EXERCISE #1

OBJECTIVE TYPE QUESTIONS

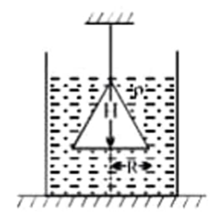
1. The vertical limbs of a U shaped tube are filled with a liquid of density ρ upto a height h on each side. The horizontal portion of the U tube having length 2h contains a liquid of density 2ρ. The U tube is moved horizontally with an accelerator g/2 parallel to the horizontal arm. The difference in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

   (a) $\frac{2h}{7}$ (b) $\frac{8h}{7}$ (c) $\frac{4h}{7}$ (d) None of these

2. 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 of these

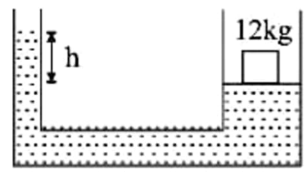
3. A cone of radius R and height H, is hanging inside a liquid of density ρ by means of a string as shown in the figure. The force, due to the liquid acting on the slant surface of the cone is



   (a) $\rho\pi gHR^2$ (b) $\rho\pi HR^2$

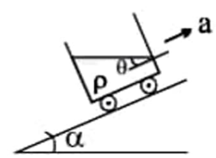
   (c) $\frac{4}{3}\rho\pi gHR^2$ (d) $\frac{2}{3}\rho\pi gHR^2$

4. 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

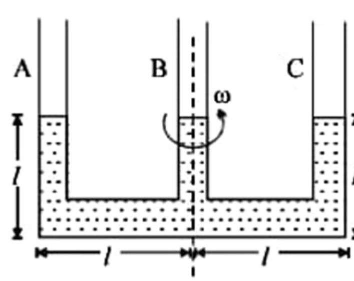
5. A fluid container is containing a liquid of density ρ is accelerating upward with acceleration a along the inclined place of inclination ρ as shown. Then the angle of inclination ρ of free surface is :



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

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

6. 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 about an axis passing through arm B. The angular frequency at which level of liquid in arm B becomes zero is



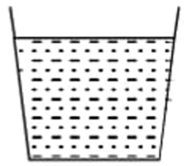
   (a) $\sqrt{\frac{2g}{3l}}$ (b) $\sqrt{\frac{g}{l}}$

   (c) $\sqrt{\frac{3g}{l}}$ (d) $\sqrt{\frac{3g}{2l}}$

7. 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

8. 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) $F_1 = F_2$ (b) $F_1 = \frac{F_2}{\pi}$ (c) $F_1 = \sqrt{\pi}F_2$ (d) $F_1 = F_2$

9. 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]:

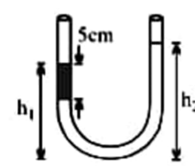


(a) 10 N (b) greater than 10N
(c) less than 10N (d) zero

10. 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

11. 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

12. 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?



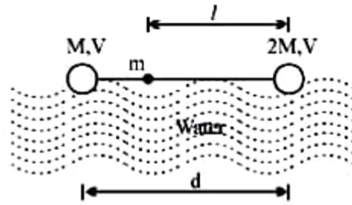
(a) 3/1 (b) 5/2 (c) 2/1 (d) 3/2

13. 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 densityρ . 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

14. 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

15. A cubical piece of wood has dimensions a, b and c. Its relative density is d. It is floating in a large 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) $2\pi\sqrt{\frac{abc}{g}}$ (b) $2\pi\sqrt{\frac{g}{da}}$ (c) $2\pi\sqrt{\frac{bc}{dg}}$ (d) $2\pi\sqrt{\frac{da}{g}}$

16. 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) $\dfrac{d(V_\rho - 2M)}{2(V_\rho + 3M)}$

17. 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

18. 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

19. A boy carries a fish in one hand and a bucket (not full) of water in the other hand. If he places the fish in the bucket, then 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

20. A cork of density 0.5gcm^{-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%

21. 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) $d_1 > \dfrac{3}{4}d$ (b) $\dfrac{d}{2} > d_1$ (c) $\dfrac{d}{4} > d_1$ (d) $d < d_1$

22. 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) $\dfrac{W_1 - W_2}{W - W_2}$

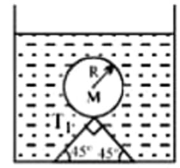
23. A ball of relative density 0.8 falls into water from a height of 2m. The depth to which the ball will sink is (neglect viscous forces):

(a) 8 m (b) 2 m (c) 6 m (d) 4 m

24. 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) $\dfrac{\sigma h}{\rho}$ (b) $\left(\dfrac{\sigma}{\rho} - 1\right)h$ (c) h (d) zero

