Exercise - I (ONLY ONE OPTION IS CORRECT)

1. STATIC FLUID

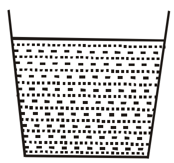
1. A bucket contains water filled upto a height = 15 cm. The bucket is tied to a rope which is passed over a frictionless light pulley and the other end of the rope is tied to a weight of mass which is half of that of the (bucket + water). The water pressure above atmosphere pressure at the bottom is

(A) 0.5 kPa (B) 1 kPa (C) 5 kPa (D) None

2. Some liquid is filled in a cylindrical vessel of radius R. Let F_1 be the force applied by the liquid on the bottom of the cylinder. Now the same liquid is poured into a vessel of uniform square cross-section of side R. Let F_2 be the force applied by the liquid on the bottom of this new vessel. Then :

(A) $F_1 = \pi F_2$ (B) $F_1 = \frac{F_2}{\pi}$ (C) $F_1 = \sqrt{\pi} F_2$ (D) $F_1 = F_2$

3. A liquid of mass 1 kg is filled in a flask as shown in figure. The force exerted by the flask on the liquid is ($g = 10\ m/s^2$) [Neglect atmospheric pressure]

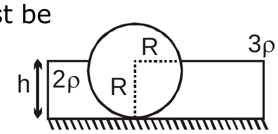


(A) 10 N (B) greater than 10 N
(C) less than 10 N (D) zero

4. A U-tube having horizontal arm of length 20 cm, has uniform cross-sectional area = 1 cm^2. It is filled with water of volume 60 cc. What volume of a liquid of density 4 g/cc should be poured from one side into the U-tube so that no water is left in the horizontal arm of the tube?

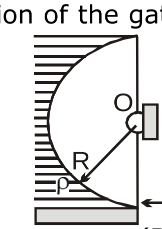
(A) 60 cc (B) 45 cc (C) 50 cc (D) 35 cc

5. In the figure shown, the heavy cylinder (radius R) resting on a smooth surface separates two liquids of densities 2ρ and 3ρ. The height 'h' for the equilibrium of cylinder must be



(A) 3R/2 (B) $R\sqrt{\frac{3}{2}}$ (C) $R\sqrt{2}$ (D) None

6. A light semi cylindrical gate of radius R is piovted at its mid point O, of the diameter as shown in the figure holding liquid of density ρ. The force F required to prevent the rotation of the gate is equal t



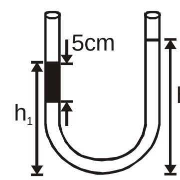
(A) $2\pi R^3 \rho g$ (B) $2\rho g R^3 l$

(C) $\frac{2R^2 l \rho g}{3}$ (D) none of these

7. The pressure at the bottom of a tank of water is 3P where P is the atmospheric pressure. If the water is drawn out till the level of water is lowered by one fifth., the pressure at the bottom of the tank will now be

(A) 2P (B) (13/5) P (C) (8/5) P (D) (4/5) P

8. An open-ended U-tube of uniform cross-sectional area contains water (density 1.0 gram/centimeter^3) standing initially 20 centimeters from the bottom in each arm. An immiscible liquid of density 4.0 grams/centimeter^3 is added to one arm until a layer 5 centimeters high forms, as shown in the figure above. What is the ratio h_2/h_1 of the heights of the liquid in the two arms ?

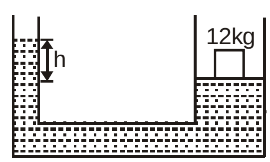


(A) 3/1 (B) 5/2 (C) 2/1 (D) 3/2

9. The vertical limbs of a U shaped tube are filled with a liquid of density ρ upto a height h on each side. The horizontal portion of the U tube having length 2h contains a liquid of density 2ρ. The U tube is moved horizontally with an accelerator g/2 parallel to the horizontal arm. The difference in heights in liquid levels in the two vertical limbs, at steady state will be

