PHYSICS

AAKASH INSTITUTE ENGLISH

MECHANICAL PROPERTIES OF FLUIDS

EXAMPLE

1. Find the pressure exerted at the tip of a board pin, of area 0.1 mm^2, if it is pressed against the board with a force 15 N.

2. Atmospheric pressure is nearly $100kPa$. How large the force does the air in a room exert on the inside of a window pan that is $40cm \times 80cm$?

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3. Find the pressure exerted below a column of water, open to the atmosphere, at depth

(i) 5 m

(ii) 20 m

(Given, density of water = $1 \times 10^3 \text{kg m}^{-3}, g = 10ms^{-2}$)

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4. A manometer tube contains mercury of density 13.6×10^3 kg m^{-3}. What difference in the levels of mercury in the two arms is indicated by a gauge pressure of $1.03 \times 10^5 Pa$?

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5. At a depth of 500m in an ocean (a) what is the absolute pressure? (b) What is the gauge pressure? Density of sea water is

$1.03 \times 10^3 kg/m^3, g = 10ms^{-2}$. Atmospheric pressure = $1.01 \times 10^5 Pa$.

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6. Two pistons of a hydraulic machine have diameters 20 cm and 2 cm. Find the force exerted on the larger piston when 50 kg wt is placed on the smaller piston. When the smaller piston moves is throught 50 cm, by what distance the other piston moves out ?

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7. A solid body floating in water has $\frac{1}{5^{th}}$ of its volume immersed in it. What fraction of its volume will be immersed, if it floats in a liquid of specific gravity 1.2 ?

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8. A cylinder of height 30 cm and radius 7 cm is immersed completely in a fluid of density $1.3 \times 10^3 kg / m^3$. What is the buoyant force acting on it? [Take g = 10 m / s^2]

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9. Water flows through a horizontal pipe of varying area of cross-section at the rate 5 cubic metre per minute. What is the velocity of water at a point where pipe radius is 10 cm?

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10. The reading of pressure meter attached with a closed water pipe is $3.5 \times 10^5 Nm^{-2}$. On opening the valve of the pipe, the reading of pressure meter is reduced to $3 \times 10^5 Nm^{-2}$. Calculate the speed of water flowing out of the pipe.

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11. At What velocity does water emerge from an orifice in a tank in which gauge pressure is $3 \times 10^5 Nm^{-2}$ before the flow starts ? (Take the density of water $= 1000 kgm^{-3}$.)

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12. A garden pipe has an internal diameter of 4 cm. It is connected to a lawn sprinkler that consists of 24 holes at the other end. Each hole is of radius 0.06 cm. If the water in the pipe has a speed of 80 cm s^{-1}, find its speed through sprinkler holes.

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13. Two glass plates each of length 16 cm and breadth 8 cm move parallel to each other in water with a relative velocity of 6 cm s^{-1}. If the viscous force is 175×10^{-5}N, what is their distance of separation ? (Given η_{water} = 0.001 PI)

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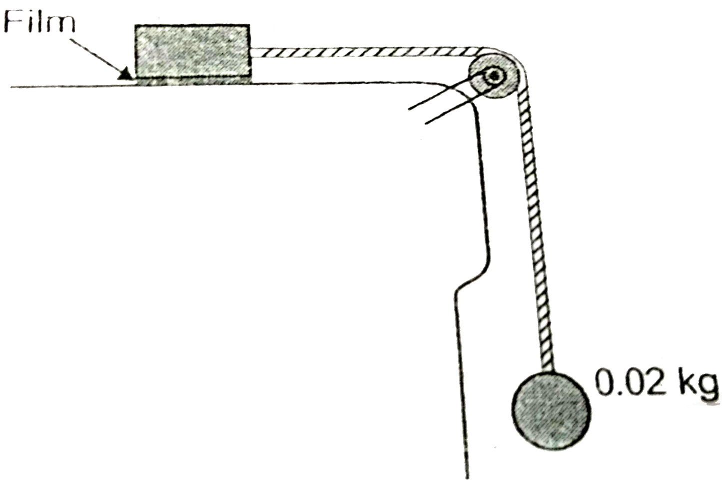
14. A metal block of area 0.10 m^2 is connected to a 0.02 kg mass via a string. The string passes over an ideal pulley (considered massless and frictionless) as shown in figure. A liquid with a flim of thickness 0.15 mm is placed between the plate and the table. When released the plate movees to the right with a constant speed of 0.075 m s^{-1}. What is the coefficient of viscosity of the liquid?



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16. Six small raindrops each of radius 1.5 mm, come down with a terminal velocity of 6 cm s^{-1}. They coalesce to form a bigger drop. What is the terminal velocity of the bigger drop?

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17. Water is flowing in a pipe of radius 1.5 cm with an average velocity 15 cm s^{-1}. What is the nature of flow? Given coefficient of viscosity of water is 10^{-3} kg $m^{-1}s^{-1}$ and its density is 10^3 kg m^{-3}

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18. The surface tension of a soap solution is $30 \times 10^{-3} Nm^{-1}$. How much work is done to increase the radius of a soap bubble from 1.5 cm to 3 cm?

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22. Water rises up in a glass capillary upto a heigh 10 cm, while mercury falls down by 3.5 cm in the same capillary. If the angles of contact for water-glass and mercury-glass are taken as 0° and 135°

respectively, compare the surface tensions of water and mercury. [Given density of water = 10^3 kg m^{-3}, density of mercury = 13.6 $\times 10^3$ kg m^{-3}]

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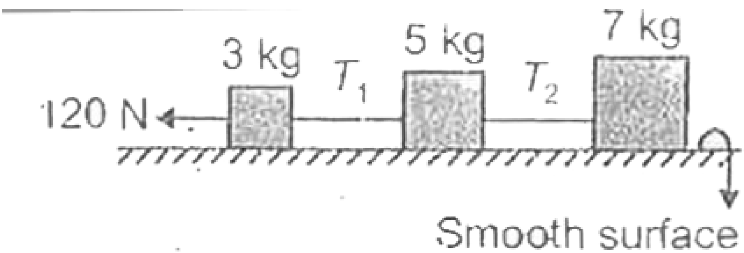
23. T_1 and T_2 in the given figure are



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

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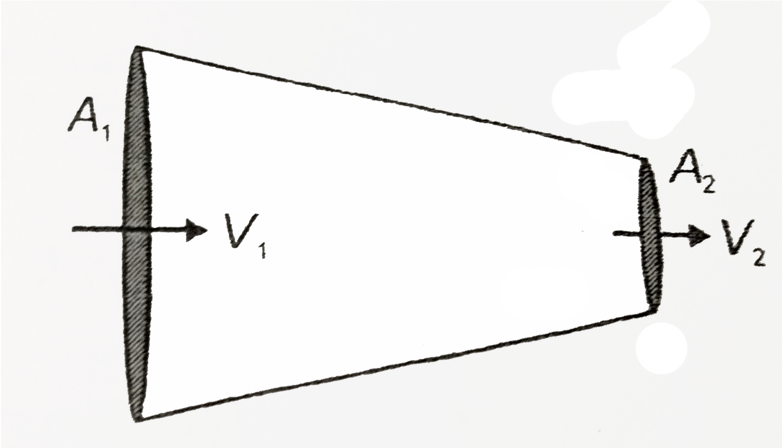
25. Calculate the rate of flow of glycerine of density 1.20 $\times 10^3 kg/m^3$ through the conical section of a pipe. If the radii of its ends are 0.1 m and 0.02 m and the pressure drop across the length is 10 $\frac{N}{m^2}$.



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26. Find the pressure exerted at the tip of a board pin, of area 0.1 mm^2, if it is pressed against the board with a force 15 N.

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27. An open container has dimensions of $4.0m \times 5.0m$ and height of 3.0 m.

(i) Find the weight of the air in the container at $20^{\circ} C$.

(ii) What is the weight of an equal volume of water ? Also find pressure at the base of container due to this weight pof water.

(iii) What is the total downward force on the base of the container due to air pressure of 1.0 atm ?

Take the denities of air and water as $1.2 kg / m^3$ and $10^3 kg / m^3$ respectively.

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(i) 5 m

(ii) 20 m

(Given, density of water = $1 \times 10^3 \text{kg m}^{-3}, g = 10 ms^{-2}$)

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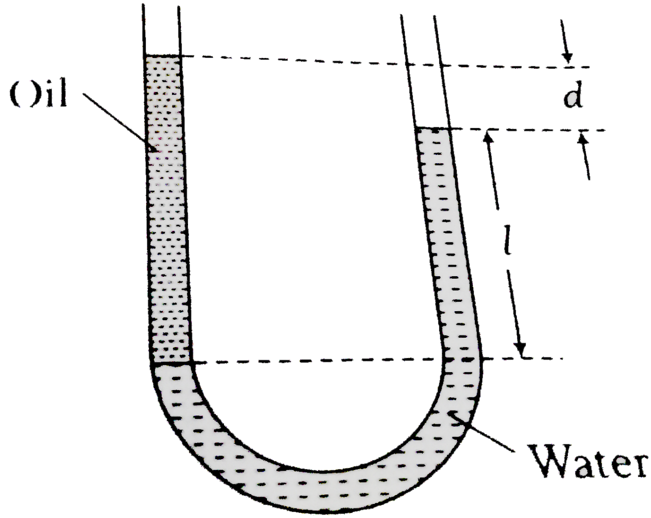
29. The U-tube in figure contains two different liquids in static equilibrium, water in the right arm and oil of unknown density ρ_x in the left. If/=135 mm and d=15 mm. Density of the oil is



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30. Prove that the average pressure of a liquid (density ρ) on the walls of the container filled upto height h with liquid is $\frac{1}{2}h\rho g$.

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31. A manometer tube contains a liquid of density $4 \times 10^3 kgm^{-3}$. When connected to a vessel containing a gas, the liquid level in the other arm of the tube is higher by 20 cm. When connected to another sample of enclosed gas, the liquid level in the other arm of the manometer tube falls 8 cm below the liquid level in the first arm. Which of the two samples exerts more pressure and by what amount ?

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32. At a depth of 500 m in an ocean , what is the absolute pressure ? Given that the density of sea water is $1.03 \times 10^3 kgm^3$ and $g = 10ms^{-2}$.

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36. A metallic sphere weighs 35 g in air and 28.5 g water. Find its relative density and also find weight in a liquid of relative density 0.9.

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37. A piece of gold weighs 50 g in air and 45 g in water. If there is a cavity inside the piece of gold, then find its volume [Density of gold = 19.3 g/cc].

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38. A piece of brass (Cu and Zn) weighs $12.9g$ in air. When completely immersed in water, it weighs $11.3g$. Then relative densities of Cu and Zn are $8.9 \text{ and } 7.1$ respectively. The mass of copper in the alloy is

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39. A pipe of varying area of cross-section is held such that its axis is horizontal. At two cross sections A and B, its radii are 8 cm and 4 cm. If velocity of water at A through the pipe is 16 cm s^{-1} and pressure at A is 10^6 dyne/cm^2 , find the pressure at cross-section B.

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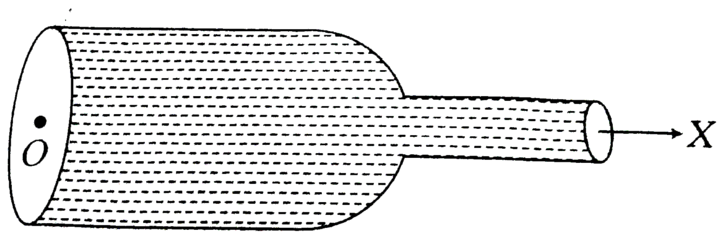
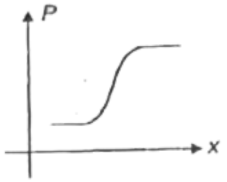
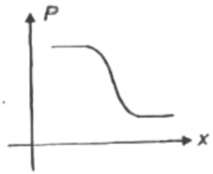
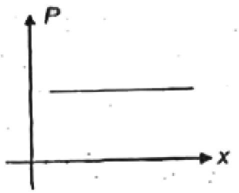
40. A non viscous liquid is flowing through a frictionless duct, cross-section varying as shown in figure.

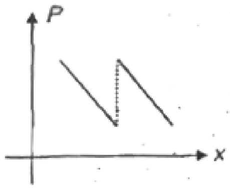


Which of the following graph represents the variation of pressure p along the axis of tube ?

A. 

B. 

C. 

D. 

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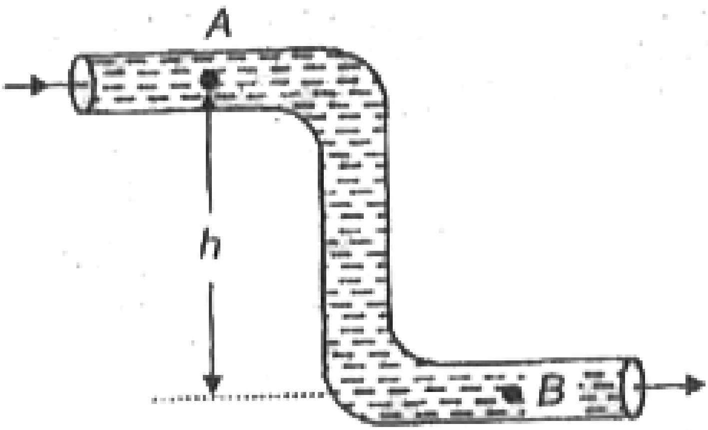
41. In this figure, an ideal liquid flows through the tube having uniform area of cross-section and is held in vertical plane. Find the ratio of speed of liquid at A and B and also find the pressure difference between- these points.



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42. A cylindrical vessel of radius r containing a liqiud is rotating about a vertical axis through the centre of circular base, If the vessel is rotating with angular velocity ω then what is the difference of the heights of liquid at centre of vessel and edge?

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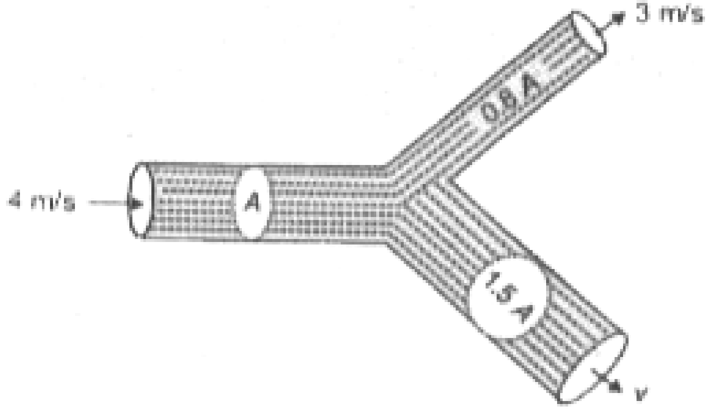
43. An incompressible liquid is flowing through a horizontal pipe as shown in figure. Find the value of v.



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44. A manometer connected to a closed tap reads $4.2 \times 10^6 \frac{N}{m^2}$ and when tap is opened the readin of manometer falls to $4.0 \times 10^6 \frac{N}{m^2}$. Find the speed of flow of water.

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45. The bottom of a cylindrical vessel has a circlular hole of radius r and at depth h below the water] level. If the diameter of the vessel is D, the find then speed with which the water level in the] vessel drops.

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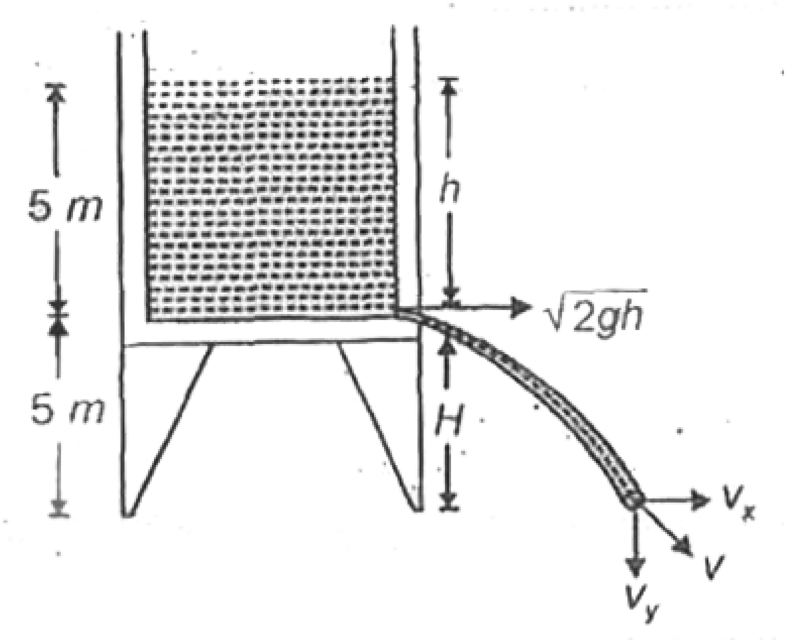
46. A water tank is placed on a platform of height 5 m high and there is an orifice near the bottom in the wall of tank at 5 m below the level of water. Find the speed with which water will hit the ground [Take g = 10 m/s^2]



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47. Two square metal plates, each of side 10 cm are immersed in water. One plate moves parallel to the other with a velocity of 5 cm s^{-1}. If the viscous force is 150 dyne, what is their distance of separation ? Given η_{water} = .001 PI

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48. The rate of steady volume flow of water through a capillary tube of length ' l ' and radius ' r ' under a pressure difference of P is V . This tube is connected with another tube of the same length but half the radius in series. Then the rate of steady volume flow through them is (The pressure difference across the combination is P)

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respectively, compare the surface tensions of water and mercury. [Given density of water = 10^3 kg m^{-3}, density of mercury = 13.6 $\times 10^3$ kg m^{-3}]

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57. A small hollow sphere which has a small hole in it is immersed in water to a depth of 40 cm, before any water is penetrated into it. If the surface tensionof water si $0.073Nm^{-1}$, find the radius of the hole.

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TRY YOURSELF

1. The two thigh bones (femur bones) each of cross-sectional area $10 cm^2$ support the upper part of a human body of mass 40 kg . Estimate the average pressure sustained by the femurs. $g = 10 m / s^2$

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2. The area of a man's foot is 80 cm^2. How much pressure will the man exert on the ground, while standing, if his weight is 80 kgf?

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3. If a pressure of 378 atm is exerted on a circular cross section of radius 0.1 mm, what is the force exerted on the area?

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4. When a pressure measuring device is immersed in a liquid, a restoring force of 2 N is exerted by the spring. If the area of cross-section of the pistion is 10 cm^2, what pressure does the fluid exert on the piston?