25. 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 45° with the horizontal as shown in the figure. The tension T_1 in the wire is:



(a) $\dfrac{\frac{4}{3}\pi R^3\rho_w g - Mg}{\sqrt{2}}$ (b) $\dfrac{2}{3}\pi R^3\rho_w g - Mg$

(c) $\dfrac{\frac{4}{3}\pi R^3\rho_w g - Mg}{2}$ (d) $\dfrac{4}{3}\pi R^3\rho_w g + Mg$

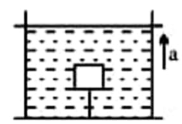
26. A metal ball of density 7800 kg/m^3 is suspected to have a large number of cavities. It weighs 9.8 kg when weighed directly on a balance and 1.5 kg less when immersed in water. The fraction by volume of the cavities in the metal ball is approximately:

(a) 20 % (b) 30 % (c) 16 % (d) 11 %

27. 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) $\left(\dfrac{\sigma}{\sigma-1}\right)^{1/3}$ (b) $\left(\dfrac{\sigma-1}{\sigma}\right)^{1/3}$ (c) $\left(\dfrac{\sigma+1}{\sigma}\right)^{1/3}$ (d) $\left(\dfrac{\sigma-1}{\sigma+1}\right)^{1/3}$

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



(a) $V\,[Dg - \rho\,(g+a)]$ (b) $V\,(g+a)\,(d-\rho)$ (c) $V\,(d-\rho)\,g$ (d) none

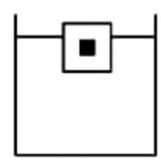
29. A hollow cone floats with its axis vertical up to one-third of its height in a liquid of relative density 0.8 and with its vertex submerged. When another liquid of relative density ρ is filled in it up to one-third of its height, then cone floats up to half its vertical height. The height of the cone is 0.10 m and the 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

30. 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

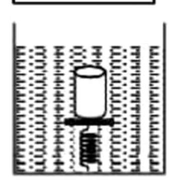
31. There is a metal cube inside a block of ice which is floating on the surface of water. The ice melts completely and metal falls in the water. Water level in the container



(a) Rises (b) Falls

(c) Remains same (d) Nothing can be concluded

32. 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 g/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 part of the cylinder in air is



(a) 0.21 cm (b) 0.25 cm (c) 0.35 cm (d) 0.4 cm

33. 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) $\rho Ag/3$

34. 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

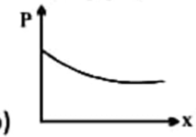
(a) $2\sqrt{D(H-D)}$ (b) $2\sqrt{DH}$ (c) $2\sqrt{D(H+D)}$ (d) $\frac{1}{2}\sqrt{DH}$

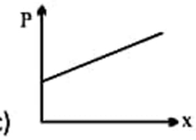
35. A jet of water with cross section of 6 cm^2 strikes a wall at an angle of 60° to the normal and rebounds elastically from the wall without losing energy. If the velocity of the water in the jet is 12 m/s, the force acting on the wall is

(a) 0.864 N (b) 86.4 N (c) 72 N (d) 7.2 N

36. 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

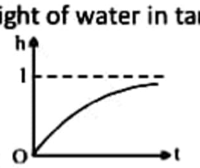
(a) 

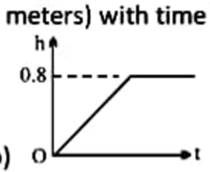
(b) 

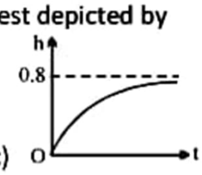
(c) 

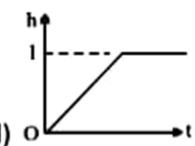
(d) 

37. 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

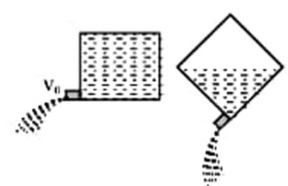
(a) 

(b) 

(c) 

(d) 

38. 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 45° 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) $v_0/\sqrt[4]{2}$

39. 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

40. 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, (η> 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) $2\sqrt{2}$

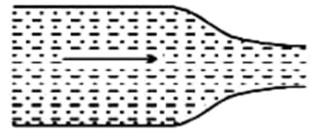
41. In the case of a fluid, Bernoulli's theorem expresses the application of the principle of conservation of:

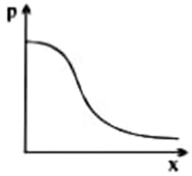
(a) linear momentum (b) energy (c) mass (d) angular momentum