(A) 2h/7 (B) 8h/7 (C) 4h/7 (D) None

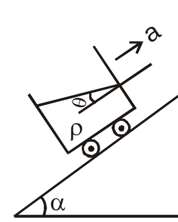
10. The area of cross-section of the wider tube shown in figure is 800 cm^2. If a mass of 12 kg is placed on the massless piston, the difference in heights h in the level of water in the two tubes is :



(A) 10 cm (B) 6 cm (C) 15 cm (D) 2 cm

2. ACCELERATED FLUID

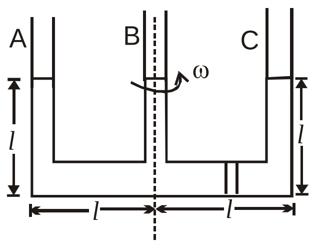
11. A fluid container is containing a liquid of density ρ is is accelerating upward with acceleration a along the inclined place of inclination α as shwon. Then the angle of inclination θ of free surface is :



(A) $\tan^{-1}\left[\dfrac{g}{g\cos\alpha}\right]$ (B) $\tan^{-1}\left[\dfrac{a+g\sin\alpha}{g\cos\alpha}\right]$

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

12. Figure shows a three arm tube in which a liquid is filled upto levels of height l. It is now rotated at an angular frequency ω about an axis passing through arm B. The angular frequency ω at which level of liquid of arm B becomes zero.

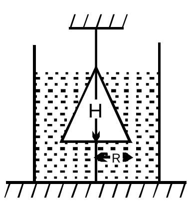


(A) $\sqrt{\dfrac{2g}{3l}}$ (B) $\sqrt{\dfrac{g}{l}}$ (C) $\sqrt{\dfrac{3g}{l}}$ (D) $\sqrt{\dfrac{3g}{2l}}$

13. An open cubical tank was initially fully filled with water. When the tank was accelerated on a horizontal plane along one of its side it was found that one third of volume of water spilled out. The acceleration was
(A) g/3 (B) 2g/3 (C) 3g/2 (D) None

3. PASCAL'S LAW & ARCHIMEDE'S PRINCIPLE

14. A cone of radius R and height H, is hanging inside a liquid of density ρ by means of a string as shown in the figure. The force, due to the liquid acting on the slant surface of the cone is (neglect atmospheric pressure)



(A) $\rho\pi gHR^2$ (B) $\pi\rho HR^2$ (C) $\dfrac{4}{3}\pi\rho gHR^2$ (D) $\dfrac{2}{3}\pi\rho gHR^2$

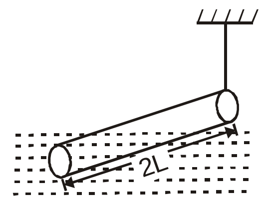
15. A heavy hollow cone of radius R and height h is placed on a horizontal table surface, with its flat base on the table. The whole volume inside the cone is filled with water of density ρ. The circular rim of the cone's base has a watertight seal with the table's surface and the top apex of the cone has a small hole. Neglecting atmospheric pressure find the total upward force exerted by water on the cone is
(A) $(2/3)\pi R^2 h\rho g$ (B) $(1/3)\pi R^2 h\rho g$ (C) $\pi R^2 h\rho g$ (D) None

16. Two cubes of size 1.0 m sides, one of relative density 0.60 and another of relative density = 1.15 are connected by weightless wire and placed in a large tank of water. Under equilibrium the lighter cube will project above the water surface to a height of
(A) 50 cm (B) 25 cm (C) 10 cm (D) zero

17. A cuboidal piece of wood has dimensions a, b and c. Its relative density is d. It is floating in a larger body of water such that side a is vertical. It is pushed down a bit and released. The time period of SHM executed by it is :

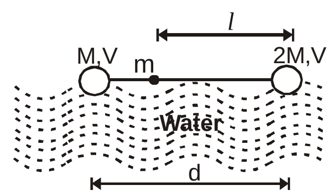
(A) $2\pi\sqrt{\dfrac{abc}{g}}$ (B) $2\pi\sqrt{\dfrac{g}{da}}$ (C) $2\pi\sqrt{\dfrac{bc}{dg}}$ (D) $2\pi\sqrt{\dfrac{da}{g}}$

