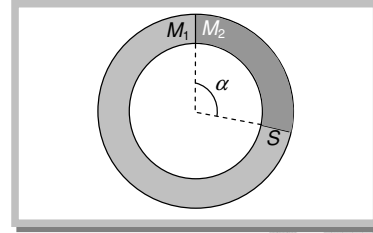


**Fluid mechanics Assignment**

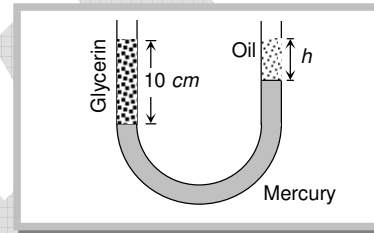
1. A ring shaped tube contains two ideal gases with equal masses and molar masses  $M_1 = 32$  and  $M_2 = 28$ . The gases are separated by one fixed partition and another movable stopper  $S$  which can move freely without friction inside the ring. The angle  $\alpha$  in degrees is

- (a) 192  
(b) 291  
(c) 129  
(d) 219



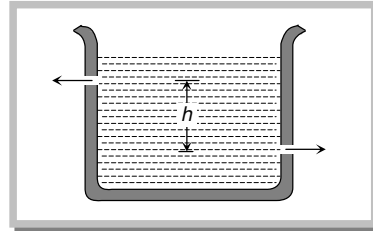
2. The height to which a cylindrical vessel be filled with a homogeneous liquid, to make the average force with which the liquid presses the side of the vessel equal to the force exerted by the liquid on the bottom of the vessel, is equal to
- (a) Half of the radius of the vessel  
(b) Radius of the vessel  
(c) One-fourth of the radius of the vessel  
(d) Three-fourth of the radius of the vessel
3. A vertical U-tube of uniform inner cross section contains mercury in both sides of its arms. A glycerin (density =  $1.3 \text{ g/cm}^3$ ) column of length  $10 \text{ cm}$  is introduced into one of its arms. Oil of density  $0.8 \text{ gm/cm}^3$  is poured into the other arm until the upper surfaces of the oil and glycerin are in the same horizontal level. Find the length of the oil column, Density of mercury =  $13.6 \text{ g/cm}^3$

- (a)  $10.4 \text{ cm}$   
(b)  $8.2 \text{ cm}$   
(c)  $7.2 \text{ cm}$   
(d)  $9.6 \text{ cm}$



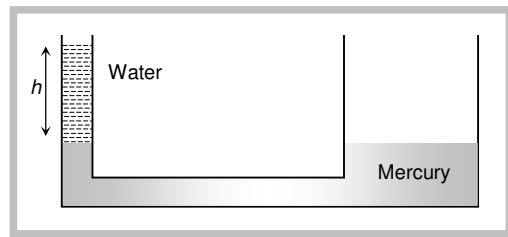
4. There are two identical small holes of area of cross-section  $a$  on the opposite sides of a tank containing a liquid of density  $\rho$ . The difference in height between the holes is  $h$ . Tank is resting on a smooth horizontal surface. Horizontal force which will has to be applied on the tank to keep it in equilibrium is

- (a)  $gh\rho a$   
(b)  $\frac{2gh}{\rho a}$   
(c)  $2\rho agh$   
(d)  $\frac{\rho gh}{a}$



5. Two communicating vessels contain mercury. The diameter of one vessel is  $n$  times larger than the diameter of the other. A column of water of height  $h$  is poured into the left vessel. The mercury level will rise in the right-hand vessel ( $s$  = relative density of mercury and  $\rho$  = density of water) by

- (a)  $\frac{n^2 h}{(n+1)^2 s}$   
(b)  $\frac{h}{(n^2+1)s}$   
(c)  $\frac{h}{(n+1)^2 s}$   
(d)  $\frac{h}{n^2 s}$



6. A triangular lamina of area  $A$  and height  $h$  is immersed in a liquid of density  $\rho$  in a vertical plane with its base on the surface of the liquid. The thrust on the lamina is

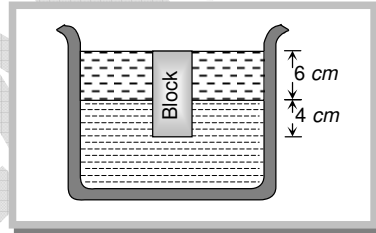
- (a)  $\frac{1}{2} A\rho gh$   
(b)  $\frac{1}{3} A\rho gh$   
(c)  $\frac{1}{6} A\rho gh$   
(d)  $\frac{2}{3} A\rho gh$