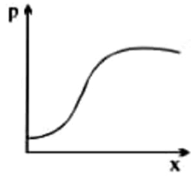
42. Fountains usually seen in gardens are generated by a wide pipe with an enclosure at one end having many small holes. Consider one such fountain which is produced by a pipe of internal diameter 2 cm in which water flows at a rate 3 ms^{-1}. The enclosure has 100 holes each of diameter 0.05 cm. The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

(a) 0.48 (b) 96 (c) 24 (d) 48

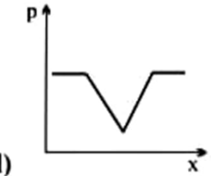
43. Water flows through a frictionless duct with a cross-section varying as shown in figure. Pressure p at points along the axis is represented by



(a) 

(c) 

(c) 

(d) 

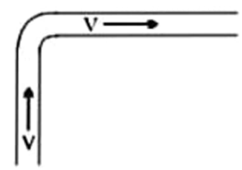
44. A cylindrical vessel filled with water up to the height H becomes empty in time t_0 due to a small hole at the bottom of the vessel. If water is filled to a height 4H it will flow out in time

(a) t_0 (b) $4t_0$ (c) $8t_0$ (d) $2t_0$

45. A cylindrical vessel open at the top is 20cm high and 10cm in diameter. A circular hole with 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 steady state is (Take g=1000 cms^{-2})

(c) 20 cm (b) 15 cm (c) 10 cm d) 5 cm

46. 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) 2ρVL (d) $\sqrt{2}\rho VL$

47. A vertical tank, opens 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) $\frac{g}{\sqrt{2N}}$ (c) $\frac{g}{N}$ (d) $\frac{g}{2\sqrt{N}}$

48. 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) 4 times that of Q (b) 2 times that of Q
(c)½ times of that of Q (d) ¼ times that of Q

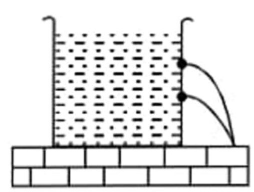
49. Water flows into a cylindrical vessel of large cross-sectional area at a rate of 10^{-4} m^3/s. It flows out from a hole of area 10^{-4} m^2, which has been punched through the base. How high does the water rise in the vessel?

(a) 0.075 m (b) 0.051 m (c) 0.031 m (d) 0.025 m

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

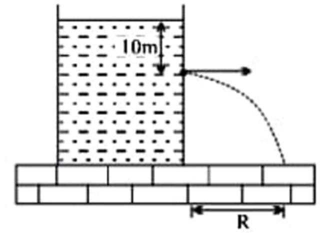
(a) H (b) 1.25 H (c) 1.5 H (d) 2 H

51. 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) $\frac{h_2 + h_1}{2}$

52. A large tank is filled with 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 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

53. 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) $\frac{R}{2}$ (b) $\frac{R^2}{4h}$ (c) $\frac{R^2}{h}$ (d) $\frac{h}{2}$

54. A cylindrical 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

55. A laminar stream is flowing vertically down from a tap of cross-section area 1 cm^2. At a distance 10 cm below the tap, the cross-section area of the stream has reduced to ½ 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

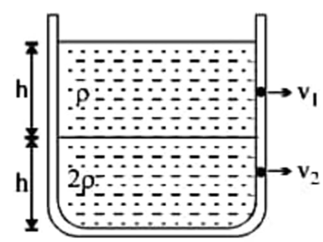
56. A horizontal right angle pipe bend has cross-sectional area = 10 cm^2 and water flows through it at speed = 20 m/s. The force on the pipe bend due to the turning of water is :

(a) 565.7 N (b) 400 N (c) 20 N (d) 282.8 N

57. 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

58. 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) $\frac{1}{\sqrt{2}}$

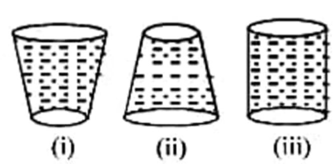
59. A horizontal pipe line carries water in a streamline flow. At a point along the tube where the cross-sectional area is 10^{-2} m^2, the water velocity is 2 ms^{-1} and the pressure is 8000 Pa. The pressure of water at another point where the cross-sectional area is 0.5×10^{-2} m^{2}is:

(a) 4000 Pa (b) 1000 Pa (c) 2000 Pa (d) 3000 Pa

60. 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

61. 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?