18. A slender homogeneous rod of length 2L floats partly immersed in water, being supported by a string fastened to one of its ends, as shown. The specific gravity of the rod is 0.75. The length of rod that extends out of water is



(A) L (B) $\dfrac{1}{2}$L (C) $\dfrac{1}{4}$L (D) 3 L

19. A dumbbell is placed in water of density ρ. It is observed that by attaching a mass m to the rod, the dumbbell floats with the rod horizontal on the surface of water and each sphere exactly half submerged as shown in the figure. The volume of the mass m is negligible. The value of length l is



(A) $\dfrac{d(V_\rho - 3M)}{2(V_\rho - 2M)}$ (B) $\dfrac{d(V_\rho - 2M)}{2(V_\rho - 3M)}$

(C) $\dfrac{d(V_\rho + 2M)}{2(V_\rho - 3M)}$ (D) $\dfrac{d(V_\rho - 2M)}{2(V_\rho + 3M)}$

20. Two bodies having volumes V and 2V are suspended from the two arms of a common balance and they are found to balance each other. If larger body is immersed in oil (density d_1 = 0.9 gm/cm^3) and the smaller body is immersed in an unknown liquid, then the balance remain in equilibrium. The density of unknown liquid is given by :
(A) 2.4 gm/cm^3 (B) 1.8 gm/cm^3
(C) 0.45 gm/cm^3 (D) 2.7 gm/cm^3

21. A container of large surface area is filled with liquid of density ρ. A cubical block of side edge a and mass M is floating in it with four-fifth of its volume submerged. If a coin of mass m is placed gently on the top surface of the block is just submerged. M is
(A) 4m/5 (B) m/5 (C) 4m (D) 5m

22. A boy carries a fish in one hand and a bucket (not full) of water in the other hand. If the places the fish in the bucket, the weight now carried by him (assume that water does not spill) :
(A) is less than before (B) is more than before
(C) is the same as before (D) depends upon his speed

23. A cork of density 0.5 gcm^{-3} floats on a calm swimming pool. The fraction of the cork's volume which is under water is
(A) 0% (B) 25% (C) 10% (D) 50%

24. Two cylinders of same cross-section and length L but made of two material of densities d_1 and d_2 are cemented together to form a cylinder of length 2L. The combination floats in a liquid of density d with a length L/2 above the surface of the liquid. If $d_1 > d_2$ then :

(A) $d_1 > \frac{3}{4}d$ (B) $\frac{d}{2} > d_1$ (C) $\frac{d}{4} > d_1$ (D) $d < d_1$

25. 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 :

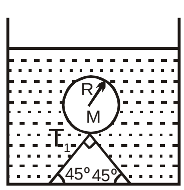
(A) $\frac{W - W_1}{W - W_2}$ (B) $\frac{W - W_2}{W - W_1}$ (C) $\frac{W_1 - W_2}{W - W_1}$ (D) $\frac{W_1 - W_2}{W - W_2}$

26. A ball of relative density 0.8 falls into water from a height of 2m. The depth to which the ball will sink is (neglect viscous forces) :
(A) 8m (B) 2m (C) 6m (D) 4m

27. A small wooden ball of density ρ is immersed in water of density σ to depth h and then released. The height H above the surface of water up to which the ball will jump out of water is

(A) $\frac{\sigma h}{\rho}$ (B) $\left(\frac{\sigma}{\rho} - 1\right)h$ (C) h (D) zero

28. A hollow sphere of mass M and radius r is immersed in a tank of water (density ρ_w). The sphere would float if it were set free. The sphere is tied to the bottom of the tank by two wires which makes angle 45º with the horizontal as shown in the figure. The tension T_1 in the wire is :



(A) $\frac{\frac{4}{3}\pi R^3 \rho_w g - Mg}{\sqrt{2}}$ (B) $\frac{2}{3}\pi R^3 \rho_w g - Mg$

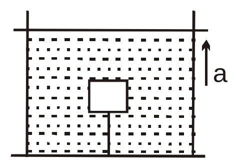
(C) $\frac{\frac{4}{3}\pi R^3 \rho_w g - Mg}{2}$ (D) $\frac{4}{3}\pi R^3 \rho_w g - Mg$