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5. What is the absolute pressure on a swimmer $10m$ below the surface of a lake? Take atmospheric pressure $1 \times 10^5 N / m^2$

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6. If the gauge pressure, at the bottom of a water tank is 2.7 kPa, what is the height of the water [Take g = 10 m s^{-2}]

Hint : Gauge Pressure = absolute pressure - atmospheric pressure = pgh

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7. The density of the atmosphere at sea level is $1.29kg/m^3$. Assume that it does not change with altitude, how high should the atmosphere extend?

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8. A rectangular tank of base area 100 m^2 has a height of 2 m. Calculate the thrust at the bottom of the tank, if it is filled upto the brim with water of density 10^3 kg m^{-3}.

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10. A column of water $40cm$ high supports a $30cm$ column of an unknown liquid . What is the density of the liquid ?

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12. The average mass that must be lifted by a hydraulic press is 80kg.If the radius of the larger piston is five times that of the smaller piston, what is the minimum force that must be applied?

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13. A solid of density 2.5 kg m^{-3} floats in a fluid with one-third of its volume immersed in it. What is the density of the fluid?

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14. Will an object of density ρ float in a fluid of density 1.5 ρ? If yes what fraction of the object's volume will remain above the fluid?

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15. A solid of volume 5 m^3 is immersed completely in a fluid of density 0.5 kg m^{-3}. What is the buoyant force acting on it? [Take g = 10 m/s^2]

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16. A solid ball of mass 5 kg occupies a volume of 240 cm^3. How much will it weigh when immersed completely in a fluid of dnesity 2.7×10^3 kg m^{-3}?

Hint : Apparent weight = Actual weight - Buoyant force

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17. Blood velocity: The flow of blood in a large artery of an anesthetised dog is diverted through a venturi meter. The wider part of the meter has a cross-sectional area equal to that of the artery. $A = 8mm^2$. The narrower part has an area $a = 4mm^2$. The pressure drop in the artery is 24 Pa. What is the pseed of the blood in the artery?

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18. Calculate the minimum pressure difference required to force the blood from the heart to the top of the head (vertical distance about 50 cm). Neglect friction.

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19. Water flows through a horizontal pipe of varying area of cross section at the rate 15 cubic metre per minute. Find the radius of pipe where water velocity is 3 ms^{-1}

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20. Two horizontal pipes of different diameters are connected together by a value. Their diameters are 3 cm and 9 cm. Water flows at speed 6 m s^{-1} in the first pipe and the pressure in it is $2 \times 10^5 Nm^{-2}$. Find the water pressure and speed in the second pipe.

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21. An open vessel contains water upto height 50 cm in it. What is the velocity of efflux through an orifice at height 30 cm above the bottom level ? [Take g = 10 m/s^2]

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22. A tank containing water has an orifice 2 m below the surface of water. If there is no wastage of energy. Find the speed of discharge.

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25. Find the viscous drag between the two liquid layers each of area 100 cm^2, and having relative velocity 8 cm s^{-1}. The viscosity of the liquid is 0.004 Pl and the layers are separated by a distance 4 cm.

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26. A metal block of area 0.10 m^2 placed at a table, is connected to a 0.010 kg mass via a string that passes over an ideal pulley. Th pulley is fixed at the edge of the table. A liquid with a film of thickness 0.30 mm is placed between the block and the table. If the coefficient of viscosity of the liquid is 3.45×10^{-3} Pa s, with what constant velocity does the block move when released?

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27. An iron ball of radius 0.3 cm falls through a column of oil of density $0.94gcm^{-3}$ .It is found to attain a terminal velocity of $0.5cms^{-1}$. Determine the viscosity of the oil. Given that the density of iron is $7.8gcm^{-3}$

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28. A viscous force of 1.018×10^{-7} N acting on a raindrop makes it fall through air with a terminal velocity of 1 ms^{-1}. If the viscosity of air is

0.018×10^{-3} PI, what is the radius of the raindrop?

Hint : Stokes' law

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29. What is the terminal velocity of a copper ball of radius 2.0 mm, which falls through an oil tank? Given that density of oil = 1.5×10^3 kg m^{-3}, density of copper $= 8.9 \times 10^3 kgm^{-3}$ and viscosity of oil is 0.99 kg $m^{-1}s^{-1}$.

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30. The flow rate of water from a tap of diameter 1.25 cm is 0.48 L/min. If the coefficient of viscoity of water is 10^{-3}Pa s, what is the nature of flow of water ?

Hint : Velocity = $\dfrac{\text{Flow rate}}{\text{Cross sectional area}}$

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31. What should be the average velocity of water in a tube of radius 2.5 mm so that the flow is just turbulent? Viscosity of water is 0.001 Pa s.

Hint : For flow to be just turbulent R_e = 2000

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32. If 72×10^{-5} J of work is done to increase the radius of a soap bubble from 2 cm to 3 cm. What is the surface tension of the soap solution?

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35. If the thickness of the plate in the above problem is 2 mm, find the downward force when plate is placed vertically on water along its longest side.

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36. Find the excess pressure inside a liquid drop of radius 2 cm, if the surface tension of water is 0.073 N m^{-1}

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37. The lower end of a capillary tube of diameter 2.00 mm is dipped 8.00 cm below the surface of water is 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 $7.30 \times 10^{-2} Pa$, density of water $= 1000 kg/m^3$, $g = 9.80 ms^{-2}$, also calculate the excess pressure.

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38. Calculate the excess pressure inside the bubble in the above problem 37.

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39. Find the total pressure inside a sperical air bubble of radius 0.2 mm. The bubble is at a depth 5

cm below the surface of a liquid of density 2×10^3 kg m^{-3} and surface tension 0.082 N m^{-1}. (Given : atmospheric pressure = 1.01 $\times 10^5 Nm^{-2}$)

Hint : $P_i = P_o + \frac{2S}{R}$

P_o = atmospheric pressure + gauge pressure of liquid column.

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40. A capillary tube of radius 1 mm is dipped in water of surface tension 0.073 N m^{-1}. Find the weight of water that rises in the tube. Take angle of contact $\theta = 0^\circ$

Hint : $h\rho g = \frac{2S\cos\theta}{2}$

Required wt = $\pi r^2 h\rho g$

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41. To what height does the liquid rise in a capillary tube of radus 0.25 mm, when dipped in a liquid of density $0.8 \times 10^3 kgm^{-3}$ and surface tension 0.05 N m^{-1}? Given $(\cos\theta = 0.4)$

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46. If value of acceleration due to gravity at a place decreases by 3% the Ti find the change in height of mercury in a barometer at that place.

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47. If pressure at the half depth of a lake is equal to $\frac{3}{4}$ times the pressure at its bottom, then find the depth of the lake. [Take g = 10 m/s^2]

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54. A solid of density 2.5 kg m^{-3} floats in a fluid with one-third of its volume immersed in it. What is the density of the fluid?

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55. Will an object of density ρ float in a fluid of density 1.5 ρ? If yes what fraction of the object's volume will remain above the fluid?

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56. A solid of volume 5 m^3 is immersed completely in a fluid of density 0.5 kg m^{-3}. What is the buoyant force acting on it? [Take g = 10 m/s^2]

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57. A solid ball of mass 5 kg occupies a volume of 240 cm^3. How much will it weigh when immersed completely in a fluid of dnesity 2.7×10^3 kg m^{-3}?

Hint : Apparent weight = Actual weight - Buoyant force

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58. The flow of blood in a large artery of an anesthetised dog is diverted through a venturimeter. The wider part of the meter has a cross-sectional area equal to that of the artery, $A = 16mm^2$. The narrower part has an area $a = 9mm^2$. The pressure drop in the artery is 24 Pa. What is the speed of the blood in the artery ?

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59. Calculate the minimum pressure difference required to force the blood from the heart to the top of the head (vertical distance about 50 cm). Neglect friction.

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60. Water flows through a horizontal pipe of varying area of cross section at the rate 15 cubic metre per minute. Find the radius of pipe where water velocity is 3 ms^{-1}

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61. Two horizontal pipes of different diameters are connected together by a value. Their diameters are 3 cm and 9 cm. Water flows at speed 6 m s^{-1} in the first pipe and the pressure in it is $2 \times 10^5 Nm^{-2}$. Find the water pressure and speed in the second pipe.

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62. An open vessel contains water upto height 50 cm in it. What is the velocity of efflux through an orifice at height 30 cm above the bottom level ? [Take g = 10 m/s^2]

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63. A tank containing water has an orifice 2 m below the surface of water. If there is no wastage of energy. Find the speed of discharge.

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64. The reading of a pressure meter attached to a horizontal closed pipe is $3 \times 10^5 Nm^{-2}$. This reading falls to $1 \times 10^5 Nm^{-2}$ when the valve is opened. What is the speed of water flowing in the pipe?

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65. Two glass plates each of length 16 cm and breadth 8 cm move parallel to each other in water with a relative velocity of 6 cm s^{-1}. If the viscous force is 175×10^{-5}N, what is their distance of separation ? (Given η_{water} = 0.001 PI)

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66. Find the viscous drag between the two liquid layers each of area 100 cm^2, and having relative

velocity 8 cm s^{-1}. The viscosity of the liquid is 0.004 Pl and the layers are separated by a distance 4 cm.

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67. A metal block of area 0.10 m^2 placed at a table, is connected to a 0.010 kg mass via a string that passes over an ideal pulley. Th pulley is fixed at the edge of the table. A liquid with a film of thickness 0.30 mm is placed between the block and the table. If the coefficient of viscosity of the liquid is 3.45×10^{-3} Pa s, with what constant velocity does the block move when released?

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68. An iron ball of radius 0.3 cm falls through a column of oil of density 0.94 g cm^{-3}. If it attains a terminal velocity of 0.54 m s^{-1}, what is the viscosity of oil? Density of iron is 7.8 g cm^{-3}

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69. A viscous force of 1.018×10^{-7} N acting on a raindrop makes it fall through air with a terminal velocity of 1 ms^{-1}. If the viscosity of air is

0.018×10^{-3} PI, what is the radius of the raindrop?

Hint : Stokes' law

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70. What is the terminal velocity of a copper ball of radius 2.0 mm, which falls through an oil tank? Given that density of oil = 1.5×10^{3} kg m^{-3}, density of copper $= 8.9 \times 10^{3} kgm^{-3}$ and viscosity of oil is 0.99 kg $m^{-1} s^{-1}$.

Watch Video Solution

71. The flow rate of water from a tap of diameter 1.25 cm is 0.48 L/min. If the coefficient of viscoity of water is 10^{-3} Pa s, what is the nature of flow of water ?

Hint : Velocity = $\frac{\text{Flow rate}}{\text{Cross sectional area}}$

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72. What should be the average velocity of water in a tube of radius 2.5 mm so that the flow is just turbulent? Viscosity of water is 0.001 Pa s.

Hint : For flow to be just turbulent R_e = 2000

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73. If 72×10^{-5} J of work is done to increase the radius of a soap bubble from 2 cm to 3 cm. What is the surface tension of the soap solution?

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74. The surface tension of a soap solution is $30 \times 10^{-3} Nm^{-1}$. How much work is done to increase the radius of a soap bubble from 2 cm to 3 cm?

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75. A rectangular glass plate of dimensions 5 cm $\times$ 4 cm is placed flat on the surface of water. Find the downward force on the plate due to surface tension. Given surface tension of water = 0.073 N m^{-1}

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76. A rectangular glass plate of dimensions 5 cm $\times$ 4 cm is placed flat on the surface of water. Find the downward force on the plate due to surface tension. Given surface tension of water = 0.073 N m^{-1}

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77. Find the excess pressure inside a liquid drop of radius 2 cm, if the surface tension of water is 0.073 N m^{-1}

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78. The lower end of a capillary tube of diameter 2.00 mm is dipped 8.00 cm below the surface of water is 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 $7.30 \times 10^{-2} Pa$, density of water $= 1000 kg/m^3$, $g = 9.80 ms^{-2}$, also calculate the excess pressure.

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79. The excess pressure inside a soap bubble is

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80. Find the total pressure inside a spherical air bubble of radius 0.2 mm. The bubble is at a depth 5 cm below the surface of a liquid of density 2×10^3 kg m^{-3} and surface tension 0.082 N m^{-1}. (Given : atmospheric pressure = 1.01 $\times 10^5 Nm^{-2}$)

Hint : $P_i = P_o + \frac{2S}{R}$

P_o = atmospheric pressure + gauge pressure of liquid column.

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81. A capillary tube of radius 1 mm is dipped in water of surface tension 0.073 N m^{-1}. Find the weight of water that rises in the tube. Take angle of contact

$\theta = 0^\circ$

Hint : $h\rho g = \dfrac{2S\cos\theta}{r}$

Required wt = $\pi r^2 h\rho g$

Watch Video Solution

82. To what height does the liquid rise in a capillary tube of radus 0.25 mm, when dipped in a liquid of density $0.8 \times 10^3 kgm^{-3}$ and surface tension 0.05 N m^{-1}? Given $(\cos\theta = 0.4)$

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SECTION - A

1. The principle of operation of a hydraulic lift is

A. Boyle's law

B. Pascal's law

C. Newton's law of gravitation

D. Dalton's law of partial pressure

Answer: B

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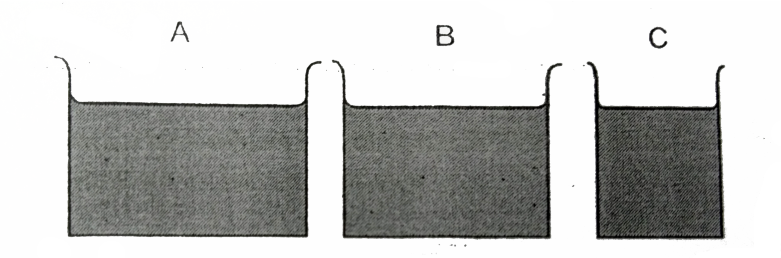
2. In the following figure, four beakers of different base areas contain water as shown



The pressure at the bottom is maximum for the beaker

A. A

B. B

C. C

D. Same for all

Answer: D

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3. Pressure has the dimensions

A. $\left[ML^{-1}T^{-2}\right]$

B. $\left[ML^{-0}T^{-1}\right]$

C. $\left[ML^{1}T^{-1}\right]$

D. $\left[MLT^{-2}\right]$

Answer: A

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4. The radius of one arm of a hydraulic lift is three times the radius of the other arm. What force should be applied on the narrow arm so as to lift 50 kg at the wider arm?

A. 60 N

B. 54.4 N

C. 26.7 N

D. 30 N

Answer: B

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5. If an object of mass 10 kg occupies a volume of 0.50 m^3, it density in SI units is

A. 200 kg/m^3

B. 20kg/m^3

C. 50kg/m^3

D. 500kg/m^3

Answer: B

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6. The absolute pressure at a depth h below the surface of a liquid of density ρ is [Given P_a = atmospheric pressure, g = acceleration due to gravity]

A. $\rho g h$

B. $P_a + \rho g h$

C. $P_a - \rho g h$

D. $P_a 2\rho g h$

Answer: B

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7. The pressure at two points in a liquid in pascal are P and 2P. The piston attached to the mouth of the liquid is given a push with pressure 2 Pa. The respevtive pressures at the two points now are in the ratio

A. $\dfrac{P-2}{2P-2}$

B. $\dfrac{P+2}{2P+2}$

C. $\dfrac{P+1}{2P+1}$

D. $\dfrac{P-1}{2P-1}$

Answer: B

Watch Video Solution

8. An incompressible liquid of density ρ is enclosed with two frictionless pistons one of cross-sectional area A and the other of 4 A. When the narrow piston moves out by a distance.

A. h

B. 4 h

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

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

Answer: C

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9. The pressure at the bottom of a liquid container is determined by the

A. Amount of liquid in it

B. Shape of the container

C. Height of the liquid column

D. Height of the container wall

Answer: C

Watch Video Solution

10. Express one atm pressure in terms of the height of mercury column.

A. 76 cm

B. 7.6 cm

C. 86 cm

D. 8.6 cm

Answer: A

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11. Which of the following is correct?

A. Gases have fixed density

B. Liquids are highly compressible

C. Liquids have small shear modulus

D. Gases have high shear modulus

Answer: C

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12. The pressure at a point in water is 10 N/m^2. The depth below this point where the pressure becomes double is (Given density of water = 10^3 kg m^{-3}, g = 10 m s^{-2})

A. 1 mm

B. 1 cm

C. 1 m

D. 10 cm

Answer: A

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13. The equation of continuity is a consequence of conservation of

A. Charge

B. Mass

C. Energy

D. Temperature

Answer: B

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14. Bernoulli's equation is a consequence of conservation of

A. Charge

B. Mass

C. Energy

D. Temperature

Answer: C

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15. The cross-sectionss of a pipe at two points A and B are in the ratio 1.4. If the speed of water flowing through the pipe at point A is v, its speed at point B is

A. 4v

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

C. 2v

D. $\frac{v}{2}$

Answer: B

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16. Scent sprayer is based on

A. Archimedes principle

B. Bernoulli's principle

C. Charles' law

D. Boyle's law

Answer: B

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17. If the speed of a liquid flowing horizontally increases at a place, then the quantity that decreases there is

A. Kinetic energy

B. Potential energy

C. Pressure

D. Density

Answer: C

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18. The velocity of efflux of a fluid through an orifice 15 cm below the fluid surface (which is open to the atmosphere) is [Take g = 10 m s^{-2}]

A. $\sqrt{3}ms^{-1}$

B. $3ms^{-1}$

C. $\frac{1}{\sqrt{3}}ms^{-1}$

D. $\frac{1}{3}ms^{-1}$

Answer: A

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

A. Atmospheric pressure

B. Height of the fluid column

C. Acceleration due to gravity

D. Density of the liquid

Answer: D

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20. A block of density ρ floats in a liquid with its one third volume immersed. The density of the liquid is

A. ρ

B. $\frac{\rho}{3}$

C. $\frac{\rho}{2}$

D. 3ρ

Answer: D

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21. A diatomic gas at STP is expanded to thirty two times its volume under adiabatic conditions the resulting temprature in kelvin ?(answer must be in two decimal points)

A. Relative velocity of the fluid is geater

B. Relative velocity of the fluid is smaller

C. Pressure is greater

D. Kinetic energy of the fluid is smaaler

Answer: A

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22. Calculate the degree of freedom of diatomic molecule?

