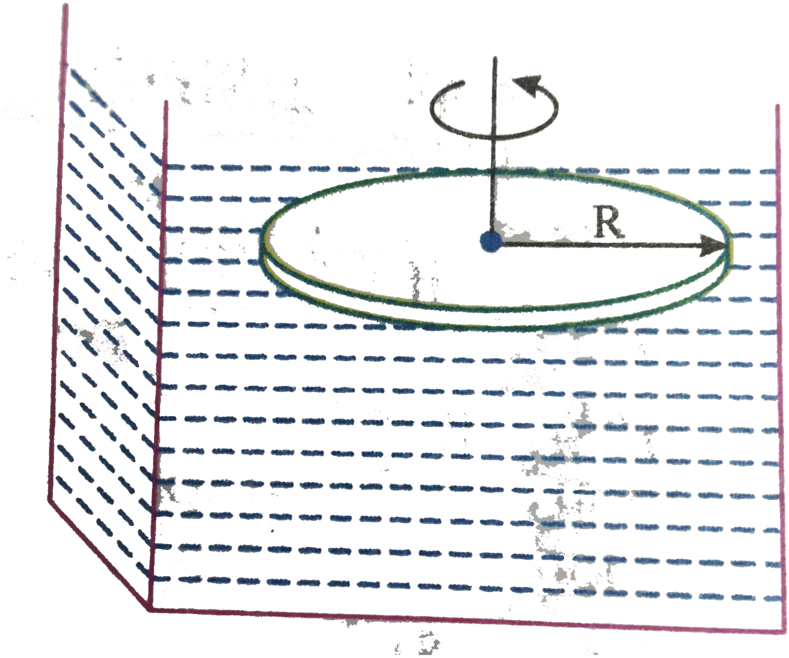


2.

Consider a disk of mass m, radius R lying on a liquid layer of thickness T and coefficient of viscosity η as shown in the fig.



The torque required to rotate the disk at a constant angular velocity Ω given the viscosity is uniformly η.

A. $\frac{4\pi\omega\eta R^4}{T}$

B. $\frac{\pi\omega\eta R^4}{2T}$

C. $\frac{2\pi\omega\eta R^4}{T}$

D. $16\pi\omega\eta R^4$

Answer: B

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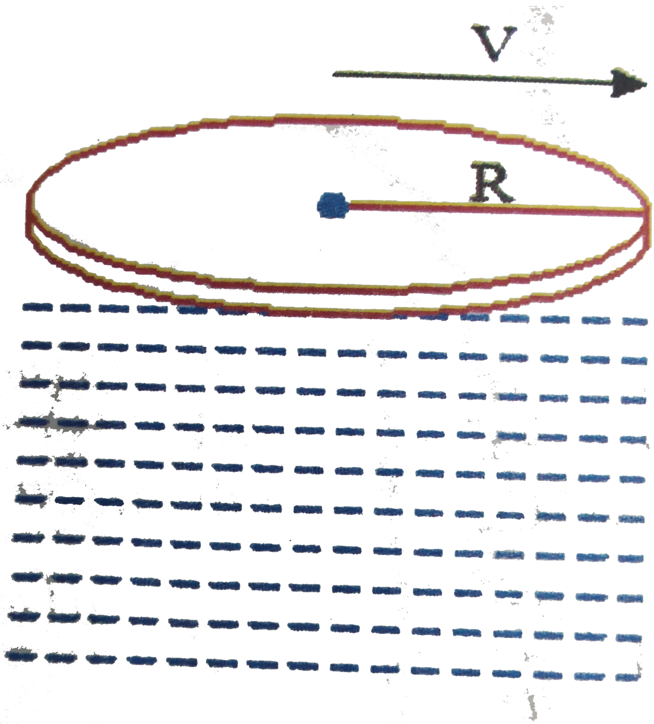
3.



Consider a disk of mass m, radius R lying on a liquid layer of thickness T and coefficient of viscosity η as shown in the fig.

A disc rotating with angularvelocity ω is placed on a viscous liquid of thickness T. Find the angle rotated by the disc before it comes to rest. (viscosity $= \eta$, mass of disc $= M$, radius of disc $= R$)

A. $\frac{4\omega_0 TM}{\eta\pi R^2}$

B. $\frac{2\omega_0 TM}{\eta\pi R^2}$

C. $\frac{\omega_0 TM}{\eta\pi R^2}$

D. $\frac{\omega_0 TM}{2\eta\pi R^2}$

Answer: C

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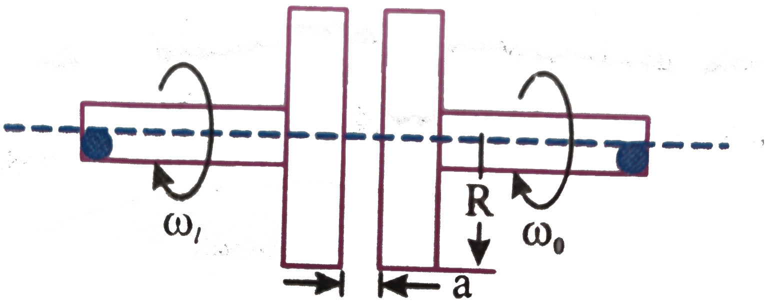
4. 

A viscous clutch as shown in figure tranmits torque. Radius of each clutch plate is R and separation between the plates is a and is completely filled with liquid of coefficient of viscous μ. If ω_i and ω_0 are angular velocities of plates connected to input and output respectively.

The torque transmitted is

A. $\frac{\pi\mu\left(\omega_i^2 - \omega_0^2\right)R^4}{\omega_i a}$

B. $\frac{\pi\mu\left(\omega_i^2 - \omega_0^2\right)R^4}{\omega_0 a}$

C. $\frac{\pi\mu\left(\omega_i^2 - \omega_0^2\right)R^4}{2\omega_0 a}$

D. $\frac{\pi\mu\left(\omega_i - \omega_0\right)R^4}{2a}$

Answer: D

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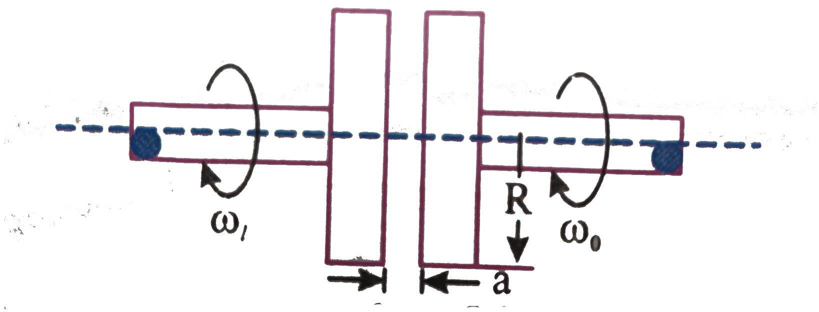
5. 

A viscous clutch as shown in figure tranmits torque. Radius of each clutch plate is R and separation between the plates is a and is completely filled with liquid of coefficient of viscous μ. If ω_i and ω_0 are angular velocities of plates connected to input and output respectively.

If efficiency of transmission is ratio of output power to input power, then efficiency is given by

A. $1 - \frac{\omega_0}{\omega_i}$

B. $\frac{\omega_0}{\omega_i}$

C. $\frac{\omega_0^2}{\omega_i^2}$

D. $\frac{\omega_0^2}{\omega_i^2}$

Answer: B

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Level 1 (H.W)

1. If the atmospheric pressure is 76 cm of Hg at what depth of water the pressure will becomes 2 atmospheres nearly.

A. 862 cm

B. 932 cm

C. 982 cm

D. 1033 cm

Answer: 4

Watch Video Solution

2. The pressure at the bottom of a lake due to water is $4.9 \times 10^6 N/m^2$.

What is the depth of the lake?

A. 500 m

B. 400 m

C. 300 m

D. 200 m

Answer: 1

Watch Video Solution

3. Two blocks A and B float in water. If block A floats with $\frac{1}{4}$ th of its volume immersed and block B floats with $\frac{3}{5}$ th of its volume immersed, the ratio of their densities is

A. $5:12$

B. $12:5$

C. $3:20$

D. $20:3$

Answer: 1

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4. A water filled cylinder of height 50 cm and base area $20cm^2$ is placed on a table with the base on the table. The thrust offered by water on the table is

A. 98 N

B. 49 N

C. 9.8 N

D. 4.9 N

Answer: 3

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5. If S_1 is the specific gravity of a solid with respect to a liqid and S_2 is the specific gravity of the liquid with respect to water, then the specific gravity of the solid with respect to water is

A. $S_1 + S_2$

B. $S_1 \times S_2$

C. $S_1 - S_2$

D. $\frac{S_1}{S_2}$

Answer: 2

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6. If a block of iron (density $5gcm^{-3}$) is size 5 cm x 5 cm x 5 cm was weight while completely submerged in water, what would be the apparent weight ?

A. $5 \times 5 \times 5 \times 5$ gm wt

B. $4 \times 4 \times 4 \times 4$ gm wt

C. $3 \times 5 \times 5 \times 5$ gm wt

D. $4 \times 5 \times 5 \times 5$ gm wt

Answer: 4

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7. A beaker is partly filled with water, the beaker and the contents have a mass of 50 gm. A piece of wood having a volume of 5 cc. is floated in the beaker. The density of wood is $0.8\frac{g}{c.c}$ the mass of the beaker and its contents:

A. 50 g

B. 54 g

C. 46 g

D. 56.25 g

Answer: 2

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8. A woman of mass 50 kg stands on a wooden block placed over a tank of water. The wooden block is such that the woman is entirely above water. If relative density of wood is 0.85, the volume of the wooden block is:

A. $0.5 \times 10^{-1} m^3$

B. $0.585 \times 10^{-1} m^3$

C. $0.33 m^3$

D. $0.54 \times 10^{-1} m^3$

Answer: 3

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9. 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.

A. $5, \frac{2}{3}$

B. $\frac{2}{3}, 5$

C. $\frac{4}{5}, 5$

D. $5, \frac{4}{5}$

Answer: 1

Watch Video Solution

10. What mass of lead will weigh as much as 8 gm of iron when both are immersed in water ? (given specific gravities of iron and lead are 8 and 11 respectively).

A. 1.1 gm

B. 2.2 gm

C. 5.5 gm

D. 7.7 gm

Answer: 4

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11. The base area of boat is $2m^2$. A man weighing 76 kg weight steps into the boat. Calculate the depth into which the boat sinks further

A. 1.2 cm

B. 2.5 cm

C. 5.5 cm

D. 7.7 cm

Answer: 3

Watch Video Solution

12. A sphere of density d is let fall in a liquid of density $\frac{d}{4}$. The acceleration of the body will be

A. $\frac{g}{4}$

B. $\frac{3g}{4}$

C. $\frac{g}{2}$

D. g

Answer: 2

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13. An iceberg is floating partly immersed in sea water, the density of sea water is $1.03 gcm^{-3}$ and that of ice is $0.92 gcm^{-3}$. The fraction of the total volume of the iceberg above the level of sea water is

A. 89 %

B. 11 %

C. 1 %

D. 34 %

Answer: 2

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14. Two water pipes of diameters 4 cm and 8 cm are connected with main supply line. The velocity of flow of water in the pipe of 8 cm diameter is hwo many times to that of 4 cm diameter pipe?

A. 4

B. $\frac{1}{4}$

C. 2

D. $\frac{1}{2}$

Answer: 2

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15. A horizontal pipe of non uniform cross section has water flow through it such that the velocity is $2ms^{-1}$ at a point where the pressure 40 kpa. The pressure at a point where the velocity of water flow is $3ms^{-1}$ is (in kilopascal)

A. 27

B. 60

C. 37.5

D. 40

Answer: 3

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16. In a horizontal pipe line of uniform cross-section, pressure falls by 5 Pa between two points separated by 1 km. The change in the kinetic energy per kg of the oil flowing at these points is (density of oil $= 800 kgm^{-3}$)

A. $6.25 \times 10^{-3} Jkg^{-1}$

B. $5.25 \times 10^{-4} Jkg^{-1}$

C. $3.25 \times 10^{-5} Jkg^{-1}$

D. $4.25 \times 10^{-2} Jkg^{-1}$

Answer: 1

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17. In a test experiment on a model aeroplane in a wind tunnel, the flow speeds on the upper and lower surfaces of the wing are $70ms^{-1}$ and $83ms^{-1}$ respectively. What is the lift on the wing, if its area is $2.5m^2$? Take the density of air to be $1.3kgm^{-3}$

A. $1513N$

B. 1513 dines

C. 151.3 N

D. 151.3 dynes

Answer: 1

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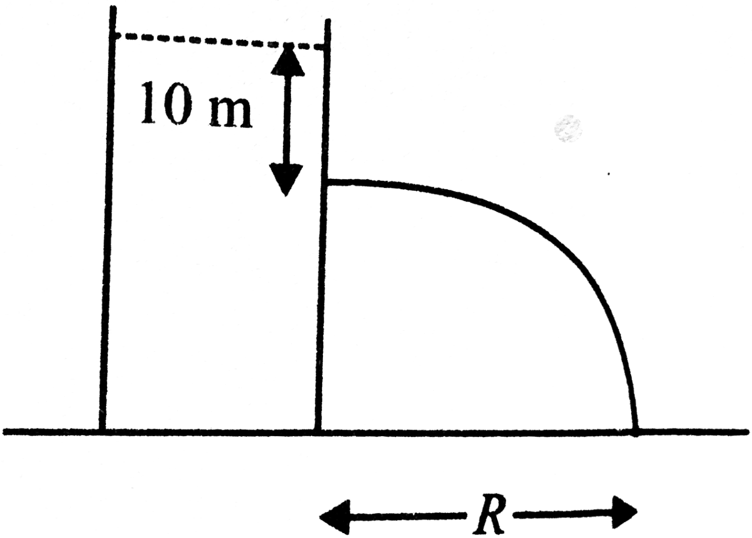
18. The range of water flowing out of a small hole made at a depth $10m$ below water surface in a large tank is R. Find the extra pressure (in atm) applied on the water surface so that range becomes $2R$. Take $1atm = 10^5 Pa$.



A. 9atm

B. 4atm

C. 5atm

D. 3atm

Answer: 4

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19. Tanks A and B open at the top contain who different liquids upto certain height in them. A hole is made on the wall of each tank at a depth h from the surface of the liquid. The area of the hole in A is twice that of in B. If the liquid mass flux through each hole is equal, then the ratio of the densities of the liquids respectively is

A. $\frac{2}{1}$

B. $\frac{3}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{2}$

Answer: 4

Watch Video Solution

20. The level of water in a tank is 5 m high. A hole of area of cross section 1 cm^2 is made at the bottom of the tank. The rate of leakage of water for the hole in $m^3 s^{-1}$ is $\left(g = 10 m s^{-2}\right)$

A. 10^{-3}

B. 10^{-4}

C. 10

D. 10^{-2}

Answer: 1

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21. Water is maintained at a constant level of 4.9 m in a big tank. The tank has a small hole to the wall near the bottom. The bottom of the tank is 2.5 above the ground level. The horizontal distace at which water touches are ground is

A. 19.6 m

B. 7 m

C. 35 m

D. 78.4 m

Answer: 2

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22. A liquid kept in a cylindrical vessel of radius 0.3 m is rotated with a speed 2 r.p.s. The difference in the height of the liquid at the centre of the vessel and at it's sides it

A. 0.01 m

B. 0.02 m

C. 0.04 m

D. 0.8 m

Answer: 4

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23. A metal plate of area $10^{-2}m^2$ is placed on a liquid layer of thickness $2 \times 10^{-3}m$. If the liquid has coefficient of viscosity 2 S.I. units the force required to move the plate with a velocity of $3\frac{cm}{s}$ is

A. 0.3 N

B. 0.03 N

C. 3 N

D. 30 N

Answer: 1

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24. The velocity of water in a river is 18 kmph near the surface. If the river is 4 m deep, the shearing stress between horizontal layers of water in Nm^{-2} is $\left(\eta_{\text{water}} = 1 \times 10^{-3}pa.s\right)$

A. 2.5×10^{-3}

B. 1.25×10^{-3}

C. 0.75×10^{-3}

D. 0

Answer: 2

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25. The radius of the capillary tube increased 0.2% then the percentage increase in the rate of flow of liquid through it is

A. 0.8%

B. 0.4%

C. 0.2%

D. 0.05%

Answer: 1

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26. A tube of length L and radius R is joinced to another tube of length $\frac{L}{3}$ and radius $\frac{R}{2}$. A fluid is flowing through this joint tube. If the pressure difference across the first tube is P then pressure difference across the second tube is

A. $\frac{16P}{3}$

B. $\frac{4P}{3}$

C. P

D. $\frac{3P}{16}$

Answer: 1

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27. Water is flowing through a capillary tube at the rate of $20 \times 10^{-6} m^3/s$. Another tube of same radius and double the length is connected in series to the first tube. Now the rate of flow of water in $m^3 s^{-1}$ is

A. 20×10^{-6}

B. 40×10^{-6}

C. 0

D. 10×10^{-6}

Answer: 4

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28. Water flows through a capillary tube at the rate of 10 cc per minute. If the pressure difference across the same tube is doubled, the rate of flow of water throught he tube wil be (in cc per minute)

A. 20

B. 5

C. 40

D. 2.5

Answer: 1

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29. Two capillary tubes of same length but radii $r_1 r_2$ are arranged horizontally side by side to the bottom of a large vessel containing water. The radius of single tube of same length that can replaced them so that the rate of volume flow through it is equal to the total rate of volume flow through the two tubes is

A. $r_1 + r_2$

B. $\left(r_1 + r_2\right)^{\frac{1}{4}}$

C. $\left(r_1 + r_2\right)^4$

D. $\left(r_1^4 + r_2^4\right)^{\frac{1}{4}}$

Answer: 4

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30. Water flows with a velocity V in a tube of diameter d and the rate of flow is Q. another tube of diameter 2d is coupled to the first one. The velocity of water flowing out and rate of flow in the second tube are respectively.

A. $\frac{V}{4}$ and Q

B. $\frac{V}{2}$ and $\frac{Q}{2}$

C. $2V$ and $2Q$

D. $\frac{V}{2}$ and $2Q$

Answer: 1

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31. The flow rate from a tap of diameter $1.25cm$ is 3 L//min. The coefficient of viscosity of water is 10^{-3} pa-s. Characterize the flow.

A. stream line

B. turbulent a

C. a and b

D. none

Answer: 1

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32. Two spherical raindrops of equal size are falling vertically through air with a velocity of $1m/s$. What would be the terminal speed if these two drops were to coalesce to form a large spherical drop?

A. $0.2\frac{m}{s}$

B. $0.1\frac{m}{s}$

C. $0.4\frac{m}{s}$

D. $0.005\frac{m}{s}$

Answer: 3

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33. The terminal velocity V of a spherical ball of lead of radius R falling through a viscous liquid varies with R such that

A. $\frac{V}{R}=$ Constant

B. $VR=$ constant

C. $V=$ constant

D. $\frac{V}{R^2}=$ constant

Answer: 4

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34. A 10 cm long wire is placed horizontally on the surface of water and is gently pulled up with a force of $2\times10^{-2}N$ to keep the wire in equilibrium. The surface tension of water in $\frac{N}{m}$ is

A. 0.002

B. 0.001

C. 0.1

D. 0.28

Answer: 3

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35. A drop of liquid pressed between two glass plates spreads to a circle of diameter 10 cm. Thickness of the liquid film is 0.5 mm and surface tension is $70 \times 10^{-3} Nm^{-1}$ the force required to pull them apart is

A. 4.4N

B. 1.1N

C. 2.2N

D. 3.6N

Answer: 3

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36. A squre wire frame of side L is dipped in a liquid. On taking out , a membrane is formed if the surface tension of liquid is T, the force acting on the frame due to the membrane will be

A. 2 TL

B. 4 TL

C. 8 TL

D. 16 TL

Answer: 3

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37. The surface tension of soap solution is 0.3 $\frac{N}{m}$. The work done in blowing a soap bubble of surface area $40cm^2$, (in J) is

A. 1.2×10^{-4}

B. 2.4×10^{-4}

C. 12×10^{-4}

D. 24×10^{-4}

Answer: 2

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38. The work done in increasing the size film with dimensions $8cm \times 3.75xm$ to $10cm \times 6cm$ is $2 \times 10^{-4}J$. The surface tension of the film in $\frac{N}{m}$ is

A. 165×10^{-2}

B. 3.3×10^{-2}

C. 6.6×10^{-2}

D. 8.25×10^{-2}

Answer: 2

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39. The work done to get n smaller identical drops to form a big spherical drop of water is proportional to

A. $\frac{1}{n^{\frac{2}{3}} - 1}$

B. $\frac{1}{n^{\frac{2}{3}} - 1}$

C. $n^{\frac{1}{3}} - 1$

D. $n^{\frac{4}{3}} - 1$

Answer: 3

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40. The work done to blow a bubble is W. The extra work to be done to double its radius is

A. W

B. 2W

C. 3W

D. 4W

Answer: 3

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41. Water rises to a height fo 6 cm in a capillary tube of radius r. If the radius of the capillary tube is 3r, the height to which water will rise is ....cm.

A. 18

B. 9

C. 2

D. 3

Answer: 3

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42. When a capillary tube is immersed in ethyl alcohol whose surface tension is 20 dyne cm^{-1}, the liquid rises to a height of 10 cm. Density of the liquid is 0.8 $gmcm^{-3}$. If $g = 10ms^{-2}$, the radius of the capillary tube is ... mm. (angle of contact of ethyl alcohol w.r.t. glass is 60°).