(a) (i) (b) (ii)
(c) (iii) (d) All will take same time

EXERCISE #2

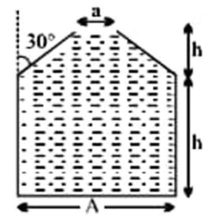
MULTIPLE CHOICE QUESTIONS (MORE THAN ONE OPTION MAY BE CORRECT)

1. A beaker is filled in with water is accelerated a m/s^2 in +x direction. The surface of water shall make on angle

(a) $\tan^{-1}(a/g)$ backwards (b) $\tan^{-1}(a/g)$ forward

(c) $\cot^{-1}(g/a)$ backwards (d) $\cot^{-1}(g/a)$ forward

2. The vessel shown in the figure has two sections. The lower part is a rectangular vessel with area of cross-section A and height h. The upper part is a conical vessel of height h with base area 'A' and top area 'a' and the walls of the vessel are inclined at an angle 30° with the vertical. A liquid of density ρ fills both the sections upto a height 2h. Neglecting atmospheric pressure



(a) The force F exerted by the liquid on the base of the vessel is $2h\rho g\dfrac{(A+a)}{2}$

(b) The pressure P at the base of the vessel is $2h\rho g\dfrac{A}{a}$

(c)The weight of the liquid W is greater than the force exerted by the liquid on the base

(d) The walls of the vessel exert a downward force (F–W) on the liquid.

3. The weight of an empty balloon on a spring balance is w_1. The weight becomes w_2 when the balloon is filled with air. Let the weight of the air itself be w .Neglect the thickness of the balloon when it is filled with air. Also neglect the difference in the densities of air inside & outside the balloon. Then:

(a) $w_2 = w_1$ (b) $w_2 = w_1 + w$ (c) $w_2 < w_1 + w$ (d) $w_2 > w_1$

4. A cubical block of wood of edge 10cm and mass 0.92kg floats on a tank of water with oil of rel. density 0.6 to a depth of 4cm above water. When the block attains equilibrium with four of its side's edges vertical

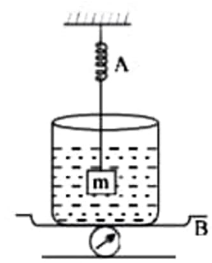
(a) 1cm of it will be above the free surface of oil.

(b) 5cm of it will be under water.

(c) 2cm of it will be above the common surface of oil and water.

(d) 8cm of it will be under water.

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



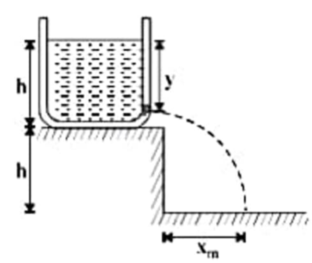
(a) The balance A will read more than 2 kg

(b)The balance B will read more than 5 kg

(c)The balance A will read less than 2 kg and B will read more than 5 kg

(d) The balances A and B will read 2 kg and 5 kg respectively

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



(a) $x_m = 2h$ (b) $x_m = 1.5\ h$

(c) $y = h$ (d) $y = 0.75\ h$

7. Water coming out of a horizontal tube at a speed v strikes normally a vertically wall close to the mouth of the tube and falls down vertically after impact. When the speed of water is increased to 2v,

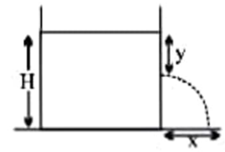
(a) The thrust exerted by the water on the wall will be doubled

(b) The thrust exerted by the water on the wall will be four times

(c)The energy lost per second by water strike up the wall will also be four times

(d) The energy lost per second by water striking the wall is increased eight times.

8. A cylindrical vessel is filled with a liquid up to height H. A small hole is made in the vessel at a distance y below the liquid surface as shown in figure. The liquid emerging from the hole strike the ground at distance x



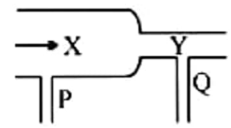
(a) if y is increased from zero to H, x will decrease and then increase

(b) x is maximum for y = $\frac{H}{2}$

(c)The maximum value of x is $\frac{H}{2}$

(d) The maximum value of x increases with the increases in density of the liquid

9. A steady flow of water passes along a horizontal tube from a wide section X to the narrower section Y, see figure. Manometers are placed at P and Q at the sections. Which of the statements A, B, C, D, E is most correct?