A. Non-steady flow

B. Compressible liquids

C. Streamlined flow

D. Turbulent flow

Answer: C

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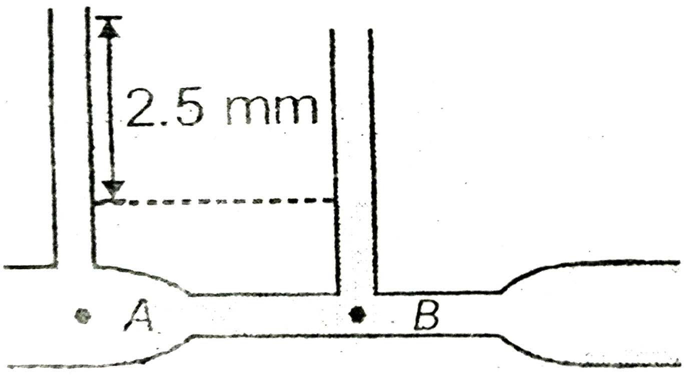
23. In the figure shown below, a fluid of density 2×10^3 kg m^{-3} is flowing in a horizontal pipe. The speed of water at point A is 4 cm s^{-1}, what is its speed at point B?



A. 3 cm s^{-1}

B. 22.72 cm s^{-1}

C. 6 cm s^{-1}

D. 60 cm s^{-1}

Answer: B

Watch Video Solution

24. An open water tank has an orifice 10 cm below the surface of water. If there is no loss of energy, then what is the speed of efflux ? (Take g = 10 m s^{-2})

A. 1.414 m s^{-1}

B. 2.5 m s^{-1}

C. 6.32 m s^{-1}

D. 3.7 m s^{-1}

Answer: A

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25. Two metal ball of radius R and 2 R falling through a fluid have same velocity at some point. The viscous drag acting on them at that instant are in the ratio

A. $1:2$

B. $1:4$

C. $1:\sqrt{2}$

D. $\sqrt{2}:1$

Answer: A

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26. The terminal velocity of a sphere of radius R, falling in a viscous fluid, is proportional to

A. R

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

C. R^2

D. $\frac{1}{R^2}$

Answer: C

Watch Video Solution

27. Eight raindrops each of radius R fall through air with teminal velocity 6 cm s^{-1}. What is the terminal velocity of the bigger drop formed by coalescing these drops together ?

A. 18 cm s^{-1}

B. 24 cm s^{-1}

C. 15 cm s^{-1}

D. 20 cm s^{-1}

Answer: B

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28. The coefficient of viscosity has the dimensional formula

A. a. $[MLT^{-2}]$

B. b. $\left[ML^2T^{-2}\right]$

C. c. $\left[ML^0T^{-2}\right]$

D. d. $\left[ML^{-1}T^{-1}\right]$

Answer: D

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29. Reynolds number for a liquid of density ρ, viscosity η and flowing through a pipe of diameter D, is given by

A. $\dfrac{\rho v D}{\eta}$

B. $\frac{\rho\eta D}{v}$

C. $\frac{\rho v\eta}{D}$

D. $\frac{\eta v D}{\rho}$

Answer: A

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30. A flow of liquid is streamline, if the Reynolds' number is

A. 3100

B. 2500

C. 200

D. 2200

Answer: C

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31. Twenty seven identical rain drops colaese to form a big rain drop. If this rain drop travels with terminal velocity of 18 ms^{-1}, what is the terminal velocity of each small rain drop?

A. a. 4 ms^{-1}

B. b. 2 ms^{-1}

C. c. 6 ms^{-1}

D. d. 10 ms^{-1}

Answer: B

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32. The coefficient of viscosity for hot air is

A. a. Greater than that for cold air

B. b. Smaller than that for cold air

C. c. Same as that of cold air

D. d. Lower at high pressures and greater at low

Answer: A

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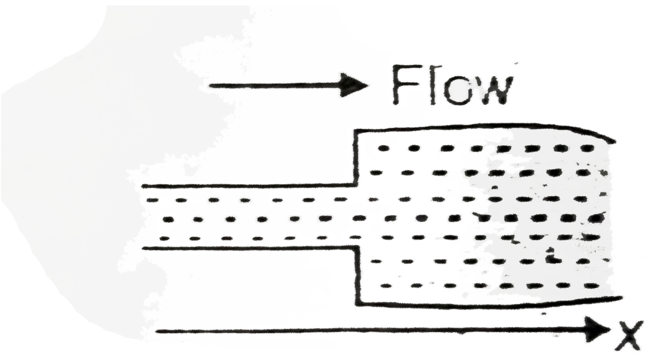
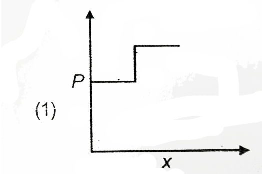
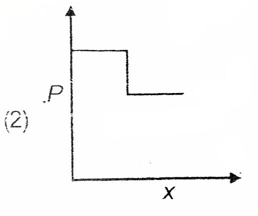
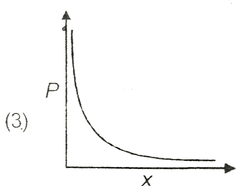
33. Water flows through a frictionless tube with a varying cross-section as shown

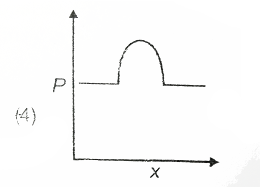


The variation of Pressure P as the fluid move through the pipe is correctly shown in

A. a. 

B. b. 

C. c. 

D. d. 

Answer: A

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34. A metal ball falls through water with terminal velocity 20 ms^{-1}. When the ball is allowed to fall through vacuum, then

A. Terminal velocity is 30 ms^{-1}

B. Terminal velocity is 20 ms^{-1}

C. Terminal velocity is 15 ms^{-1}

D. There is no terminal velocity

Answer: D

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35. Water flows at a speed 5 cm s^{-1} through a pipe of radius 2 cm. The visosity of water is 0.001 PI. The Reynolds number and the nature of flow are respectively

A. 2000, unsteady

B. 1500, turbulent

C. 1000, turbulent

D. 2500, laminar

Answer: A

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36. The Reynolds number of a flow is the ratio of

A. Viscous force and gravitational force

B. Inertial force and viscous force

C. Inertial force and gravitational force

D. Viscous force and surface energy

Answer: B

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37. When stirred with a spoon and left, water comes to rest after some time. It occurs due to

A. a. Surface tension

B. b. Energy conservation

C. c. Pressure

D. d. Viscosity

Answer: D

Watch Video Solution

38. In the absence of any external force, liquid drop are sperical in shape. It is due to

A. a. Surface tension

B. b. Energy conservation

C. c. Pressure

D. d. Viscosity

Answer: A

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39. The excess energy possessed by molecules at the free surface of a liquid is roughly equal to

A. a. Heat of evaporation

B. b. Half the heat of evaporation

C. c. Double the heat of evaporation

D. d. One third the heat of evaporation

Answer: B

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40. The amount of work done in blowing up a soap bubble of radius 2 cm is [Given surface tension of soap solution = 4 $\times 10^{-2}$ N m^{-1}]

A. 1.28×10^{-4} J

B. 32×10^{-4} J

C. 1.08×10^{-4} J

D. 4.02×10^{-4} J

Answer: D

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41. The excess pressure inside a liquid drop of water will be maximum for the one having radius

A. R

B. 2 R

C. $\frac{R}{2}$

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

Answer: D

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

A. 0°

B. 90°

C. 60°

D. 120°

Answer: D

Watch Video Solution

43. Adding detergents to the water increases its

A. Surface tension

B. Angle of contact

C. Wetting action

D. Viscosity

Answer: C

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44. Water rises to a height h when a capillary of radius r is dipped in water. For another capillary of radius 2r dipped in water, it rises to the height

A. a. h

B. b.2h

C. c.$\frac{h}{4}$

D. d. $\frac{h}{2}$

Answer: D

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45. The angle of contact of a liquid in a capillary tube is 60°. The shape of the meniscus is

A. Concave

B. Convex

C. Flat

D. None of these

Answer: A

Watch Video Solution

46. A spherical drop of water has 2.5 mm radius. If the surface tension of water is 70×10^{-3} N m^{-1}, then the excess pressure inside the drop is

A. 70 N m^{-2}

B. 56 N m^{-2}

C. 35 N m^{-2}

D. 48 N m^{-2}

Answer: B

Watch Video Solution

47. Two water droplets merge with each other to from a larger droplet. In this process

A. Energy is liberated

B. Energy is absorbed

C. Some mass is connverted into energy

D. Energy is neither liberated nor absorbed

Answer: A

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48. To what height does a liquid of density 0.4×10^3 kg m^{-3} and surface tension 0.05 Nm^{-1} rise in a capillary tube of radius 0.2 mm when dipped in ? [Given $\cos\theta = 0.4 g = 10 ms^{-2}$]

A. 25 cm

B. 15 cm

C. 5 cm

D. 20 cm

Answer: C

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49. The pressure inside an air bubble of radius 2 cm formed 20 cm below an open water surface is (Given surface tension of water = $70 \times 10^{-3} Nm^{-1}$)

A. $0.3 \times 10^{5} Nm^{-2}$

B. $0.2 \times 10^{5} Nm^{-2}$

C. $2.03 \times 10^{5} Nm^{-2}$

D. $1.03 \times 10^{5} Nm^{-2}$

Answer: D

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50. The minimum force required to separate a light glass plate of perimeter 5m from a water surface is (Given surface tension of water = 70×10^{-3}N/m)

A. 350×10^{-3}N

B. 75×10^{-3}N

C. 100×10^{-3}N

D. 150×10^{-3} N

Answer: A

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SECTION - B

1. Three capillaries of length $L, \frac{L}{2}$ and $\frac{L}{3}$ are connected in a series. Their radii are $r, \frac{r}{2}$ and $\frac{r}{3}$ respectively. If a streamlined flow is to be maintained and pressure difference across the first capillary is ρ, then the pressure difference across the second capillary will be

A. 2ρ

B. 8ρ

C. ρ

D. $\frac{\rho}{2}$

Answer: B

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2. The work done to get 'n' smaller equal size spherical drop from a bigger size 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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3. The terminal velocity of small sized spherical body of radius r falling veertically in a viscous liquid is given by a following proportionality

A. $\frac{1}{r^2}$

B. r^2

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

D. r

Answer: B

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4. If Q is the rate of flow of liquid through a capillary tube of length l and radius r at constant pressure P, then the rate of flow of liquid through a capillary tube when radius is reduced to one third and length of tube is doubled

A. $\frac{Q}{162}$

B. $\frac{Q}{32}$

C. $\frac{Q}{64}$

D. $\frac{Q}{81}$

Answer: A

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5. When a drop of water splits up is to number of drops

A. Volume increases and energy is liberated

B. Area increases and energy liberated

C. Area decreases and energy is absorbed

D. Area increases and energy is absorbed

Answer: D

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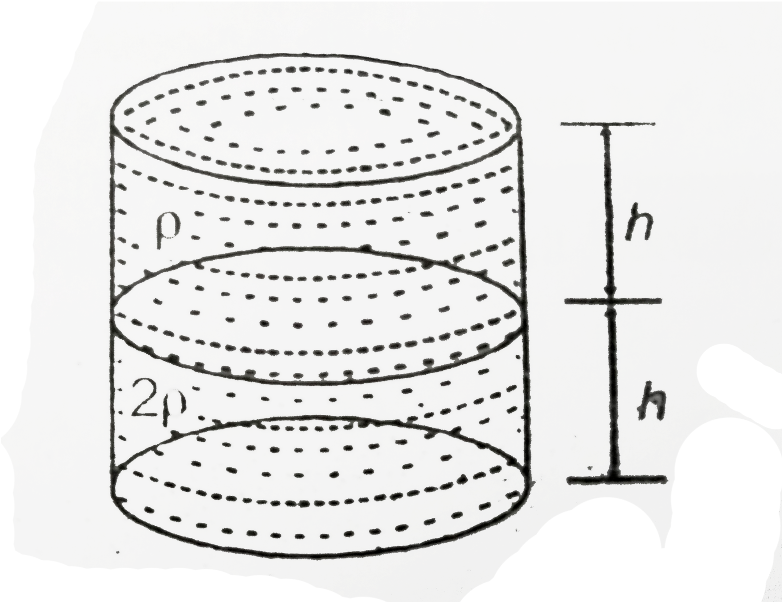
6. A container of cross-section area A resting on a horizontal surface, holds two immiscible and incompressible liquid of densities ρ and 2ρ as shown in figure. The lower density liquid is open to the atmosphere having pressure P_0. The pressure at the bottom of the container is



A. $3h\rho g - P_0$

B. $3h\rho g$

C. $3h\rho g + P_0$

D. $2h\rho g + P_0$

Answer: C

Watch Video Solution

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

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

B. Air flows from the bigger bubble to smaller bubble till the size are interchanged.

C. Air flows the smaller bubble to the bigger

D. There is no flow of air

Answer: C

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8. A piece of steel has a weight w in air, w_1 when completely immersed in water and w_2 when completely immersed in an unknown liquid. The relative density (specific gravity) of liquid is

A. $\dfrac{W - W_1}{W - W_2}$

B. $\dfrac{W - W_2}{W - W_1}$

C. $\dfrac{W_1 - W_2}{W - W_1}$

D. $\dfrac{W_1 - W_2}{W - W_2}$

Answer: B

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9. There is a horizontal film of soap solution. On it a thread is placed in the form of a loop. The film is pierced inside the loop and the thread becomes a circular loop of radius R. If the surface tension of the loop be T, then what will be the tension in the thread?

A. $\dfrac{\pi R^2}{T}$

B. $\pi R^2 T$

C. $2\pi RT$

D. 2 RT

Answer: D

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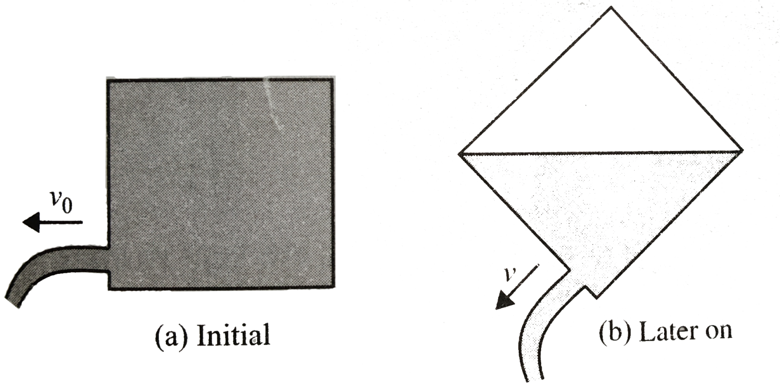
10. A square box of water has a small hole located the bottom corners. When the box is full and sitting on a level surface, complete opening of the hole results in a flow of water with a speed v_0 as shown in Fig. (a). when the box is still half empty, it is tilted by 45° so that hole is at the lowest 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. $\frac{v_0}{\sqrt[4]{2}}$

Answer: D

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11. A boll made up of a cork material of relative density $\frac{1}{2}$, is dropped from rest from a height 20 m into a lake. Neglecting all dissipative forces, calculate the maximum dept to which the body sinks before returning to float on the surface (poission ratio is zero)

A. 10 m

B. 40 m

C. 20 m

D. 5 m

Answer: C

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12. A liquid of density ρ is filled in a vessel up to height H and a hole of cross section area A is made at a depth h below the free surface of liquid. The speed of liquid coming out of the hole is independent of

A. h

B. a

C. ρ

D. g

Answer: C

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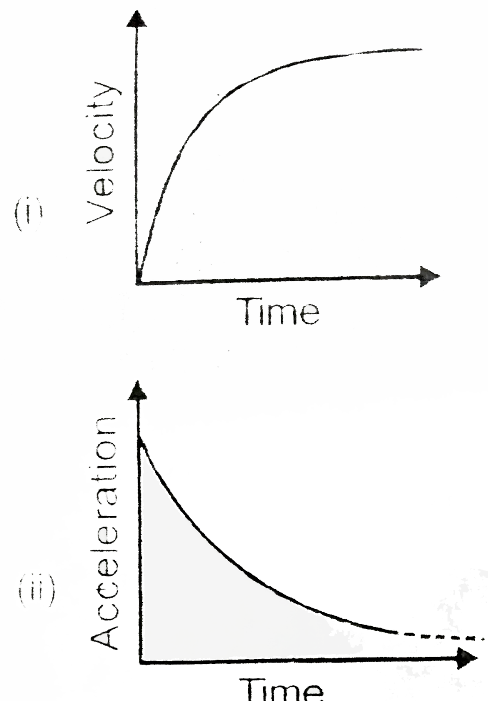
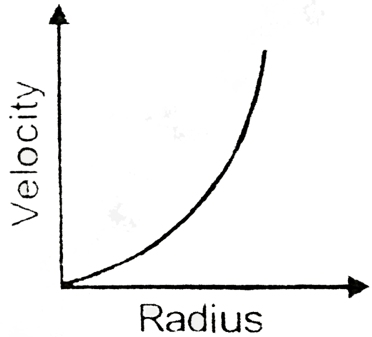
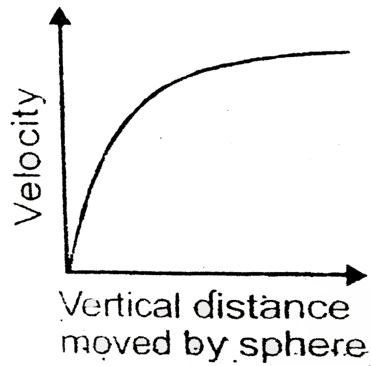
13. A sphere of radius r is dropped in a liquid from its surface. Which of the following graphs is/are correct?



(iii)



(iv)



A. (i) & (iii)

B. (ii) & (iv)

C. (i), (ii) & (iii)

D. All of these

Answer: D

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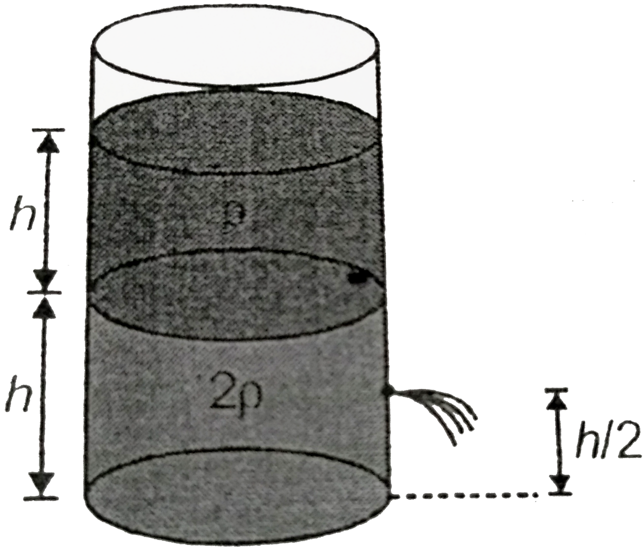
14. A vessel is filled with two different liquids of densities $\rho \text{ and } 2\rho$ respectively as shown in the figure. The velocity of flow of liquid through a hole at height $\frac{h}{2}$ from bottom is



A. $2\sqrt{hg}$

B. $\sqrt{3hg}$

C. $\frac{1}{2}\sqrt{3hg}$

D. $2\sqrt{2hg}$

Answer: A

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15. What is the barometric height of a liquid of density 3.4 g cm^{-3} at a place, where that for mercury barometer is 70 cm?