A. 0.0025

B. 0.025

C. 0.25

D. 2.5

Answer: 2

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Watch Video Solution

43. Water rises in a capillary tube through a height l. If the tube is inclined to the liquid surface at 30° the liquid will rise in the tube upto it's length equal to

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

B. $2l$

C. $\sqrt{3}\frac{l}{2}$

D. $\frac{2l}{\sqrt{3}}$

Answer: 2

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44. A long cylinderical glass vessel has a small hole of radius r at its bottom. The depth to which the vessel can be lowered vertically in a deep water (surface tension S) without any water entering inside is

A. $\frac{2T}{r}$

B. $\frac{2T}{rgd}$

C. $\frac{T}{rgd}$

D. $\frac{rgd}{2}$

Answer: 2

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45. Water raises to a height of $10cm$ in a capillary tube and mercury falls to a depth of 3.5 cm in the same capillary tube. If the density of mercury is $13.6\frac{gm}{c.c}$ and its angle of contact is 135° and density of water is $1\frac{gm}{c.c}$ and its angle of contact is $0^\circ C$ then the ratio of surface tensions of two liquids is $\left(\cos 135^\circ = 0.7\right)$

A. $1:14$

B. $5:34$

C. $1:5$

D. $5:27$

Answer: 2

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46. A glass capillary tube of inner diameter 0.28 mm is lowered vertically into water in a vessel. The pressure to be applied on the water in the capillary tube so that water level in the tube is same as the vessel in $\frac{N}{m^2}$ is (surface tension of water $= 0.07\frac{N}{m}$ atmospheric pressure $= 10^5\frac{N}{m^2}$

A. 10^3

B. 99×10^3

C. 100×10^3

D. 101×10^3

Answer: 4

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47. A capillary tube of radius r is immersed in water and water rises in to a height h. The mass of water in the capillary tube is 5g. Another capillary tube of radius 2 r is immersed in water. The mass of water that will rise in this tube is

A. m

B. 2m

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

D. $4m$

Answer: 2

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48. The surface tension of soap solution is $0.05Nm^{-1}$ if the diameter of the soap bubble is 4 cm. The excess pressure inside the soap bubble over that of outside is (in pascal)

A. 10

B. 1

C. 0.1

D. 0.25

Answer: 1

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49. The excess pressure inside a small air bubble of radius 0.05 mm in water of surface tension 70 dyne cm^{-1} (in pascal)

A. 28.2

B. 2.8×10^2

C. 2800

D. 280

Answer: 3

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50. What should be the pressure inside a small air bubble of $0.1mm$ radius situated just below the surface of water? Surface tension of water $= 72 \times 10^{-3} N/m$ and atmospheric pressure $= 1.013 \times 10^{5} N/m^{2}$

A. $1.44 \times 10^{2} Pa$

B. $1.44 \times 10^{3} Pa$

C. $1.44 \times 10^{4} Pa$

D. $1.44 \times 10^{5} Pa$

Answer: 2

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51. Two soap bubbles are blown. In first soap bubble excess pressure is 4 times of the second soap bubble. The ratio of the radii of the first and second soap bubble is

A. $1:4$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: 1

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52. Two soap bubble of radii 3 mm and 4 mm are in contact radius of curvature of interface between those two bubbles is

A. 1mm

B. 7mm

C. 12mm

D. $\frac{12}{7}$mm

Answer: 3

Watch Video Solution

53. Two liquid drops of radii 1 mm and 2 mm merge in vacuum isothermally. Radius of resulting drop is

A. $3mm$

B. $3^{1/3}mm$

C. $3^{\frac{2}{3}}$mm

D. 6mm

Answer: 3

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54. A spherical soap bubble of radius 1 cm is formed inside another of radius 3 cm the radius of single soap bubble which maintains the same pressure difference as inside the smaller and outside the larger soap bubble is ___cm

A. $\frac{4}{3}$

B. $\frac{3}{4}$

C. $\frac{1}{2}$

D. 2

Answer: 2

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55. A soap bubble of radius 6 cm and another bubble of 8 cm coalesce under isothermal xonditions in vacuum. The radius of the new bubble is

A. 3 cm

B. 4 cm

C. 10 cm

D. 7 cm

Answer: 3

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Level 2 (H.W)

1. The force does water exert on the base of a house tank of base area $1.5m^2$ when it is filled with water up to a height of 1 m is $\left(g = 10\frac{m}{s^{-2}}\right)$

A. 1200 kgwt

B. 1500 kgwt

C. 1700 kgwt

D. 2000 kgwt

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2. A rectangular block of wood of density $800kgm^{-3}$ having a mass of 2 kg is pushed in to water so that it is completely submerged and then released. Neglecting viscous forces, the initial acceleration of the block will be $\left(g = 10\frac{m}{s^2}\right)$

A. $1.25\frac{m}{s^2}$ downward

B. $2.5\frac{m}{s^2}$ upwards

C. $1.25\frac{m}{s^2}$ upward

D. $2.5\frac{m}{s^2}$ downward

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3. A vessel contains (density d) over mercury (density D). A homogenous solid sphere floats with half of its volume in mercury and the other half in the oil . The density of the material of the sphere is

A. $\sqrt{Dd}$

B. $\frac{2Dd}{D + d}$

C. $\frac{D + d}{2}$

D. $\frac{Dd}{D+d}$

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4. A block of wood floats in water with $\left(\frac{4}{5}\right)^{th}$ of its volume submerged. In an oil, it floats with $\left(\frac{9}{10}\right)^{th}$ volume submerged. The ratio of the density of oil and water is

A. $\frac{8}{9}$

B. $\frac{9}{8}$

C. $\frac{19}{25}$

D. $\frac{25}{18}$

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5. A small block of wood of relative density 0.5 is submerged in water at a depth of 5 m When the block is released it starts moving upwards, the acceleration of the block is $\left(g = 10ms^{-2}\right)$

A. $5ms^{-2}$

B. $10ms^{-2}$

C. $7.5ms^{-2}$

D. $15ms^{-2}$

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6. A hemispherical bowl just floats without sinking in a liquid of density $1.2 \times 10^3 kg/m^3$. If outer diameter and the density of the bowl are $1m$ and $2 \times 10^4 kg/m^3$ respectively, then the inner diameter of bowl will be

A. 1.91 m

B. 0.5 m

C. 0.98 m

D. 1.75 m

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7. A cubical block of wood of edge a and density ρ floats in water of density 2ρ. The lower surface of the cube just touches the free end of a mass less spring of force constant K fixed at the bottom of the vessel. The weight W put over the block so that it is completely immersed in water without wetting the weight is

A. $a\left(a^2\rho g + k\right)$

B. $a(a\rho g + 2k)$

C. $a\left(\frac{a\rho g}{2} + 2k\right)$

D. $a\left(a^2\rho g + \frac{k}{2}\right)$

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8. A fisherman hooks an old log of wood of weight 12 N and volume 1000 cm^3. He pulls the log half way out of water. The tension in the string at this instant is

A. 12 N

B. 8 N

C. 10 N

D. 7 N

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9. A sphere of solid material of relative density 9 has a concentric spherical cavity and sinks in water. If te radius of the sphere be R. Then the radius of the cavity (r) will be related to R as

A. $r^3 = \frac{8}{9}R^3$

B. $r^3 = \frac{2}{3}R^3$

C. $r^3 = \frac{\sqrt{8}}{3}R^3$

D. $r^3 = \sqrt{\frac{2}{3}}R^3$

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10. A raft of wood (density $= 600kg/m^3$) of mass $120kg$ floats in water. How much weight can be put on the raft to make it just sink?

A. 120 kg

B. 200 kg

C. 40 kg

D. 80 kg

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11. A body of density d and volume V floats with volumes V of its total volume V immersed in a liquid of density d and the rest of the volume V_2 immersed in another liquid of density $d_2\left(< d_1\right)$. The volume V_1 immersed in liquid of density d_1 is

A. $\left(\frac{d - d_2}{d_1 - d_2}\right)V$

B. $\left(\frac{d + d_2}{d_1 + d_2}\right)V$

C. $\left(\frac{d_1 - d_2}{d_1}\right)V$

D. $\frac{d_1}{d_2}V$

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12. At a point P in a water pipe line the velocity is $1ms^{-1}$ and the pressure is $3 \times 10^5 pa$. At another point Q the area of cross section is half that of at

P and the pressure is 5×10^5 pa. The difference of heights between P and Q in metre is $\left(g = 10ms^{-2}\right)$

A. 10.5

B. 20.15

C. 4.5

D. zero

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13. An ideal liquid flowing through a pipe A of cross-section $0.2m^2$ with velocity $10\frac{m}{s}$ enters a T-junction. One side of the T-junction B has cross-section area $0.1m^2$ and the other side C has cross-section area $0.05m^2$. If the velocity of water is C is $15\frac{m}{s}$ then in B the velocity is

A. $1\frac{m}{s}$

B. $10\frac{m}{s}$

C. $12.5\frac{m}{s}$

D. $1\frac{cm}{s}$

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14. A tank with vertical walls is monted so that its base is at height of 1.2 m above the horizotnal ground. The tank is filled with water to depth 2.8 m. A holw is punched in the side wall of the tank at a depth x m below the surface of water to have maximum range of the emerging stream. then the value of x in metre is

A. 4

B. 1.6

C. 2

D. 2.3

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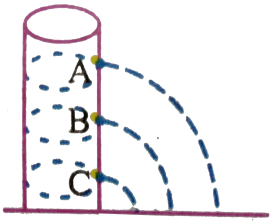
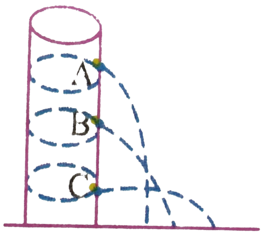
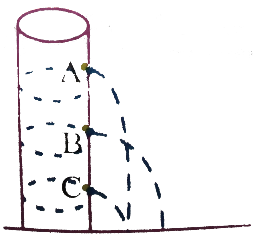
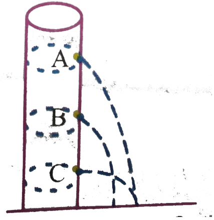
15. Water stands at a height of 100 cm in a vessel whose side walls are vertical. A B and C are holes at height 80 cm, 50 cm, and 20 cm respectively from the bottom of the vessel. The correct system of flowing out is:

A. 

B. 

C. 

D. 4)



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16. There is a hole at the bottom of a large open vessel. If water is filled upto a height h, it flows out in time t. if water is filled to a height 4h, it will flow out in time

A. $4t$

B. $\frac{t}{4}$

C. $\frac{t}{2}$

D. $2t$

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17. A large tank filled with water to a height h is to be emptied through a small hole at the bottom. The ratio of times taken for the level of water to fall from h to $\frac{h}{2}$ and from $\frac{h}{2}$ to zero is

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. $\sqrt{2} - 1$

D. $\frac{1}{\sqrt{2} - 1}$

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18. Tanks A and B open at the top contain who different liquids upto certain height in them. A hole is made on the wall of each tank at a depth h from the surface of the liquid. The area of the hole in A is twice that of in B. If the liquid mass flux through each hole is equal, then the ratio of the densities of the liquids respectively is

A. $\frac{2}{1}$

B. $\frac{3}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{2}$

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19. A large open top container of negligible mass and uniform ross sectional area A has a small uniform cross sectional area a in its side wall near the bottom. The container is kept over a smooth horizontal floor and contains a liquid of density ρ and mass m_0. Assuming that the liqudi starts flowing through the hole A the acceleration of the container will be

A. $\frac{2ag}{A}$

B. $\frac{ag}{A}$

C. $\frac{2Ag}{a}$

D. $\frac{Ag}{a}$

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20. When a capillary tube is connected to a pressure head quantity of water flows per secind is V (in c.c.) if another tube of same length but half the radius is connected to the first in series to the same pressure head, the quantity of water flowing through them per sencond will be (in c.c)

A. $\frac{V}{16}$

B. $\frac{V}{17}$

C. $\frac{17V}{16}$

D. V

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21. A volume V of a viscous liquid flows per unit time due to a pressure head ΔP along a pipe of diameter d and length l. instead of this pipe a set of four pipes each of diameter $\frac{d}{2}$ and length 2l is connected to the same pressure head ΔP. Now the volume of liquid flowing per unit time is:

A. V

B. $\frac{V}{4}$

C. $\frac{V}{8}$

D. $\frac{V}{16}$

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22.

A horizontal composite capillary tube has a radius $2r$ for a length $2L$ and radius r for a length L as shown and is connected to a tank at one end and left free at the other end The tank contains a liquid of coefficient of viscosity η. if a constant pressure difference P exist across the ends of the capillary tube, the volme flux thorugh the capillary tube is

A. $\left(\frac{16}{17}\right)\frac{\pi P r^4}{8\eta L}$

B. $\left(\frac{9}{8}\right)\frac{\pi P r^4}{8\eta L}$

C. $\left(\frac{17}{16}\right)\frac{\pi P r^4}{8\eta L}$

D. $\left(\frac{8}{9}\right)\frac{\pi P r^4}{8\eta L}$

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23. A stream-lined body falls through air from a height h on the surface of a liquid . Let d and D denote the densities of the materials of the body and the liquid respectively, if $D > d$, then the time after which the body will be intantaneously at rest, is:

A. $\sqrt{\frac{2h}{g}}$

B. $\sqrt{\frac{2h}{g}\frac{D}{d}}$

C. $\sqrt{\frac{2h}{g}\frac{d}{D}}$

D. $\frac{d}{(D - d)}\sqrt{\frac{2h}{g}}$

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24. Two rain drops reach the earth with different terminal velocities having ratio 94 then te ratio fo their volume is

A. $3:2$

B. $4:9$

C. $9:4$

D. $27:8$

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25. A solid sphere falls with a terminal velocity V in CO_2 gas. If its is allowed to fall in vacuum

A. Terminal velocity of sphere $= V$

B. Terminal velocity of sphere $< V$

C. Terminal velocity of sphere $> V$

D. Sphere never attains terminal velocity

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26. If the force required to pull out a glass plate of length 9.8 cm and thickness 2 mm from a liquid is 0.6 gmwt. The surface tension of water is Nm^{-1}

A. 2.94×10^{-3}

B. 29.4×10^{3}

C. 29.4×10^{-2}

D. 29.4×10^{-3}

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27. A wire of length L metres, made of a material of specific gravity 8 is floating horizontally on the surface of water. If it is not wet by water, the maximum diameter of the wire (in mm) upto which it can continue to float is (surface tension of water is $T = 70 \times 10^{-3} Nm^{-1}$)

A. 1.5

B. 1.1

C. 0.75

D. 0.55

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28. A glass plate of length 20 cm and breadth 0.2 cm just touches the water surface in a beaker. The surface tension of water is 72 dyne/cm. The weight of the glass plate is 25 g. The weight that must be placed in the right pan to counter pose the balance is

A. 25 g

B. 28 g

C. 22 g

D. 21.3 g

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29. Two vertical parallel glass plates are partially submerged in water. The distance between the plates is d and the length is l. Assume that the water between the plates does not reach the upper edges of the plates and the wetting is complete. The water will rise to height ($\rho =$ density of water and $\alpha =$ surface tension of water)

A. $\frac{2T}{d\rho g}$

B. $\frac{T}{2d\rho g}$

C. $\frac{T}{d\rho g}$

D. None of these

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30. A liquid drop of radius R breaks into 64 tiny droplets each of radius r if the surface tension of liquid is T then gain in energy is

A. $48\pi R^2 T$

B. $12\pi r^2 T$

C. $96\pi r^2 T$

D. $192\pi r^2 T$

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31. When water rises in a capillary tube of radius r to height h, then its potential energy U_1 if capillary tube of radius 2r is dipped in same water then potential energy of water is U_2 then $U_1 : U_2$ will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

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32. A glass rod of radius r_1 is inserted symmetrically into a vertical capillary tube of radius r_2 such that their lower ends are at the same level. The arrangement is now dipped in water. The height to which water will rise into the tube will be ($\sigma =$ surface tension of water, $\rho =$ density of water)

A. $\frac{2\sigma}{(r_2 - r_1)\rho g}$

B. $\frac{\sigma}{(r_2 - r_1 \rho g)}$

C. $\frac{2\sigma}{(r_2 - r_1)\rho g}$

D. $\frac{2\sigma}{(r_2^2 + r_1^2)\rho g}$

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33. A long capillary tube of radius 1 mm, open at both ends is filled with water and placed vertically. What will be the height of water column left in the capillary ? (Surface tension of water is $73.5 \times 10^{-3} Nm^{-1}$)

A. 0.3 cm

B. 3 cm

C. 6 cm

D. 0.03 cm

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34. Two narrow bores of diameters 3.0mm and 6.0 mm are joined together to form a U-shaped tube open at both ends. If th U-tube contains water, what is the difference in its levels in the two limbs of the tube? Surface tension of water at the temperature of the experiment is $7.3 \times 10^{-2} Nm^{-1}$. Take the angle of contact to be zero. and density of water to be $1.0 \times 10^3 kg/m^3$.

$\left(g = 9.8 ms^{-2}\right)$

A. 3mm

B. 2mm

C. 4mm

D. 5.0mm

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35. The excess pressure in soap bubble is $10\frac{N}{m^2}$ if eight soap bubble are combined to form a big soap bubble excess pressure in big bubble is (in $\frac{N}{m^2}$)

A. 5

B. 10

C. 20

D. 2.5

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36. Two air bubbles of radii 0.002 m and 0.004 m of same liquid come together to form a single bubble under isothermal condition. Find the radius of the buble formed. Given surface tension of liquid is $0.072Nm^{-1}$

A. 6 mm with concave surface towards smaller bubble.

B. mm with concave surface towards bigger bubble.

C. 4 mm with concave surface towards smaller bubble.

D. 4 mm with concave surface towards bigger bubble.

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37. A water drop is divided into eight equal droplets. The pressure difference between inner and outer sides of big drop is

A. will be the same as for smaller droplet

B. will be half of the for smaller droplet

C. will be $\frac{1}{(4)^{th}}$ of that for smaller droplet

D. will be twice of that for smaller droplet

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38. Two soap bubble of radii r_1 and r_2 combime to form a single bubble of radius r under isothermal conditions . If the external pressure is P, prove that surface tension of soap solution is given by $S = \frac{P\left(r^3 - r_1^3 - r_2^3\right)}{4\left(r_1^2 + r_2^2 - r^2\right)}$.

A. $\frac{P_0\left(R^3 + R_1^3 + R_2^3\right)}{4\left(R^2 + R_1^2 + R_2^2\right)}$

B. $\frac{P_0\left(R_1^3 + R_2^3 - R^3\right)}{4\left(R^2 - R_1^2 - R_2^2\right)}$

C. $P_0\left(R_1^3 + R_2^3 - R^3\right)$

D. $4P_0\left(R_1^3 + R_2^3 - R^3\right)$

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39. One end of a glass capillary tube with a radius $r = 0.05cm$ is immersed into water to a depth of $h = 2cm$.Excess pressure required to blow an air bubble out of the lower end of the tube will be $(S.T$ of water $= 70\text{dyne}/cm)$.Take $g = 980cm/s^2$.

A. $480\frac{N}{m^2}$

B. $680\frac{N}{m^2}$

C. $120\frac{N}{m^2}$

D. $820\frac{N}{m^2}$

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Illustration

1. The pressure at the bottom of a lake due to water is $4.9 \times 10^6 N/m^2$. What is the depth of the lake?

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2. What is force on the base of a tank of base area $1.5m^2$ when it is filled with water upto a height of 1m

$\left(\rho_{\text{water}} = 10^3 kg/m^3, P_0 = 10^5 Pa \text{ and } g = 10m/s^2\right)$

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3. A beaker containing a liquid of density ρ moves up with an acceleration a. The pressure due to the liquid at a depth h below the free surface of the liquid is.

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4. In a hydraulic jack as shown, mass of the car $= W = 800kg, A_1 = 10cm6(2), A_2 = 10m^2$. What is the the minimum force F required to lift the car ? Take $g = 10m/s^2$

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5. A vertical U - tube of uniform cross - section contains water in both the arms. A 10 cm glycerine column (R.D. = 1.2) is added to one of the limbs. What is the level difference between the two free surface in the two limbs?

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6. A vessel contains a liquid has a constant acceleration $19.6\frac{m}{s^2}$ in horizontal direction.The free surface of water get sloped with horizontal at angle

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7. When equal volumes of two metals are mixed together the specific gravity of alloy is 4. When equal masses of the same two metals are mixed together the specific gravity of the alloy becomes 3. find specific gravity of each metal?

(specific gravity $= \frac{\text{density of substance}}{\text{density of water}}\Big)$

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8. When a polar bear jumps on an iceberg, its weight 240 kg is just sufficient to sink the iceberg. What is the mass of the iceberg? (specific gravity of ice is 0.9 and that of sea water is 1.02)

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9. Four-fifth of a cylindrical block of wood, floats in a liquid. Assuming the relative density of wood be 0.8 find the density of the liquid.

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10. Two bodies are in equilibrium when suspended in water from the arms of a balance.The mass of one body is $28g$ and its density is $5.66g/cm^3$. If the mass of the other body is $36g$, what is its density ?

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11. 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.

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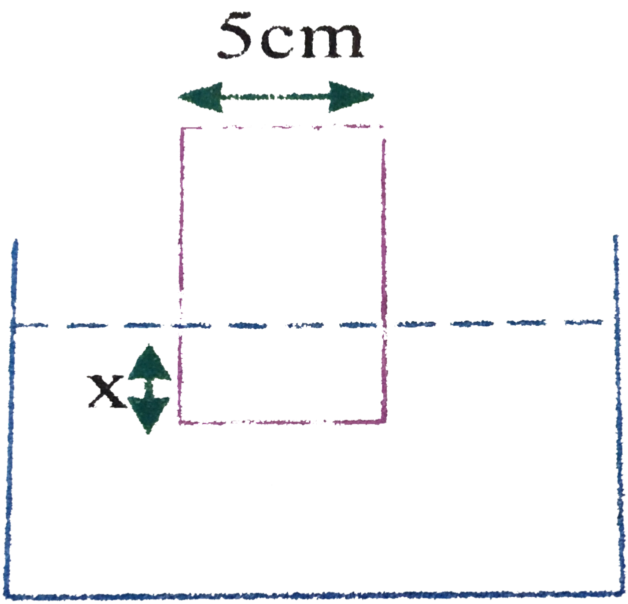
12.



A cubical block of iron of side 5 cm is floating in mercury taken in a vessel.

What is the height of the block above mercury level.

$\left(\rho_{Hg} = 13.6g/cm^3, \rho_{Fe} = 7.2g/cm^3\right)$

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13. A solid sphere of radius R has a concentric cavity of radius $\frac{R}{3}$ inside it. The sphere is found to just float in water with the highest point of it touching the water surface. Find the specific gravity of the material of the sphere.

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

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15. A ball of mass m and density ρ is immersed in a liquid of density 3ρ at a depth h and released. To what height will the ball jump up above the surface of liqud ? (neglect the reistance of water and air).

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16. Two spheres of volume 250 cc each but of relative densities 0.8 an d 1.2 are connected by a string and the combination is immersed in a liquid. Find the tension T in the string. $\left(g = 10m/s^2\right)$

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17. A uniform cylinder of length L and mass M having cross-sectional area A is suspended, with its length vertical, from a fixed point by a massless spring such that it is half submerged in a liquid of density σ at equilibrium position. The extension x_0 of the spring when it is in equlibrium is:

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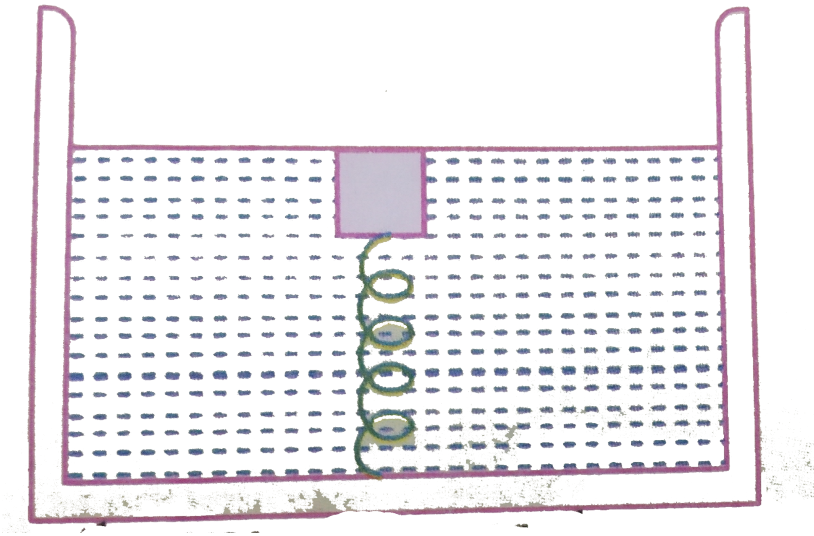
18. A block is fully submerged in a vessel filled with water by a spring attached to the bottom of the vessel. In equilibrium position spring is compressed. If the vessel now moves downwards with an acceleration $a(\ < g)$. What happens to the length of the spring.?



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19. What are the dimensions of Reynolds number ?

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20. What should be the average velocity of water in a tube of diameter 2 cm so that the flow is (i) laminar (ii) turbulent? The viscosity of water is 0.001 Pa-s. (for water pipes $R < 2000$ stream line flow, $R > 3000$ turbulent flow)

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21. A pipe having an internal diameter D is connected to another pipe of same size. Water flows into the second pipe through n holes, each of diameter d. if the water in the first pipe has speed v, the speed of water leaving the second pipe is

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22. A syringe of diameter 1 cm having a nozzle of diameter 1 mm is placed horizontally at a height 5 m from the ground an incompressible non-viscous liquid is filled in the syringe and the liquid is compressed by moving the piston at a speed of $0.5ms^{-1}$ the horizontal distance travelled by the liquid jet is $\left(g = 10ms^{-2}\right)$

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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.

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24. 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 $= 10^3 kg.\, m^{-3}$)

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25. 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 $10N/m^2$.

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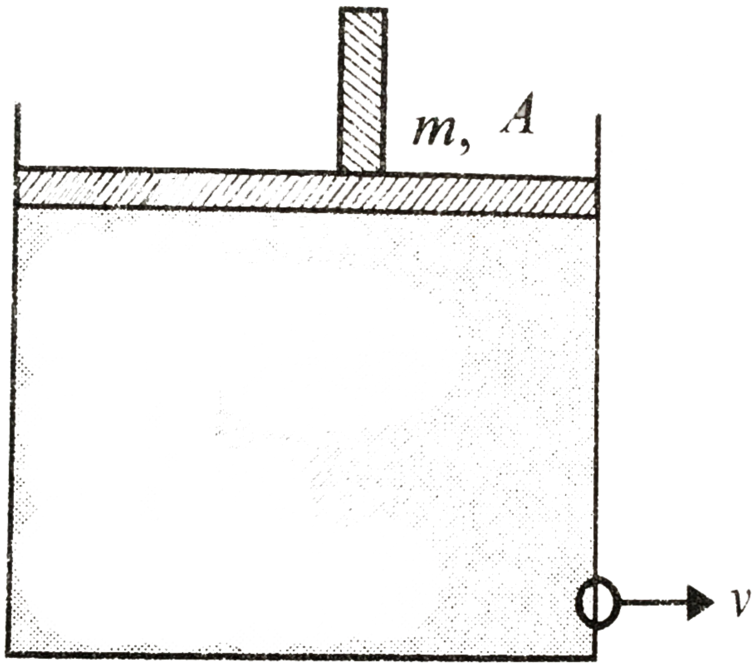
26. A cylindrical vessel contains a liquid of density ρ up to height h. The liquid is closed by a piston of mass m and area of cross section A. There is a small hole at the bottom of the vessel. The speed v with which the liquid comes out of the hole is



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27. A pump draws water from a reservoir and sends it through a horizontal pipe with speed v. Find the relation between power of the pump and velocity of liquid.