(a) Water velocity at X is greater than at Y

(b) The manometer at P shows lower pressure than at Q

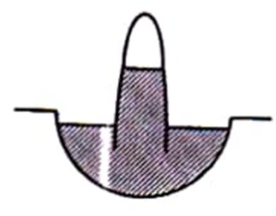
(c)Kinetic energy per m^3 of water at X = kinetic energy per m^3 at Y

(d) The manometer at P shows greater pressure than at Y

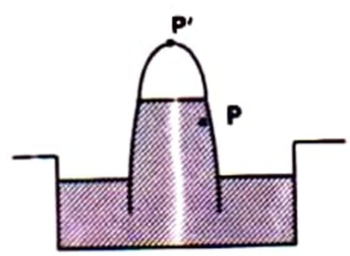
EXERCISE #3

Comprehension and Match the Column

Comprehension – I



Torricelli was the first to devise an experiment for measuring atmospheric pressure. He took a calibrated hard glass tube, 1 m in length and of uniform cross section, closed at one end. He filled the whole tube with dry mercury taking care that no air or water droplets remain inside the tube, closed the opposite end of the tube tightly with thumb and inverted mercury tube into a mercury trough, taking care that the end of the remains inside the mercury rough. An interesting thing was noticed. Mercury in the tube fell down at first and then stopped at a particular position. The height was 76 cm above the free surface of mercury in the trough. When the given tube was inclined or lowered in the mercury trough, the vertical height of mercury level in the tube was always found constant.



Torricelli explained this by saying that the mercury column is supported by the atmospheric pressure acting on the free surface or mercury in the trough. Hence, the hydrostatic pressure exerted by the vertical mercury column in the tube above free surface of mercury in the trough measures the atmospheric pressure.

Read the paragraph carefully and answer the following questions:

1. If a small hole is made at point P in the barometer tube, then

(a) mercury will come out instantly form the hole

(b) mercury will come out of the tube after some time

(c) mercury will not come out of the hole.

(d) none of the above

2. If an additional hole is also made at P' at the top point of the tube, then

(a) mercury will not come out of the tube.

(b) mercury may come out of the tube after some time

(c) mercury will come out of the tube instantly

(d) none of the above

3. If this experiment uses water instead of mercury, then

(a) length of water will be equal to 76 cm

(b) length of water will be less than 76 cm

(c) length of water will be greater than 76 cm

(d) none of the above

4. If the apparatus used in Torricelli experiment is kept in a chamber and all the air form the chamber is pulled out, then

(a) level of mercury will decrease (b) level of mercury will increase

(c) level of mercury will drop down to zero (d) none of the above

5. In Torricelli's experiment, the length of free space in tube us

(a) 76 m (b) 24 cm (c) none of the above (d) no information given.

ASSERTION REASONING TYPE

6. **Statement-1:** When a body is inside a static liquid it experience is up by buoyancy force.

because

Statement-2: Pressure varies with depth in a static liquid.

(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) Statemtn-1 is False, Statement-2 is True.

7. **STATEMENT-1:** Bernoulli's theorem is conservation of energy.

because

STATEMENT-1: Mass flowing per second at every cross section in tube of flow corresponding to incompressible liquid remains constant.

(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) Statemtn-1 is False, Statement-2 is True.

8. **STATEMENT-1:** When a container containing a liquid accelerated horizontally buoyancy force is not vertical.

because

STATEMENT-2: Pressure also varies horizontally when container is accelerated horizontally.

(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) Statemtn-1 is False, Statement-2 is True.

ANSWER KEY

EXERCISE #1

1. b	**2.** b	**3.** d	**4.** c	**5.** b	**6.** c	**7.** b
8. d	**9.** a	**10.** d	**11.** b	**12.** c	**13.** a	**14.** b
15. d	**16.** b	**17.** b	**18.** c	**19.** c	**20.**d	**21.** a
22. b	**23.** a	**24.** b	**25.** a	**26.**c	**27.** a	**28.** b
29. d	**30.** b	**31.** b	**32.** b	**33.** b	**34.** a	**35.** b
36. a	**37.** c	**38.** d	**39.** b	**40.** c	**41.** b	**42.** d
43. a	**44.** d	**45.** d	**46.** d	**47.** c	**48.** a	**49.** b
50. c	**51.** d	**52.** d	**53.** b	**54.** b	**55.** b	**56.** a
57. b	**58.**d	**59.** c	**60.** c	**61.** a		

EXERCISE #2

1. a,c	**2.** d	**3.** a,c	**4.** c,d	**5.** b,c	**6.** a,c	**7.** b,d
8. b	**9.** d					

EXERCISE #3

Comprehension – I

1.	**c**	2.	**b**	3.	**c**	4.	**c**	5.	**b**
6.	**a**	**7.**	**b**	**8.**	**a**				