A. 70 cm

B. 140 cm

C. 280 cm

D. 340 cm

Answer: C

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16. Water flows through a horizontal pipe of radius 1 cm at a speed of 8 cm s^{-1}. What will be the speed of flow of water under similar conditions, if the radius of the pipe is doubled ?

A. 8 cm s^{-1}

B. 4 cm s^{-1}

C. 2 cm s^{-1}

D. 1 cm s^{-1}

Answer: C

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17. A wooden cube floats just inside the water, when a mass of x(in grams) is placed on it. If the mass is removed, the cube floats with a height $\frac{x}{100}$ (cm) above the water surface. The length of the side of cube is (density of water is 1000 kg / m^3)

A. a. 10 cm

B. b. 15 cm

C. c. 20 cm

D. d. 30 cm

Answer: A

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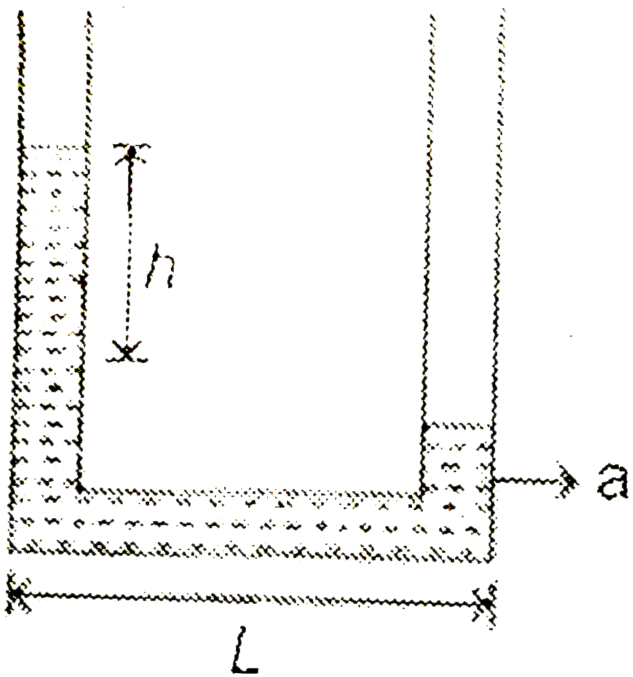
18. When at rest, a liquid stands at the same level in the tubes shown in figure. But as indicated a height difference h occurs when the system is given an acceleration a towards the right. Here, h is equal to



A. $\frac{aL}{2g}$

B. $\frac{gL}{2a}$

C. $\frac{gL}{a}$

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

Answer: D

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19. A ball floats on the surface of water in a container exposed to the atmosphere. Volume V_1 of its volume is inside the water. The container is now covered and the air is pumped out. Now let V_2 be the volume immersed in water. Then

A. $V_1 = V_2$

B. $V_1 > V_2$

C. $V_2 > V_1$

D. $V_2 = 0$

Answer: A

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20. When a liquid is subjected to a 15 atmospheric pressure, then its volume decreases by 0.1%. Then bulk modulus of elasticity (K) of the liquid is (1 atm pressure = $10^5 N/m^2$)

A. $1.5 \times 10^{10} N/m^2$

B. $1.4 \times 10^8 N/m^2$

C. $1.5 \times 10^9 N/m^2$

D. $1.4 \times 10^9 N/m^2$

Answer: D

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21. If equal masses of two liquids of densities d_1 and d_2 are mixed together, the density of the mixture is

A. $\dfrac{d_1 d_2}{(d_1 + d_2)}$

B. $\dfrac{2d_1 d_2}{(d_1 + d_2)}$

C. $\dfrac{d_1 d_2}{2(d_1 + d_2)}$

D. $\dfrac{(d_1 + d_2)}{2}$

Answer: B

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22. The angle which the free surface of a liquid filled in a container will make with horizontal if the container is accelerated horizontally with acceleration $\frac{g}{\sqrt{3}}$ is

A. 30°

B. 45°

C. 60°

D. 15°

Answer: A

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23. Bernoulli's equation is conservation of

A. Energy

B. Momentum

C. Angular momentum

D. Mass

Answer: A

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SECTION - C

1. A beaker filled with water, is accelerated at a rate a $\frac{m}{s^2}$ in forward direction. The surface of water shall make an angle

A. a. $\tan^{-1}\left(\frac{a}{g}\right)$ backward

B. b. $\tan^{-1}\left(\frac{a}{g}\right)$ forward

C. c. $\cot^{-1}\left(\frac{g}{a}\right)$ backward

D. d. $\cot^{-1}\left(\frac{g}{a}\right)$ forward

Answer: B::D

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2. A cube of ice of side length 10 cm is floating in water of density 1000 kg/m^3. Then pick up the correct statement (density of ice = 900 kg/m^3)

A. a. 1 cm of the cube will be out of water

B. b'. 9 cm of the cube will be out of water

C. c. 9 cm of the cube will be in water

D. d. 1 cm of the cube will be in water

Answer: A::C

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3. Among the following daily life activities, Bernoulli's theorem is applicable in

A. Uplifting of the air foil

B. Swinging of the cricket ball

C. Spinning of the cricket ball

D. Spray pump used to spray pesticides

Answer: A::B::D

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4. A cubical block of wood having an edge 10 cm and mass 0.92 kg floats on a tank of water with oil of relative density 0.5 to a height of 4 cm above water. When the block attains equilibrium with four of its edges vertical

A. a. 1 cm of it will be above the free surface of oil

B. b. 5 cm of it will be under water

C. c. 1.6 cm of it will be above the comon surface of oil and water

D. d. 8.4 cm of it will be under water

Answer: C::D

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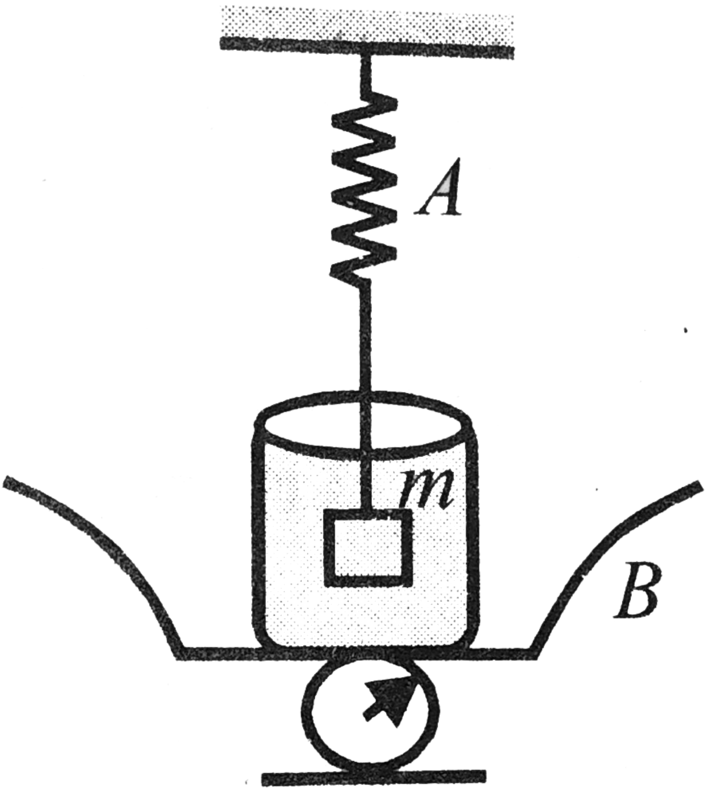
5. The spring balance A reads $2kg$ with a block in suspended from it. A balance B reads $5kg$ when a beaker with liquid is put on the pan of the balance. The two balances are now so arranged that the hinging mass is inside the liquid in the beaker as shown in the figure. In this situation,



A. The balance A will read more than 2 kg

B. The balance B will read more than 2 kg

C. The balance A will read less than 2 kg and B will read more than 5 kg

D. The balance A and B will read 2 kg and 5 kg respectively

Answer: B::C

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6. Let T represent the true weight of a body, B the force of buoyancy on the body when immersed in a liquid. A represents the apparent weight of the body and W be twice the weight of liquid displaced by te body. Then which of the following relation is correct?

A. T = B - A

B. T - B = A

C. T = B + A - W

D. T - A = W - B

Answer: B::D

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7. A vessel in the form of a truncated cone has base area a_1 and top area a_2. It is filled to the brim with a liquid. The force at the bottom of the vessel is

A. a.Equal to weight of the liquid, if $a_1 < a_2$

B. b.Greater than weight of the liquid, if $a_2 < a_1$

C. c.Less than weight of the liquid, if $a_1 < a_2$

D. d.Equal to weight of the liquid, for any value of the areas

Answer: B::C

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8. Select the correct option

A. As we move down through a liquid at rest the pressure increases

B. As we move along horizontal through a liquid at rest the pressure remains unchanged

C. As we move along horizontal through a liquid subjected to a horizontal acceleration, the pressure increases in the direction of acceleration

D. The gauge pressure at a point inside a liquid depends on atmospheric pressure

Answer: A::B

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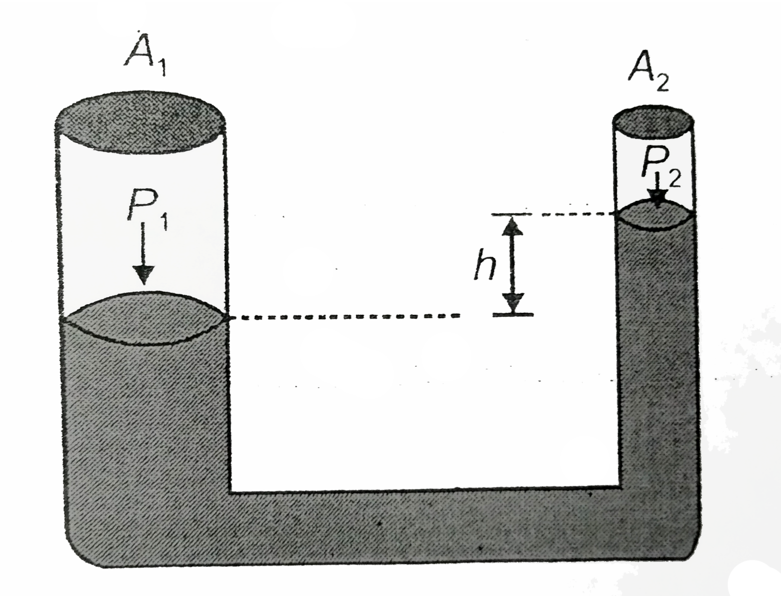
9. In the adjoing figure P_1 and P_2 are the pressures in broad and narrow tubes with closed ends. Select the correct option



A. $P_1 > P_2$

B. $P_2 - P_1 \propto h^{\circ}$

C. $P_1 - P_2 \propto h$

D. $P_1 - P_2 \propto (A_1 - A_2)^{\frac{1}{2}}$

Answer: A::C

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10. Select the correct option

A. Surface tension depends on nature of liquid

B. Surface tension depends on area of surface of liquid

C. Surface tension of a liquid decreases with rise in temperature

D. Surface tension has dimensions $[ML^{-2}T^{-1}]$

Answer: A::C

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11. Select the incorrect option (T = surface tension, R = radius of drop, bubble, meniscus)

A. Excess pressure inside a liquid drop in air is equal to $\frac{2T}{R}$

B. Excess presure inside a liquid bubbles in air is equal to $\frac{2T}{R}$

C. Excess pressure for spherical liquid meniscus is $\frac{4T}{R}$

D. Excess pressure for cylindrical bubble in air is

$$\frac{4T}{R}$$

Answer: A::C::D

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12. A liquid rises to same heigt in three capillaries at same temperature. Select the correct option(s)

A. a.The weight of liquid in capillaries may not be equal

B. b.The radius of meniscus are equal

C. c.The capillaries must be cylindrical

D. d.The hydrostatic pressure at the base of capillaries is equal

Answer: A::B::D

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13. A small iron ball falls from rest through a large height h into a water column, the final velocity

A. Does not depend on h

B. Is proportional to $\sqrt{h}$

C. Is uniform

D. All these statements are not correct

Answer: A::C

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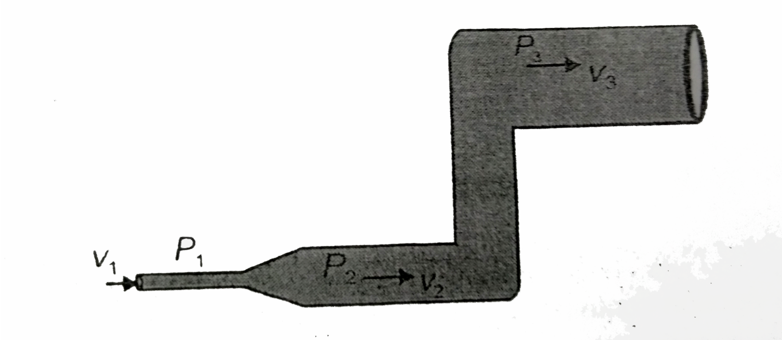
14. Water is flowing through a pipe as shown in figure. If P_1, P_2 and P_3 are pressures and v_1, v_2 and v_3 are velocities of water at the different sections as shown in figure, then



A. $P_1 > P_2 > P_3$

B. $v_1 > v_2 > v_3$

C. $P_2 > P_1$

D. $v_3 > v_2 > v_1$

Answer: B::C

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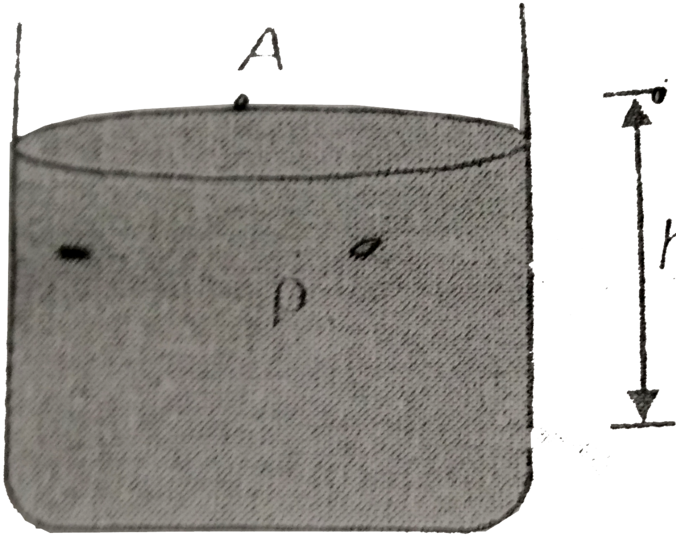
15. If velocity of efflux is v and area of orifice is A_0 then



A. $v \propto A_0$

B. $v \propto h^{\frac{1}{2}}$

C. $v \propto \rho^0$

D. $v \propto \frac{A}{A_0}$

Answer: B::C

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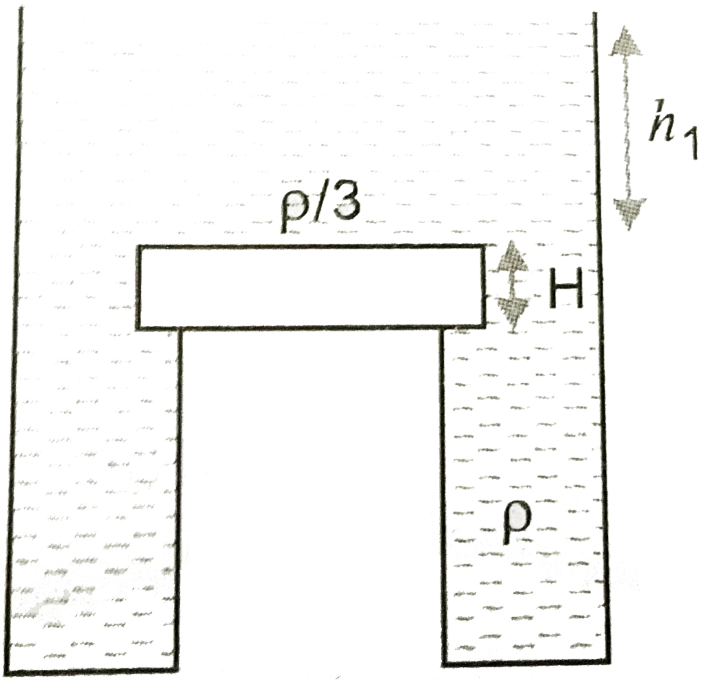
SECTION - D

1. A wooden cylinder of diameter 4 r, height H and density $\rho/3$ is kept on a hole of diameter 2 r of a tank, filled with water of density ρ as shown in the



If level of liquid starts decreasing slowly, when the level of liquid is at a height h_1 above the cylinder, the block just start moving up. Then the value of h_1 is

A. a. $\frac{2h}{3}$

B. b. $\frac{5h}{4}$

C. c. $\frac{5h}{3}$

D. d. $\frac{5h}{2}$

Answer: C

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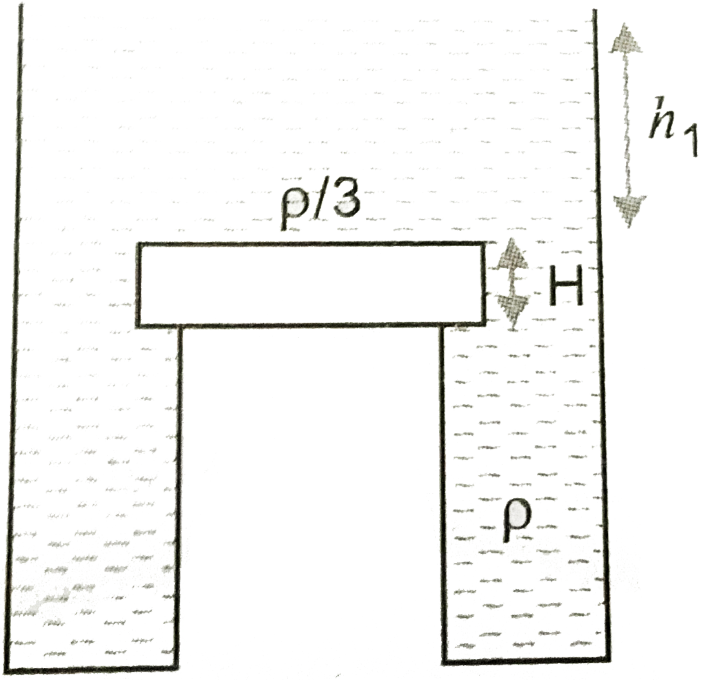
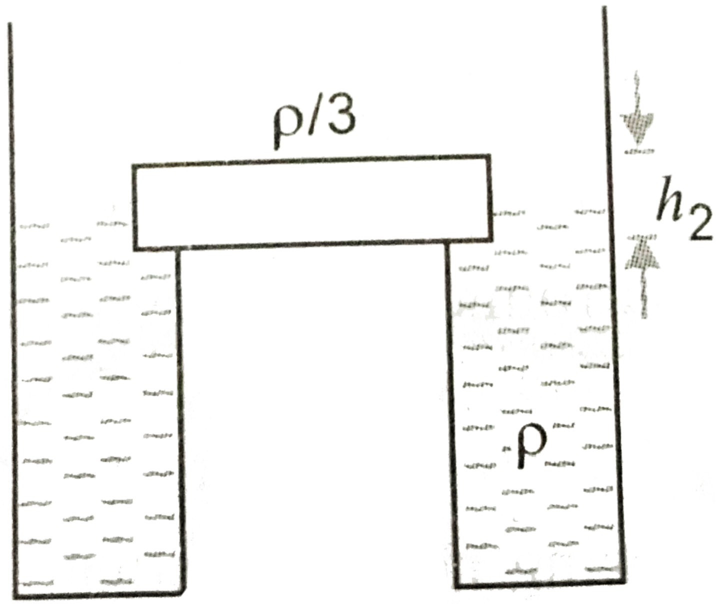
2. A wooden cylinder of diameter 4 r, height H and density $\rho/3$ is kept on a hole of diameter 2 r of a tank, filled with water of density ρ as shown in the



The block in the above question is maintained by external means and the level of liquid is lowered. The height h_2 when this external force reduces to zero is



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

B. $\frac{4h}{9}$

C. $\frac{2h}{3}$

D. h

Answer: B

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SECTION - E

1. Statement-1 : Two bodies of different masses and shapes may experience same thrust in a given liquid.

And

Statement-2 : The buoyancy is independent of factors of the body such as its mass and shape.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-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: A

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2. A ball floats on the surface of water in a container exposed to atmosphere.