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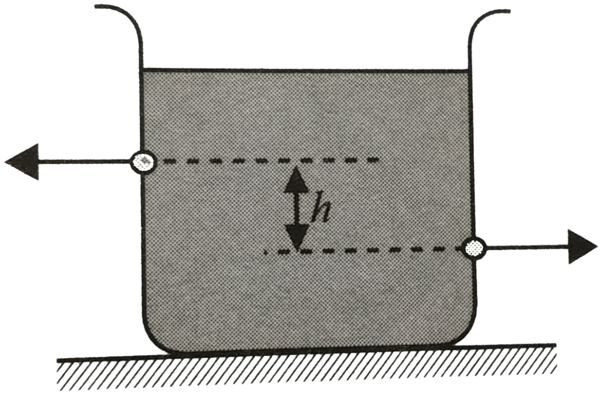
28. There are two identical small holes of area of cross section a on the opposite sides of a tank containing liquid of density ρ. The differences in height between the holes is h. The tank is resting on a smooth horizontal surface. The horizontal force which will have to be applied on the tank to keep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



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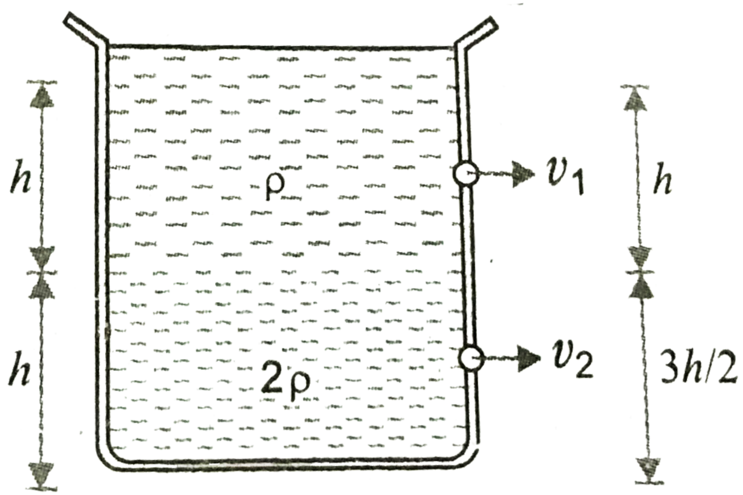
29. Equal volume of two immissible liquid of densities ρ and 2ρ are filled in a vessel as shown in Fig. 7(CF).15. Two small holes are punched at depth $\frac{h}{2}$ and $\frac{3h}{2}$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then v_1/v_2 is



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30. A hose shoots water straight up to a height of 2.5 m. The opening end of the hose has an area of $0.75 cm^2$. What is the speed of the water as it leaves the hose? How much water will come out in one minute?

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31. 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

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32. A boat of area $10m^2$ floating on the surface of river is made to move horizontally with a speed of 2m/s by applying a tangential force. If the river is 1 m deep and the water in contact with the bed is stationary, find the tangential force needed to keep the boat moving with constant speed.

$\left(\text{coefficient of viscosity of water } = 10^{-2} \text{ poise}\right)$

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33. A $16cm^3$ of water flows per second through a capillary tube of radius r cm and of length 1 cm, when connected to a pressure head of h cm of water. If a tube of the same length and radius $r/2$ is connected to the same pressure head, find the mass of water flowing per minute through the tube.

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34. Water flows in a streamline manner through a capillary tube of radius a. The pressure difference being P and the rate of flow is Q . If the radius is reduced to $a/2$ and the pressure difference is increased to 2P, then find the rate of flow.

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35. Capillary tubes of length l and $2l$ are connected in series, their radii are r and $2r$ respectively. If stream line flow is maintained and pressure difference across first and second capillary tubes are P_1 and P_2 respectively then find the ratio $\frac{P_1}{P_2}$.

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36. Three capillary tubes of same radius 1 cm but of length 1 m 2 m and 3 m are fitted horizontally to the bottom of a long vessel containing a liquid at constant pressure and flowing through these. What is the length of a single tube which can replace the three capillaries.

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37. Two equal drops of water are falling through air with a steady velocity v. If the drops coalesced, what will be the new velocity?

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38. A spherical steel ball released at the top of along column of glycerin of length l falls through a distance $l/2$ with accelerated motion and the remaining distance $l/2$ with uniform velocity let t_1 and t_2 denote the times taken to cover the first and second half and w_1 and w_2 are the work done against gravity in the two halves, then compare times and work done.

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39. A small steel ball falls through a syrup at a constant speed of $10cms^{-1}$. If the steel ball is pulled upwards with a force equal to twice its effective weight, how fast will it move upwards?

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40. A small piece of wire of length 4 cm is floating on the surface of water. If a force of 560 dynes in excess of its apparent weight is required to pull it up from the surface find the surface tension of water.

Watch Video Solution

41. An annular metal ring of inner radius 7 cm and outer radius 14 cm and negligible weight is floating on the surface of a liquid if surface tension of liquid is $0.08 Nm^{-1}$ calculate the force required to detach it from liquid surface.

Watch Video Solution

42. A wire is bent in the form of a U-shape and a slider of negligible mass is connecting the two vertical sides of the U-shape. This arrangement is dipped in a soap solution and lifted a thin soap film is formed in t he frame it supports a weight of $2.0 \times 10^{-2} N$ if the length of the slider is 40 cm what is the surface tension of the film?

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43. A metallic wire of diameter d is lying horizontally o the surface of water. The maximum length of wire so that is may not sink will be

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44. If the surface tension of soap solution is $35\text{dynes}/cm$, calculate the work done to form an air bubble of diameter 14 mm with that solution.

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45. A soap bubble is blown to a radius of 3 cm. if it is to be further blown to a radius of 4 cm what is the work done? (surface tension of soap solution $= 3.06 \times 10^{-2} Nm^{-1}$)

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46. A water drop of diameter 2 mm is split up into 10^9 identical water drops. Calculate the work done in this process. (the surface tension of water is $7.3 \times 10^{-2} Nm^{-1}$)

Watch Video Solution

47. 1000 drops of a liquid each of diameter 4 mm coalesce to form a single large drop. If surface tension of liquid is 35 dyne cm^{-1} calculate the energy evolved by the system in the process.

Watch Video Solution

48. A large number of liquid drops each of radius 'a' coalesce to form a single spherical drop of radish b. The energy released in the process is converted into kinetic energy of the big drops formed. The speed of big drop will be

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49. A drop of radius R is split under isothermal condition into into n droplets each of radius r the ratio of surface energies of big and each small drop is

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50. Number of droplets (n) are combined isothermally to form a big drop the ratio of initial and final surface energies of the system is

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51. When a big drop of water is formed from n small drops of water, the energy loss is 3E, where, E is the energy of the bigger drop. If R is the radius of the bigger drop and r is the radius of the smaller drop then number of smaller drops (n) is?

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52. Find the weight of water supported by surface tension in a capillary tube with a radius of 0.2 mm. Surface tension of water is $0.072Nm^{-1}$ and angle of contact of water is 0^0.

Watch Video Solution

53. A capillary tube of radius r is immersed in water and water rises to a height of h mass of water in the capillary tube is 5×10^{-3} kg the same capillary tube is now immersed in a liquid whose surface tension in $\sqrt{2}$ times the surface tension of water. The angle of contact between the capillary tube and this liquid is 45° the mass of liquid which rises into the capillary tube now is (in kg)

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54. A U-tube is supported with its limbs vertical and is partly filled with water. If the internal diameters of the limbs are $1 \times 10^{-2}m$ and $1 \times 10^{-4}m$

respectively. What will be the difference in heights of water in the two limbs? (Surface tension of water is 0.07 N/m.)

Watch Video Solution

55. Water rises to a height of 10 cm in capillary tube and mercury falls to a depth of 3.112 cm in the same capillary tube. If the density of mercury is 13.6 and the angle of contact for mercury is 135°, the ratio of surface tension of water and mercury is

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56. A 20 cm long capillary tube is dipped in water. The water rises up to 8 cm. If the entire arrangement is put in a freely falling elevator, the length of water column in the capillary tube will be

Watch Video Solution

57. Two soap bubble of radii R_1 and R_2 are kept in vacuum at constant temperature, the ratio of masses of air inside them, is

Watch Video Solution

58. Two soap bubble of radii R_1 and R_2 are in atmosphere of pressure P_0 at constant temperature. Ratio of masses of air inside them is

Watch Video Solution

59. Two soap bubble are combined isothermally to form a big bubble of radius R. If ΔV is change in volume, ΔS is change in surface area and P_0 is atmospheric pressure then show that $3P_0(\Delta V) + 4T(\Delta S) = 0$

Watch Video Solution

60. When air bubble comes from bottom to the top of a lake its radius becomes n times. If temprerature remains constant through out the lake the depth of the lake will be.

Watch Video Solution

61. The lower end of a capillary tube of diameter 2.0 mm is dipped 8.00cm below the surface of water in a beaker. What is the pressure required in the tube in order to blow a hemispherical bubble at its end in water? The surface tension of water at temperature of the experiments is $7.30 \times 10^{-2} Nm^{-1}$. 1 atmospheric pressure $= 1.01 \times 10^{5} Pa$, density of water $= 1000 kg/m^{3}, g = 9.80 ms^{-2}$. also calculate the excess pressure.

Watch Video Solution

62. A glass U-tube is such that the diameter of one limb is $3.0 mm$ and that of the other is 6.0mm. The tube is inverted vertically with the open ends below the surface of water in a beaker. What is the difference between the height to which water rises in the two limbs? Surface tension of water is $0.07 Nm^{-1}$. Assume that the angle of contact between water and glass is $0°$.

Watch Video Solution

EVALUATE YOURSELF - 1

1. The pressure at the bottom of a lake due to water is $4.9 \times 10^6 N/m^2$. What is the depth of the lake?

A. 500 m

B. 200 m

C. 120 m

D. 300 m

Answer: A

Watch Video Solution

2. The force does water exert on the base of a house tank of base area $1.5m^2$ when it is filled with water up to a height of 1 m is $\left(g = 10\frac{m}{s^{-2}}\right)$

A. 1700 kg wt

B. 1500 kg wt

C. 500 kg wt

D. 1400 kg wt

Answer: B

Watch Video Solution

EVALUATE YOURSELF - 2

1. The neck and bottom of a bottle are 3 cm and 15 cm in radius respectively. If the cork is pressed with a force 12 N in the neck of the bottle, then force exerted on the bottom of the bottle is :-

A. 80 N

B. 40 N

C. 300 N

D. 60 N

Answer: C

Watch Video Solution

2. The volume of an air bubble is doubled as it rises from the bottom of lake to its surface, The atmospheric pressure is 75 cm of mercury. The ratio of density of mercury to that of lake water is $\frac{40}{30}$, the depth of the lake in metre is

A. 15

B. 10

C. 30

D. 20

Answer: B

View Text Solution

EVALUATE YOURSELF - 3

1. Equal masses of two substance of densities ρ_1 and ρ_2 are mixed together. What is the density of the mixture?

A. $\frac{2d_1d_2}{d_1 - d_2}$

B. $\frac{2d_1d_2}{d_1 + d_2}$

C. $\frac{d_1d_2}{d_1 + d_2}$

D. $\frac{d_1 + d_2}{2d_1d_2}$

Answer: B

Watch Video Solution

EVALUATE YOURSELF - 4

1. A wooden cube first floats inside water when a 200 g mass is placed on it. When the mass is removed the cube is 2 cm above water level. The side of cube is

A. 2 cm

B. 10 cm

C. 12 cm

D. 14 cm

Answer: B

Watch Video Solution

2. A block of wood floats in water with $(4/5)th$ of its volume submerged. If the same block just floats in a liquid, the density of liquid in $\left(kgm^{-3}\right)$ is

A. $600 kgm^{-3}$

B. $400 kgm^{-3}$

C. $800 kgm^{3}$

D. $200 kgm^{-3}$

Answer: C

Watch Video Solution

3. A piece of solid weighs 120 g in air, 80 g in water and 60 g in a liquid. The relative density of the solid and that of the liquid are respectively

A. 2, 3/2

B. 3, 1/2

C. 2, 1/2

D. 3, 3/2

Answer: D

Watch Video Solution

EVALUATE YOURSELF - 5

1. The flow rate from a tap of diameter $1.25cm$ is 3 L//min. The coefficient of viscosity of water is 10^{-3} pa-s. Characterize the flow.

A. Turbulent

B. Stream line

C. Turbulent or Stream line

D. Steady

Answer: A

Watch Video Solution

2. Water flows through a non-uniform tube of area of cross section A, B and C whose values are 25, 15 and $35cm^2$ respectively. The ratio of the velocities of water at the sections A,B and C is

A. $21 : 15 : 35$

B. $25 : 15 : 35$

C. $35 : 15 : 25$

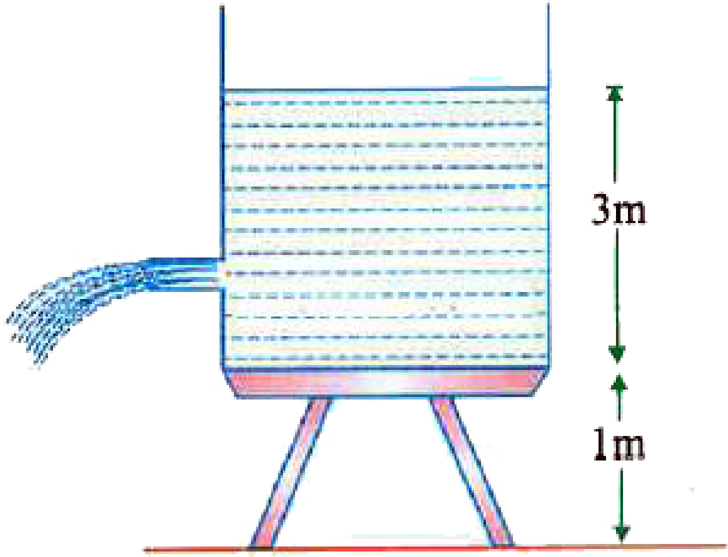
D. $21 : 35 : 15$

Answer: D

Watch Video Solution

EVALUATE YOURSELF - 6

1. Water is filled in tank 3 m height. The base of the tank is at height 1 m above the ground. What should be the height of a hole made in it, so that water can be sprayed upto maximum horizontal distance on ground?



A. 3 m from ground

B. 1 m from ground

C. 4 m from ground

D. 2 m from ground

Answer: D

View Text Solution

2. At what speed, the velocity head of water is equal to pressure head of 40 cm of mercury?

A. 10.32 m/s

B. 10.23 m/s

C. 10.52 m/s

D. 10.54 m/s

Answer: A

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 $= 10^3 kg. m^{-3}$)

A. 200 Pa

B. 300 Pa

C. 500 Pa

D. 400 Pa

Answer: C

Watch Video Solution

4. A rectangular vessel when full of water takes 10 minutes to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water

A. 4 Min

B. 5 Min

C. 6 Min

D. 7 Min

Answer: D

Watch Video Solution

EVALUATE YOURSELF - 7

1. A metal plate of area $10^3 \quad cm^2$ rests on a layer o oil 6 mm thick. A tangential force of 10^{-2} N is appled on it to move it with a constant velocity of 6 cm s^{-1} . The coefficient of viscosity of the liquid is :-

A. 0.1 poise

B. 0.2 poise

C. 0.3 poise

D. 0.4 poise

Answer: A

Watch Video Solution

2. Water flows in a stream line manner through a capillary tube of radius a. the pressure difference being P and the rate of the flows is Q. If the radius is reduced to $\frac{a}{4}$ and the pressure is increased to 4P, then the rate of flow becomes

A. $Q_2 = 64Q$

B. $Q_2 = Q/64$

C. $Q_2 = Q/32$

D. $Q_2 = Q/16$

Answer: B

Watch Video Solution

3. Two water pipes P and Q having diameters $2 \times 10^{-2} m$ and $4 \times 10^{-2} m$, respectively, are joined in series with the main supply line of water. The velocity of water flowing in pipe P is

A. $V_p = V_Q$

B. $V_p = 2V_Q$

C. $V_P = 3V_Q$

D. $V_P = 4V_Q$

Answer: D

Watch Video Solution

4. A large wooden plate of area $10m^2$ floating on the surface of river is made to move horizontally wilth a speed of $2ms^{-1}$ by applying a tangential force. If the river is 1m deep and the water contact with the bed is stationary, find the tangential force needed to keep the plate moving. Coefficient of viscosity of water at the temperature of the river $= 10^{-2} poise.$

A. $1 \times 10^{-2} N$

B. $2 \times 10^{-2} N$

C. $32 \times 10^{-2} N$

D. $4 \times 10^{-2} N$

Answer: B

Watch Video Solution

5. Capillary tubes of length l and $2l$ are connected in series, their radii are r and $2r$ respectively. If stream line flow is maintained and pressure difference across first and second capillary tubes are P_1 and P_2 respectively then find the ratio $\frac{P_1}{P_2}$.

A. $8:1$

B. $6:1$

C. $1:8$

D. $1:1$

Answer: A

Watch Video Solution

6. Water flows in a streamline manner through a capillary tube of radius a. The pressure difference being P and the rate of flow is Q . If the radius is reduced to $a/2$ and the pressure difference is increased to 2P, then find the rate of flow.

A. V

B. $\frac{V}{8}$

C. $\frac{V}{2}$

D. $\frac{V}{4}$

Answer: B

Watch Video Solution

EVALUATE YOURSELF - 8

1. A drop of water of radius 0.0015 mm is falling in air. If the coefficient of viscosity of air is $1.8 \times 10^{-8} kgm^{-1}s^{-1}$ what will be the terminal velocity of the drop. Density of air can be neglected.

A. $1.72 \times 10^{-4} m/\sec$

B. $5.4 \times 10^{4} m/\sec$

C. $6.72 \times 10^{-4} m/\sec$

D. $2.72 \times 10^{-4} m/\sec$

Answer: D

Watch Video Solution

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

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

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

C. $Mg\left(\frac{d_2}{d_1}\right)$

D. $Mg\left(\frac{d_1}{d_2}\right)$

Answer: B

Watch Video Solution

3. Find the terminal velocity of a rain drop of radius 0.01 mm. The coefficient of viscosity of air is $1.8 \times 10^{-5} N - sm^{-2}$ and its density is $1.2 kgm^{-3}$.Density of water $= 1000 kgm^{-3}$. $Take g = 10 ms^{-2}$

A. 0.2 m/sec

B. 0.02 m/sec

C. 0.12 m/sec

D. 0.012 m/sec

Answer: C

Watch Video Solution

EVALUATE YOURSELF - 9

1. A square plate of side 15 cm. is floating on the surface of water. It the surface tension of water is 60 dyne/cm., the excess force applied to separate this plate from water will be

A. 600 dyne

B. 1600 dyne

C. 3600 dyne

D. 360 dyne

Answer: C

View Text Solution

2. A thin wire ring of 1m. Is situated on the surface of a liquid. If the excess force required to lift it upwards (before the liquid film breaks) from the liquid surface is 8N, then the surface tension of liquid is :-(in N/m)

A. $\frac{1}{\pi}$

B. $\frac{2}{\pi}$

C. π

D. 2π

Answer: B

View Text Solution

3. A circular frame made of 20 cm long thin wire is floating on the surface of water. If the surface tension of water is 70 dyne/cm. the required excess force to separate this frame from water will be :

A. 2800 dyne

B. 800 dyne

C. 280 dyne

D. 1800 dyne

Answer: A

View Text Solution

EVALUATE YOURSELF - 10

1. Find the work done in increasing the volume of a soap bubble by 700% if its radius is R and surface tension is T?

A. $94R^2J$

B. $94\pi R^2J$

C. $94\pi RJ$

D. $4\pi R^2J$

Answer: B

View Text Solution

2. A bubble of radius 2cm is blown inside a cold drink using a straw. If the surface tension of liquids is 60 dyme/cm. Find the workdone (in ergs) in blowing the bubble?

A. $960\pi erg$

B. $160\pi erg$

C. $96\pi erg$

D. $860\pi erg$

Answer: A

View Text Solution

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

A. $2^{1/2}W$

B. $3^{1/3}W$

C. $4^{1/2}W$

D. $4^{1/3}W$

Answer: D

Watch Video Solution

4. A water film is formed between two parallel wires of 10 cm length. The distance of 0.5 cm between the wires is increased by 1mm. What will be the work done ? (Given, surface tension of water of $72 \times 10^{-3}Nm^{-1}$)

A. 144 erg

B. 14 erg

C. 288 erg

D. 24 erg

Answer: A

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5. If 10^6 tiny drops coalesce to form a big drop. The surface tension of liquid is T. Then find the $\%$ fractional energy loss?

A. 9%

B. 19%

C. 99%

D. 48%

Answer: C

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6. A liquid drop of radius R breaks into 64 tiny droplets each of radius r if the surface tension of liquid is T then gain in energy is

A. $12\pi r^2 J$

B. $22\pi r^2 J$

C. $24\pi r^2 J$

D. $32\pi r^2 J$

Answer: A

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EVALUATE YOURSELF - 11

1. When a cylindircal tube is dipped vertically into a liquid the angle of contact is 80°. When the tube is dipped with an inclination of 40° the angle of contact is :

A. 60°

B. 40°

C. 30°

D. 80°

Answer: D

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2. On dipping one end of a capiilary in liquid and inclining the capillary at an angles 30° and 60° with the vertical, the lengths of liquid columns in it are found to be l_1 and l_2 respectively. The ratio of l_1 and l_2 is

A. $1:1$

B. $1:\sqrt{3}$

C. $\sqrt{3}:1$

D. $2:\sqrt{3}$

Answer: B

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3. Water rises in two capillaries of same material up to heights of 40 and 60 mm the ratio of their radii is :

A. $3:2$

B. $2:3$

C. $1:2$

D. $1:1$

Answer: A

View Text Solution

4. When a capillary is dipped in water, water rises 0.015 m in it. If the surface tension of water is $75 \times 10^{-3} N/m$, the radius of capillary is

A. 2mm

B. 3mm

C. 4mm

D. 1mm

Answer: D

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EVALUATE YOURSELF - 12

1. If the excess pressure inside a soap bubble is balanced by an oil column of height 2 mm, then the surface tension of soap solution will be $\left(r = 1cm, \text{ density of oil } = 0.8g/cm^3\right)$

A. $1.92 \times 10^{-2} N/m^2$

B. $4 \times 10^{-2} N/m^2$

C. $3.92 \times 10^{-3} N/m^2$

D. $1.92 \times 10^{-3} N/m^2$

Answer: B

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2. A glass capillary tube of inner diameter 0.28 mm is lowered vertically into water in a vessel. The pressure to be applied on the water in the capillary tube so that water level in the tube is same as the vessel in $\frac{N}{m^2}$ is (surface tension of water $= 0.07 \frac{N}{m}$ atmospheric pressure $= 10^5 \frac{N}{m^2}$

A. $101 \times 10^3 N/m^2$

B. $10 \times 10^3 N/m^2$

C. $202 \times 10^3 N/m^2$

D. $20 \times 10^3 N/m^2$

Answer: A

Watch Video Solution

3. The excess pressure inside a spherical drop of water is four times that of another drop. Then, their respective mass ratio is

A. $1:4$

B. $16:1$

C. $64:3$

D. $1:64$

Answer: D

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C.U.Q(PRESSURE, FORCE OF BUOYANCY, LAWS OF FLOATATION)

1. The force of buoyancy is equal to

A. weight of the body

B. weight of the liquid displaced by the body

C. apparent weight of the body

D. Viscous force

Answer: B

View Text Solution

2. The weight of the body is maximum in

A. air

B. hydrogen

C. water

D. vaccum

Answer: D

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3. When a boat in a river enters the sea water, then it

A. sinks a little

B. rises a little

C. remains same

D. will drown

Answer: B

Watch Video Solution

4. When a body is fully immersed in a liquid the loss of weight of the body is equal to

A. apparent weight of the body

B. force of buoyancy

C. half the force of buoyancy

D. twice the force of buoyancy

Answer: B

Watch Video Solution

5. An iron block is on a boat which floats in a pond. The block is thrown into the water. The level of water in the pond will be

A. go up

B. fall down

C. remain the same

D. can not be decided

Answer: B

Watch Video Solution

6. A large block of ice floats in a liquid. Whe ice melts the liquid level rises. The density of liquid is

A. greater than that of water

B. less than that of water

C. equal to that of water

D. half of that of water

Answer: A

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7. Identify the correct choice: (A) when a body floats in a liquid, it displaces the liquid whose weight is equal to its own weight.

(B). When a body sinks in a liquid, it displaces the liquid whose volume is equal to its own volume.