29. A metal ball of density 7800 kg/m^3 is suspected to have a large number of cavities. It weighs 9.8 kg when weighed directly on a balance and 1.5 kg less when immersed in water. The fraction by volume of the cavities in the metal ball is approximately :
(A) 20% (B) 30% (C) 16% (D) 11%

30. A sphere of radius R and made of material of relative density σ has a concentric cavity of radius r. It just floats when placed in a tank full of water. The value of the ratio R/r will be

(A) $\left(\frac{\sigma}{\sigma - 1}\right)^{1/3}$ (B) $\left(\frac{\sigma - 1}{\sigma}\right)^{1/3}$ (C) $\left(\frac{\sigma + 1}{\sigma}\right)^{1/3}$ (D) $\left(\frac{\sigma - 1}{\sigma + 1}\right)^{1/3}$

31. A body having volume V and density ρ is attached to the bottom of a container as shown. Density of the liquid is d(>ρ). Container has a constant upward acceleration a. Tension in the string is

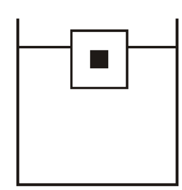


(A) V[Dg – ρ(g + a)] (B) V (g + a) (d – ρ)
(C) V (d – ρ) g (D) none

32. A hollow cone floats with its axis vertical upto one-third of its height in a liquid of relative density 0.8 and with its vertex submerged. When another liquid of relative density ρ is filled in it upto one-third of its height, the cone floats upto half its vertical height. The height of the cone is 0.10 m and radius of the circular base is 0.05 m. The specific gravity ρ is given by
(A) 1.0 (B) 1.5 (C) 2.1 (D) 1.9

33. A beaker containing water is placed on the platform of a spring balance. The balance reads 1.5 kg. A stone of mass 0.5 kg and density 500 kg/m^3 is immersed in water without touching the walls of beaker. What will be the balance reading now ?
(A) 2 kg (B) 2.5 kg (C) 1 kg (D) 3 kg

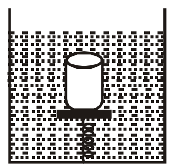
34. There is a metal cube inside a block of ice which is floating on the surface of water. The ice melts completely and metal falls in the water. Water level in the container



(A) Rises (B) Falls (C) Remains same
(D) Nothing can be concluded

35. A uniform solid cylinder of density 0.8 g/cm^3 floats in equilibrium in a combination of two non-mixing liquid A and B with its axis vertical. The densities of liquid A and B are 0.7 g/cm^3 and 1.2 gm/cm^3. The height of liquid A is h_A = 1.2 cm and the length of the part of cylinder immersed in liquid B is h_B = 0.8 cm. Then the length of the cylinder in air is
(A) 0.21 m (B) 0.25 cm (C) 0.35 cm (D) 0.4 cm

36. A cylindrical block of area of cross-section A and of material of density ρ is placed in a liquid of density one-third of density of block. The block compresses a spring and compression in the spring is one-third of the length of the block. If acceleration due to gravity is g, the spring constant of the spring is



(A) ρAg (B) $2\rho Ag$ (C) $2\rho Ag/3$ (D) $\rho Ag/3$

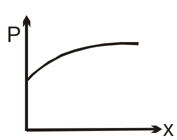
37. A body of density ρ' is dropped from rest at a height h into a lake of density ρ, where $\rho > \rho'$. Neglecting all disipative froces, calculate the maximum depth to which the body sinks before returning of float on the surface.
(A) $\frac{h}{\rho-\rho'}$ (B) $\frac{h\rho'}{\rho}$ (C) $\frac{h\rho'}{\rho-\rho'}$ (D) $\frac{h\rho}{\rho-\rho'}$