Statement-1 : If the container is shifted to moon, the ball will rise a little (gravity on moon is $\frac{1}{6}$th that on the earth).

And

Statement-2 : Buoyant force on the ball will decrease.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-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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3. A liquid is filled in a vessel and a hole is made at a depth h below the free surface of the liquid.

Statement-1 : Greater is the distance of the hole form the free surface of liquid, greater will be the velocity of efflux.

And

Statement-2 The speed of the liquid coming out of the orifice depends on the quantity of liquid in the vessel.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-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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4. Statement-1 : Pressure on a body is always compressive while stress can be compressive or tensile.

And

Statement-2 : Pressure is always normal to the area while stress can be either normal or tangential.

A. a.Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. b.Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-1

C. c.Statement-1 is True, Statement-2 is False

D. d.Statement-1 is False, Statement-2 is True

Answer: D

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5. Statement-1 : When two speres of same size but of different densities are dropped in a fluid, sphere of greater density will have greater terminal velocity.

And

Statement-2 : Greater the density and viscosity of the fluid, lesser will be the terminal velocity.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-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: B

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6. Statement-1 : In a capillary tube, excess pressure is balanced by hydrostatic pressure and not by weight.

And

Statement-2 : The vertical height of a liquid column in capillaries of different shapes and sizes will be same if the radius of meniscus remains same.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-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: B

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7. Statement-1 : If adhesion is greater than cohesion, then the meniscus is concave.

And

Statement-2 : If adhesion is greater than cohesion, then the liquid will not wet the solid.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-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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8. Statement-1 : When an air bubble moves up from the bottom of a lake, its acceleration decreases and becomes zero.

And

Statement-2 : When an air bubble moves up from the bottom of a lake, its velocity increases and become constant.

A. a.Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. b.Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-1

C. c.Statement-1 is True, Statement-2 is False

D. d.Statement-1 is False, Statement-2 is True

Answer: B

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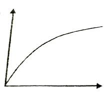
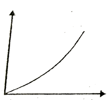
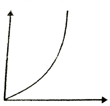
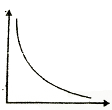
SECTION - F

1. A sphere of radius r is dropped in a liquid of viscosity x. Match the Column-I showing some graph with Column-II giving the names of graphs.

Column-I	Column-II
(A) 	(p) Vertical distance moved by sphere-velocity
(B) 	(q) Terminal velocity-radius
(C) 	(r) Terminal velocity-viscosity of liquid
(D) 	(s) Velocity-time graph

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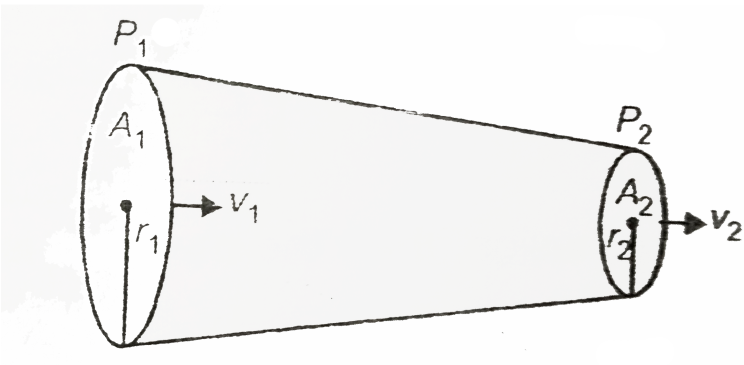
2. A conical section of a pipe is shown in figure through which water is flowing. Let A be the area of crosss-section, r be the radius of cross-section, P be the pressure at a point difference and v be the velocity of water.



Match the column-I with column-II containing values of ratio of quantities given in Column-I

Column-I	Column-II
(A) If $A_1 : A_2 = 2 : 1$, then $v_1 : v_2 =$	(p) 1 : 4
(B) If $r_1 : r_2 = 2 : 1$, then $v_1 : v_2 =$	(q) 1 : 2
(C) If $A_1 : A_2 = 4 : 1$, then $\frac{A_1 v_1}{A_2 v_2} =$	(r) 1 : 1
(D) If $A_1 : A_2 = 1 : 1$, then $v_1 : v_2 =$	(s) 1 : 8

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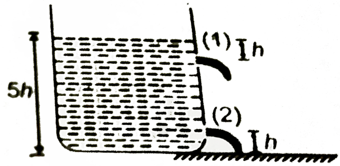
3. The area of hole (1) is A_1 and of hole (2) is A_2. The velocity of efflux and range of liquid is v_1, v_2 and x_1, x_2 for holes (1) and (2) respectively. The time taken by liquid, jet to reach the ground from holes (1) and (2) are t_1 and t_2 respectively. Cross section of tank is very very large compared to size of holes.



Column-I	Column-II
(A) $v_1 : v_2$	(p) 2 : 1
(B) $x_1 : x_2$	(q) 1 : 2
(C) $t_1 : t_2$	(r) 1 : 1
(D) If $A_1 : A_2 = 2 : 1$, then $v_1 : v_2 =$	(s) 4 : 1

	Column-I		Column-II
(A)	$v_1 : v_2$	(p)	$2:1$
(B)	$x_1 : x_2$	(q)	$1:2$
(C)	$t_1 : t_2$	(r)	$1:1$
(D)	$\text{if} A_1 : A_2 = 2:1, \text{then} v_1 : v_2 =$	(s)	$4:1$

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SECTION - G

1. An ice cube of edge a is placed in an empty cylindrical vessel of radius 2a. Find the edge (in cm) of ice cube when it just leaves the contact with the bottom assuming that ice melts uniformly maintaining its cubical shape. Take a = 12 π cm (Ice is lighter than water)

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2. Two soap bubbles of radii 2 cm and 3 cm are brought in contact. Find the radius of curvature (in cm) of the contact surface.

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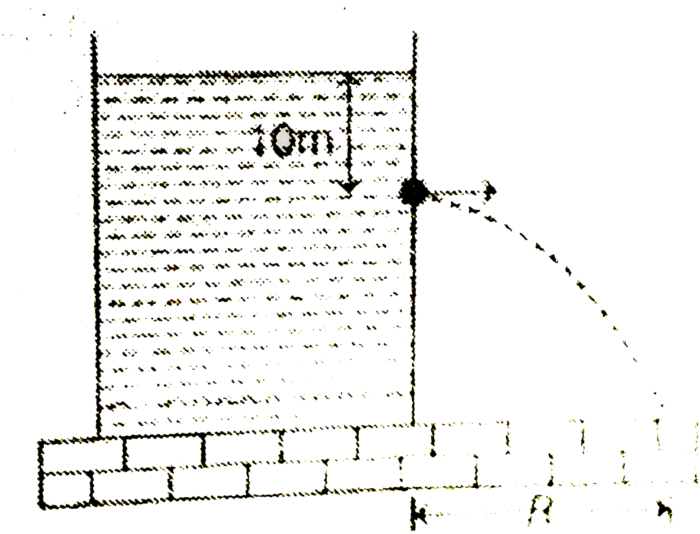
3. A large tank is filled waith water (density $= 10^3 kg/m^3$). A small hole is made at a depth 10 m below water surface. The range of water issuing out of the hole is R on ground. Approximately what extra pressure must be applied on the water surface so that the range becomes 2R

(take $1 atm = 10^5 Pa$ and $g = 10 m/s^2$)



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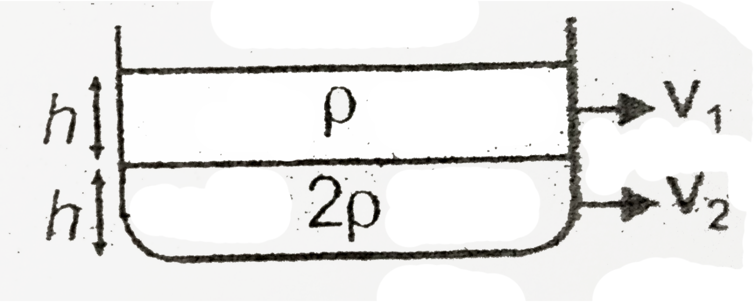
4. Equal volumes of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in figure. Two small holes are punched at depth h/2 and 3h/2 from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes then $\left(\frac{v_2}{v_1}\right)^2$ is



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5. A cubical block is floating in a liquid with half of its volume immersed in the liquid. When the whole system acelerates upwards with a net acceleration of g/3. The fraction of volume immersed in the liquid will be $\frac{3}{x}$ Find x.

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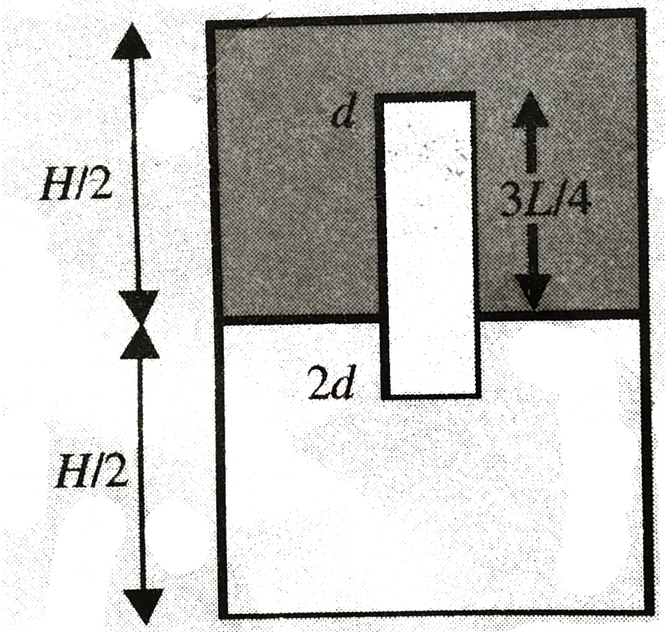
6. A container of a large uniform cross sectional area A strong on horizontal surface holds two immiscible, non viscous and incompressible liquids of densities d and $2d$, each of height $H/2$ as shown in the figure. The lower density liquid is open to atmosphere. A homogeneous solid cylinder of length $L(L > H/2)$, cross sectional area $A/5$ is immersed such that it floats with its axis vertical of the liquid liquid interface wit length $L/4$ in the denser liquid. Determine a density D of the solid and b the total pressure at the bottom of the container (atmosphere pressure $= P_0$).



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SECTION - H

1. Statement-1 : When two soap bubbles of unequal radii are connected by a tube, the smaller bubble decreases in size.

Statement-2 : In floating, weight of the floating body is equal to the weight of displaced fluid.

Statement-3 : When ice converts into water its volume decreases.

A. T T T

B. F T F

C. F F T

D. F F F

Answer: A

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2. Statement-1 : When an orifice is made in the middle of the wall of a vessel, the range of the liquid coming out of the orifice is equal to the height of the liquid.

Statement-2 : Liquid is flowing through two identical pipes A and B. Volume of liquid flowing per second through A and B are v_0 and $2v_0$ respectively. Flow in A is turbulent and steady in B.

Statement-3 : Rate of flow of a viscous liquid through a pipe is directly proportional to he fourth power of the radius of pipe.

A. T T T

B. T T F

C. T F T

D. F T T

Answer: C

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3. Statement-1 : Bernoullis equation is based on energy conservation.

Statement-2 : Bernoullis equation can only be applied if the flow is streamlined.

Statement-3 : Bernoullies equation can be applied evern if the flow is not streamlined as total energy is always conserved.

A. a.T T T

B. b.T F T

C. c.T T F

D. d.F F F

Answer: C

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4. Statement-1 : If there is a soap bubble in air then excess pressure inside it is $\frac{4T}{R}$, where T is surface tension of soap and R is the radius of the bubble.

Statement-2 : If there is a water drop in air then excess pressure inside it is $\frac{2T}{R}$

Statement-3 : If there is an air bubble in water then excess pressure inside it is $\frac{4T}{R}$

A. T T T

B. T T F

C. T F F

D. T F T

Answer: B

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5. Statement-1 : The value of moduli of elasticity is directly proportional to stress.

Statement-2 : The value of moduli of elasticity is inversely proportional to strain.

Statement-3 : The value of moduli of elasticiy is independent of magnitude of stress and strain.

A. T T F

B. F F T

C. T F F

D. F F F

Answer: B

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SECTION - I

1. A cylinder vessel of radius 10 cm containing a liquid is rotating about a vertical axis through the centre of circular base. The vessel is rotating with angular frequency 10 rad/s. Find the difference of the heights of liquid at centre of vessel and edge.

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2. The terminal speed of a sphere of gold of density 22.5 kg/m^3 is 40 cm/s in a viscous liquid of density 2.5 kg/m^3 Find the terminal speed of a sphere of aluminium of density 15.5 kg/m^3 of same size in same liquid.

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3. A cylindrical tank of height 2 m is open at the top and has a radius 50 cm. Water is filled in it upto a height 1.75 m. Calculate how long it will take to empty the tank through a hole of radius 0.05 cm in its bottom.

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4. A block hangs from a spring balance. The balance reads 40 N in air, 35 N when block is immersed in water and 25 N when block is immersed in another liquid. Find the density of block and other liquid.

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5. A solid ball is immersed in a liquid. The coefficient of volume expansion of ball and liquid are 3×10^{-6} per/C and 9×10^{-6} per $,^{\circ}$ C respectively. Find the percentage change in upthrust when the temperature is increased by $25^{\circ} C$

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6. If the lower end of a capillary tube of radius 2.5 mm is dipped 8 cm below the surface of water in a beaker, then calculate the pressure within a bubble blown at its end in water, in excess of atompheric pressure. [Surface tension of water 72×10^{-3} N/m]

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SECTION - J

1. What will be the breaking strength of the material if a horizontal rod of density ρ and length unity, which is rotating about a vertical axis (passing through its centre), ruptures at 10 rps.

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2. A ball of density ρ is released from deep inside of a liquid of density 2ρ. It will move up

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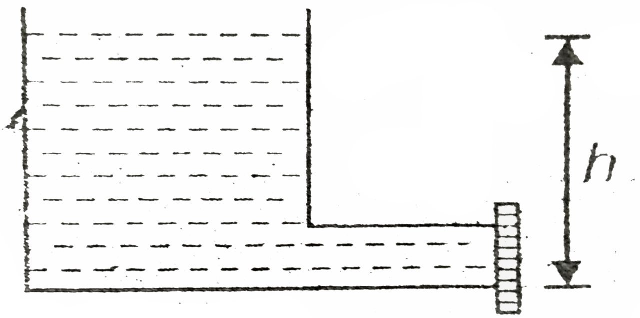
3. The opening near the bottom of the vessel shown has an area A. A disk is held against the opening to keep the liquid, from running out. It is given that net force on the disk applied by liquid and air in this case is F. Now the disc is moved away from the opening by a short distance. The liuid comes out and strikes the disk inelastically. What will be the initial force exerted by the liquid on the disk in this condition.



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4. A wooden cylinder of length l floats vertically in a liquid of specific gravity ρ with $\left(\frac{1}{3}\right)^{rd}$ part of its length submerged. Another liquid that is immiscible with the previous liquid is poured into it, to just completely submerge the cylinder. If the density of the liquid at the bottom, density of cylinder and density of upper liquid are in G.P., find the fraction of the cylinder submerged in lower liquid.

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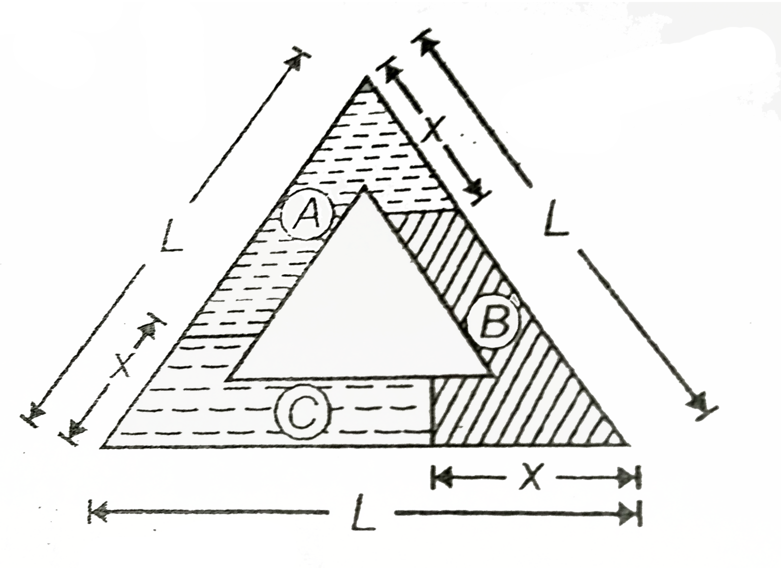
5. A thin triangular glass tube containing immiscible liquids A, B, C of densities $\rho, 2\rho, 3\rho$ is at rest in

vertical plane. Find x.