A. A is true but B is false.

B. A is false but B is true.

C. Both A and Bare true.

D. Both A and B are false.

Answer: C

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8. 100 kg of iron and cotton are weighed by using a spring balance on the surface of the earth if R_1 and R_2 are the reading shown by the balance, then

A. $R_1 < R_2$

B. $R_1 = R_2$

C. $R_1 > R_2$

D. $R_1 = R_2 = 0$

Answer: C

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9. A swimmer goes from the surface of water to a depth of 20m the change in the pressure on his body is nearly

A. 3 atmospheres

B. 1 atmospheres

C. 2 atmosphere

D. Zero

Answer: C

Watch Video Solution

10. A bucket of water contain a wooden block floating in water with $(4/5)$ th of its volume sub merged in the water. The bucket is placed on the floor of a lift and the lift now starts moving down with uniform acceleration. The block of wood now

A. moves upward

B. moves downward

C. Remains at same place

D. moves horizontally

Answer: C

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11. Clouds appear to float in air due to

A. low density

B. air current

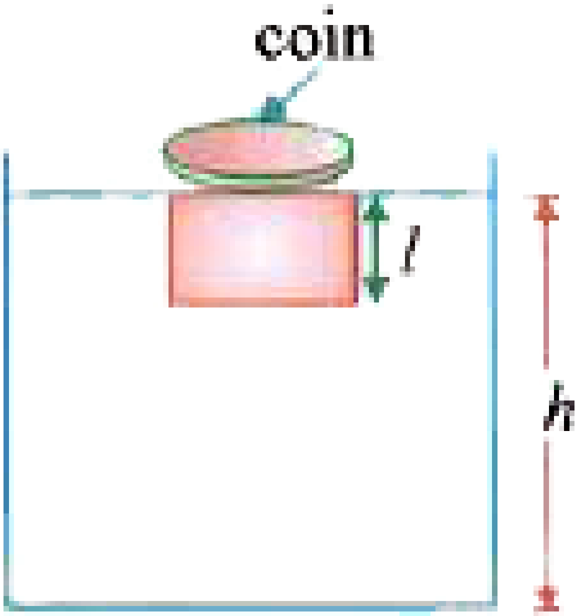
C. viscosity of air

D. buoyancy

Answer: D

Watch Video Solution

12. A wooden block with a coin placed on its top floats in water as shown. 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: D

View Text Solution

13. In order that a floating object be in a stable equilibrium its centre of buoyancy should be

A. vertical below its centre of gravity

B. horizontally inline with its centre of gravity

C. vertically above its centre of gravity

D. may be anywhere

Answer: C

Watch Video Solution

14. A piece of ice floats in a liquid denser than water. The liquid fills the vessel upto the edge. If ice melts completely then

A. water level remains unchanged

B. water level decreases

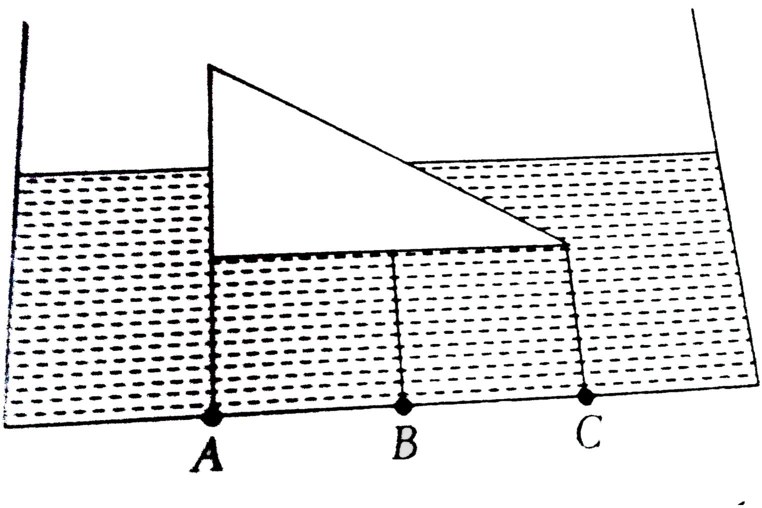
C. water overflows

D. data is insufficient

Answer: C

Watch Video Solution

15. An object of uniform density is allowed to float in water kept in a beaker. The object has triangular cross-section as shown in the figure. If the water pressure measured at the three points A, B and C below the object are P_A, P_B and P_C respectively. Then



A. $P_A > P_B > P_C$

B. $P_A > P_B < P_C$

C. $P_A = P_B = P_C$

D. $P_A = P_C < P_B$

Answer: C

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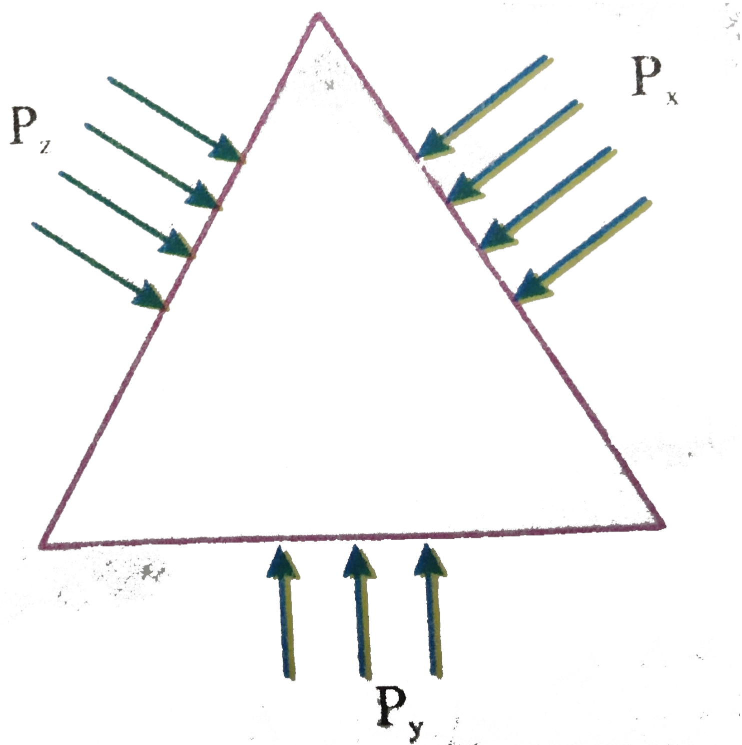
16.



A triangular element of the liquid is shown in the fig. P_x, P_y and P_z represent the pressures on the element of the liquid then:

A. $P_x = P_y \neq P_z$

B. $P_x = P_y = P_z$

C. $P_x \neq P_y \neq P_z$

D. $P_x^2 + P_y^2 + P_z^2 = \text{constant}$

Answer: B

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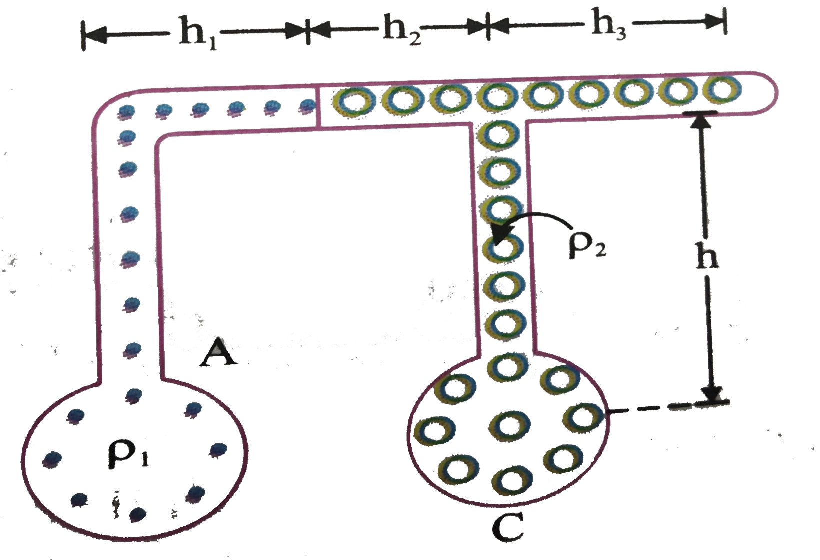
17. 

The difference in pressures in bulbs A and C having fluids of densities ρ_1 and ρ_2 when tube B is horizontal will be

A. $\rho_1 < \rho_2 < \rho_3$

B. $\rho_1 < \rho_3 < \rho_2$

C. $\rho_3 < \rho_1 < \rho_2$

D. $\rho_1 > \rho_3 > \rho_2$

Answer: B

Watch Video Solution

C.U.Q (EQUATION OF CONTINUITY, BERNOULLI.S THEOREM)

1. Stream line motion becomes turbulent motion when the velocity of the liquid is

A. beyond critical velocity

B. critical velocity

C. below critical velocity

D. variable velocity

Answer: A

Watch Video Solution

2. In turbulent flow the velocity of the liquid molecules in contact with the walls of the tube.

A. is zero

B. is maximum

C. is equal to critical velocity

D. may have any value

Answer: A

Watch Video Solution

3. Which of the following is a characteristic of turbulent now?

A. velocity more than critical velocity

B. irregular flow

C. molecules crossing from one layer to the other

D. 1, 2, 3

Answer: D

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4. When the value of Reynolds number is less, the predominant forces are

A. viscous forces

B. inertial forces

C. surface tension forces

D. gravitational forces

Answer: A

Watch Video Solution

5. In a laminar flow at a given point the magnitude and direction of the velocity of the fluid

A. both are constant

B. magnitude is only constant

C. direction is only constant

D. both are not constant

Answer: A

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6. The liquid flow is most stream lined when

A. liquid of high viscosity and high density flowing through a tube of small radius

B. liquid of high viscosity and low density flowing through a tube of small radius

C. liquid of low viscosity and low density flowing through a tube of large radius

D. liquid of low viscosity and high density flowing through a tube of large radius

Answer: B

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7. If the flow is stream lined then Reynolds number is less than

A. 2000

B. 3000

C. 1000

D. 4000

Answer: C

Watch Video Solution

8. The rate of flow of the liquid is the product of

A. area of cross section of the liquid and velocity of the liquid.

B. length of the tube of the flow and velocity of the liquid.

C. volume of the tube of the flow and velocity of the liquid.

D. viscous force acting on the liquid layer and velocity of the liquid

Answer: A

Watch Video Solution

9. The equation of continuity leads to

A. law of conservation of moments of liquid flow.

B. law of conservation of energy

C. law of equipartition of energy

D. law of conservation of mass.

Answer: D

Watch Video Solution

10. The volume of a liquid flowing per second out of an orifice at the bottom of a tank does not depend upon

A. the density of the liquid

B. acceleration due to gravity

C. the height of the liquid above orifice

D. the area of the orifice

Answer: A

Watch Video Solution

11. Water is flowing in a pipe of uniform cross section under constant pressure difference At some place the pipe becomes narrow. The pressure of at water at this place

A. remains same

B. may increase or decrease

C. increases

D. decrease

Answer: D

Watch Video Solution

12. What flows through a horizontal pipe of radius r at a speed V. if the radius of the pipe is doubled, the speed of flow of water under similar conditions is

A. 2V

B. $\frac{V}{2}$

C. $\frac{V}{2}$

D. 4V

Answer: C

Watch Video Solution

13. A liquid is under stream lined motion through a horizontal pipe of non uniform cross section. If the volume rate of flow at cross section a is V, the volume rate of flow at cross section $\frac{a}{2}$ is

A. $\frac{V}{2}$

B. 2V

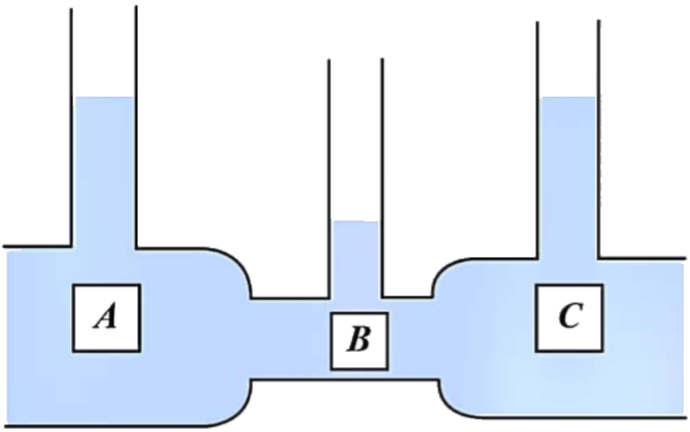
C. $\frac{V}{4}$

D. V

Answer: D

Watch Video Solution

14. A non-viscous liquid is flowing through a horizontal pipe as shown in the figure. Three tube A,B and C are connected to the pipe. The radii of the tubes A, B and C at the junction are 2 cm, 1 cm and 2 cm respectively. It can be said that the



A. in A is maxinmum

B. in A and C is equal

C. is same in all the three

D. in A and B is same

Answer: B

Watch Video Solution

15. Bernoulli's theorem is applicable in the case of

A. compressible liquid in stream lined flow

B. compressible liquid in turbulent flow

C. incompressible liquid in stream lined flow

D. incompressible liquid in turbulent flow.

Answer: C

Watch Video Solution

16. If air is blown under one of the pans of a physical balance in equilibrium, then the pan will

A. rises up

B. remains in the same position

C. lowers down

D. rises or lowers depending upon the velocity of air blown

Answer: C

Watch Video Solution

17. If air blown through the space between a calendar suspended from a nail on wall and the wall, then

A. the calendar moves close to the wall.

B. the calendar moves farther from the wall.

C. the position of the calendar does not change.

D. the position of the calendar may or may not change.

Answer: A

Watch Video Solution

18. A spinning ball is moving in a direction opposite to the direction of the wind. The ball moves in a curved path as

A. the pressure at the top and the botom of the ball are equal.

B. the pressure at the top $>$ the pressure at the bottom

C. the pressure at the top $<$ the pressure at the bottom

D. there is no relation between the pressures.

Answer: B

Watch Video Solution

19. The dynamic lift of an aeroplane is based on

A. Torricelli theorem

B. Bernoulli's theorem

C. Conservation of angular Momentum

D. Principle of continuity.

Answer: B

Watch Video Solution

20. A gale is on a house. The force on the roof due to the gale is

A. directed downward

B. zero

C. directed upward

D. information insufficient

Answer: C

Watch Video Solution

21. A train goes past a person standing at the edge of a platform at high speed. Then the person will be

A. attracted towards the train

B. unaffected by the train

C. pushed away by the train

D. affected only if its speed is greater than critical velocity.

Answer: A

Watch Video Solution

22. The velocity distribution curve of the stream line flow of a liquid advancing through a capillary tube is

A. circular

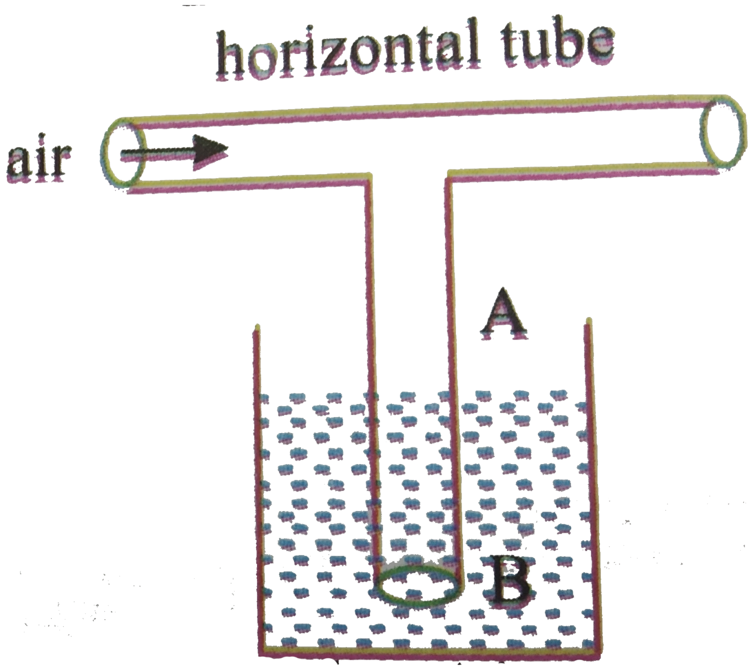
B. elliptical

C. parabolic

D. a straight line

Answer: C

Watch Video Solution



23.

Water stands at level A in the arrangement shown in figure. If a jet of air is gently blown into the horizontal tube in the direction shown in figure, then

A. water will fall below A in the capillary tube

B. water will rise above A in the capillary tube

C. there will be no effect on the level of water in the capillary tube

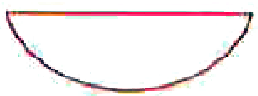
D. air will emerge from end B in the form of bubbles.

Answer: B

Watch Video Solution

24. The vertical sections of the wing of a fan are shown. Maximum upthrust is in

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

25. A car moving on a road when overtaken by a bus

A. is pulled towards the bus

B. is pushed away from the bus

C. is not affected by the bus

D. information is insufficient.

Answer: A

Watch Video Solution

C.U.Q (TORRICELLI.S THEOREM AND VISCOSITY)

1. When the temperature increases the viscosity of

A. a and c are true

B. b and c are true

C. b and d are true

D. a and d are true

Answer: A

Watch Video Solution

2. A water barrel having water upto a depth d is placed on a table of height h. A small hole is made on the wall of barrel at its bottom. If the stream of water coming out of the hole falls on the ground at a horizontal distance R from the barrel, then the value of d is

A. $\frac{4h}{R^2}$

B. $4hR^2$

C. $\frac{R^2}{4h}$

D. $\frac{h}{4R^2}$

Answer: C

Watch Video Solution

3. The main cause of viscosity is

A. force of repulsion between molecules

B. cohesive forces

C. adhesive forces

D. both cohesive and adhesive forces.

Answer: B

Watch Video Solution

4. As the depth of the river increases, the velocity of flow

A. increases

B. decreases

C. remains unchanged

D. may increase or decrease

Answer: B

Watch Video Solution

5. Viscosity is the property by virtue of which a liquid.

A. occupies minimum surface area

B. offers resistance for the relative motion between its layers.

C. becomes spherical in shape

D. tends to gain its deformed position.

Answer: B

Watch Video Solution

6. Which of the following substances has the greatest viscosity?

A. Mercury

B. Water

C. Kerosene

D. Glycerin

Answer: D

Watch Video Solution

7. Machine parts are jammed in winter due to

A. increase in viscosity of lubricant

B. decrease in viscosity of lubricant

C. increase in surface tension of lubricant

D. decrease in surface tension of lubricant

Answer: A

Watch Video Solution

8. Viscosity is most closely related to

A. density

B. velocity

C. friction

D. energy

Answer: C

Watch Video Solution

9. Rain drops fall with terminal velocity due to

A. buoyancy

B. viscosity

C. low weight

D. surface tention

Answer: B

Watch Video Solution

10. The force which tends to destroy the relative motion between liquid layers is known as

A. force due to surface tension

B. viscous force

C. gravitational force

D. force of Cohesion

Answer: B

Watch Video Solution

11. Two identical lead shots are dropped at the same time in two glass jars containing water and glycerin. The glass jars containing water and glycerin. The lead shot dropped in glycerin descends slowly because

A. viscous force is more in water than in glycerin

B. viscous force is more in glycerin than in water

C. surface tension is more in water

D. surface tension is more in glycerin

Answer: B

Watch Video Solution

12. After the storm, the sea water waves subside due to

A. surface tension of sea-water

B. disappearance of heavy currents

C. the viscosity of sea water

D. gravitational pull of the storm

Answer: C

Watch Video Solution

13. When a metallic sphere is dropped in a long column of a liquid, the motion of the sphere is opposed by the viscous force of the liquid. If the apparent weight of the sphere equals to the retardation forces on it, the sphere moves down with a velocity called.

A. critical velocity

B. terminl velocity

C. velocity gradient

D. constant velocity

Answer: B

Watch Video Solution

14. The tangential forces per unit area of the liquid layer required to maintain unit velocity gradient is known as

A. coefficient of gravitation of liquid layer

B. coefficient of friction between layers

C. coefficient of viscosity of the liquid

D. temperature coefficient of viscosity

Answer: C

Watch Video Solution

15. The quality of fountain-pen ink depends largely on

A. surface tension of the liquid

B. viscosity of ink

C. impurities in ink

D. density of ink

Answer: B

Watch Video Solution

16. The tangential force or viscous force on any layer of the liquid is directly proportional to the velcoity gradient dv/dx. Then the direction of velcoity gradient is

A. perpendicular to the direction of flow of liquid

B. parallel to the direction of flow of liquid

C. opposite to the direction of flow of the liquid

D. independent of the direction of flow of liquid.

Answer: A

Watch Video Solution

17. Viscosity of the fluids is analogous to

A. random motion of the gas molecules

B. friction between the solid surfaces

C. integral motion

D. non uniform motion of solids

Answer: B

Watch Video Solution

18. The viscous drag is

A. inversely proportional to the velocity gradient

B. directly proportional to the surface area of layers in contact

C. independent of nature of liquid

D. perpendicular to the directional liquid flow

Answer: B

Watch Video Solution

19. For an ideal fluid viscosity is

A. zero

B. infinity

C. finite but small

D. unity

Answer: A

Watch Video Solution

20. When stirring of a liquid is stopped, the liquid comes to rest due to

A. surface tension

B. gravity

C. viscosity

D. buoyancy

Answer: C

Watch Video Solution

21. Viscosity is exhibited by

A. Solids, liquids, and gases.

B. liquids and gases

C. Solids and gases

D. Solids and liquids

Answer: B

Watch Video Solution

22. A good lubricant must have

A. high viscosity

B. lpw viscosity

C. high density

D. low density

Answer: A

Watch Video Solution

23. With the increase of temperature

A. the viscosity of a liquid increases

B. the viscosity of a liquid decreases

C. the viscosity of a gas decreases

D. the viscosity of a gas remains unchanged.

Answer: B

Watch Video Solution

24. Coefficient of viscosity of a gas

A. increases with increase of temperature

B. decreases with increase of temperature

C. remains constant with increase of temperature

D. may increase or decrease with increase of temperature.

Answer: A

Watch Video Solution

25. Viscosity of water at constant temperature is

A. more in deep water

B. more in shallow waters

C. less in deep water

D. same in both deep water and shallow waters

Answer: A

Watch Video Solution

26. Hot syrup flows faster because

A. surface tension increases with temperature

B. viscosity decreases with temperature

C. viscosity increases with temperature

D. surface tension decreases with temperature

Answer: B

Watch Video Solution

27. The pressure at a depth h in a liquid of density ρ is plotted on the Y-axis and the value of h on the X-axis the graph is a straight line. The slope of the straight line is ($g =$ acceleration due to gravity)

A. ρg

B. $1/\rho g$

C. ρ/g

D. g/ρ

Answer: A

Watch Video Solution

28. A drop of water of radius r is falling rhough the air of coefficient of viscosity η with a constant velocity of v the resultant force on the drop is

A. $\frac{1}{6\pi\eta rv}$

B. $6\pi\eta rv$

C. $\sqrt{6\pi\eta rv}$

D. zero

Answer: D

Watch Video Solution

29. The paint-gun works on the principle of

A. Boyle's law

B. Bernoulli's principle

C. Archimedis' principle

D. Newton's laws of motion

Answer: B

Watch Video Solution

C.U.Q(POISEUILLE.S EQUATION)

1. The rate of flow of a liquid through a capillary tube is

A. directly proportional to the length of the tube

B. inversely proportional to the difference of pressure between the ends of the tube.

C. directly proportional to the 4^{th} power of the radius of the tube.

D. independent of the nature of the liquid

Answer: C

Watch Video Solution

2. Poiseuille's equation holds good when

A. the flow is steady and stream line

B. the pressure is constant at every cross section

C. The liquid in contact with the walls is stationary

D. All the above

Answer: D

Watch Video Solution

3. If l is length of the tube and r is the radius of the tube, then the rate of volume flow of a liquid is maximum for the following measurements. Under the same pressure difference.

A. l, r

B. $\frac{L}{2}, 2r$

C. $2l, \frac{r}{2}$

D. $2l, 2r$

Answer: B

Watch Video Solution

4. Which factor better controls the flow rate of a liquid through the syringe?

A. the pressure exerted by the thumb

B. the length of the needle

C. the nature of the liquid

D. the radius of the syringe bore.

Answer: D

Watch Video Solution

5. After terminal velocity is reached the acceleration of a body falling through a viscous fluid is:

A. zero

B. g

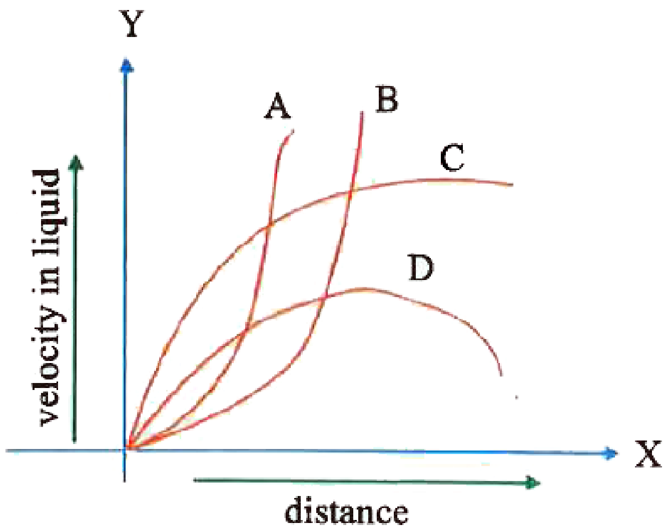
C. less than g

D. greater than g

Answer: A

Watch Video Solution

6. A small ball is dropped in a viscous liquid. Its fall in the liquid is best described by the figure



A. curve A

B. curve B

C. curve C

D. curve D

Answer: C

View Text Solution

7. A solid rubber ball of density d and radius R falls vertically through air. Assume that the air resistance acting on the ball is $F = KRV$ where K is constant and V is its velocity. Because of this air resistance the ball attains a constant velocity called terminal velocity v_T after some time. Then V_T

A. $\dfrac{4\pi R^2 dg}{3K}$

B. $\dfrac{3K}{4\pi R^2 dg}$

C. $\dfrac{4}{3}\dfrac{\pi r^3 dg}{K}$

D. $\pi r d g k$

Answer: A

Watch Video Solution

8. The terminal velocity of a small ball falling in a viscous liquid depends upon

i) its mass m

ii) its radius r

iii) the coefficient of viscosity of the liquid η and

iv) acceleration due to gravity. Which of the following relations is dimensionally true for the terminal velocity.