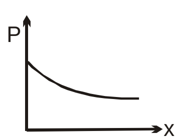
4. FLUID FLOW & BERNOULLI'S PRINCIPLE

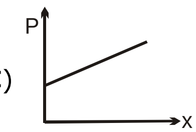
38. A rectangular tank is placed on a horizontal ground and is filled with water to a height H above the base. A small hole is made on one vertical side at a depth D below the level of the water in the tank. The distance x from the bottom of the tank at which the water jet from the tank will hit the ground is
(A) $2\sqrt{D(H-D)}$ (B) $2\sqrt{DH}$ (C) $2\sqrt{D(H+D)}$ (D) $\frac{1}{2}\sqrt{DH}$

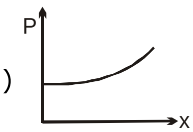
39. A jet of water with cross section of 6 cm^2 strikes a wall at an angle of 60º to the normal and rebounds elastically from the wall without losing energy. If the velocity of the water in the jet is 12 m/s, the force acting on the wall is
(A) 0.864 Nt (B) 86.4 Nt (C) 72 Nt (D) 7.2 Nt

40. The cross sectional area of a horizontal tube increases along its length linearly, as we move in the direction of flow. The variation of pressure, as we move along its length in the direction of flow (x-direction), is best depicted by which of the following graphs

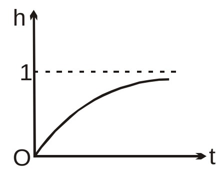
(A)


(B)


(C)


(D)


41. A cylindrical tank of height 1 m and cross section area A = 4000 cm^2 is initially empty when it is kept under a tap of cross sectional area 1 cm^2. Water starts flowing from the tap at t = 0, with a speed = 2 m/s. There is a small hole in the base of the tank of cross-sectional area 0.5 cm^2. The variation of height of water in tank (in meters) with time t is best depicted by

(A)


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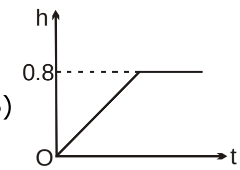
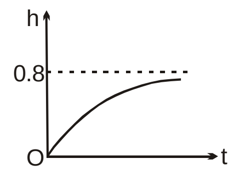
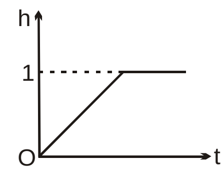
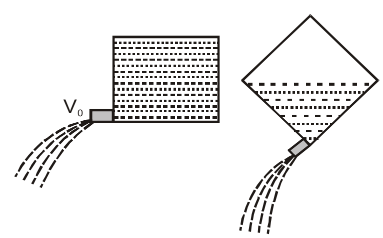


(C)


(D)


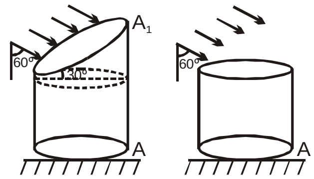
42. A cubical box of wine has a small spout located in one of the bottom corners. When the box is full and placed on a level surface, opening the spout results in a flow of wine with a initial speed of v_0 (see figure). When the box is half empty, someone tilts it at 45º so that the spout is at the lowest point (see figure). When the spout is opened the wine will flow out with a speed of



(A) v_0 (B) $v_0/2$ (C) $v_0/\sqrt{2}$ (D) $v_0/\sqrt[4]{2}$

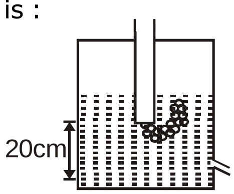
43. Water is flowing steadily through a horizontal tube of non uniform cross-section. If the pressure of water is 4 × 10^4 N/m^2 at a point where cross-section is 0.02 m^2 and velocity of flow is 2 m/s, what is pressure at a point where cross-section reduces to 0.01 m^2
(A) 1.4 × 10^4 N/m^2 (B) 3.4 × 10^4 N/m^2
(C) 2.4 × 10^{-4} N/m^2 (D) none of these

44. A vertical cylindrical container of base area A and upper cross-section area A_1 making an angle 30° with the horizontal is placed in an open rainy field as shown near another cylindrical container having same base area A. The ratio of rates of collection of water in the two containers will be.