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6. Find the volume density of the elastic deformation energy in fresh water at a depth of h = 1 m. (Bulk modulus of water = 2 $\times 10^9 N/m^2$)

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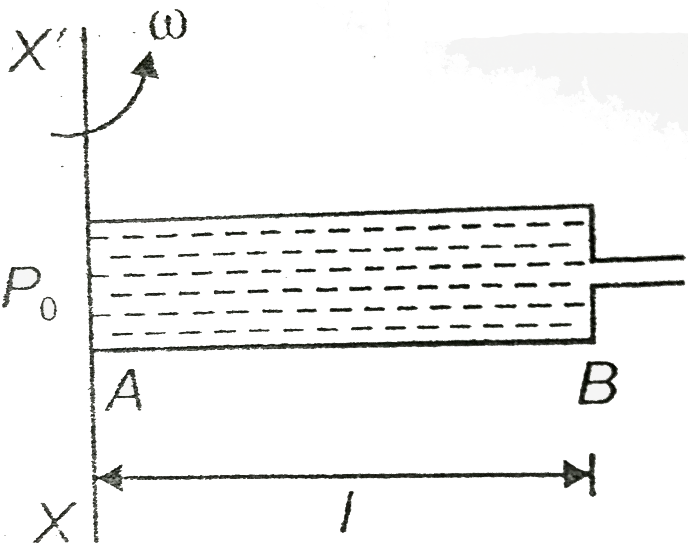
7. A horizontally orientd tube of length l rotates with a constant angular velocity ω about a stationary vertical axis. XX passing through end A. The tube is filled with ideal fluid.

The end A of tube is having pressure P_0. The closed end B has a small hole and at time t = 0, the fluid column has length of l. Find velocity of fluid relative to tube at the instant t = 0



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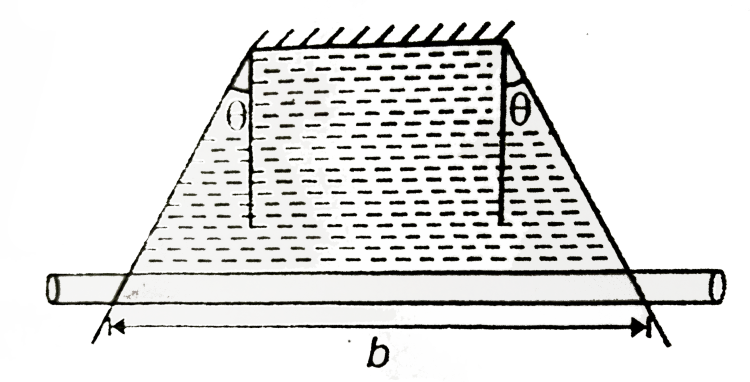
8. A rod of mass m can move vertically on two fixed inclined rod in vertical plane, weight of the rod is blanced by thin liquid film between rods as shown. (Surface tension of liquid is S).

If rod is displaced a little in downward direction and released, then what will be the time period of oscillation of rod.



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9. Mercury of density ρ_m is poured into cylinderical communicating vessels of cross-sectional area 2A and A respectively. A solid iron cube of volume V_0 and relative density 2 is dropped into the broad

vessel, and as a result the level of the mercury in it rises. Then, water is poured into the broader vessel until the mercury reaches the previous level in it. Find the height of water column if it does not submerge the block.

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EXERCISE

1. The dimensional formula of pressure gradient is

A. $[M^{\circ}L^{\circ}T^{\circ}]$

B. $[ML^{-1}T^{2}]$

C. $[M^{\circ} L^1 T^{-2}]$

D. $[M^{\circ} L^1 T^{\circ}]$

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2. The two Femurs each of cross-sectional area $10cm^2$ support the upper part of a human body of mass 40 kg .The average pressure sustained by the femurs is (take g $=10ms^{-2}$)

A. $2.5 \times 10^5 N/m^2$

B. $4 \times 10^5 N/m^2$

C. $5 \times 10^5 N / m^2$

D. $10^6 N / m^2$

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3. What is the pressure on a swimmer 10 m below the surface of a lake?

A. 1 atm

B. 2 atm

C. 3 atm

D. 4 atm

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4. Water stands upto a height h behind the vertical wall of a dam what is the net horizontal force pushing the dam down by the stream if width of the dam is σ? ($\rho =$ density of water)

A. $\rho g \sigma H^2$

B. $\frac{1}{2} \rho g \sigma H^2$

C. $2 \rho g \sigma H^2$

D. $4 \rho g \sigma H^2$

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5. A beaker is filled with a liquid of density ρ upto a height h If the beaker is at rest, the mean pressure at the walls is:

A. $\rho g h$

B. $\frac{1}{2}\rho g h$

C. $\frac{1}{4}\rho g h$

D. $\frac{1}{8}\rho g h$

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6. A cylinder of radius R full of liquid of density p is rotated about its axis at w rad/s. The increase in pressure at the centre of the cylinder will be

A. $\frac{\rho\omega^2 R^2}{2}$

B. $\frac{\rho\omega^2 R}{2}$

C. $\frac{\rho^2\omega R^2}{2}$

D. $\frac{\rho^2\omega^2 R^2}{2}$

7. Increase in pressure at one point of the enclosed liquid in equilibrium at rest is transmitted equally to all other points. This is as per

A. Buoyancy

B. Pascal's law

C. Conservation of momentum

D. Impulse

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8. By sucking through a straw, a student can reduce the pressure in his lungs to 750 mm of Hg(density $13.6 gcm^{-3}$) using the straw, he can drink water from a glass up to a maximum depth of

A. 13.6 cm

B. 1.36 cm

C. 0.136 cm

D. 10 cm

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9. An open U-tube contains mercury. When 11.2 cm of water is poured into one of the arms of the tube, how high does the mercury rise in the other arm from its initial level ?

A. 1 cm

B. 0.5 crn

C. 10 cm

D. 5 cm

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10. A barometer kept in a stationary elevator reads $76cm$. If the element starts accelerating up the reading will be

A. 74

B. 75

C. 76

D. 77

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11. An object of mass m is floating in a liquid of density σ. If the object is made up of density ρ, then appare weight of the object in the liquid is

A. mg

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

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

D. Zero

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12. A cube of edge length 10 cm is just balanced at the interface of two liquids A and B as shown in figure. If A and B has specific gravity 0.6 and 0.4 respectively, then mass of cube is

A. 240 g

B. 360 g

C. 480 g

D. 540 g

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

A. Increases

B. Decreases

C. May increase or decrease

D. Neither increases nor decreases

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14. If two liquids of same volume but different densities ρ_1 and ρ_2 are mixed, then the density of the mixture is:

A. $\dfrac{\rho_1 + \rho_2}{2}$

B. $(\rho_1 + \rho_2)$

C. $\dfrac{2\rho_1\rho_2}{\rho_1 + \rho_2})$

D. $2\rho_1 + 2\rho_2$

Watch Video Solution

15. When two liquid of same, mass but different densities ρ_1 and ρ_2 are mixed together, then the density of the mixture is

A. $(\rho_1 + \rho_2)$

B. $\dfrac{\rho_1 + \rho_2}{2}$

C. $\dfrac{2\rho_1\rho_2}{\rho_1 + \rho_2}\Bigg)$

D. $2\rho_1 + 2\rho_2$

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16. If there were no gravity, whicch of the following will not be there for a fluid?

A. Viscosity

B. Surface tension

C. Pressure

D. Archimpde's upward thrust

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17. A piece of ice is floating in a vessel containing water and inside the ice is a bubble of air. What will be the effect on the level of water, when the ice melts?

A. It will remain unchanged

B. It will fall

C. It will rise

D. First it will fall and then rise

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18. An ice-breg of density $900 kgm^{-3}$ is floating in water of density $1000 kgm^{-3}$ .the percnetage of volume of ice-berg outside the water is

A. 0.1

B. 0.45

C. 0.75

D.) 90%

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19. The reading of spring balance when a block is suspended from it in air, is 60 N. This reading is changed to 40 N when the block is immersed in water. The specific gravity of the block is

A. 3

B. 2

C. 6

D. 1.5

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20. The weight of a body in water is one third of its weight in air. The density of the body is

A. 0.5 g/cm^3

B. 1.5 g/cm^3

C. 2.5 g/cm^3

D. 3.5 g/cm^3

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21. A liquid is flowing in a horizontal pipe of non-uniform cross section. Which of the following quantities may remain unchanged with respect to time?

A. Kinetic energy per unit volume

B. Pressure energy per unit volume

C. Potential energy per unit volume

D. Speed of flow

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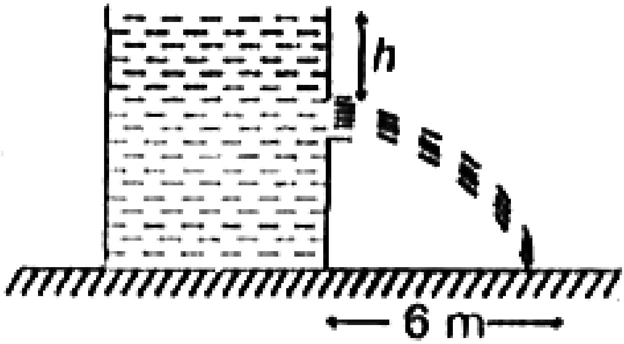
22. A liquid is coming out from the orifice of tank and falls upto a maximum horizontal distance of 6

m. The height h is equal to



A. 1.5 m

B. 3.0 m

C. 4.5 m

D. 6.0 m

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23. A liquid of density $10^3 k\frac{g}{m^3}$ and coefficient of viscosity `8 xx10^(-2) decapoise is flowing in a tube of radius 2 cm with speed 2 m/s. The. Reynold's number is

A. 500

B. 1000

C. 1500

D. 2000

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24. A sudden drop in the mercury level by 10 mm or more is a sign of

A. Storm

B. Flood

C. Snow fall

D. Rain

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25. If velocity of flow is 4 m/s, then velocity head is

A. 0/2 m

B. 0.4 m

C. 0.6 m

D. 0.8 m

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26. The property of a liquid by which it opposes the flow of itself is called

A. Surface tension

B. Bulk modulus

C. Elasticity

D. Viscosity

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27. |f. water is flowing in a pipe with speed 2 m/s then its kinetic energy per unit volume is

A. 500 J/m^3

B. 1000 J/m^3

C. 1500 J/m^3

D. 2000 J/m^3

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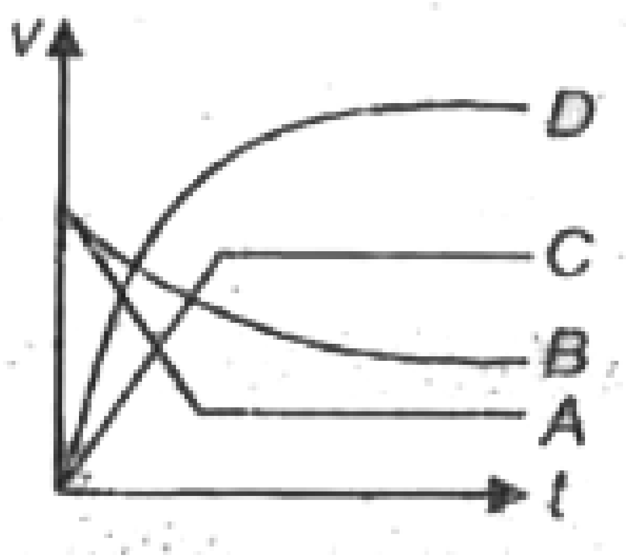
28. A ball is thrown downward with some velocity into a.viscous liquid. Which of the following curves represents correct variation for velocity versus time?



A. A

B. B

C. C

D. D

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29. A liquid having coefficient of viscosity 0.02 decapoise is filled in a container of cross-sectional area 20 m^2 viscous drag between two adjacent layers in flowing is 1 N, then velocity gradient is

A. $2.0s^{-1}$

B. $2.5s^{-1}$

C. $3.0s^{-1}$

D. $3.5s^{-1}$

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30. A liquid drop of mass m andradius r is falling from great height. Its velocity is proportional to

A. $\frac{m}{r}$

B. $\frac{m}{r^2}$

C. $\frac{m}{r^3}$

D. $\frac{m}{r^4}$

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31. Assertiion: Angle of contact does not depend upon the inclination of the solid in the liquid.

Reason: Angle of contact depends on cohesive and adhesive force.

A. Temperature

B. Soluble impurity

C. Cohesive force

D. The inclination of surface in contact

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32. If a capillary tube of radius 1 mm is immersed in water , the mass of water rising in the capillary tube is M . If the radius tube is doubled , then the mass of water , that rises in the capillary tube will be

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

B. 2 M

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

D. 4 M

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33. What will be the work done in increasing the radius of soap bubble from $\frac{r}{2}$ to 2r, if surface tension of soap solution is T?

A. 3nr^(2)T

B. 30nr^(2)T

C. 15nr^(2)T

D. 12nr^(2)T

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34. Pressure inside two soap bubble are 1.02 and 1.03 atm . Then ratio of their volumes is

A. $\frac{125}{8}$

B. $\frac{25}{4}$

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

D. $\frac{2}{5}$

35. The property utilized in the manufacture of lead shots is

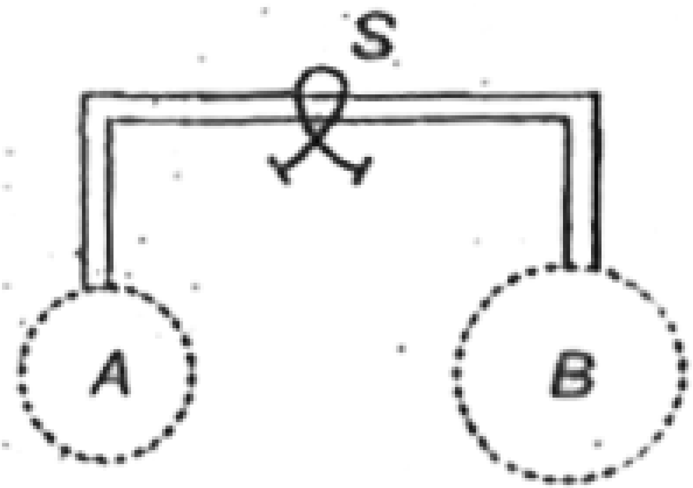
A. Specific gravity of liquid lead

B. Specific weight of liquid lead

C. Compressibility of liquid lead

D. Surface tension of liquid lead

36. Two soap bubbles are connected by a tube as shown in figure. What happens when stopper S is removed?



A. Size of bubble A increases

B. Size of bubble B decreases

C. Both bubble take the same size

D. Size of bubble A decreases and size of bubble B increases

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37. Two soap bubbles of radii 2 cm and 4 cm join to form a double bubble in air, then radius of. curvature of interface is

A. $2\sqrt{5}$ cm

B. $2cm$

C. 4 cm

D. $2\sqrt{3}cm$

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38. A square wire frame of side / is floating on the surface of liquid of surface tension T. The force required to pull out the frame from the liquid is

A. Tl

B. 2Tl

C. 4Tl

D. 8Tl

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39. Two drops of a liquid are merged to form a single drop . In this process,Energy would be

A. Absorbed

B. Evolved

C. Either absorbed or evolved

D. Neither absorbed nor evolved

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40. The value of surface tension of a liquid at critical temperature

A. - Maximum

B. Unchanged

C. Zero

D. None of these

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Assignment(SECTION-A)(Objective type questions)

1. The term 'fluid' is used for

A. Liquids only

B. Gases only

C. A mixture of liquid and gas only'

D. Both liquids and gases

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2. Select wrong statement about pressure

A. Pressure is a scalar quantity

B. Pressure is always compressive in nature

C. Pressure at a point is same in all directions

D. None of these

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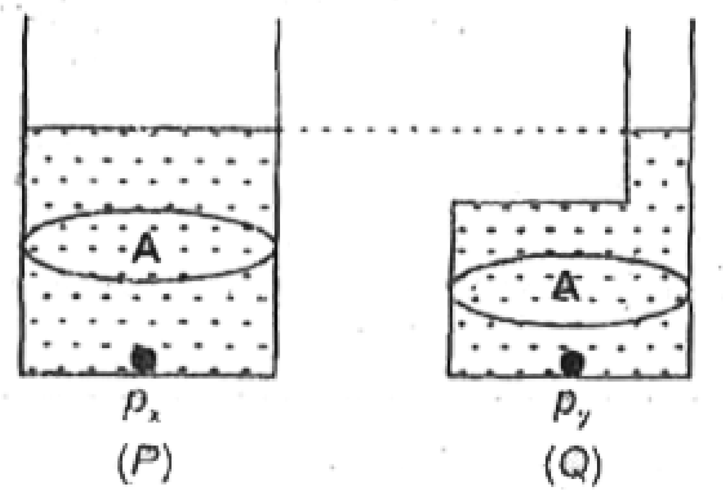
3. Figure shows two -containers P-and Q with same base area A and each filled upto same height with same liauid. Select the correct alternative



A. $P_x = P_y$

B. $P_x > P_y$

C. $P_Y > P_X$

D. Cannot say

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4. The pressure of confined air is p. If the atmospheric pressure is P, then :-

A. P is equal to p

B. P is less than p

C. P is greater than p

D. P may be less or greater than p depending on the ijiass of the confined air.

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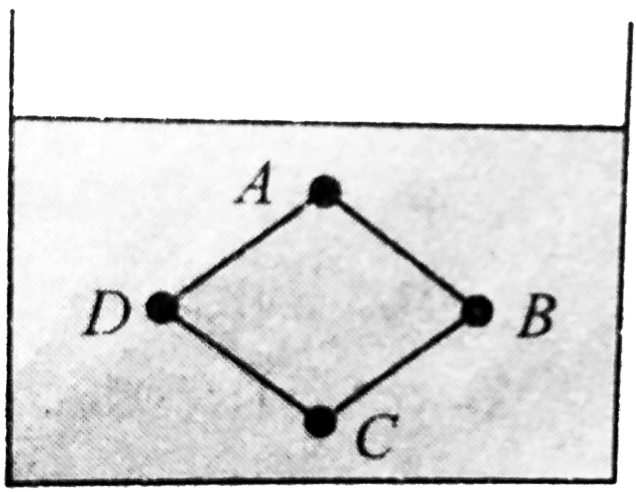
5. Figure shows a container filled with a liquid of density ρ. Four points A, B, C and D lie on the vertices of a vertical square. Points A and C lie on a vertical line and points B and D lies on a horizontal line. Choose the correct statement(s) about the pressure at the four points.