A. $V = \frac{Kmg}{\eta r}$

B. $V = \frac{Kmgr}{\eta}$

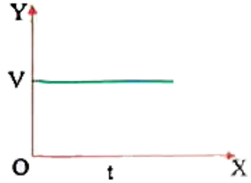
C. $V = \frac{Kmg\eta}{r}$

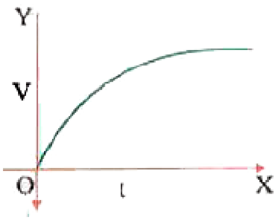
D. $V = \frac{Kr\eta}{mg}$

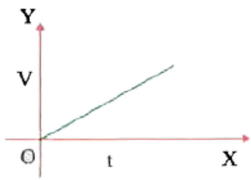
Answer: A

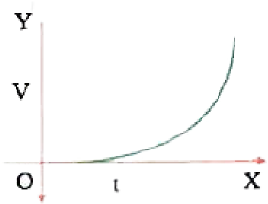
View Text Solution

9. A ball is dropped into coaltar. Its velocity time curve will be

A. 

B. 

C. 

D. 

Answer: B

Watch Video Solution

10. Two needles are floating on the surface of water. A hot needle when touches water surface between the needles then they move

A. closer

B. away

C. out of the liquid

D. into the liquid

Answer: B

Watch Video Solution

11. When there are no external forces, shape of the liquid is determined by

A. density of liquid

B. temperature only

C. surface tension

D. viscosity

Answer: C

Watch Video Solution

12. In a gravity free space, shape of a large drop of liquid is

A. spherical

B. ellisodial

C. neither Spherical nor cylindrical

D. may be Spherical or cylindrical

Answer: A

Watch Video Solution

13. Liquid drops acquire spherical shape due to

A. gravity

B. surface tension

C. viscosity

D. intermolecular separation

Answer: B

View Text Solution

14. A capillary tube, made of glass is dipped into mercury. Then

A. mercury rises in the capillary tube

B. mercury descends in capillary tube

C. mercury rises and flows out of capillary tube

D. mercury neither rises nor descends in the capillary tube.

Answer: B

Watch Video Solution

15. The height upto which water will rise in a capillary tube will be:

A. maximum when water temperature is $4^\circ C$

B. minimum when water temperature is $4^\circ C$

C. minimum when water temperature is $4^\circ C$

D. same at all temperatures

Answer: B

Watch Video Solution

16. At critical temperature surface tension becomes

A. 0

B. 1

C. infinite

D. negative

Answer: A

Watch Video Solution

17. The fundamental quantity which has the same power in the dimensional formula of surface tension and coefficient of viscosity is

A. mass

B. length

C. time

D. none

Answer: A

Watch Video Solution

18. Small droplets of a liquid are usually more spherical in shape than larger drops of the same liquid because

A. force of surface tension is equal and opposite to the force of gravity

B. force of surface tension predominates the force of gravity

C. force of gravity predominates the surface tension

D. force of surface tension and force of gravity act in the same direction and are equal.

Answer: B

Watch Video Solution

19. Mercury does not wet glass, wood or iron because

A. cohesive force is less than adhesive force

B. cohesive force is greater than adhesive force

C. angle of contact is less than 90°

D. cohesive force is equal to adhesive force

Answer: B

Watch Video Solution

20. The surface tension of a liquid at its boiling point is

A. maximum

B. zero

C. same as at room temperature

D. minimum but more than zero

Answer: B

Watch Video Solution

21. The addition of soap changes the surface tension of water to T_1 and that of salt solution changes to T_2. Then

A. $T_1 = T_2$

B. $T_1 > T_2$

C. $T_1 < T_2$

D. $T_1 \geq T_2$

Answer: C

Watch Video Solution

22. Surface tension of water is T_1. When oil spreads on water surface tension becomes T_2, then

A. $T_1 > T_2$

B. $T_1 = T_2$

C. $T_1 < T_2$

D. $T_1 = \frac{T_2}{2}$

Answer: A

Watch Video Solution

23. Two pieces of glass plate one upon the other with a little water between them cannot be separated easily because of

A. inertia

B. pressure

C. viscosity

D. surface tension

Answer: D

Watch Video Solution

24. The quantity on which the rise of liquid in a capillary tube does not depend is

A. density of liquid

B. radius of capillary tube

C. angle of contact

D. atmospheric pressure

Answer: D

Watch Video Solution

25. The end of a glass tube becomes round on heating due to

A. friction

B. viscosity

C. gravity

D. surface tension

Answer: D

Watch Video Solution

26. The potential energy of molecule on the surface of a liquid as compared to in side the liquid is

A. zero

B. smaller

C. the same

D. greater

Answer: D

Watch Video Solution

27. A drop of water breaks into two droplets of equal size. In this process which of the following statements is correct?

(1). The sum of temperature of the two droplets together is equal to the original temperature of the drop.

(2).the sum of masses of the two droplets is equal to the original mass of the drop.

(3). the sum of the radii of the two droplets is equal to the radius of the original drop.

(4). the sum of the surface areas of the two droplets is equal to the surface area of the original drop.

A. 1 is correct

B. 2 is correct

C. 3 is correct

D. 4 is correct

Answer: B

Watch Video Solution

28. It is difficult to fill a capillary tube with mercury that with water since

A. angle of contact between glass & mercury is more than 90° and the angle of contact between glass and water is less than 90°.

B. angle of contact is between glass and mercury is less than 90° and the angle of contact between glass and water is more than 90°.

C. angle of contact is same for both water and mercury.

D. mercury is less dense than water.

Answer: A

Watch Video Solution

29. A water proofing agent chages the angle of contact from

A. acute to $\pi/2$

B. $\pi/2$ to obtuse

C. acute to obtuse value

D. obtuse to acute value

Answer: C

Watch Video Solution

30. A liquid does not wet the solid surface if the angle of contact is

A. 0°

B. $= 45^{\circ}$

C. $= 90^{\circ}$

D. $> 90^{\circ}$

Answer: D

Watch Video Solution

31. The liquid meniscus in a capillary tube will be convex, if the angle of contact is

A. greater than 90°

B. less than 90°

C. equal to 90°

D. equal to zero

Answer: A

Watch Video Solution

32. The rise of liquid into capillary tube is h_1. If the apparatus is taken in a lift moving up with acceleration the height is h_2 then

A. $h_1 = h_2$

B. $h_1 > h_2$

C. $h_2 > h_1$

D. $h_2 = 0$

Answer: B

Watch Video Solution

33. The nature of r-h graph (r is radius of capillary tube and h is capillary rise) is

A. straight Line

B. parabola

C. ellipse

D. rectangular hyperbola

Answer: D

Watch Video Solution

34. If L is the capillary rise or dip and A the cross sectional area of the tube, other condition being the same, then

A. $LA = Constant$

B. $L\sqrt{A} = \text{Constant}$

C. $L/A = \text{Constant}$

D. $L/\sqrt{A}$ = Constant

Answer: B

Watch Video Solution

35. Water rises in a capillary tube to a height H, when the capillary tube is vertical. If the same capillary is now inclined to the vertical the length of water column in it will

A. increase

B. decrease

C. will not change

D. may increase or decrease depending on the angle of inclination.

Answer: A

Watch Video Solution

36. The excess pressure inside a soap bubble is

A. inversely proportional to the surface tension

B. inversely proportional to its radius

C. directly proportional to square of its radius

D. directly proportional to its radius

Answer: B

Watch Video Solution

37. The surface tension of a liquid ___ with rise of temperature.

A. increases

B. decreases

C. remains same

D. first decreased and then increases

Answer: B

Watch Video Solution

38. If two soap bubbles of different radii are connected by a tube.

A. air flows from the bigger bubbles to the smaller bubble till the sizes become equal.

B. air flows from bigger bubble to the smaller bubble till the sizes are interchanged

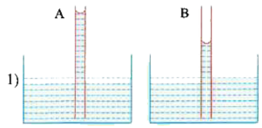
C. air flows from the smaller bubble to the bigger.

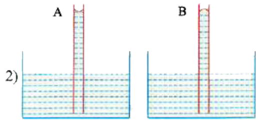
D. there is no flow of air.

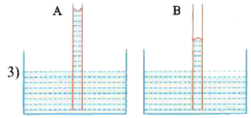
Answer: C

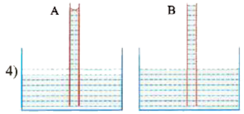
Watch Video Solution

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

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

40. If a big drop of liquid at 27° is broken into number of small drops then the temperature of the droplets is

A. $= 27^{\circ} C$

B. $> 27^{\circ} C$

C. $< 27^{\circ} C$

D. $= 54^{\circ} C$

Answer: C

Watch Video Solution

41. With the increase in temperature the angle of contact glass and water

A. decreases

B. increases

C. remains cont

D. some times increases and some times decreases

Answer: A

Watch Video Solution

42. When a capillary tube is dipped into a liquid, the liquid neither rises nor falls in the capillary.

A. 20°

B. 90°

C. 30°

D. 70°

Answer: B

Watch Video Solution

43. The water proofing agents:

A. increase the surface tension T and decrease the angle of contact θ

B. increase both T and θ

C. decrease both T and θ

D. decrease T and increase θ

Answer: B

Watch Video Solution

44. A capillary is dipped in water vessel kept on a freely falling lift, then

A. water will not rise in the tube

B. water will rise to the maximum available height of the tube

C. water will rise to the height observed under normal condition

D. water will rise to the height below that observed under normal condition.

Answer: B

Watch Video Solution

EXERCISE - I - (C.W) (PRESSURE AND PASCAL.S LAW)

1. In car lift compressed air exerts a force F_1 on a small piston having a radius of 5 cm. This pressure is transmitted to a second piston of radius 15 cm. If the mass of the car to be lifted is 1350 kg, what is F_1? What is the pressure necessary to ac complish this task ?

A. $14.7 \times 10^3 N$

B. $1.47 \times 10^3 N$

C. $2.47 \times 10^3 N$

D. 24.7×10^3

Answer: B

Watch Video Solution

2. A bucket containing water of depth 15 cm is kept in a lift which is moving vertically upward with an acceleration 2g. Then the pressure on the bottom of the bucket in $kgwt/cm^2$ is

A. 0.45

B. 0.045

C. 0.015

D. 0.15

Answer: B

Watch Video Solution

3. An inverted u-tube has its two limbs in water and kerosene contained in two beakers. If water rises to a height of 10 cm to what height does kerosene (density $= 0.8gm/cc$) rise in the other limb?

A. 10 cm

B. 12.5 cm

C. 15 cm

D. 20 cm

Answer: B

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4. Vessel contains oil $(density 0.8 g/cc)$ over mercury (density $13.6 g/cc$) A homogeneous sphere floats with half its volume immersed in mercury and the other half in oil. The density of the sphere in g/c c is

A. 14.4

B. 7.2

C. 3.6

D. 12.2

Answer: B

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5. An air tight container having a lid with negligible mass and an area of $8cm^2$ is partially evacuated. If a 48 N forces is required to pull the lid of the container and the atmospheric pressure is $1.0 \times 10^5 Pa$ the pressure in the container before it is opened must be

A. 0.6atm

B. 0.5 atm

C. 0.4 atm

D. 0.2 atm

Answer: C

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6. A brass sphere weighs 100 gm. Wt in air. It is suspended by a thread in a liquid of specific gravity $= 0.8$. If the specific gravity of brass is 8, the tension in the thread in newtons is

A. 0.0882

B. 8.82

C. 0.882

D. 0.00882

Answer: C

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7. A cube of side 20 cm is floating on a liquid with 5 cm of the cube outside the liquid. If the density of liquid is $0.8gm/cc$ then the mass of the cube is

A. 4.2 kg

B. 4.8 kg

C. 5kg

D. 5.2 kg

Answer: B

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8. If a body floats with $(m/n)^{th}$ of its volume above the surface of water, then the relative density of the material of the body is

A. $(n - m)/n$

B. m/n

C. n/m

D. $(n - m)/m$

Answer: A

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9. When a body lighter than water is completely submerged in water, the buoyant force acting on it is found to be n times its weight. The specific gravity of the material of the body is

A. $\frac{1}{1+n}$

B. $\frac{1}{n}$

C. n

D. $n+\frac{1}{n}$

Answer: B

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EXERCISE - I - (C.W) (EQUATION OF CONTINUITY, BERNOULLI.S THEOREM AND APPLICATIONS)

1. The velocity of the wind over the surface of the wing of an aeroplane is $80ms^{-1}$ and under the wing $60ms^{-1}$. If the area of the wing is $4m^2$, the dynamic lift experienced by the wing is [density of air $= 1.3kg.m^{-3}$]

A. 3640 N

B. 7280 N

C. 14560 N

D. 72800 N

Answer: B

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2. An aeroplane of mass 5000 kg is flying at an altitude of 3 km. if the area of the wings is $50m^2$ and pressure at the lower surface of wings is $0.6 \times 10^5 Pa$, the pressure on the upper surface of wings is (in pascal) $\left(g = 10ms^{-2}\right)$

A. 59×10^3

B. 2×10^4

C. 6×10^3

D. 59

Answer: A

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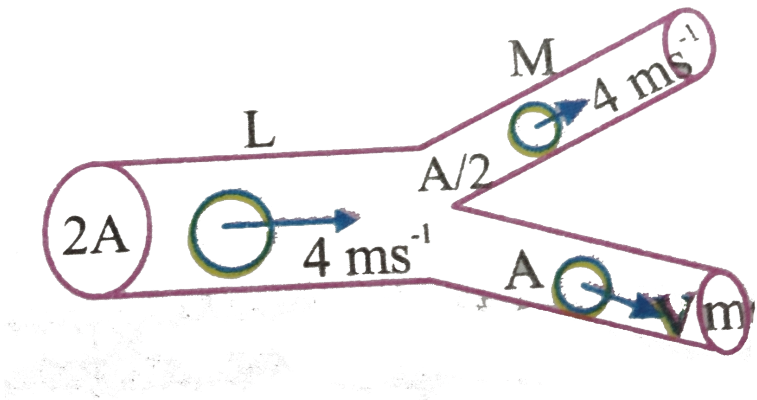

3.

An incompressible liquid flows through a horizontal tube LMN as shown in the figure. Then the velocity V of the liquid through the tube N is:

A. $1ms^{-1}$

B. $2ms^{-1}$

C. $4.5ms^{-1}$

D. $6ms^{-1}$

Answer: D

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4. A liquid is kept in a cylindrical jar, which is rotated about the cylindrical axis. The liquid rises at its sides. The radius of the jar is r and speed of rotation is ω the difference in height at the centre and the sides of the jar is

A. $\frac{r^2\omega^2}{g}$

B. $\frac{r^2\omega^2}{2g}$

C. $\frac{g}{r^2\omega^2}$

D. $\frac{2g}{r^2\omega^2}$

Answer: B

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5. The reading of pressure meter attached with a closed pipe is $3.5 \times 10^5 Nm^{-2}$. On opening the value of the pipe, the reading of the pressure meter is reduced to $3.0 \times 10^5 Nm^{-2}$. Calculate the speed of the water flowing in the pipe.

A. 10 cm/s

B. 10 m/s

C. 0.1 m/s

D. 0.1 cm/s

Answer: B

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6. At the mount of the tap area of cross-section is $2.0 cm^2$ and the speed of water is $3 m/s$. The area of cross-section of the water column 80 cm below the tap is (use $g = 10 m/s^2$)

A. $0.6cm^2$

B. $21.2cm^2$

C. $1.5cm^2$

D. $2.0cm^2$

Answer: B

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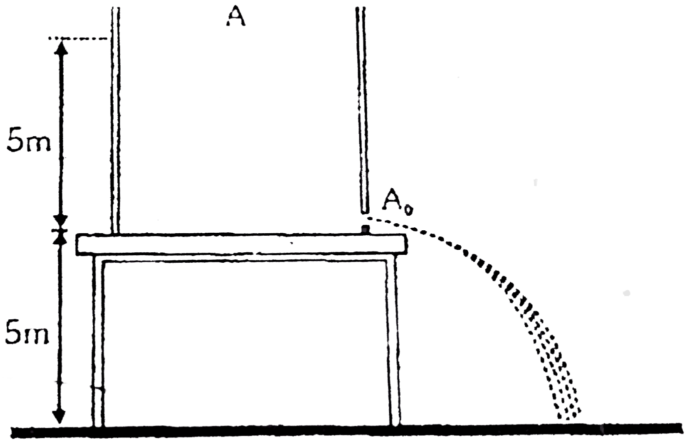
EXERCISE - I - (C.W) (TORRICELLI.S THEOREM)

1. 

A cylinderical tank 1 m in radius rests on a plaform 5 m high. Initially the tank is filled with upto a height of 5m a plug whose area is $10^{-4}cm^2$ is removed from an orifice on the side of the tank at the bottom.

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

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

A. 10

B. 5

C. $5.\sqrt{2}$

D. $10.\sqrt{2}$

Answer: A

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2. In the above problem, the initial speed with which water strikes the ground in ms^{-1} is

A. 10

B. 5

C. $5\sqrt{2}$

D. $10\sqrt{2}$

Answer: D

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3. There is a hole at the side-bottom of a big water tank. The area of the hole is $4mm^2$ to it a pipe is connected. The upper surface of water is 5 m above the hole. The rate of flow of water through the pipe is (in $m^3 s^{-1}$)$(g = 10 ms^{-2})$

A. 4×10^{-5}

B. 4×10^{5}

C. 4×10^{-6}

D. 28×10^{-5}

Answer: A

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EXERCISE - I - (C.W) (COEFFICIENTY OF VISCOSITY & VISCOUS FORCE)

1. If the shearing stress between the horizontal layers of water in a river is 1.5 milli newton$/m^2$ and $\eta_{\text{water}} = 1 \times 10^{-3} Pa.s$ The velocity gradient is ...s^{-1}

A. 1.5

B. 3

C. 0.7

D. 1

Answer: A

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2. A force of 10 N is required to draw rectangular glass plate on the surface of a liquid with some velocity. Force needed to draw another glass plate of 3 times length and 2 times width with same velocity is

A. $5/3N$

B. 10 N

C. 60 N

D. 30 N

Answer: C

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EXERCISE - I - (C.W) (POISEUILLE.S EQUATION)

1. Water is flowing through a capillary tube at the rate of $20 \times 10^{-6} m^3 / s$. Another tube of same radius and double the length is connected in series to the first tube. Now the rate of flow of water in $m^3 s^{-1}$ is

A. 10×10^{-6}

B. 3.33×10^{-6}

C. 6.67×10^{-6}

D. 20×10^{-6}

Answer: C

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2. An artery in a certain person has been widened $1\frac{1}{2}$ times the original diameter. If the pressure difference across the artery is maintained constant, the blood flow through the artery will be increased to

A. $3/2 \times$

B. $9/4 \times$

C. no change

D. $81/16 \times$

Answer: D

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3. Water flowing from a hose pipe fills a 15 litre container in one minute. The speed of water from the free opening of radius 1 cm is (in ms^{-1})

A. 2.5

B. $\frac{\pi}{2.5}$

C. $\frac{2.5}{\pi}$

D. 5π

Answer: C

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4. Two liquids are allowed to flow through two capillary tubes of length in the ratio $1:2$ and radii in the ratio $2:3$ under the same pressure difference. If the volume rates of flow of the liquids are in the ratio $8:9$ the ratio of their coefficients of viscosity is

A. $1:3$

B. $3:1$

C. $4:9$

D. $9:4$

Answer: C

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5. The viscous resistance of a tube to liquid flow is R. its resistance for a narrow tube of same length and $\frac{1}{3}$ times radius is

A. $R/3$

B. 3R

C. 27R

D. 8IR

Answer: D

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EXERCISE - I - (C.W) (TERMINAL VELOCITY & VISCOUS FORCE)

1. Eight spherical rain drops of the same mass and radius are falling down with a terminal speed of $6cms^{-1}$. If they coalesce to form one big drop , what will be the terminal speed of bigger drop ? (Neglect the buoyancy of the air)

A. $1.5cms^{-1}$

B. $6cms^{-1}$

C. $324cms^{-1}$

D. $32cms^{-1}$

Answer: C

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

A. $mg\left(\frac{d_1}{d_2}\right)$

B. $mg\left(1 - \frac{d_2}{d_1}\right)$

C. $mg\left(\frac{d_1 + d_2}{d_1}\right)$

D. $mg\left(\frac{d_1 + d_2}{d_2}\right)$

Answer: B

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EXERCISE - I - (C.W) (FORCE DUE TO SURFACE TENSION)

1. The length of a rubber cord floating on water is 5 cm. The force needed to pull the cord out of water is ....N (surface tension of water is $7.2 \times 10^{-4} Nm^{-1}$).

A. 7.2×10^{-3}

B. 7.2×10^{-4}

C. 7.2×10^{-5}

D. 7.2×10^{-2}

Answer: C

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2. Calculate the force required to separate the glass plates of area $10^{-2}m^2$ with a film of water 0.05 mm thickness between them (surface tension of water $= 70 \times 10^{-3}N/m\big)$)

A. 28N

B. 112N

C. 5.6 N

D. 11.2 N

Answer: A

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3. A thin wire ring of 3 cm radius float on the surface of liquid. The pull required to raise the ring before the film breaks is $30.14 \times 10^{-3}N$ more than its weight. The surface tension of the liquid (in $Nm^{-1}\big)$ is

A. 80×10^{-3}

B. 87×10^{3}

C. 90×10^{3}

D. 98×10^{-3}

Answer: A

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4. A wire is bent in the form of a U-shape and a slider of negligible mass is connecting the two vertical sides of the U-shape. This arrangement is dipped in a soap solution and lifted a thin soap film is formed in t he frame it supports a weight of $2.0 \times 10^{-2}N$ if the length of the slider is 40 cm what is the surface tension of the film?

A. $25Nm^{-1}$

B. $2.5Nm^{-1}$

C. $2.5 \times 10^{-2}Nm^{-1}$

D. $2.5 \times 10^{-3} Nm^{-1}$

Answer: C

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5. A ring of inner and outer radii 8 and 9 cm is pulled out of water surface with a force of [S.T of water $(T) = 70 \text{dyne}/cm$]

A. $26 \times 10^{-2} N$

B. $12.6 \times 10^{-2} N$

C. $7.48 \times 10^{-2} N$

D. $3.08 \times 10^{-2} N$

Answer: C

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6.