(A) $2/\sqrt{3}$ (B) $4/\sqrt{3}$ (C) 2   (D) None

45. A tube is attached as shown in closed vessel containing water. The velocity of water coming out from a small hole is :



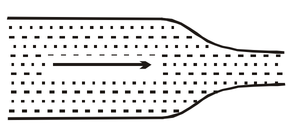
(A) $\sqrt{2}\,m/s$ (B) 2 m/s
(C) depends on pressure of air inside vessel
(D) None of these

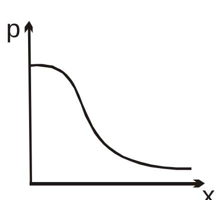
46. A large tank is filled with water to a height H. A small hole is made at the base of the tank. It takes T_1 time to decrease the height of water to H/η, ($\eta > 1$) and it takes T_2 time to take out the rest of water. If $T_1 = T_2$, then the value of η is :
(A) 2   (B) 3   (C) 4   (D) $2\sqrt{2}$

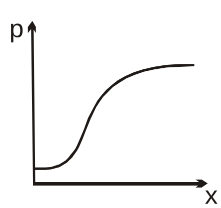
47. In the case of a fluid, Bernoulli's theorem expresses the application of the principle of conservation of
(A) linear momentum   (B) energy
(C) mass   (D) angular momentum

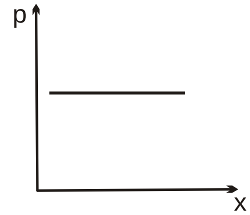
48. Fountains usually seen in gardens are generated by a wide pipe with an enclosure at one end having many small holes. Consider one such fountain which is produced by a pipe of internal diameter 2 cm in which water flows at a rate $3ms^{-1}$. The enclosure has 100 holes each of diameter 0.05 cm. The velocity of water coming out of the holes is (in ms^{-1}) :
(A) 0.48   (B) 96   (C) 24   (D) 48

49. Water flows through a frictionless duct with a cross-section varying as shown in figure. Pressure p at points along the axis is represented by



(A)


(B)


(C)


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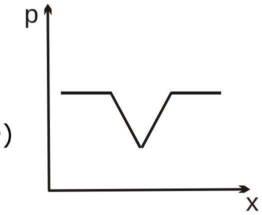
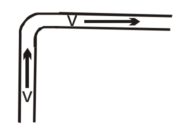


50. A cylindrical vessel filled with water upto the height H becomes empty in time t_0 due to a small hole at the bottom of the vessel. If water is filled to a height 4H it will flow out in time
(A) t_0 (B) $4t_0$ (C) $8t_0$ (D) $2t_0$

51. A cylindrical vessel open at the open at the top is 20 cm high and 10 cm in diameter. A circular hole whose cross-sectional area 1 cm^2 is cut at the centre of the bottom of the vessel. Water flows from a tube above it into the vessel at the rate 100 cm^3s^{-1}. The height of water in the vessel under state is (Take g = 1000 cms^{-2})
(A) 20 cm   (B) 15 cm   (C) 10 cm   (D) 5 cm

52. A fire hydrant delivers water of density ρ at a volume rate L. The water travels vertically upward through the hydrant and then does 90° turn to emerge horizontally at speed V. The pipe and nozzle have uniform cross-section throughout. The force exerted by the water on the corner of the hydrant is :



(A) ρVL (B) zero   (C) $2\rho VL$ (D) $\sqrt{2}\,\rho VL$

53. A vertical tank, open at the top, is filled with a liquid and rests on a smooth horizontal surface. A small hole is opened at the centre of one side of the tank. The area of cross-section of the tank is N times the area of the hole, where N is a large number. Neglect mass of the tank itself. The initial acceleration of the tank is

(A) $\frac{g}{2N}$ (B) $\frac{g}{\sqrt{2}N}$ (C) $\frac{g}{N}$ (D) $\frac{g}{2\sqrt{N}}$

54. Two water pipes P and Q having diameters 2×10^{-2} m and 4×10^{-2} m, respectively, are joined in series with the main supply line of water. The velocity of water flowing in pipe P is
(A) 4 times that of Q   (B) 2 times that of Q
(C) 1/2 times of that of Q   (D) 1/4 times that of Q