A. `rho_(D) = rho_(B)

B. $\rho_A > \rho_B = \rho_D < \rho_C$

C. $\rho_D = \rho_B = \dfrac{\rho_C - \rho_A}{2}$

D. $\rho_D = \rho_B = \dfrac{\rho_C + \rho_A}{2}$

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6. The volume of an air bubblebecomes three times as it rises from the bootom of a lake to its surface. Assuming temperature to be constant and atmospheric pressure to be 75 cm of Hg and the density of water to be $1/10$ of the density of the mercury, the depth of the lake is

A. 10

B. 15

C. 20

D. 25

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7. A beaker containing a liquid of density moves up with an acceleration a. The pressure due to the liquid at a depth h below the free surface of the liquid is

A. $h\rho g$

B. $h\rho(g-a)$

C. $h\rho(g+a)$

D. $2h\rho g\left(\frac{g+a}{g-a}\right)$

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8. A barometer kept in an elevator reads 76 cm when it is at rest. If the elevator goes up with increasing speed, the reading will be

A. 76 cm

B. gt 76 cm

C. lt 76 cm

D. Zero

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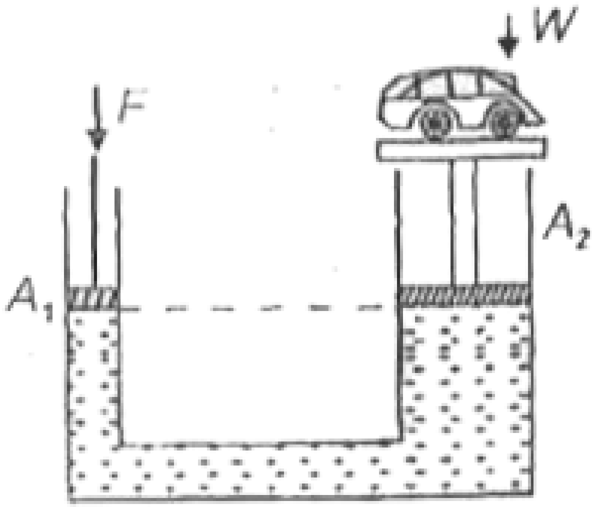
9. In a hydraulic jack as shown, mass of the car is m = 800 kg, $A_1 = 10cm^2, A_2 = 10m^2$. The minimum force F required to lift the car is



A. 1 N

B. 0.8 N

C. 8N

D. 16N

Answer: B

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10. A wooden cube just floats inside water when a 200 gm mass is placed on it. When the mass is removed, the cube is 2 cm above the water level. The size of the cube is

A. 6 cm

B. 8 cm

C. 10 cm

D. 12 cm

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11. A block of steel of size $5cm \times 5cm \times 5cm$ is weighed in water. If the relative density of steel is 7. its apparent weight is:

A. $6 \times 5 \times 5 \times 5$ gwt

B. $4 \times 4 \times 4 \times 7$gwt

C. $5 \times 5 \times 5 \times 7$ gwt

D. $4 \times 4 \times 4 \times 6$ gwt

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12. A block of wood floats in water with $\left(\frac{4}{5}\right)^{th}$ of its volume submerged .If the same block just floats in a liquid, the density of the liquid (in kgm^{-3}) is

A. 750

B. 800

C. 1000

D. 1250

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13. A cubical block is floating in a liquid with one fourth o its volume immersed in the liquid. If whole of the system accelerates upward with acceleration g/4, the fraction of volume immersed in the liquid will be :-

A. $1/4$

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

C. $\frac{1}{3}$

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

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14. A body of density ρ is dropped from a height h into a lake of density $\sigma(\sigma > \rho)$. The maximum depth the body sinks inside the liquid is (neglect viscous effect of liquid)

A. $\dfrac{h}{\sigma - \rho}$

B. $\dfrac{h\rho}{\sigma}$

C. $\dfrac{h\rho}{\sigma - \rho}$

D. $\dfrac{h\sigma}{\sigma - \rho}$

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15. A boat floating in a water tank is carrying a number of stones. If the stones were unloaded into water, then the water level

A. Remain unchanged

B. Rise

C. Fall

D. Rise or fall depends on the number of stones unloaded

Watch Video Solution

16. A block of ice is floating in a liquid of specific gravity 1.2 contained in the beaker. What will be the effect on the level of liquid in the beaker when the whole ice melts?

A. Increases

B. Decreases

C. Remain unchanged

D. First increases then decreases

Watch Video Solution

17. Equal masses of two substance of densities ρ_1 and ρ_2 are mixed together. What is the density of the mixture?

A. $\frac{d_1 + d_2}{2}$

B. $\frac{d_1 + d_2}{d_1 d_2}$

C. $\frac{d_1 d_2}{d_1 + d_2}$

D. $\frac{2d_1 d_2}{d_1 + d_2}$

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18. A barometer tube reads 76 cm of Hg. If tube is : gradually inclined at an angle of 60° with vertical, keeping the open end in the mercury reservoir, the length of mercury column will be

A. $152cm$

B. $76cm$

C. $38cm$

D. $38\sqrt{3}$ cm

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19. A metallic sphere of mass 3 kg in air is held by a string so as to be completely immersed in a liquid of relative density 0.8. The relative density of metallic sphere is 10. The tension in the string is :-

A. 187 N

B. 42.5 N

C. 32.7 N

D. 27.6 N

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20. A rectangular block is $5cm \times 5cm \times 10cm$ in size. The block is floating in water with 5 cm side vertical. If it floats with 10 cm side vertical, what change will occur in the level of water?

A. Rise

B. Fall

C. Remain same

D. Change, according to density of block

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21. Two cubical blocks identical in dimensions float in water in such a way that 1st block floats with half part immersed in water and second block floats with 3/4 of its volume inside the water. The ratio of densities of blocks is

A. $2:3$

B. $3:4$

C. $1:3$

D. $1:4$

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22. In a capillary tube , water rises to a height of 4 cm If its cross section area were one forth , the water would have to rises a height of

A. 2 cm

B. 4 cm

C. 8 cm

D. 11 cm

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23. A flat plate of area $0.1m^2$ is placed on a flat surface and is separated from it by a film of oil 10^{-5} m thick whose coefficielnt of .viscosity is $1.5Nsm^{-2}$. The force required to cause the plate to slide on the surface at constant speed of $1mms^{-1}$is

A. 10 N

B. 15 N

C. 20 N

D. 25 N

Watch Video Solution

24. Viscous drag force depends on

A. Size of body

B. Velocity with which it moves

C. Viscosity of fluid

D. All of these

Watch Video Solution

25. The terminal velocity of small sized spherical body of radius r falling veertically in a viscous liquid is given by a following proportionality

A. $v \propto \frac{1}{r^2}$

B. $v \propto r^2$

C. $v \propto \frac{1}{r}$

D. $v \propto r$

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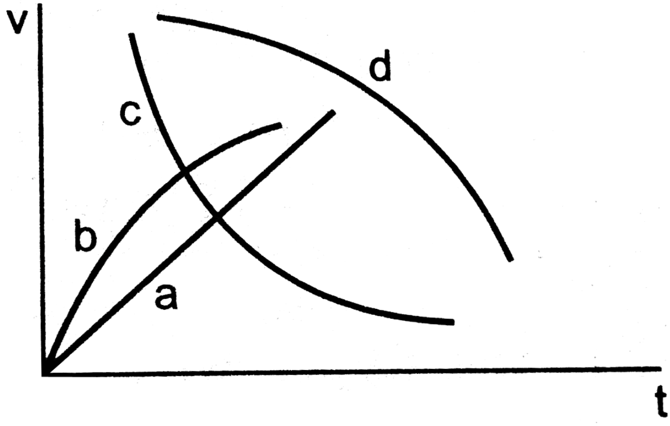
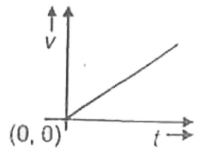
26. A spherical ball is dropped in a long column of a viscous liquid. The speed of the ball as a function of time may be best represented by the graph



A.



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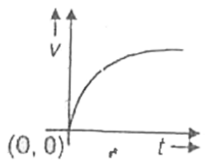

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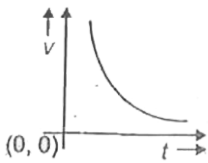
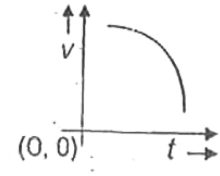


D. 

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27. Which of the following is an intensive property of the system?

A. Fluid flow is irrotational

B. Fluid flow is streamline

C. Fluid is incompressible

D. Fluid is viscous

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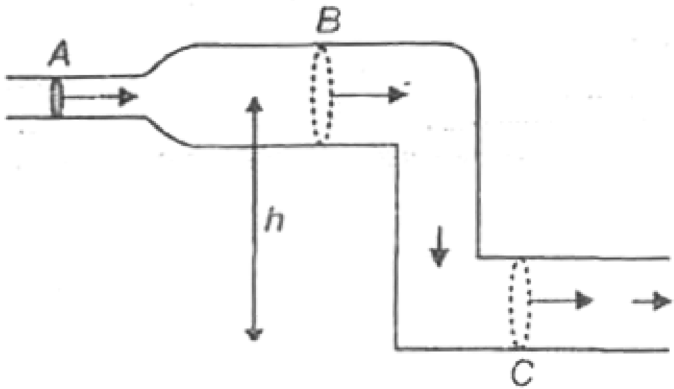
28. Water is flowing through a channel (lying in a vertical plane) as shown in the figure. Three sections A, B and C are shown. Sections B and Chave equal area of cross section. If $P_A, P_B \text{and} P_C$ are the pressures at A, B and C respectively then



A. $P_A > P_B = P_C$

B. $P_A < P_B < P_C$

C. $P_A < P_B = P_C$

D. $P_A > P_B > P_C$

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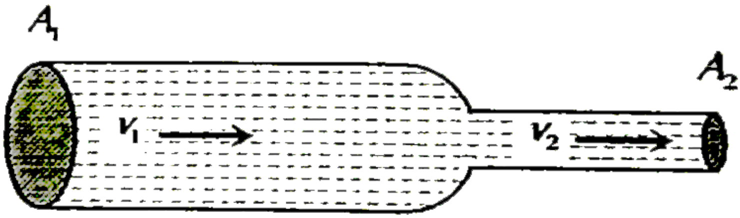
29. A liquid flows in a tube from left to right as shown in figure. A_1 and A_2 are the cross-section of the portions of the tube as shown. Then the ratio of speeds v_1 / v_2 will be



A. $\dfrac{A_1}{A_2}$

B. $\dfrac{A_2}{A_1}$

C. $\sqrt{\dfrac{A_2}{A_1}}$

D. $\sqrt{\dfrac{A_1}{A_2}}$

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30. Water (p = 1000 kg/m^3) and kerosene (a = 800kg/m^3) are filled in two identical cylindrical vessels. Both vessels have small holes at their bottom. The speed of the water and kerosene coming out of their holes are v_1 and v_2 respectively. Select the correct alternative

A. $v_1 = v_2$

B. $v_1 = 0.8v_2$

C. $0.8v_1 = v_2$

D. $v_1 = \sqrt{0.8}v_2$

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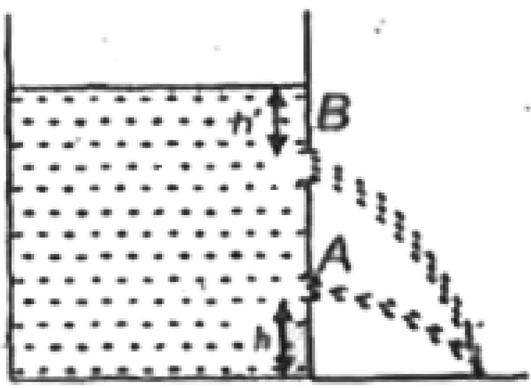
31. A tank is filled with water and two holes A and B are made in it.- For getting same range, ratio of h' and h is



A. 2

B. 1/2

C. 1/3

D. 1

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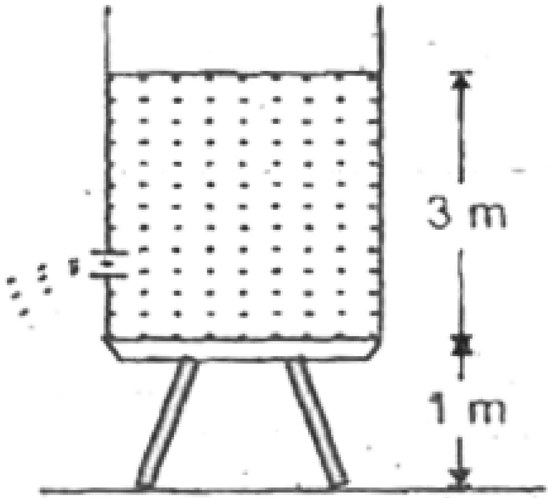
32. Water is filled in a tank upto 3 m height. The base of the tank is at height 1 m above the ground. What should be the height of a hole made in it, so that water can be sprayed upto maximum horizontal distance on ground?



A. 3 m from ground

B. 1.5 m from ground

C. 1.5 m from base of tank

D. 2 m from ground

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33. Soap helps in cleaning the clothes because

A. It attracts the dirt particles

B. it decreases the surface tension of water

C. It increases the cohesive force between wa^ molecules

D. It increases the angle of contact

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34. Explain the effect of increasing the temperature of a liquid, on intermolecular forces operating between its particles. What will happen to the viscosity of a liquid if its temperature is increased ?

A. Increases

B. Decreases

C. Remains constant

D. First increases and tl leri decreases

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35. The raincoats are made water proof by coating with a material, which

A. Absorb wate

B. Increase surface tension of water ‘

C. Increase the angle of contact

D. Decreases the density of water

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36. When a greased iron needle is placed gently on the surface of water at rest, it floats on the surface of water. Why?

A. It displaces water more than its weight

B. The density of material of needle is less than that of water

C. Of surface tension

D. Of its shape

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37. Two water droplets merge with each other to from a larger droplet. In this process

A. Energy is liberated

B. Energy is absorbed

C. Energy is neither liberated nor absorbed

D. Some mass is converted into energy

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38. The radius of soap bubble is R and surface tension of soap solution is T, keeping the temperature constant, the extra energy needed to double the radius of the soap bubble by blowing will be

A. $24\pi r^2$S

B. $8\pi r^2$S

C. $16\pi r^2$S

D. $12\pi r^2$S

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39. The surface tension of liquid is 0.5 N / m . If a film is held on a ring of area 0.02 m square , its surface energy is

A. 5x10^(-2) j

B. 2.5x10^(-2) j

C. 2x10^(-2) j

D. 3x10^(-1) j

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40. Two soap bubbles having radii 3 cm and 4 cm in vacuum, coalesce under isothermal conditions. The radius of the new bubble is

A. 1cm

B. 5 cm

C. 7 cm

D. 3.5 cm

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41. The excess pressure in a soap bubble is thrice that in other one. Then the ratio of their volumes is

A. $1:27$

B. $1:8$

C. $1:4$

D. $1:1$

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42. If σ be the surface tension, the work done in breaking a big drop of radius R in n drops of equal radius is

A. $\dfrac{1}{n^{\frac{2}{3}}} - 1$

B. $\dfrac{1}{n^{\frac{1}{3}}} - 1$

C. $n^{\frac{1}{3}} - 1$

D. $n^{\frac{4}{3}} - 1$

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43. Kerosene oil rises up the wick in a lantern

A. Due to high surface tension of oil

B. Because the wick attract s the oil

C. Because wick decreases the surface tension of oil

D. Due to capillaries formed in the wick

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44. The ploughing of fields helps in the conservation of water in the soil. Explain.

A. By creating capillaries

B. By breaking capillaries

C. By turning the soil upside down ’

D. None of these . ,

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45. A capillary tube of radius R is immersed in water and water rises in it to a height h. Mass of water will rise in the capillary tube will be

A. 2M

B. M

C. $M/2$

D. $M/4$

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46. A massless inextensible string in the form of a loop is placed on a horizontal film of soap solution of surface tension T. If film is pierced inside the loop and it convert into a circular loop of diameter d, then the tension produced in string is

A. Td

B. πTd

C. πd^2T

D. $\dfrac{\pi d^2 T}{4}$

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Assignment(SECTION-B)(Objective type questions)

1. The atmospheric pressure at a place is 10^5 Pa. If tribromomethane (specific gravity = 2.9) be employed as the barometric liquid, the barometric height is:

A. 3.52 m

B. 1.52 m

C. 4.52 m

D. 2.52 m

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2. A vertical U-tube of uniform cross-section contains water jn both the arms. A 10 cm glycerine column (R.D. = 1.2) is added to one of the limbs. The level difference between the two free surfaces in the two limbs wiil be

A. 4cm

B. 2cm

C. 6cm

D. 8cm

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3. The pressure at the bottom of a water tank is 4 P, where P is .atmospheric pressure. If water is drawn out till the water level decreases by $-\frac{3}{5}$th, then pressure at the bottom of the tank is

A. $\frac{3P}{8}$

B. $\frac{7P}{6}$

C. $\frac{11P}{5}$

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

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4. A air bubble rises from bottom of a lake to surface. If its radius increases by 200% and atmospheric pressure is equal to water coloumn of height H, then depth of lake is

A. 21H

B. 8H

C. 9H

D. 26H

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5. A piece of gold weighs 10g in air and 9g in water. What is the volume of cavity? (Density of gold = $19.3gcm^{-3}$)

A. 0.182 cc

B. 0.282cc

C. 0.382 cc

D. 0.482 cc

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6. Water flows in a stream line 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 $\frac{a}{4}$ and the pressure is increased to 4P. then the rate of flow becomes

A. 4Q

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

C. Q

D. $\frac{Q}{64}$

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7. A vessel contains a liquid has a constant acceleration $19.6m/s^2$ in horizontal direction. The free surface of water get sloped with horizontal at angle

A. $\tan^{-1}\left[\frac{1}{2}\right]$

B. $\sin^{-1}\left[\frac{1}{\sqrt{3}}\right]$

C. $\tan^{-1}[2]$

D. $\sin^{-1}\left[\frac{2}{\sqrt{5}}\right]$

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8. A water barrel stands on a table of height h. If a small hole 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. H

B. R

C. $\sqrt{RH}$

D. $R^2 / 4H$

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9. Air streams horizontally past an air plane. The speed over the top surface is 60 m/s, and that under the bottom surface is 45 m/s. The density of air is 1.293 kg/m^3, then the difference in pressure

A. $1018 N/m^2$

B. $516 N/m^2$

C. $1140 N/m^2$

D. $2250 N/m^2$

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10. 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. Four times that of Q

B. Two times that of Q

C. 5times that of Q

D. 3 times that of Q

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11. At what speed will the velocity of a stream of water be equal to 20 cm of mercury column?