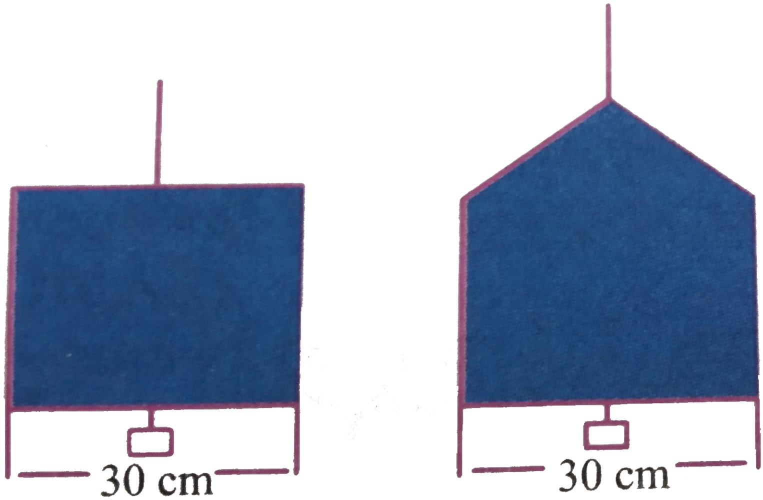

Fig (i) Fig (ii)

In Fig(i) a thin film supports a small weight $3.5 \times 10^{-2} N$ The weight supported by a film of the same liquid at the same temperature in fig.(ii) is

A. $3.5 \times 10^{-2} N$

B. $3.5 \times 10^{-3} N$

C. $3.5 \times 10^{-1} N$

D. $3.5 \times 10^{-4} N$

Answer: A

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7. Work of 6.0×10^{-4}N joule is required to the done in increasing the size of soap film form $10cm \times 6cm$ to $10cm \times 11cm$. The surface tension of the film is (in N/m)

A. 5×10^{-2}

B. 6×10^{-2}

C. 1.5×10^{-2}

D. 1.2×10^{-2}

Answer: B

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8. The work done in increasing the radius of a soap bubble from 4 cm to 5 cm is Joule (given surface tension of soap water to be $25 \times 10^{-3} N/m$)

A. 0.5657×10^{-3}

B. 5.657×10^{-3}

C. 56.5×10^{-3}

D. 565×10^{-3}

Answer: A

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9. A mercury drop of radius 1 cm is sprayed into 10^6 drops of equal size. The energy expended in joule is (surface tension of mercury is $\left(460 \times 10^{-3} N/m\right)$

A. 0.057

B. 5.7

C. 5.7×10^{-4}

D. 5.7×10^{-6}

Answer: A

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10. 8000 identical water drops combine together to form a big drop. Then the ratio of the final surface energy of all the initial surface energy of all the drops together is

A. $1:10$

B. $1:15$

C. $1:20$

D. $1:25$

Answer: C

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EXERCISE - I - (C.W) (CAPILLARITY & CAPILLARY RISE)

1. When two capillary tubes A and B are immersed in water , the heights of water columns are found to be in the ratio $2:3$ the ratio of the radii of tubes A and B is

A. $2:3$

B. $4:9$

C. $9:4$

D. $3:2$

Answer: D

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2. A capillary tube of radius 0.25 mm is dipped vertically in a liquid of density $800kgm^{-3}$ and of surface tension $3 \times 10^{-2}Nm^{-2}$. The angle of contact of liquid -glass is given by $\cos\theta = 0.3$ If $g = 10ms^{-2}$ the rise of liquid in the capillary tube is.. Cm

A. 9

B. 0.9

C. 9×10^{-3}

D. 0.09

Answer: B

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3. When a clean lengthy capillary tube is dipped vertically in a beaker containing water, the water rises to a height of 8 cm. What will happen if another capillary tube of length 4 cm and same radius is dipped vertically in the same beaker containing water. (angle of contact of water is 0°)

A. Water will flow out like a fountain.

B. Water will rise to a height of 4 cm only and the angle of contact will be zero.

C. Water will rise to a height of 4 cm only and the angle of contact will be 60°

D. Water will not rise at all

Answer: C

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4. Capillary tubes of diameters 1,1.5,2 mm are dipped vertically in the same liquid. The capillary ascents of the liquid in the tube are in the ratio

A. $2:3:4$

B. $6:4:3$

C. $3:4:6$

D. $4:3:2$

Answer: B

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5. A capillary tube is taken from the Earth to the surface of the moon. The rise of the liquid column on the Moon (acceleration due to gravity on the Earth is 6 times that of the Moon) is

A. six times that on the Earth surface

B. $\frac{1}{6}$ that on the Earth's surface

C. equal to that on the Earth's surface.

D. zero

Answer: A

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6. When a capillary tube is lowered into water the mass of the water raised above the outside level is 5 gm. If the radius of the tube is doubled the mass of water that raises in the tube above the outside level is

A. 25 gm

B. 5 gm

C. 310 gm

D. 20 gm

Answer: C

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7. A vessel has a small hole at its bottom. If water can be poured into it upto a height of 7 cm without leakage $\left(g = 10ms^{-2}\right)$ the radius of the hole is (surface tension of water is $0.7Nm^{-1}$)

A. 2 mm

B. 0.2 mm

C. 0.1 mm

D. 0.4 mm

Answer: B

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8. A 20 cm long capillary tube is dipped in water. The water rises up to 8 cm. If the entire arrangement is put in a freely falling elevator, the length of water column in the capillary tube will be

A. 4 cm

B. 20 cm

C. 8 cm

D. 10 cm

Answer: B

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9. When a cylindrical tube is dipped vertically into a liquid the angle of contact is 140°. When the tube is dipped with an inclination of 40° the angle of contact is

A. 100°

B. 140°

C. 180°

D. 60°

Answer: B

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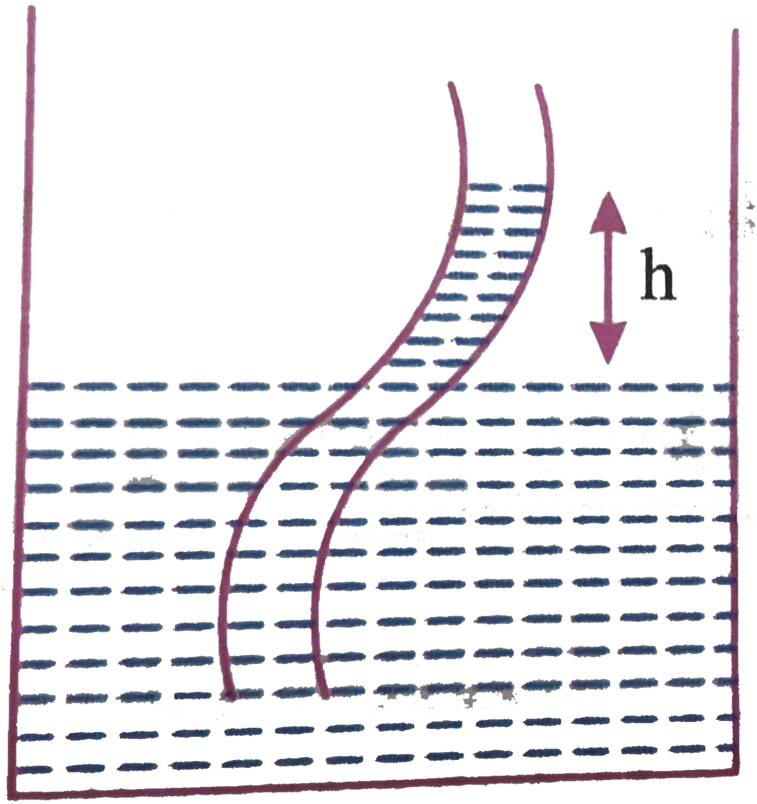
10.



Water rises in a straight capillary tube upto a height of 5 cm when held vertical in water. If the tube is bent as shown figure then the height of water column in it will be

A. 5 cm

B. less than 5 cm

C. more than 5 cm

D. $5\cos\alpha$

Answer: A

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EXERCISE - I - (C.W) (EXCESS PRESSURE INSIDE A LIQUID DROP AND SOAP BUBBLE)

1. Two liquid drops have their diameters as 1 mm and 2 mm. The ratio of excess pressures in them is

A. $1:2$

B. $2:1$

C. $4:1$

D. $1:4$

Answer: B

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2. The pressure inside two soap bubbles is 1.01 and 1.02 atmosphere. The ration of their respective volumes is

A. $102:101$

B. $(102)^2:(101)^2$

C. $8:1$

D. $2:1$

Answer: C

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3. Excess pressure inside one soap bubble is four times that of other. Then the ratio of volume of first bubble to second one is

A. $1:64$

B. $64:1$

C. $4 : 1$

D. $1 : 2$

Answer: A

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EXERCISE - I - (C.W) (COMBINATION OF DROPS & BUBBLES)

1. If a soap bubble of radius 3 cm coalesce with another soap bubble of radius 4 cm under isothermal conditions the radius of the resultant bubble formed is in cm

A. 7

B. 1

C. 5

D. 12

Answer: C

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EXERCISE - I - (H.W) (PRESSURE AND PASCAL.S LAW)

1. If the atmospheric pressure is 76 cm of Hg at what depth of water the pressure will becomes 2 atmospheres nearly.

A. 862cm

B. 932 cm

C. 982cm

D. 1033 cm

Answer: D

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EXERCISE - I - (H.W) (VARIATION OF PRESSURE, UPTHRUST)

1. Two blocks A and B float in water. If block A floats with $\frac{1}{4}$ th of its volume immersed and block B floats with $\frac{3}{5}$ th of its volume immersed, the ratio of their densities is

A. $5:12$

B. $12:5$

C. $3:20$

D. $20:3$

Answer: A

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2. A water filled cylinder of height 50 cm and base area $20cm^2$ is placed on a table with the base on the table. The thrust offered by water on the table is

A. 98N

B. 49N

C. 9.8N

D. 4.9 N

Answer: C

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3. If S_1 is the specific gravity of a solid with respect to a liquid and S_2 is the specific gravity of the liquid with respect to water, then the specific gravity of the solid with respect to water is

A. $S_1 + S_2$

B. $S_1 \times S_2$

C. $S_1 - S_2$

D. S_1 / S_2

Answer: B

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4. If a block of iron (density $5gcm^{-3}$) is size 5 cm x 5 cm x 5 cm was weight while completely submerged in water, what would be the apparent weight ?

A. $5 \times 5 \times 5 \times 5$ gm wt

B. $4 \times 4 \times 4 \times 5$ gm wt

C. $3 \times 5 \times 5 \times 5$ gm wt

D. $4 \times 5 \times 5 \times 5$ gm wt

Answer: D

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5. A beaker is partly filled with water, the beaker and the contents have a mass of 50 gm. A piece of wood having a volume of 5 cc. is floated in the beaker. The density of wood is $0.8\frac{g}{c.c}$ the mass of the beaker and its contents:

A. 50g

B. 54g

C. 46g

D. 56.25g

Answer: B

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6. A woman of mass 50 kg stands on a wooden block placed over a tank of water. The wooden block is such that the woman is entirely above water. If relative density of wood is 0.85, the volume of the wooden block is:

A. $0.5 \times 10^{-1} m^3$

B. $0.585 \times 10^{-1} m^3$

C. $0.33 m^3$

D. $054 \times 10^{-1} m^3$

Answer: C

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7. A metallic block weighs $15N$ in air. It weights $12N$ when immersed in water and $13N$ when immersed in another liquid. What is the specific gravity of the liquid?

A. $5, \frac{2}{3}$

B. $\frac{2}{3}, 5$

C. $\frac{4}{5}, 5$

D. $5, \frac{4}{5}$

Answer: A

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8. What mass of lead will weigh as much as 8 gm of iron when both are immersed in water ? (given specific gravities of iron and lead are 8 and 11 respectively).

A. 1.1 gm

B. 2.2 gm

C. 5.5 gm

D. 7.7 gm

Answer: D

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9. The base area of boat is $2m^2$. A man weighing 76 kg weight steps into the boat. Calculate the depth into which the boat sinks further

A. 1.2cm

B. 2.5cm

C. 33.8cm

D. 4.2cm

Answer: C

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10. A sphere of density d is let fall in a liquid of density $\frac{d}{4}$. The acceleration of the body will be

A. $\frac{g}{4}$

B. $\frac{3g}{4}$

C. $\frac{g}{2}$

D. g

Answer: B

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EXERCISE - I - (H.W) (EQUATION OF CONTINUITY, BERNOULLI.S THEOREM AND ITS APPLICATIONS)

1. An iceberg is floating partly immersed in sea water, the density of sea water is $1.03gcm^{-3}$ and that of ice is $0.92gcm^{-3}$. The fraction of the total volume of the iceberg above the level of sea water is

A. 89%

B. 11%

C. 1%

D. 34%

Answer: B

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2. Two water pipes of diameters 4 cm and 8 cm are connected with main supply line. The velocity of flow of water in the pipe of 8 cm diameter is how many times to that of 4 cm diameter pipe?

A. 4

B. $1/4$

C. 2

D. $1/2$

Answer: B

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3. A horizontal pipe of non uniform cross section has water flow through it such that the velocity is $2ms^{-1}$ at a point where the pressure 40 kpa.

The pressure at a point where the velocity of water flow is $3ms^{-1}$ is (in kilopascal)

A. 27

B. 60

C. 37.5

D. 40

Answer: C

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4. In a horizontal pipe line of uniform cross-section, pressure falls by 5 Pa between two points separated by 1 km. The change in the kinetic energy per kg of the oil flowing at these points is (density of oil $= 800 kgm^{-3}$)

A. $6.25 \times 10^{-3} Jkg^{-1}$

B. $5.25 \times 10^{-4} Jkg^{-1}$

C. $3.25 \times 10^{-5} Jkg^{-1}$

D. $4.25 \times 10^{-2} Jkg^{-1}$

Answer: A

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5. In a test experiment on a model aeroplane in a wind tunnel, the flow speeds on the upper and lower surfaces of the wing are $70ms^{-1}$ and $83ms^{-1}$ respectively. What is the lift on the wing, if its area is $2.5m^2$? Take the density of air to be $1.3kgm^{-3}$

A. 1513 N

B. 1513 dynes

C. 151.3 N

D. 151.3 dynes

Answer: A

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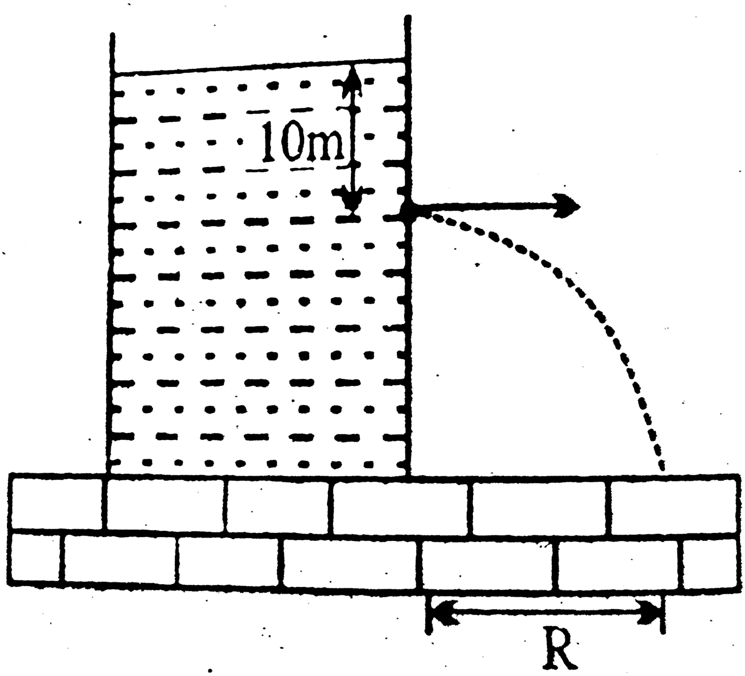
EXERCISE - I - (H.W) (TORRICELLI.S THEOREM)

1. A large tank is filled with water $\left(\text{density} = 10^3 kg/m^3\right)$. A small hole is made at a depth 10m below water surface. The range of water issuing out of the hole Is R on ground. What extra pressure must be applied on the water surface so that the range becomes 2R $\left(\text{take} 1 atm = 10^5 Pa \text{ and } g = 10 m/s^2\right)$:



A. 9 atm

B. 4 atm

C. 5 atm

D. 3 atm

Answer: D

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2. Tanks A and B open at the top contain who different liquids upto certain height in them. A hole is made on the wall of each tank at a depth h from the surface of the liquid. The area of the hole in A is twice that of in B. If the liquid mass flux through each hole is equal, then the ratio of the densities of the liquids respectively is

A. $\frac{2}{1}$

B. $\frac{3}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{2}$

Answer: D

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3. The level of water in a tank is 5 m high. A hole of area of cross section 1 cm^2 is made at the bottom of the tank. The rate of leakage of water for the hole in $m^3 s^{-1}$ is $\left(g = 10ms^{-2}\right)$

A. 10^{-3}

B. 10^{-4}

C. 10

D. 10^{-2}

Answer: A

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4. Water is maintained at a constant level of 4.9 m in a big tank. The tank has a small hole to the wall near the bottom. The bottom of the tank is 2.5 above the ground level. The horizontal distance at which water touches are ground is

A. 19.6m

B. 7.m

C. 35 m

D. 78.4 m

Answer: B

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5. A liquid kept in a cylindrical vessel of radius 0.3 m is rotated with a speed 2 r.p.s. The difference in the height of the liquid at the centre of the vessel and at it's sides it

A. 0.01m

B. 0.02m

C. 0.04m

D. 0.8m

Answer: D

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EXERCISE - I - (H.W) (COEFFICIENT OF VISCOSITY & VISCOUS FORCE)

1. A metal plate of area $10^{-2} m^2$ is placed on a liquid layer of thickness $2 \times 10^{-3} m$. If the liquid has coefficient of viscosity 2 S.I. units the force required to move the plate with a velocity of $3 \frac{cm}{s}$ is

A. 0.3N

B. 0.03 N

C. 3 N

D. 30 N

Answer: A

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2. The velocity of water in a river is 18 kmph near the surface. If the river is 4 m deep, the shearing stress between horizontal layers of water in Nm^{-2} is $\left(\eta_{\text{water}} = 1 \times 10^{-3} pa. s\right)$

A. 2.5×10^{-3}

B. 1.25×10^{-3}

C. 0.75×10^{-3}

D. 0

Answer: B

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EXERCISE - I - (H.W) (POISEUILLE.S EQUATION)

1. The radius of the capillary tube increased 0.2% then the percentage increase in the rate of flow of liquid through it is

A. 0.8%

B. 0.4%

C. 0.2%

D. 0.05%

Answer: A

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2. A tube of length L and radius R is joined to another tube of length $\frac{L}{3}$ and radius $\frac{R}{2}$. A fluid is flowing through this joint tube. If the pressure difference across the first tube is P then pressure difference across the second tube is

A. $16P/3$

B. $4P/3$

C. P

D. $3P/16$

Answer: A

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3. Water is flowing through a capillary tube at the rate of $20 \times 10^{-6} m^3/s$. Another tube of same radius and double the length is connected in series to the first tube. Now the rate of flow of water in $m^3 s^{-1}$ is

A. 20×10^{-6}

B. 40×10^{-6}

C. 0

D. 10×10^{-6}

Answer: D

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4. Water flows through a capillary tube at the rate of 10 cc per minute. If the pressure difference across the same tube is doubled, the rate of flow of water through the tube will be (in cc per minute)

A. 20

B. 5

C. 40

D. 2.5

Answer: A

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5. Two capillary tubes of same length but radii $r_1 r_2$ are arranged horizontally side by side to the bottom of a large vessel containing water. The radius of single tube of same length that can replaced them so that the rate of volume flow through it is equal to the total rate of volume flow through the two tubes is

A. $r_1 + r_2$

B. $\left(r_1 + r_2\right)^{1/4}$

C. $\left(r_1 + r_2\right)^4$

D. $\left(r_1^4 + r_2^4\right)^{1/4}$

Answer: D

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6. Water flows with a velocity V in a tube of diameter d and the rate of flow is Q. another tube of diameter 2d is coupled to the first one. The velocity of water flowing out and rate of flow in the second tube are respectively.

A. $\frac{V}{4}$ and Q

B. $\frac{V}{2}$ and $\frac{Q}{2}$

C. $2V$ and $2Q$

D. $\frac{V}{2}$ and $2Q$

Answer: A

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EXERCISE - I - (H.W) (REYNOLDS NUMBER)

1. The flow rate from a tap of diameter $1.25cm$ is 3 L//min. The coefficient of viscosity of water is 10^{-3} pa-s. Characterize the flow.

A. stream line

B. turbulent

C. a and b

D. none

Answer: A

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EXERCISE - I - (H.W) (TERMINAL VELOCITY)

1. Eight spherical drops of equal size are falling vertically through air with a terminal velocity $0.1m/s$. If the drops coalesce to form a large spherical drop it is terminal velocity would be.

A. $0.2m/s$

B. $0.1m/s$

C. $0.4m/s$

D. $0.005m/s$

Answer: C

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EXERCISE - I - (H.W) (FORCE DUE TO SURFACE TENSION)

1. The terminal velocity V of a spherical ball of lead of radius R falling through a viscous liquid varies with R such that

A. $\frac{V}{R} = \text{ Constant}$

B. $VR = \text{Constant}$

C. $V = \text{Constant}$

D. $\frac{V}{R^2} = \text{Constant}$

Answer: D

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2. A 10 cm long wire is placed horizontally on the surface of water and is gently pulled up with a force of $2 \times 10^{-2} N$ to keep the wire in equilibrium. The surface tension of water in $\frac{N}{m}$ is

A. 0.002

B. 0.001

C. 0.1

D. 0.280.

Answer: C

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3. A drop of liquid pressed between two glass plates spreads to a circle of diameter 10 cm. Thickness of the liquid film is 0.5 mm and surface tension is $70 \times 10^{-3} Nm^{-1}$ the force required to pull them apart is

A. 4.4 N

B. 1.1N

C. 2.2 N

D. 3.6 N

Answer: C

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4. A square wire frame of side L is dipped in a liquid. On taking out , a membrane is formed if the surface tension of liquid is T, the force acting on the frame due to the membrane will be

A. 2 TL

B. 4 TL

C. 8 TL

D. 16 TL

Answer: C

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EXERCISE - I - (H.W) (WORK & SURFACE ENERGY)

1. The surface tension of soap solution is 0.3 $\frac{N}{m}$. The work done in blowing a soap bubble of surface area $40cm^2$, (in J) is

A. 1.2×10^{-4}

B. 2.4×10^{-4}

C. 12×10^{-4}

D. 24×10^{-4}

Answer: B

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2. The work done in increasing the size of a rectangular soap film with dimensions 8 cm x 3.75 cm to 10 cm x 6 cm is $2 \times 10^{-4} J$. The surface tension of the film in $\left(Nm^{-1}\right)$ is

A. 165×10^{-2}

B. 3.3×10^{-2}

C. 6.6×10^{-2}

D. 8.25×10^{-2}

Answer: B

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3. The work done to get n smaller identical drops to form a big spherical drop of water is proportional to

A. $\dfrac{1}{n^{2/3} - 1}$

B. $\dfrac{1}{n^{1/3} - 1}$

C. $n^{1/3} - 1$

D. $n^{4/3} - 1$

Answer: C

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EXERCISE - I - (H.W) (CAPILLARITY & CAPILLARY RISE)

1. The work done to blow a bubble is W. The extra work to be done to double its radius is

A. W

B. 2W

C. 3W

D. 4W

Answer: C

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2. Water rises to a height of 6 cm in a capillary tube of radius r. If the radius of the capillary tube is 3r, the height to which water will rise is ....cm.

A. 18

B. 9

C. 2

D. 3

Answer: C

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3. When a capillary tube is immersed in ethyl alcohol whose surface tension is 20 dyne cm^{-1}, the liquid rises to a height of 10 cm. Density of the liquid is 0.8 $gmcm^{-3}$. If $g = 10ms^{-2}$, the radius of the capillary tube is ... mm. (angle of contact of ethyl alcohol w.r.t. glass is 60°).

A. 0.0025

B. 0.025

C. 0.25

D. 2.5

Answer: B

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4. Water rises in a capillary tube through a height l. If the tube is inclined to the liquid surface at 30° the liquid will rise in the tube upto it's length equal to

A. $l/2$

B. $2l$

C. $\sqrt{3}\frac{l}{2}$

D. $\frac{2l}{\sqrt{3}}$

Answer: B

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5. There is a hole of radius r in a cylindrical glass pot. To what depth in the sea can it be immersed so that water may not enter it ? (Surface tension of water is T)

A. $\frac{2T}{r}$

B. $\frac{2T}{rgd}$

C. $\frac{T}{rgd}$

D. $\frac{rgd}{2}$

Answer: B

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6. Water raises to a height of $10cm$ in a capillary tube and mercury falls to a depth of 3.5 cm in the same capillary tube. If the density of mercury is $13.6\frac{gm}{c.c}$ and its angle of contact is 135° and density of water is $1\frac{gm}{c.c}$ and its angle of contact is $0^\circ C$ then the ratio of surface tensions of two liquids is $\left(\cos 135^\circ = 0.7\right)$

A. $1:14$

B. $5:34$

C. $1:5$

D. $5:27$

Answer: B

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7. A glass capillary tube of inner diameter 0.28 mm is lowered vertically into water in a vessel. The pressure to be applied on the water in the capillary tube so that water level in the tube is same as the vessel in $\frac{N}{m^2}$ is (surface tension of water $= 0.07\frac{N}{m}$ atmospheric pressure $= 10^5\frac{N}{m^2}$

A. 10^3

B. 99×10^3

C. 100×10^3

D. 101×10^3

Answer: D

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EXERCISE - I - (H.W) (EXCESS PRESSURE INSIDE A LIQUID DROP AND SOAP BUBBLE)

1. A capillary tube of radius 'r' is immersed in water and water rises in it to a height H. Mass of water in the capillary tube is m. If the Capillary of radius 2r is taken and dipped in water, the mass of water that will rise in the capillary tube will be

A. m

B. 2m

C. $m/2$

D. 4m

Answer: B

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2. The surface tension of soap solution is $0.05Nm^{-1}$ if the diameter of the soap bubble is 4 cm. The excess pressure inside the soap bubble over that of outside is (in pascal)

A. 10

B. 1

C. 0.1

D. 0.25

Answer: A

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3. The excess pressure inside a small air bubble of radius 0.05 mm in water of surface tension 70 dyne cm^{-1} (in pascal)

A. 28.2

B. 2.8×10^2

C. 2800

D. 280

Answer: C

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4. What should be the pressure inside a small air bubble of 0.2mm diameter situated just below the surface of water.