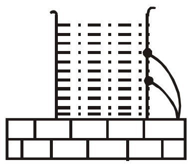
55. Water flows into a cylindrical vessel of large cross-sectional area at a rate of $10^{-4}m^3/s$. It flows out from a hole of area 10^{-4} m^2, which has been punched through the base. How high does the water rise in the vessel ?
(A) 0.075 m   (B) 0.051 m   (C) 0.031 m (D) 0.025 m

56. A tank is filled up to a height 2H with a liquid and is placedon a platform of height H from the ground.

The distance x from the ground where a small hole is punched to get the maximum range R is :

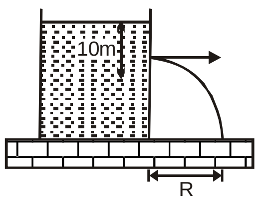
(A) H (B) 1.25 H (C) 1.5 H (D) 2 H

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



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

58. A large tank is filled with water (density = 10^3 kg/m^3). A small hole is made at a depth 10m below water surface. The range of water issuing out of the hole is Ron ground. 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) :



(A) 9 atm (B) 4 atm (C) 5 atm (D) 3 atm

59. 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 barrel. The depth of water in the barrel is

(A) R/2 (B) $R^2/4h$ (C) R^2/h (D) h/2

60. A cyclindrical vessel of cross-sectional area 1000 cm^2, is fitted with a frictionless piston of mass 10 kg, and filled with water completely. A small hole of cross-sectional area 10 mm^2 is opened at a point 50 cm deep from the lower surface of the piston. The velocity of efflux from the hole will be

(A) 10.5 m/s (B) 3.4 m/s (C) 0.8 m/s (D) 0.2 m/s

61. A laminar stream is flowing vertically down from a tap of cross-section area 1 cm^2. At a distane 10 cm below the tap, the cross-section area of the stream has reduced to 1/2 cm^2. The volumetric flow rate of water from the tap must be about

(A) 2.2 litre/min (B) 4.9 litre/min
(C) 0.5 litre/min (D) 7.6 litre/min

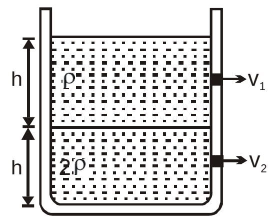
62. A horizontal right angle pipe bend has cross-sectional area = 10 cm^2 and water flows through it at speed = 20 m/s. The force on the pipe bend due to the turning of water is :

(A) 565.7 N (B) 400 N (C) 20 N (D) 282.8 N

63. A jet of water having velocity = 10 m/s and stream cross-section = 2 cm^2 hits a flat plate perpendicularly, with the water splashing out parallel to plate. The plate experiences a force of

(A) 40 N (B) 20 N (C) 8 N (D) 10 N

64. 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 a flux at these two holes, then v_1/v_2 is :



(A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{\sqrt{2}}$

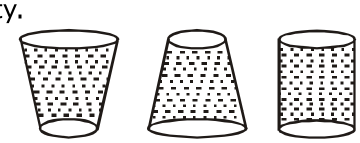
65. A horizontal pipe line carries water in a streamline flow. At a point along the tube where the cross-sectional area is 10^{-2}m^2, the water velocity is 2 ms^{-1} and the pressure is 8000 Pa. The pressure of water at another point where the cross-sectional area is 0.5 × 10^{-2} m^2 is :

(A) 4000 Pa (B) 1000 Pa (C) 2000 Pa (D) 3000 Pa

66. Water is pumped from a depth of 10 m and delivered through a pipe of cross section 10^{-2}m^2. If it is needed to deliver a volume of 10^{-1}m^3 per second the power required will be :

(A) 10 kW (B) 9.8 kW (C) 15 kW (D) 4.9 kW

67. The three water filled tanks shown have the same volume and height. If small identical holes are punched near this bottom, which one will be the first to get empty.