(Taking, g =10 ms^{-2})

A. 2.8 m/s

B. 10.32 m/s

C. 5.6 m/s .

D. 8.4 m/s

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12. If the terminal speed of a sphere of gold (of density $19.5 g / cm^3$) is 0.2 m/s in a viscous liquid of density 1.5 g / cm^3 find the terminal speed of a sphere of silver (of density $0.5 g / cm^3$) of the same size in the same liquid

A. 0.2 m/s

B. 0.4 m/s

C. 0.1 m/s

D. 0.133 m/s

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13. 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 43P

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

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

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

A. $2\pi a$

B. a

C. $\frac{a}{\sqrt{2\pi}}$

D. $\frac{a}{\pi}$

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15. If T is the surface tension of a liquid, the energy needed to break a liquid drop of radius R into 64 drops is

A. $6\pi R^2 T$

B. piR^(2)T

C. $12\pi R^2 T$

D. $8\pi R^2 T$

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16. The excess pressure inside a spherical drop of water is four times that of another drop. Then their respective mass ratio is $1 : x$ find x,

A. $1 : 16$

B. $1 : 64$

C. $1:4$

D. $1:8$

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17. The work done in blowing a soap bubble of 10 cm radius is (Surface tension of the soap solution is $\frac{3}{100}$ N/m)

A. $37.68 \times 10^{-4} J$

B. $75.36 \times 10^{-4} J$

C. $126 \times 10^{-4} J$

D. $75.36 \times 10^{-3} J$

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18. A glass capiliary tube of inner diameter 0.28 mm is lowered vertically into water in a vessel. They pressure to be applied on the water in the capillary tube so that water level in the tube is same as that in the vessel in N/m^2 is (surface tension of water = 0.07 N/m, atmospheric pressure $= 10^5 N/m^2$ and angle of contact $= 0^\circ$)

A. 10^3

B. 99×10^3

C. 100×10^3

D. 101×10^3

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19. 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

A. $1 : 0.5$

B. $1 : 3$

C. $1 : 6.5$

D. $1.5 : 1$

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20. A spherical drop of water has 1 mm radiusHf the surface tension of water is 75×10^{-3} N/m, then difference of pressure between inside and outside of the drop is

A. $35N/m^2$

B. $70N/m^2$

C. $140N/m^2$

D. $150N/m^2$

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21. 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. 20cm

B. 4cm

C. 10cm

D. 8cm

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22. If the excess pressure inside a soap bubble is balanced by an oil column of height 2 cm, then the surface tension of soap solution will be(r=1cm , density of oil =0.8g/cm 3)

A. 3.9 N/m

B. $3.9 \times 10 -^{2}$ N/m

C. $3.9 \times 10^{-3} N / m$

D. $3.9 \times 10^{-1} N / m$

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23. There is a small hole in a hollow sphere . The water enters in it when it is taken to depth of 40 cm under water. The surface tension of water is 0.07 N/m. The diameter of hole is-

A. 7mm

B. 0.07mm

C. 0.0007mm

D. 0.7m

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24. Two drops , of the same radius , are falling through air with a steady velocity of $5cms^{-1}$. If the two drops coalesce , the terminal velocity would is

A. $5 \times (4)^{1/3} cm/s$

B. $5\sqrt{2}cm / s$

C. $\frac{5}{\sqrt{2}}cm / s$

D. $5 \times 2cm / s$

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25. A small drop of water falls from rest through a large height h in air, the final velocity is

A. Proportional to $\sqrt{h}$

B. Proportional to h

C. Inversely proportional to h

D. Almost independent of h

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26. A spring balance reads 200 gF when carrying a lump of lead in air. If the lead is now immersed with half of its volume in brine solution, what will be the new reading of the spring balance? . specific gravity of lead and brine are 11.4 and 1.1 respectively

A. 190.4 gF .

B. T80.4 gF

C. 210 gF

D. 170.4 gF

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27. A liquid mixture of volume V, has two liquids as its ingredients with densities α and β. If density of the mixture is σ, then mass of the first liquid in mixture is

A. $\dfrac{\alpha V[\sigma\beta + 1]}{\beta[\alpha + \sigma]}$

B. $\dfrac{\alpha V[\sigma - \beta]}{[\alpha + \beta]}$

C. $\dfrac{\alpha V[\beta-\sigma]}{\beta-\alpha}$

D. $\dfrac{\alpha V[1-\sigma\alpha]}{\beta[\alpha-\sigma]}$

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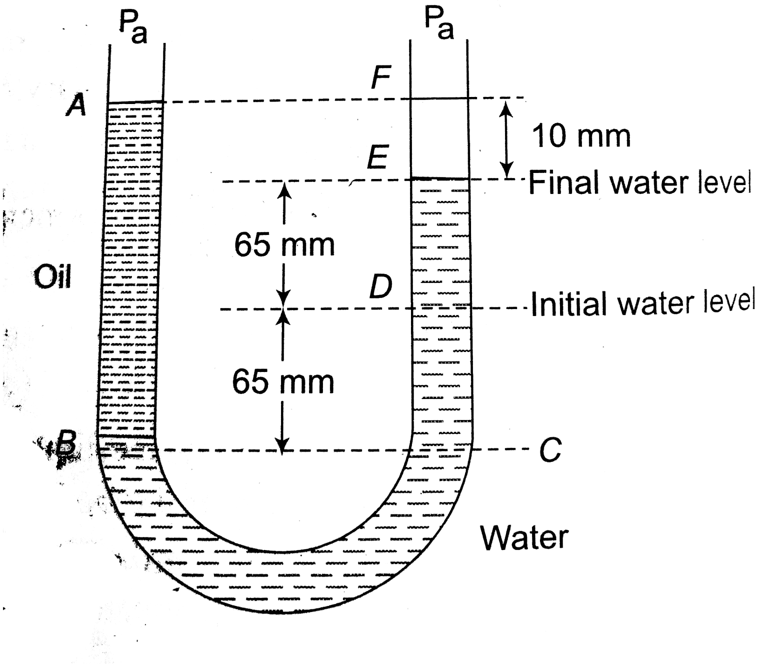
Assignment(SECTION-C)(Previous year questions)

1. A U-tube with both ends open to the atmosphere is partially filled with water. Oil, which is immiscible with water. Is poured into one side until it stands at a distance of $10mm$ above the water level on the other side. Meanwhile the water rises by $65mm$

from its original level (see diagram). The density of

the oil is:



A. $650 kgm^{-3}$

B. $435 kgm^{-3}$

C. $800 kgm^{-3}$

D. $928 kgm^{-3}$

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2. A rectangular film of liquid is extended from $(4cm \times 2cm)$ to $(5cm \times 4 \times cm)$. If the work done is $3 \times 10^{-4} J$, the value of the surface tension of the liquid is

A. $0.250 Nm^{-1}$

B. $0.125 Nm^{-1}$

C. $0.2 Nm^{-1}$

D. $8.0 Nm^{-1}$

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3. Three liquids of densities ρ_1, ρ_2 and ρ_3 (with $\rho_1 > \rho_2 > \rho_3$), having the same value of surface tension T, rise to the same height in three identical capillaries. The angles of contact θ_1, θ_2 and θ_3 obey

A. $\frac{\pi}{2} > \theta_1 > \theta_2 > \theta_3 \geq 0$

B. $0 \leq \theta_1 < \theta_2 < \theta_3 < \frac{\pi}{2}$

C. $\frac{\pi}{2} < \theta_1 < \theta_2 < \theta_3 < \pi$

D. $\pi > \theta_1 > \theta_2 > \theta_3 > \frac{\pi}{2}$

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4. Two non-mixing liquids of densities ρ and $n\rho$ $(n > 1)$ 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(n-1)p}ρ

B. $\{1 + (n + 1)p\}$rho`

C. {2 + (n + 1)p}ρ

D. $\{2+(n-1)p\}$rho`

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5. 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. $\dfrac{V^2R}{nr}$

B. $\dfrac{VR^2}{n^2r^2}$

C. $\dfrac{VR^2}{nr^2}$

D. $\frac{VR^2}{n^3r^3}$

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6. Water rises to a 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 upto the tip of capillary tube and then starts overflowing like a fountain

C. Water rises 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

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7. 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

$(p_{\text{air}} = 1.2kg / m^3)$

A. $2.4 \times 10^5 N$, downwards

B. 4.8×10^5, downwards

C. $4.8 \times 10^5 N$, upwards

D. $2.4 \times 10^5 N$, upwards

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8. 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 $=4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

D. Energy is neither released nor absorbed

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9. The wettability of a surface by a liquid depends primarily on

A. surface tension

B. Density

C. Angle of contact between the surface and the liquid

D. Viscosity

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10. 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. 30N

B. 150N

C. 300N

D. 600N

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11. A liquid X of density $3.36g/cm^3$ poured in a U-tube which contains Hg. Another liquid Y is poured in left arm with heght 8 cm upper levels of X and Y are same. What is density of Y?

A. 0.8`gcc^(-1)

B. 1.2gcc^(-1)`

C. 1.4gcc^(-1)`

D. 1.6gcc^(-1)`

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12. A wooden ball of density D is immersed in water of density d to a depth h//2 below the surface of water and then relased. To what height will the ball jump out of water ?

A. $\frac{d}{D}h$

B. $\left(\frac{d}{D}-1\right)\frac{h}{2}$

C. h

D. Zero

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13. A piece of solid weighs 120 g in air ,80 g in water and 60 kg in a liquid . The relative density of the solid and that of the liquid are respectively

A. 3.2

B. $2, 3.4$

C. $\frac{3}{2}, 2$

D. $3, \frac{3}{2}$

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14. A solid sphere having volume V and density ρ floats at the interface of two immiscible liquids of densites ρ_1 and ρ_2 respectively. If $\rho_1 < \rho < \rho_2$, then the ratio of volume of the parts of the sphere in upper and lower liquid is

A. $\dfrac{\rho_2 - \rho}{\rho - \rho_1}$

B. $\dfrac{\rho + \rho_1}{\rho + \rho_2}$

C. $\dfrac{\rho + \rho_2}{\rho + \rho_1}$

D. $\dfrac{\sqrt{\rho_1 \rho_2}}{\rho}$

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15. Ice pieces are floating in a beaker A containing water and also in a beaker B containing miscible liquid of specific gravity 1.2 When ice melts, the level of

A. Water increases in A

B. Water decreases in A

C. Liquid in B decreases

D. Liquid in B increases

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

A. 12.8

B. 7.2

C. 6.4

D. 3.3

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17. Two solid pieces, one of steel and the other of aluminium when immersed completely in water have equal weights. When the solid pieces are weighed in air

A. The weight of aluminium is half the weight of steel

B. Steel peice will weigh more

C. They have the same weight

D. Aluminium piece will weigh more

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18. A piece of wood is floating in water. When the temperature of water rises, the apparent weight of the wood will

A. Increase

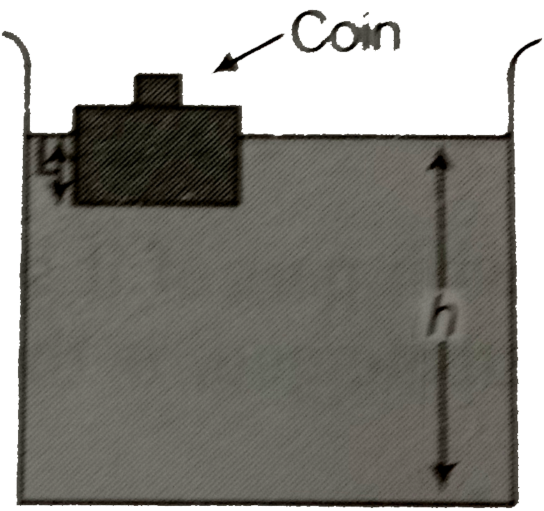
B. Decrease

C. May increase or decrease

D. Remain same

Watch Video Solution

19. A wooden block with a coin placed on its top, floats in water as shown in figure.



The distance l and h are shown in the figure. After sometime, the coin falls into the water. Then,

A. Both / and h increase .

B. Both / and h decrease

C. I decreases and h increase

D. l increases and h decreases

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20. An iceberg is floating in water. The density of ice in the iceberg is $900 kgm^{-1}$ and the density of water is $1000 kgm^{-3}$ What percentage fraction of the iceberg would be visible?

A. 0.05

B. 0.1

C. 0.12

D. 0.08

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21. A piece of wax wieghs 18.03 g in air. A piece of metal is found to weigh 17.03 g in water. It is tied to the wax and both together weigh 15.23 g in water. Then, the specific gravity of wax is

A. $\frac{18.03}{17.03}$

B. $\frac{17.03}{18.03}$

C. $\frac{18.03}{19.83}$

D. $\frac{15.03}{19.83}$

Answer: A::C

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22. Eight equal drops of water are falling through air with a steady velocity of 10 cms^{-1}. If the drops combine to form a single drop big in size, then the terminal velocity of this big drop is

A. $80cms^{-1}$

B. $30cms^{-1}$

C. $10cms^{-1}$

D. $40cms^{-1}$

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23. A small spherical ball falling through a viscous medium of negligible density has terminal velocity v. Another ball of the same mass but of radius twice that of the earlier falling through the same viscous medium will have terminal velocity

A. v

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

C. $\frac{v}{2}$

D. 4v

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24. Streamline flow is more likely for liquids with

A. High density-and low viscosity

B. Low density and high viscosity

C. High density and high viscosity

D. Low density and low viscosit

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25. An air bubble of radius 10^{-2} m is rising up at a steady rate of $2 \times 10^{-3} ms^{-1}$ through a liquid of density $1.5 \times 10^{3} kgm^{-3}$, the coefficient of viscosity neglecting the the density of air, will be $(g = 10ms^{-2})$

A. 23.2 unit

B. 83.5 units

C. 334 units

D. 167 units

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26. The flow of liquid is laminar or streamline is determined by

A. Rate of flow of liquid

B. Density of fluid

C. Radius of the tube

D. Coefficient of viscosity of liquid

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27. A boat floating in a water tank is carrying a number of stones. If the stones were unloaded into water, then the water level

A. Rises

B. Falls

C. Remains unchanged

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

Watch Video Solution

28. 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. $Mg\left(1 - \frac{d_2}{d}d_1\right)$

B. $Mg\frac{d_1}{d_2}$

C. $mg(d_1 - d_2)$

D. mgd_1d_2

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29. 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

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

B. $sqtrt(400)m/s$

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

D. $\sqrt{800}m/s$

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31. Water is in streamline flows along a horizontal pipe with non-uniform cross-section. At a point in the pipe where the area of cross-section is $10cm^{-2}$, the velocity of water is $1ms^{-1}$ and the pressure is 2000 Pa.

The pressure at another point where the cross-sectional area is $5cm^2$ is

A. 200Pa

B. 400Pa

C. 500Pa

D. 800Pa

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32. 10 min are taken to emptied a rectangular vessel of height h through an orifice in its bottom. How much time will it take to be emptied the vessel when half filled ?

A. 9 min

B. 7 min

C. 5 min

D. 3 min

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33. 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. 0.5 poise

C. 0.7 poise

D. 0.9 poise

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34. With an increase in temperature , surface tension of liquid (except molten copper and cadmium)

A. Increases

B. Remain same

C. Decreases

D. First decreases then increases

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35. Determine the energy stored in the surface of. a soap bubble of radius 2.1 cm if its tension is $4.5 \times 10^{-2} Nm^{-1}$

A. 8mJ

B. 2.46 mJ

C. $4.93 \times 10^{-6} J$

D. None of these

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36. A mercury drop of radius 1.0 cm is sprayed into 10^6 droplets of equal sizes. The energy expended in this process is (surface tension of mercury is equal to $32 \times 10^{-2} Nm^{-1}) x \times 10^{-2}$ Joules. Find x.

A. $3.98 \times 10^{-4} J$

B. $8.46 \times 10^{-4} J$

C. $3.98 \times 10^{-2} J$

D. $8.46 \times 10^{-2} J$

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37. When a glass capillary tube of radius 0.015 cm is dipped in water, the water rises to a height of 15 cm within it. Assuming contact angle between water and glass to be 0°, the surface tension of water.is [pwaler = 1000 kg m^{-3}, g = 9.81 ms $\wedge(-2)$]

A. $0.11 Nm^{-1}$

B. $0.7 Nm^{-1}$

C. $0.072 Nm^{-1}$

D. None of these

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

A. obtuse

B. 90°

C. Acute

D. Zero

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39. Two drops of equal radius coalesce to form a bigger drop. What is ratio of surface energy of bigger drop to smaller one?

A. $2^{1/2} : 1$

B. $1 : 1$

C. $2^{2/3} : 1$

D. None of these

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40. The excess pressure inside a spherical drop of water is four times that of another drop. Then their respective mass ratio is $1 : x$ find x,

A. $1 : 16$

B. $8 : 1$

C. $1 : 4$

D. $1 : 64$

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41. A balloon with mass M is descending down with an acceleration $a(a < g)$. What mass of its contents must be removed so that it starts moving up with same acceleration a?

A. $\dfrac{2ma}{g+a}$

B. $\dfrac{2ma}{g-a}$

C. $\dfrac{ma}{g+a}$

D. $\dfrac{ma}{g-a}$

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Assignment(SECTION-D)(Assertion reasoning type)

1. A : Hydraulic lift is based on Pascal's Law.

R : Hydrostatic pressure is a scalar quantity

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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2. A : The apparent weight of a body floating on the surface of a liquid is zero.

R : The net force on a body floating on the surface of a liquid is zero.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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3. A : It is better to wash cloths in hot water than cold water.

R : On increasing temperature surface tension of water decreases.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If Assertion is false and Reason is true, then mark (4).

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4. Assertion : The impurities always decrease the surface tension of a liquid.

Reason : The change in surface tension of the liquid depends upon the degree of contamination of the impurity.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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5. High speed wind blows over a house. The force on the roof is

A. in horizontal direction

B. in upward direction

C. downward direction

D. zero.

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6. Statement I: A raindrop after failing through some height attains a constant velocity.

Statement II: At constant velocity, the viscous drag is just equal to its weight.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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7. When water droplets merge to form a bigger drop

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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8. A : Equation ofcontinuity is $A_1 v_1 \rho_1 = A_2 v_2 \rho_2$ (symbols have their usual meanings).

R : Equation of continuity is valid only for incompressible liquids.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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9. Bernoulli's theorem is based on conservation of

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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10. The spiders and insects move and run on the surface of water without sinking because

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

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