(Surface tension of water $= 0.072 N/m$)

A. $1.44 \times 10^2 Pa$

B. $1.44 \times 10^3 Pa$

C. $1.44 \times 10^4 Pa$

D. $1.44 \times 10^5 Pa$

Answer: B

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5. Two soap bubbles are blown. In first soap bubble excess pressure is 4 times of the second soap bubble. The ratio of the radii of the first and second soap bubble is

A. $1:4$

B. $1:2$

C. $2:1$

D. $4 : 1$

Answer: A

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EXERCISE - I - (H.W) (COMBINATION OF DROPS & BUBBLES)

1. Two soap bubble of radii 3 mm and 4 mm are in contact radius of curvature of interface between those two bubbles is

A. 1mm

B. 7mm

C. 12mm

D. 4mm

Answer: C

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2. Two liquid drops of radii 1 mm and 2 mm merge in vacuum isothermally. Radius of resulting drop is

A. 3mm

B. $3^{1/3}mm$

C. $3^{2/3}mm$

D. 6mm

Answer: C

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3. A spherical soap bubble of radius 1 cm is formed inside another of radius 3 cm the radius of single soap bubble which maintains the same pressure difference as inside the smaller and outside the larger soap bubble is ____cm

A. $4/3$

B. $3/4$

C. $1/2$

D. 2

Answer: B

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4. A soap bubble of radius 6 cm and another bubble of 8 cm coalesce under isothermal xonditions in vacuum. The radius of the new bubble is

A. 3 cm

B. 4 cm

C. 10 cm

D. 7 cm

Answer: C

Watch Video Solution

EXERCISE - II (C.W) (PRESSURE AND PASCAL.S LAW)

1. A bird of mass 1.23 kg is able to hover by imparting a downward velocity of $10m/s$ uniformly to air of density $\rho kg/m^3$ over an effective area $0.1m^2$ the acceleration due to gravity is $10m/s^2$ then the magnitude of ρ in kg/m^3

A. 0.34

B. 0.89

C. 1.23

D. 4.8

Answer: C

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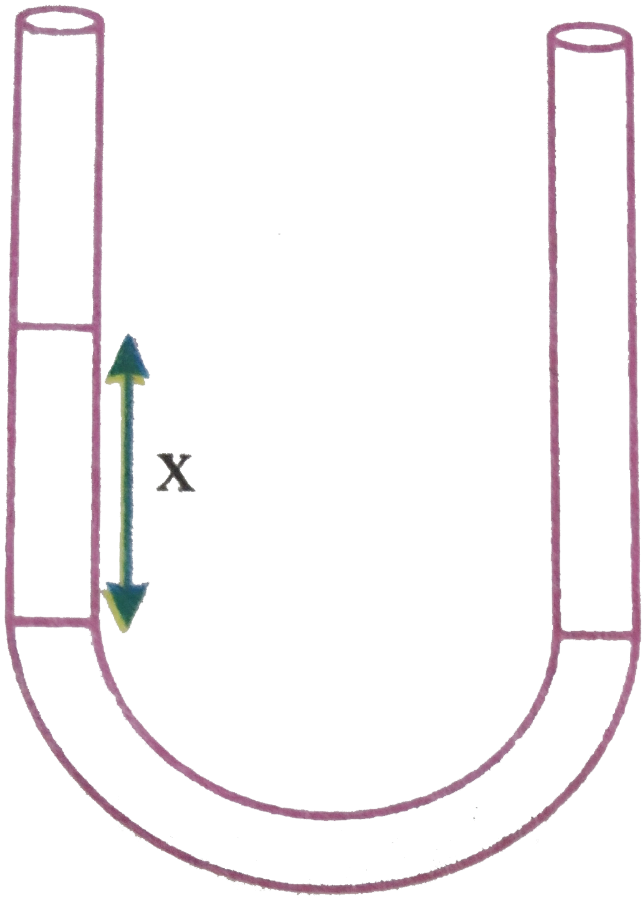
EXERCISE - II (C.W) (VARIATION OF PRESSURE, UPTHRUST)

1. one end of a U-tube of uniform bore (area A) containing mercury is connected to a suction pump. Because of it the level of liquid of density ρ falls in one limb. When the pump is removed, the restoring force in the other limb is:



A. $2x\rho Ag$

B. $x\rho g$

C. $A\rho g$

D. $x\rho Ag$

Answer: A

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2. A boat having length 2 m and width 1 m is floating in a lake. When a man stands on the boat, it is depressed by 3 cm. The mass of the man is

A. 50kg

B. 55kg

C. 60 kg

D. 70 kg

Answer: C

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3. A cube of wood supporting 200 g mass just floats in water. When the mass is removed, the cube rises by 1 cm, the linear dimension of cube is

A. 10 CM

B. 20cm

C. $10\sqrt{2}cm$

D. $5\sqrt{2}cm$

Answer: C

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4. A large block of ice 4 m thick has a vertical hole drilled through it and is floating in the middle of water in a lake. The minimum length of rope required to scoop up a bucket full of the through the hole is (density of ice $= 0.9CGS$ unit, density of water $= 1CGS$ unit)

A. 40 cm

B. 24 cm

C. 20 cm

D. 360 cm

Answer: A

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5. A hollow metal sphere is found to float in water with the highest point just touching the free surface of water. If d is the density of the metal in cgs units, the fraction that represents the volume of the hollow in terms of the volume of the sphere is

A. $\frac{1}{d}$

B. $\left(1 - \frac{1}{d}\right)$

C. $\frac{d}{(d - 1)}$

D. $\left(1 + \frac{1}{d}\right)$

Answer: B

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6. A solid body is found floating in water with $\left(\frac{\alpha}{\beta}\right)^{th}$ of its volume submerged. The same solid is found floating in a liquid with $\left(\frac{\alpha}{\beta}\right)^{th}$ of its volume above the liquid surface. The specific gravity of the liquid is

A. $\frac{\beta - \alpha}{\alpha}$

B. $\frac{\alpha - \beta}{\beta}$

C. $\frac{\alpha}{\beta - \alpha}$

D. $\frac{\beta}{\alpha - \beta}$

Answer: C

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7. A wooden cube is found to float in water with $\frac{1}{2} cm$ of its vertical side above the water. On keeping a weight of 50 gm over its top, it is just submerged in the water. The specific gravity of wood is

A. 0.8

B. 0.9

C. 0.85

D. 0.95

Answer: D

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8. A solid sphere of radius R has a concentric cavity of radius '$R/2$' inside it. The sphere is found to just float in water with the highest point of it touching the water surface. The specific gravity of the material of the sphere is

A. 1

B. $\frac{7}{8}$

C. $\frac{8}{7}$

D. $\frac{8}{9}$

Answer: C

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EXERCISE - II (C.W) (EQUATION OF CONTINUITY, BERNOULLI.S THEOREM AND ITS APPLICATIONS)

1. Water from a tap emerges vertically downwards with initial velocity $4ms^{-1}$. The cross-sectional area of the tap is A. The flow is steady and pressure is constant throughout the stream of water. The distance h vertically below the tap, where the cross-sectional area of the stream becomes $\left(\frac{2}{3}\right)A$ is $\left(g = 10m/s^2\right)$

A. 0.5 m

B. 1 m

C. 1.5 m

D. 2.2 m

Answer: B

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EXERCISE - II (C.W) (TORRICELLI.S THEOREM)

1. Two identical tall jars are filled with water to the brim. The first jar has a small hole on the side wall at a depth $h/3$ and the second jar has a small hole on the side wall at a depth of $2h/3$, where h is the height of the jar. The water issuing out from the first jar falls at a distance R_1 from the base and the water issuing out from the second jar falls at a distance R_2 From the base. The correct relation between R_1 and R_2 is

A. $R_1 > R_2$

B. $R_1 < R_2$

C. $R_2 = 2 \times R_1$

D. $R_1 = R_2$

Answer: D

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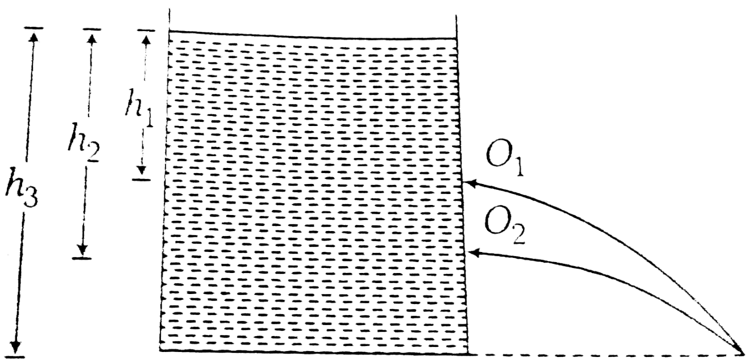
2. There are two holes O_1 and O_2 in a tank of height H. The water emerging from O_1 and O_2 strikes the ground at the same points, as shown in figure. Then



A. $H = h_1 + h_2$

B. $H = h_2 - h_1$

C. $H = h_1 h_2$

D. $H = h_2 / h_1$

Answer: A

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3. A tube is mounted so that it's base is at height h above the horizontal ground. The tank is filed with water to a depth h. A hole is punched in the side of the tank at depth y below water surface. Then the value of y so that the range of emerging stream be maximum is

A. h

B. $h/2$

C. $h/4$

D. $3\frac{h}{4}$

Answer: A

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4. A tank full of water has a small hole at the bottom. If one-fourth of the tank is emptied in t_1 seconds and the remaining three-fourths of the tank is emptied in t_2 seconds. Then the ratio $\frac{t_1}{t_2}$ is

A. $\sqrt{3}$

B. $\sqrt{2}$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{2}{\sqrt{3}} - 1$

Answer: D

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5. There are two holes one each along the opposite sides of a wide rectangular tank. The cross section of each hole is $0.01m^2$ and the vertical distance between the holes is one meter. The tank is filled with water. The net force on the tank in newton when water flows out of the holes is (density of water $1000kg/m^3$)

A. 100

B. 200

C. 300

D. 400

Answer: B

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6. A tank with vertical walls is mounted so that its base is at a height H above the horizontal ground. The tank is filled with water to a depth h. A hole is punched in the side wall of the tank at depth x below the water surface. To have maximum range of the emerging stream, the value of x is

A. $\frac{H+h}{4}$

B. $\frac{H+h}{2}$

C. $\frac{H+h}{3}$

D. $\frac{3(H+h)}{4}$

Answer: B

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7. A hole is made at the bottom of the tank filled with water (density $= 1000 kgm^{-3}$). If the total pressure at the bottom of the tank is three atmospheres (1 atmosphere $= 10^5 Nm^{-2}$), then the velocity of efflux is nearest to

A. $\sqrt{400} m/s$

B. $\sqrt{200} m/s$

C. $\sqrt{600}m/s$

D. $\sqrt{500}m/s$

Answer: A

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EXERCISE - II (C.W) (POISEUILLE.S EQUATION)

1. The level of a liquid in a vessel kept constant at 50 cm. it has three identical horizontal tubes each of length 60 cm coming out at heights 5,10 and 15 cm respectively. If a single tube of the same radius as that of the three tubes can replace the three tubes when placed horizontally at the bottom of the vessel length of that tube is

A. 25cm

B. 40cm

C. 12.5 cm

D. 50 cm

Answer: A

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2. A tube of radius R and length L is connected in series with another tube of radius $\frac{R}{2}$ and length $\frac{L}{8}$ if the pressure across the tubes taken together is P, the pressure across the two tubes separately are:

A. $\frac{P}{2}$ and $\frac{P}{2}$

B. $\frac{P}{3}$ and $\frac{3P}{2}$

C. $\frac{P}{4}$ and $\frac{3P}{2}$

D. $\frac{P}{3}$ and $\frac{2P}{3}$

Answer: D

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3. A capillary tube is attached horizontally to a constant pressure head arrangement. If the radius of the capillary tube is increased by 10%, then the rate of flow of the liquid shall change nearly by

A. -40%

B. $+40\%$

C. $+21\%$

D. $+46\%$

Answer: D

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4. Three horizontal capillary tubes of same radii and length L_1, L_2 and L_3 are fitted side by side a little above the bottom, to the wall of a tank that is filled with water. The length of a single capillary tube of same radius that can replace the three tubes such that the rate of flow of water through the single tube equals the combined rate of flow through the three tubes is

A. $\frac{L_1L_2L_3}{L_1 + L_2 + L_3}$

B. $\frac{L_1L_2L_3}{L_1L_2 + L_2L_3 + L_3L_1}$

C. $\frac{L_1 + L_2 + L_3}{L_1L_2L_3}$

D. $\frac{L_1L_2 + L_2L_3 + L_3L_1}{L_1L_2L_3}$

Answer: B

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EXERCISE - II (C.W) (TERMINAL VELOCITY)

1. One spherical ball of radius R, density of released in liquid of density $d/2$ attains a terminal velocity V. Another ball of radius 2R and density 1.5 d released in the liquid will attain a terminal velocity

A. 2V

B. 4V

C. 6V

D. 8V

Answer: D

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2. When a solid ball of volume V is falling through a viscous liquid, a viscous force F acts of it. If another ball of volume 2 V of the same material is falling through the same liquid then the viscous force experienced by it will be (when both fall with terminal velocities).

A. F

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

C. 2F

D. $\frac{F}{4}$

Answer: C

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EXERCISE - II (C.W) (FORCE DUE TO SURFACE TENSION)

1. A metallic wire of diameter d is lying horizontally o the surface of water. The maximum length of wire so that is may not sink will be

A. $\sqrt{\frac{2T}{\pi dg}}$

B. $\sqrt{\frac{2T}{\pi d}}$

C. $\sqrt{\frac{2\pi d}{Td}}$

D. any length

Answer: D

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2. A liquid is filled into a semi elliptical cross section with a as semi major axis and b as semi minor axis. The ratio of surface tension forces on the curved part and the plane part of the tube in vertical position will be

A. $\frac{\pi(a+b)}{4b}$

B. $\frac{2\pi a}{b}$

C. $\frac{\pi a}{4b}$

D. $\frac{\pi(a-b)}{4b}$

Answer: A

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EXERCISE - II (C.W) (WORK & SURFACE ENERGY)

1. A liquid drop of diameter D breaks up into 27 drops. Find the resultant change in energy.

A. $2\pi TD^2$

B. πTD^2

C. $\frac{\pi TD^2}{2}$

D. $4\pi TD^2$

Answer: A

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2. A film of water is formed between two straight parallel wires of length 10 cm each separated by $0.5cm$ If their separation is increased by $1mm$ while still maintaining their parallelism, how much work will have to be done (Surface tension of water $= 7.2 \times 10^{-2} \frac{N}{m}$)

A. $7.22 \times 10^{-6} J$

B. $1.44 \times 10^{-5} J$

C. $2.88 \times 10^{-5} J$

D. $5.76 \times 10^{-5} J$

Answer: B

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3. A soap film in formed on a frame of area $4 \times 10^{-3} m^2$. If the area of the film in reduced to half, then the change in the potential energy of the film is (surface tension of soap solution $= 40 \times 10^{-3} N/m$)

A. $32 \times 10^{-5} J$

B. $16 \times 10^{-5} J$

C. $8 \times 10^{-5} J$

D. $16 \times 10^{5} J$

Answer: B

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4. The work done in blowing a soap bubble of volume V is W. The work done in blowing a soap bubble of volume $2V$ is

A. W

B. $2^{\frac{2}{3}}W$

C. $3^{\frac{2}{3}}W$

D. 2W

Answer: B

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EXERCISE - II (C.W) (CAPILLARITY & CAPILLARY RISE)

1. The lower end of a capillary tube of radius r is placed vertically in water of density ρ , surface tension S. The rice of water in the capillary tube is upto height h, then heat evolved is

A. $+\frac{\pi r^2 h^2 dg}{2J}$

B. $+\frac{\pi r^2 h^2 dg}{J}$

C. $-\frac{\pi r^2 h^2 dg}{2J}$

D. $-\frac{\pi r^2 h^2 dg}{J}$

Answer: A

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2. Four identical capillary tubes a,b,c and d are dipped in four beakers containing water with tube a vertically, tube b at 30° tube c at 45° and tube d at 60° inclination with the vertical. Arrange the lengths of water column in the tubes in descending order.

A. d, c, b, a

B. d, a, b, c

C. a, c, d, b

D. a,b,c,d.

Answer: A

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3. A vessel whose bottom has round holes with diameter of 1 mm is filled with water Assuming that surface tension acts only at holes, then the maximum height to which the water can be filled in vessel without leakage is (given surface tension of water is $75 \times 10^{-3} N/m$) and $g = 10 m/s^2$

A. 3 cm

B. 0.3 cm

C. 3mm

D. 3 m

Answer: A

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4. Water rises to a height h_1 in a capillary tube in a stationary lift. If the lift moves up with uniform acceleration it rises to a height h_2, then acceleration of the lift is

A. $\left[\frac{h_2 - h_1}{h_2}\right]g$

B. $\left[\frac{h_2 - h_1}{h_1}\right]g$

C. $\left[\frac{h_1 - h_2}{h_1}\right]g$

D. $\left[\frac{h_1 - h_2}{h_2}\right]g$

Answer: D

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5. The radii of the two columne is U-tube are r_1 and $r_2\left(> r_1\right)$. When a liquid of density ρ (angle of contact is 0°)) is filled in it, the level different of liquid in two arms is h. The surface tension of liquid is

($g =$ acceleration due to gravity)

A. $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$

B. $\frac{\rho g h(r_2 - r_1)}{2 r_2 r_1}$

C. $\frac{2(r_1 - r_2)}{\rho g h r_2 r_1}$

D. $\frac{2(r_1 - r_2)}{\rho g h}$

Answer: A

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6. The potential energy of the liquid of surface tension T and density ρ that rises into the capillary tube is

A. $\pi^2 T^2 \rho^2 g$

B. $4\pi T^2 \rho^2 g$

C. $\frac{2\pi T^2}{\rho g}$

D. $\frac{\pi T^2}{\rho g}$

Answer: C

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EXERCISE - II (C.W) (EXCESS PRESSURE INSIDE A LIQUID DROP AND IN A SOAP BUBBLE)

1. A small air bubble of 0.1 mm diameter is formed just below the surface of water. If surface tension tension of water is 0.072 Nm^{-1}, the pressure inside the air bubble in kilo pascal is (Atmospheric pressure $= 1.01 \times 10^5 Pa$)

A. 28.9

B. 0.289

C. 0.0289

D. 103.88

Answer: D

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2. A spherical soap bubble of radius 1 cm is formed inside another of radius 4 cm. The radius of single soap bubble which maintains the same pressure difference as inside the smaller and outside the larger soap bubble is -------------- cm.

A. 1

B. 0.8

C. 0.5

D. 0.25

Answer: B

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3. The depth of water at which air bubble of radius 0.4 mm remains in equilibrium is $\left(T_{\text{water}} = 72 \times 10^{-3} N/m\right)$

A. 3.67cm

B. 3.67 m

C. 6.37 cm

D. 5.32 cm

Answer: A

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4. Two separate air bubbles (radii $0.002 cm$ and 0.004) formed of the same liquid (surface tension $0.07 N/m$) come together to form a double bubble. Find the radius and the sense of curvature of the internal film surface common to both the bubbles.

A. 0.001cm

B. 0.002 cm

C. 0.004 cm

D. 0.003 cm

Answer: C

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5. The excess pressure inside a spherical soap bubble of radius 1 cm is balanced by a column of oil (Specific gravity = 0.8), 2 mm high, the surface tension of the bubble is

A. $3.92 N / m$

B. $0.0392 N / m$

C. $0.392 N / m$

D. $0.00392 N / m$

Answer: B

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EXERCISE - II (H.W) (VARIATION OF PRESSURE AND UPTHRUST)

1. A rectangular block of wood of density $800 kgm^{-3}$ having a mass of 2 kg is pushed in to water so that it is completely submerged and then released. Neglecting viscous forces, the initial acceleration of the block will be $\left(g = 10\frac{m}{s^2}\right)$

A. $1.25 m/s^2$ downward

B. $2.5 m/s^2$ upward

C. $1.25 m/s^2$upward

D. $2.5 m/s^2$ downward

Answer: B

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2. A vessel contains (density d) over mercury (density D). A homogenous solid sphere floats with half of its volume in mercury and the other half in the oil . The density of the material of the sphere is

A. $\sqrt{Dd}$

B. $\frac{2Dd}{D+d}$

C. $\frac{D+d}{2}$

D. $\frac{Dd}{D+d}$

Answer: C

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3. A block of wood floats in water with $\left(\frac{4}{5}\right)^{th}$ of its volume submerged. In an oil, it floats with $\left(\frac{9}{10}\right)^{th}$ volume submerged. The ratio of the density of oil and water is

A. $8/9$

B. $9/8$

C. $19/25$

D. $25/18$

Answer: A

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4. A small block of wood of relative density 0.5 is submerged in water at a depth of 5 m When the block is released it starts moving upwards, the acceleration of the block is $\left(g = 10ms^{-2}\right)$

A. $5ms^{-2}$

B. $10ms^{-2}$

C. $7.5ms^{-2}$

D. $15ms^{-2}$

Answer: B

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5. A hemispherical bowl just floats without sinking in a liquid of density $1.2 \times 10^3 kg/m^3$. If outer diameter and the density of the bowl are $1m$ and $2 \times 10^4 kg/m^3$ respectively, then the inner diameter of bowl will be

A. 1.91 m

B. 0.5m

C. 0.98 m

D. 1.75 m

Answer: C

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6. A cubical block of wood of edge a and density ρ floats in water of density 2ρ. The lower surface of the cube just touches the free end of a mass less spring of force constant K fixed at the bottom of the vessel. The weight W put over the block so that it is completely immersed in water without wetting the weight is

A. $a\left(a^2\rho g + k\right)$

B. $a(a\rho g + 2k)$

C. $a\left(\frac{a\rho g}{2} + 2k\right)$

D. $a\left(a^2\rho g + \frac{k}{2}\right)$

Answer: D

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7. A fisherman hooks an old log of wood of weight 12 N and volume 1000 cm^3. He pulls the log half way out of water. The tension in the string at this instant is

A. 12 N

B. 8 N

C. 10 N

D. 7 N

Answer: D

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8. A sphere of solid material of relative density 9 has a concentric spherical cavity and sinks in water. If the radius of the sphere be R. Then the radius of the cavity (r) will be related to R as

A. $r^3 = \frac{8}{9}R^3$

B. $r^3 = \frac{2}{3}R^3$

C. $r^3 = \frac{\sqrt{8}}{3}R^3$

D. $r^3 = \sqrt{\frac{2}{3}}R^3$

Answer: A

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9. A raft of wood (density $= 600 kg/m^3$) of mass $120 kg$ floats in water. How much weight can be put on the raft to make it just sink?

A. 120 kg

B. 200 kg

C. 40 kg

D. 80 kg

Answer: D

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10. A body of density d and volume V floats with volumes V of its total volume V immersed in a liquid of density d and the rest of the volume V_2 immersed in another liquid of density $d_2\left(< d_1\right)$. The volume V_1 immersed in liquid of density d_1 is

A. $\left(\frac{d - d_2}{d_1 - d_2}\right)V$

B. $\left(\frac{d + d_2}{d_1 + d_2}\right)V$

C. $\left(\frac{d_1 - d_2}{d_1}\right)V$

D. $\frac{d_1}{d_2}V$

Answer: A

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EXERCISE - II (H.W) (EQUATION OF CONTINUITY, BERNOULLI.S THEOREM AND ITS APPLICATIONS)

1. At a point P in a water pipe line the velocity is $1ms^{-1}$ and the pressure is $3 \times 10^5 pa$. At another point Q the area of cross section is half that of at P and the pressure is 5×10^5 pa. The difference of heights between P and Q in metre is $\left(g = 10ms^{-2}\right)$

A. 10.5

B. 20.15

C. 4.5

D. zero

Answer: B

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2. An ideal liquid flowing through a pipe A of cross-section $0.2m^2$ with velocity $10\frac{m}{s}$ enters a T-junction. One side of the T-junction B has cross-section area $0.1m^2$ and the other side C has cross-section area $0.05m^2$. If the velocity of water is C is $15\frac{m}{s}$ then in B the velocity is

A. $1m/s$

B. $10m/s$

C. $12.5m/s$

D. $1cm/s$

Answer: C

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EXERCISE - II (H.W) (TORRICELLI.S THEOREM)

1. A tank with vertical walls is mounted so that its base is at height of 1.2 m above the horizontal ground. The tank is filled with water to depth 2.8 m. A hole is punched in the side wall of the tank at a depth x m below the surface of water to have maximum range of the emerging stream. Then the value of x in metre is

A. 4

B. 1.6

C. 2

D. 2.3

Answer: C

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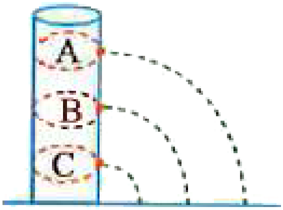
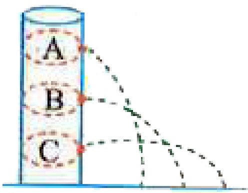
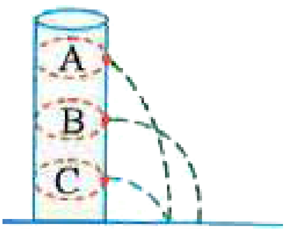
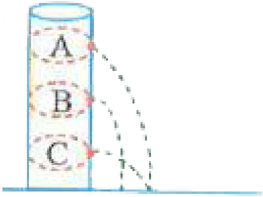
2. Water stands at a height of 100 cm in a vessel whose side walls are vertical. A B and C are holes at height 80 cm, 50 cm, and 20 cm respectively from the bottom of the vessel. The correct system of flowing out is:

A. 