(i) (ii) (iii)

(A) (i) (B) (ii) (C) (iii)
(D) All will take same time

68. A cylindrical vessel filled with water upto height of H stands on a horizontal plane. The side wall of the vessel has a plugged circular hole touching the bottom. The coefficient of friction between the bottom of vessel and plane is μ and total mass of water plus vessel is M. What should be minimum diameter of hole so that the vessel begins to move on the floor if plug is removed (here density of water is ρ)

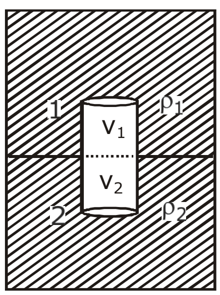
(A) $\sqrt{\frac{2\mu M}{\pi\rho H}}$ (B) $\sqrt{\frac{\mu M}{2\pi\rho H}}$ (C) $\sqrt{\frac{\mu M}{\rho H}}$ (D) none

69. Which of the following is not an assumption for an ideal fluid flow for which Bernoulli's principle is valid
(A) Steady flow (B) Incompressible
(C) Viscous (D) Irrotational

ASSERTION - REASON

70. **Statement - 1 :** A helium filled balloon does not rise indefinitely in air but halts after a certain height.
Statement - 2 : Viscosity opposes the motion of balloon
Choose any one of the following four responses :
(A) If both (A) and (R) are true and (R) is the correct explanation of (A)
(B) If both (A) and (R) are true but (R) is not correct explanation of (A)
(C) If both (A) if true but (R) is false
(D) If (A) is false and (R) is true

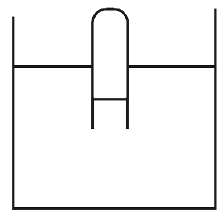
71. **Statement - 1 :** When a body floats such that it's parts are immersed into two immiscible liquids force exerted by liquid - 1 is of magnitude $\rho_1 v_1 g$.
Statement - 2 : Total Buogyant force = $\rho_1 v_1 g + \rho_2 v_2 g$



(A) Statement - 1 is true, statement - 2 is true and statement - 2 is correct explanation for statement - 1
(B) Statement - 1 is true, statement - 2 is true and statement - 2 is NOT the correct explanation for statement - 1
(C) Statement - 1 is true, statement - 2 is false.
(D) Statement - 1 is false, statement - 2 is true.

72. **Statement - 1 :** When temperature rises the coefficient of viscosity of gases decreases.
Statement - 2 : Gases behave more like ideal gases at higher temperature
(A) Statement - 1 is true, statement - 2 is true and statement - 2 is correct explanation for statement - 1
(B) Statement - 1 is true, statement - 2 is true and statement - 2 is NOT the correct explanation for statement - 1
(C) Statement - 1 is true, statement - 2 is false.
(D) Statement - 1 is false, statement - 2 is true.

73. **Statement -1 :** A partly filled test tube is floating in a liquid as shown. The tube will remain as atmospheric pressure changes.
Statement - 2 : The buoyant force on a submerged object is independent of atmospheric pressure



(A) Statement - 1 is true, statement - 2 is true and statement - 2 is correct explanation for statement - 1
(B) Statement - 1 is true, statement - 2 is true and statement - 2 is NOT the correct explanation for statement - 1
(C) Statement - 1 is true, statement - 2 is false.
(D) Statement - 1 is false, statement - 2 is true.

74. **Statement -1 :** Submarine sailors are advised that they should not allow it to rest on floor of the occen
Statement - 2 : The force exerted by a liquid on a submerged body may be downwards.
(A) Statement - 1 is true, statement - 2 is true and statement - 2 is correct explanation for statement - 1
(B) Statement - 1 is true, statement - 2 is true and statement - 2 is NOT the correct explanation for statement - 1
(C) Statement - 1 is true, statement - 2 is false.
(D) Statement - 1 is false, statement - 2 is true.

75. **Statement - 1 :** The free surface of a liquid at rest with respect to stationary container is always normal to the $\vec{g}_{eff}$
Statement - 2 : Liquids at rest cannot have shear stress.
(A) Statement - 1 is true, statement - 2 is true and statement - 2 is correct explanation for statement - 1
(B) Statement - 1 is true, statement - 2 is true and statement - 2 is NOT the correct explanation for statement - 1
(C) Statement - 1 is true, statement - 2 is false.
(D) Statement - 1 is false, statement - 2 is true.