B. 

C. 

D. 

Answer: C

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3. There is a hole at the bottom of a large open vessel. If water is filled upto a height h, it flows out in time t. if water is filled to a height 4h, it will flow out in time

A. 4t

B. $t/4$

C. $t/2$

D. $2t$

Answer: D

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4. A large tank filled with water to a height h is to be emptied through a small hole at the bottom. The ratio of times taken for the level of water to fall from h to $\frac{h}{2}$ and from $\frac{h}{2}$ to zero is

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. $\sqrt{2} - 1$

D. $\frac{1}{\sqrt{2} - 1}$

Answer: C

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5. Tanks A and B open at the top contain who different liquids upto certain height in them. A hole is made on the wall of each tank at a depth h from the surface of the liquid. The area of the hole in A is twice that of

in B. If the liquid mass flux through each hole is equal, then the ratio of the densities of the liquids respectively is

A. $\frac{2}{1}$

B. $\frac{3}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{2}$

Answer: D

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6. A large open top container of negligible mass and uniform cross sectional area A has a small uniform cross sectional area a in its side wall near the bottom. The container is kept over a smooth horizontal floor and contains a liquid of density ρ and mass m_0. Assuming that the liqud starts flowing through the hole A the acceleration of the container will be

A. $\frac{2ag}{A}$

B. $\frac{ag}{A}$

C. $\frac{2Ag}{a}$

D. $\frac{Ag}{a}$

Answer: A

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EXERCISE - II (H.W) (POISEUILLE.S EQUATION)

1. When a capillary tube is connected to a pressure head quantity of water flows per second is V (in c.c.) if another tube of same length but half the radius is connected to the first in series to the same pressure head, the quantity of water flowing through them per sencond will be (in c.c)

A. $\frac{V}{16}$

B. $\frac{V}{17}$

C. $\frac{17V}{16}$

D. V

Answer: B

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2. A volume V of a viscous liquid flows per unit time due to a pressure head ΔP along a pipe of diameter d and length l. instead of this pipe a set of four pipes each of diameter $\frac{d}{2}$ and length 2l is connected to the same pressure head ΔP. Now the volume of liquid flowing per unit time is:

A. V

B. $\frac{V}{4}$

C. $\frac{V}{8}$

D. $\frac{V}{16}$

Answer: C

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3.

A horizontal composite capillary tube has a radius $2r$ for a length $2L$ and radius r for a length L as shown and is connected to a tank at one end and left free at the other end The tank contains a liquid of coefficient of viscosity η. if a constant pressure difference P exist across the ends of the capillary tube, the volume flux through x the capillary tube is

A. $\left(\frac{16}{17}\right)\frac{\pi P r^4}{8\eta L}$

B. $\left(\frac{9}{8}\right)\frac{\pi P r^4}{8\eta L}$

C. $\left(\frac{17}{16}\right)\frac{\pi P r^4}{8\eta L}$

D. $\left(\frac{8}{9}\right)\frac{\pi P r}{8\eta L}$

Answer: D

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4. A stream-lined body falls through air from a height h on the surface of a liquid . Let d and D denote the densities of the materials of the body and the liquid respectively, if $D > d$, then the time after which the body will be intantaneously at rest, is:

A. $\sqrt{\frac{2h}{g}}$

B. $\sqrt{\frac{2h}{g}\frac{D}{d}}$

C. $\sqrt{\frac{2h}{g}\frac{d}{D}}$

D. $\frac{d}{(D - d)}\sqrt{\frac{2h}{g}}$

Answer: D

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5. Two rain drops reach the earth with different terminal velocities having ratio 9:4. Then, the ratio of their volumes is

A. $3:2$

B. $4:9$

C. $9:4$

D. $27:8$

Answer: D

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6. A solid sphere falls with a terminal velocity V in CO_2 gas. If its is allowed to fall in vacuum

A. Terminal velocity of sphere=V

B. Terminal velocity of sphere $< V$

C. Terminal velocity of sphere $>$ V

D. Sphere never attains terminal velocity

Answer: D

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EXERCISE - II (H.W) (PORCE DUE TO SURFACE TENSION)

1. If the force required to pull out a glass plate of length 9.8 cm and thickness 2 mm from a liquid is 0.6 gmwt. The surface tension of water is Nm^{-1}

A. 2.94×10^{-3}

B. 29.4×10^{3}

C. 29.4×10^{-2}

D. 29.4×10^{-3}

Answer: D

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2. A wire of length L metres, made of a material of specific gravity 8 is floating horizontally on the surface of water. If it is not wet by water, the maximum diameter of the wire (in mm) upto which it can continue to float is (surface tension of water is $T = 70 \times 10^{-3} Nm^{-1}$)

A. 1.5

B. 1.1

C. 0.75

D. 0.55

Answer: A

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3. A glass plate of length 20 cm and breadth 0.2 cm just touches the water surface in a beaker. The surface tension of water is 72 dyne/cm. The weight of the glass plate is 25 g. The weight that must be placed in the right pan to counter pose the balance is

A. 25 g

B. 28 g

C. 22 g

D. 21.3 g

Answer: B

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4. Two parallel glass plates are held vertically at a small separation d and dipped in a liquid of surface tension T , the angle of contact $\theta = 0^\circ$ and density ρ . The height of water that climbs up in the gap between glass plates is given by

A. $2T/d\rho g$

B. $T/2d\rho g$

C. $T/d\rho g$

D. None of these

Answer: A

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EXERCISE - II (H.W) (WORK & SURFACE ENERGY)

1. A liquid drop of radius R breaks into 64 tiny droplets each of radius r if the surface tension of liquid is T then gain in energy is

A. $48\pi R^2 T$

B. $12\pi r^2 T$

C. $96\pi r^2 T$

D. $192\pi r^2 T$

Answer: D

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EXERCISE - II (H.W) (CAPILLARITY AND CAPILLARY RISE)

1. When water rises in a capillary tube of radius r to height h, then its potential energy U_1 if capillary tube of radius 2r is dipped in same water then potential energy of water is U_2 then $U_1 : U_2$ will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

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2. A glass rod of radius r_1 is inserted symmetrically into a vertical capillary tube of radius r_2 such that their lower ends are at the same level. The arrangement is now dipped in water. The height to which water will rise into the tube will be ($\sigma =$ surface tension of water, $\rho =$ density of water)

A. $\frac{2\sigma}{(r_2 - r_1)\rho g}$

B. $\frac{\sigma}{(r_2 - r_1)\rho g}$

C. $\frac{2\sigma}{(r_2 + r_1)\rho g}$

D. $\frac{2\sigma}{(r_2^2 + r_1^2)\rho g}$

Answer: A

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3. A long capillary tube of radius 1 mm, open at both ends is filled with water and placed vertically. What will be the height of water column left in the capillary ? (Surface tension of water is $73.5 \times 10^{-3} Nm^{-1}$)

A. 0.3cm

B. 3cm

C. 6cm

D. 0.03 cm

Answer: B

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4. Two narrow bores of diameters 3.0mm and 6.0 mm are joined together to form a U-shaped tube open at both ends. If th U-tube contains water, what is the difference in its levels in the two limbs of the tube? Surface tension of water at the temperature of the experiment is $7.3 \times 10^{-2} Nm^{-1}$. Take the angle of contact to be zero. and density of water to be $1.0 \times 10^3 kg/m^3$.

$\left(g = 9.8 ms^{-2}\right)$

A. 3 mm

B. 2mm

C. 4mm

D. 5.0 mm

Answer: D

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EXERCISE - II (H.W) (EXCESS PRESSURE IN A LIQUID DROP AND IN A SOAP BUBBLE

1. The excess pressure in soap bubble is $10\frac{N}{m^2}$ if eight soap bubble are combined to form a big soap bubble excess pressure in big bubble is (in $\frac{N}{m^2}$)

A. 5

B. 10

C. 20

D. 2.5

Answer: A

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2. Two air bubbles of radii 0.002 m and 0.004 m of same liquid come together to form a single bubble under isothermal condition. Find the radius of the buble formed. Given surface tension of liquid is $0.072Nm^{-1}$

A. 6 mm with concave surface towards smaller bubble.

B. 2 mm with concave surface towards bigger bubble

C. 4 mm with concave surface towards smaller bubble.

D. 4 mm with concave surface towards bigger bubble.

Answer: C

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3. A water drop is divided into 8 equal droplets. The pressure difference between the inner and outer side of the big drop will be

A. will be the same as for smaller droplet

B. will be half of that for smaller droplet

C. will be $1/4^{\text{th}}$ of that for smaller droplet

D. will be twice of that for smaller droplet

Answer: B

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4. Two soap bubbles of radii R_1 and R_2 kept in atmosphere are combined isothermally to form a big bubble of radius R. The expression for surface tension will be

A. $\dfrac{P_0\left(R^3 + R_1^3 + R_2^3\right)}{4\left(R^2 + R_1^2 + R_2^2\right)}$

B. $\dfrac{P_0\left(R_1^3 + R_2^3 - R^3\right)}{4\left(R^2 - R_1^2 - R_2^2\right)}$

C. $P_0\left(R_1^3 + R_2^3 - R^3\right)$

D. $4P_0\left(R_1^3 + R_2^3 - R^3\right)$

Answer: B

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5. One end of a glass capillary tube with a radius $r = 0.05cm$ is immersed into water to a depth of $h = 2cm$.Excess pressure required to blow an air bubble out of the lower end of the tube will be $(S.T$ of water $= 70\text{dyne}/cm)$.Take $g = 980cm/s^2$.

A. $480N/m^2$

B. $680N/m^3$

C. $120N/m^2$

D. $820N/m^2$

Answer: A

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EXERCISE - III

1. A rectangular vessel when full of water takes 10 minutes to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water

A. 9 min

B. 7 min

C. 5 min

D. 3 min

Answer: B

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2. An air bubble of radius 1 cm rises from the bottom portion through a liquid of density $1.5 gcc^{-1}$ at a constant speed of $0.25 cms^{-1}$. If the density of air is neglected, the coefficient of viscosity of the liquid is approximately, (in Pa-s)

A. 13000

B. 1300

C. 130

D. 13

Answer: C

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3. The terminal speed of a sphere of gold (density = 19.5 kg m^{-3}) is 0.2 ms^{-1} in a viscous liquid (density = 1.5 kg m^{-3}). Then, the terminal speed of a sphere of silver (density = 10.5 kg m^{-3}) of the same size in the same liquid is

A. $0.4ms^{-1}$

B. $0.133ms^{-1}$

C. $0.1ms^{-1}$

D. $0.2ms^{-1}$

Answer: C

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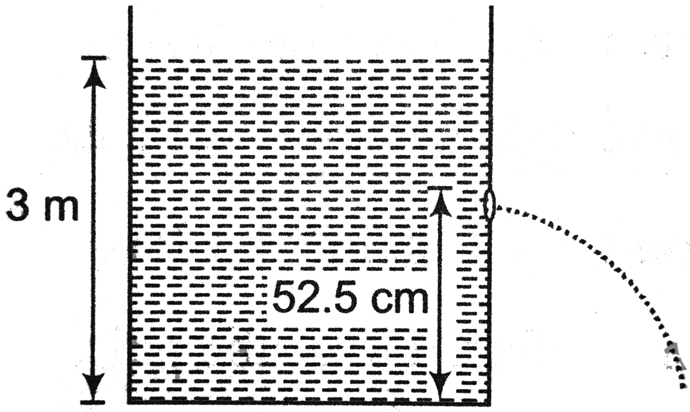
4. Water is filled in a cylindrical container to a height of $3m$. The ratio of the cross-sectional area of the orifice and the beaker is 0.1. The square of the speed of the liquid coming out from the orifice is $\left(g = 10m/s^2\right)$.



A. $50m^2s^{-2}$

B. $50.5m^2s^{-2}$

C. $51m^2s^{-2}$

D. $52m^2s^{-2}$

Answer: A

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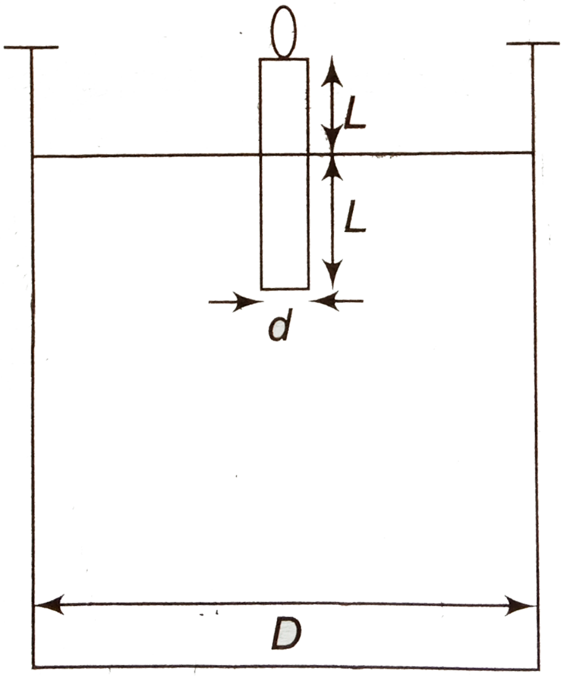
5. A candle of diameter d is floating on a liquid in a cylindrical container of diameter $D(D < < d)$ as shown in figure. If is burning at the rate of $2cm/h$ then the top of the candle will :



A. remain at the same height

B. fall at the rate of $1cmh^{-1}$

C. fall at the rate of $2cmh^{-1}$

D. go up at the rate of $1cmh^{-1}$

Answer: B

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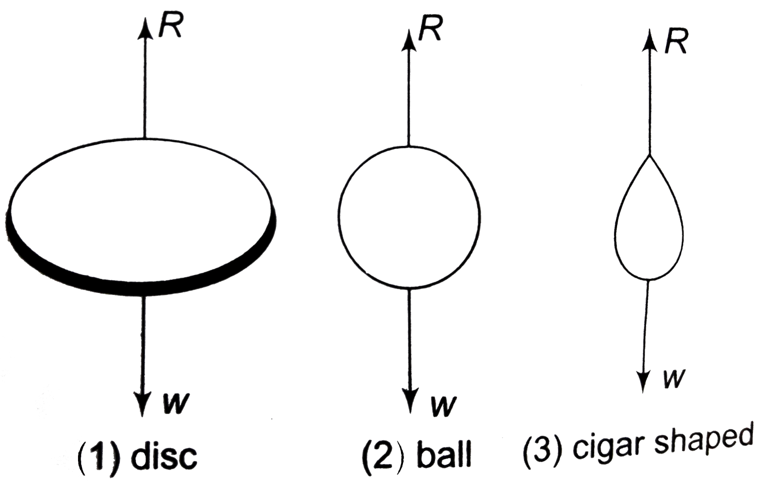
6. When a body falls in a air, the resistance of air depends to a great extent on the shape of the body. The different shapes are given. Identify the combination of air resistance which truly represents the physical situation?

(The cross-sectional areas are the same)



A. 1 lt 2 lt 3

B. 2 lt3 lt 1

C. 3 lt 2 lt1

D. 3 lt 1 lt 1

Answer: C

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7. The heart of a man pumps 5 liters of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be $13.6 \times 10^3 kg/m^3$ and $g = 10 m/s^2$ then the power of heat in watt is :

A. 1.5

B. 1.7

C. 2.35

D. 3

Answer: B

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8. Water rises to height h in capillary tube. If the length of capillary tube above the surface of water is made less than h then

A. water does not rise at all

B. water rise the tip of capillary tube and then starts overflowing like a fountain.

C. water riscs upto the top of capillary tube and stays there without overflowing

D. water rises upto a point a little below the top and stays there.

Answer: C

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9. The value of coefficient of volume expansion of glycerin is $5 \times 10^{-4} K^{-1}$. The fractional change in the density of glycerin for a rise of $40^{\circ} C$ in its temperature is

A. 0.01

B. 0.015

C. 0.02

D. 0.025

Answer: C

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10. The approximate depth of an ocean is 2700 m. The compressibility of water is $45.4 \times 10^{-11} Pa^{-1}$ and density of water is $10^3 kg/m^3$. What fractional compression of water will be obtained at the bottom of the ocean ?

A. 1.2×10^{-2}

B. 1.4×10^{-2}

C. 0.8×10^{-2}

D. 1.0×10^{-2}

Answer: A

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11. By sucking a straw a student can reduce the pressure in his lungs to $750mm$ of $Hg(\text{density}) = 13.6kg/cm^3\big)$ Using the straw, he can drink water from a glass up to a maximum depth of :

A. 10 cm

B. 75 cm

C. 13.6 cm

D. 1.36 cm

Answer: C

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12. A drop of water of radius 0.0015 mm is falling in air .If the cofficient of viscosity of air is $2.0 \times 10^{-5} kgm^{-1} s^{-1}$,the terminal velocity of the drop will be

(The density of water = $10^3 kgm^{-3}$ and g = $10 ms^{-2}$)

A. $1.0 \times 10^{-4} m/s$

B. $2.0 \times 10^{-4} m/s$

C. $2.5 \times 10^{-4} m/s$

D. $5.0 \times 10^{-4} m/s$

Answer: C

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13. A spherical body of diameter D is falling in viscous medium. Its terminal velocity is proportional to

A. $V_t \propto D^{1/2}$

B. $V_t \propto D^{3/2}$

C. $V_t \propto D^2$

D. $V_t \propto D^{5/2}$

Answer: C

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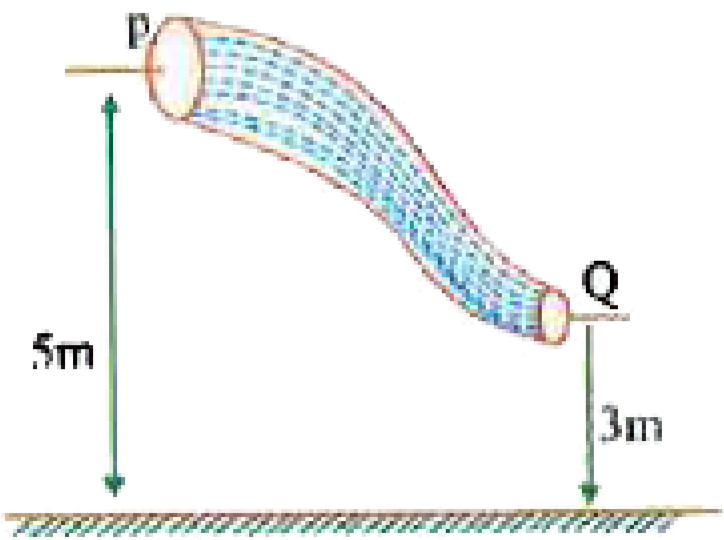
14. A non-viscous fluid of constant density of $1000 kg/m^3$ flows in stream line motion along a tube of variable cross-section



The area of

cross-section at two P and Q at lengths 5m are $40cm^2$ and $20cm^2$ respectively. If velocity of fluid at P is $3m/s$ then find velocity of fluid at Q.

A. $3m/s$

B. $4m/s$

C. $5m/s$

D. $6m/s$

Answer: D

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15. The work done in increasing the size of a rectangular soap film with dimensions 8 cm x 3.75 cm to 10 cm x 6 cm is $2 \times 10^{-4}J$. The surface tension of the film in $\left(Nm^{-1}\right)$ is

A. 1.65×10^{-2}

B. 3.3×10^{-2}

C. 6.6×10^{2}

D. 8.25×10^{-2}

Answer: B

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16. Surface area of a soap bubble is $1.3 \times 10^{-4} m^2$. The work done to doble the surface area will be (Surface tension for soap solution = 3×10^{-3} N//m)

A. 3.9×10^{7} joule

B. 3×10^{7} joule

C. 2.6×10^{7} joule

D. 2.3×10^{7} joule

Answer: A

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17. If the radius of a soap bubble is four times that of another, then the ratio of their pressures will be

A. $1:4$

B. $4:1$

C. $16:1$

D. $1:16$

Answer: B

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18. Two small drops of mercury, each of radius R, coalesce to form a single large drop. The ratio of the total surface energies before and after the change is

A. $1:2^{1/3}$

B. $2^{1/3}:1$

C. $2:1$

D. $1:2$

Answer: B

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19. A frame made of metalic wire enclosing a surface area A is covered with a soap film. If the area of the frame of metallic wire is reduced by 50% the energy of the soap film will be changed by:

A. 100%

B. 75%

C. 50%

D. 25%

Answer: C

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20. The potential energy of molecule on the surface of a liquid as compared to in side the liquid is

A. zero

B. lesser

C. equal

D. grater

Answer: D

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21. The wattability of a surface by a liquid depends primarily on

A. surface tentsion

B. density

C. angle of contact between the surface and the liquid

D. viscosity

Answer: C

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22. A certain number of spherical drops of a liquid of radius r coalesce to form a single drop of radius R and volume V. If T is the surface tension of the liquid, then

A. energy $= 4VT\left(\frac{1}{r} + \frac{1}{R}\right)$ is released

B. energy $= 3VT\left(\frac{1}{r} + \frac{1}{R}\right)$ is absorbed

C. energy $= 3VT\left(\frac{1}{r} - \frac{1}{R}\right)$ is released

D. energy is neither released nor absorbed.

Answer: C

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23. A boy has 60 kg-wt. He wants to swim in a river with the help of a wooden log. If relative density of wood is 0.6. What is the minimum volume of wooden log $\left(\text{Density of river water is } 1000kg/m^3\right)$

A. $6.66m^3$

B. $150m^3$

C. $\frac{3}{1}m^3$

D. $\frac{3}{20}m^3$

Answer: D

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24. Two non-mixing liquids of densities ρ and $(n > 1)$ are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length $pL(p < 1)$ in the denser liquid. The density d is equal to :

A. $\{1 + (n + 1)p\}\rho$

B. $\{2 + (n + 1)p\}\rho$

C. $\{2 + (n - 1)p\}\rho$

D. $\{1 + (n - 1)p\}\rho$

Answer: D

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25. A hole is made at the bottom of the tank filled with water (density $= 1000 kgm^{-3}$). If the total pressure at the bottom of the tank is three atmospheres (1 atmosphere $= 10^5 Nm^{-2}$), then the velocity of efflux is nearest to

A. $\sqrt{400} m/s$

B. $\sqrt{200} m/s$

C. $\sqrt{600} m/s$

D. $\sqrt{500} m/s$

Answer: A

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26. A capillary tube is attached horizontally to a constant pressure head arrangement. If the radius of the capillary tube is increased by 10%, then the rate of flow of the liquid shall change nearly by

A. $+10\%$

B. $+46\%$

C. -10%

D. -40%

Answer: B

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27. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of $2ms^{1}$. The mass per unit length of water in the pipe is $100kgm^{-1}$. What is the power of the engine?

A. 400 W

B. 200 W

C. 100 W

D. 800 W

Answer: D

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28. A wind with speed $40m/s$ blows parallel to the roof of a house. The area of the roof is $250m^2$. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be : $\left(\rho_{air} = 1.2kg/m^3\right)$

A. $4.8 \times 10^5 N$, upwards

B. $2.4 \times 10^5 N$, upwards

C. $2.4 \times 10^5 N$, downwards

D. $4.8 \times 10^5 N$, downwards

Answer: B

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29. The cylindrical tube of a spray pump has radius R, one end of which has n fine holes, each of radius r. If the speed of the liquid in the tube is V, the speed of the ejection of the liquid through the holes is:

A. $\frac{V^2R}{nr}$

B. $\frac{VR^2}{n^2r^2}$

C. $\frac{VR^2}{nr^2}$

D. $\frac{VR^2}{n^3r^2}$

Answer: C

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30. Water rises to height h in capillary tube. If the length of capillary tube above the surface of water is made less than h then

A. water does not rise at all

B. water rises up to the tip of capillary tube and then starts overflowing like a fountain.

C. water rises up to the top of capillary tube and stays there without overflowing

D. water rises up to a point a little below the top and stays there.

Answer: C

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