7. Pressure applied to an enclosed fluid is transmitted undiminished to every portion of the fluid and the walls of the containing vessel. This law was first formulated by

- (a) Bernoulli  
(b) Archimedes  
(c) Boyle  
(d) Pascal

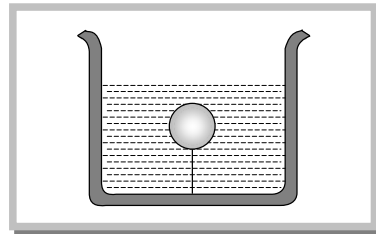
## GRAVITY CLASSES

8. A piston of cross-section area  $100 \text{ cm}^2$  is used in a hydraulic press to exert a force of  $10^7$  dynes on the water. The cross-sectional area of the other piston which supports an object having a mass 2000 kg. is  
 (a)  $100 \text{ cm}^2$  (b)  $10^9 \text{ cm}^2$  (c)  $2 \times 10^4 \text{ cm}^2$  (d)  $2 \times 10^{10} \text{ cm}^2$
9. A block of steel of size  $5 \text{ cm} \times 5 \text{ cm} \times 5 \text{ cm}$  is weighed in water. If the relative density of steel is 7, its apparent weight is  
 (a)  $6 \times 5 \times 5 \times 5 \text{ gf}$  (b)  $4 \times 4 \times 4 \times 7 \text{ gf}$  (c)  $5 \times 5 \times 5 \times 7 \text{ gf}$  (d)  $4 \times 4 \times 4 \times 6 \text{ gf}$
10. A body is just floating on the surface of a liquid. The density of the body is same as that of the liquid. The body is slightly pushed down. What will happen to the body  
 (a) It will slowly come back to its earlier position (b) It will remain submerged, where it is left  
 (c) It will sink (d) It will come out violently
11. A uniform rod of density  $\rho$  is placed in a wide tank containing a liquid of density  $\rho_0$  ( $\rho_0 > \rho$ ). The depth of liquid in the tank is half the length of the rod. The rod is in equilibrium, with its lower end resting on the bottom of the tank. In this position the rod makes an angle  $\theta$  with the horizontal  
 (a)  $\sin \theta = \frac{1}{2} \sqrt{\rho_0 / \rho}$  (b)  $\sin \theta = \frac{1}{2} \cdot \frac{\rho_0}{\rho}$  (c)  $\sin \theta = \sqrt{\rho / \rho_0}$  (d)  $\sin \theta = \rho_0 / \rho$
12. A cork is submerged in water by a spring attached to the bottom of a bowl. When the bowl is kept in an elevator moving with acceleration downwards, the length of spring  
 (a) Increases (b) Decreases (c) Remains unchanged (d) None of these
13. A cubical block of wood 10 cm on a side floats at the interface between oil and water with its lower surface horizontal and 4 cm below the interface. The density of oil is  $0.6 \text{ gcm}^{-3}$ . The mass of block is  
 (a) 706 g (b) 607 g (c) 760 g (d) 670 g



14. A solid sphere of density  $\eta$  ( $> 1$ ) times lighter than water is suspended in a water tank by a string tied to its base as shown in fig. If the mass of the sphere is  $m$  then the tension in the string is given by

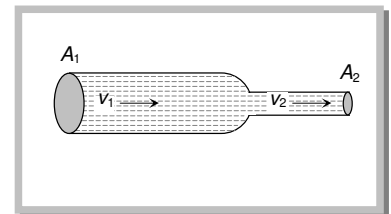
- (a)  $\left(\frac{\eta-1}{\eta}\right)mg$   
 (b)  $\eta mg$   
 (c)  $\frac{mg}{\eta-1}$   
 (d)  $(\eta-1)mg$



15. A spherical ball of radius  $r$  and relative density 0.5 is floating in equilibrium in water with half of it immersed in water. The work done in pushing the ball down so that whole of it is just immersed in water is : (where  $\rho$  is the density of water)  
 (a)  $\frac{5}{12} \pi r^4 \rho g$  (b)  $0.5 \pi r g$  (c)  $\frac{4}{3} \pi r^3 \rho g$  (d)  $\frac{2}{3} \pi r^4 \rho g$
16. A hollow sphere of volume  $V$  is floating on water surface with half immersed in it. What should be the minimum volume of water poured inside the sphere so that the sphere now sinks into the water  
 (a)  $V/2$  (b)  $V/3$  (c)  $V/4$  (d)  $V$
17. A rectangular block is  $5 \text{ cm} \times 5 \text{ cm} \times 10 \text{ cm}$  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) No change (b) It will rise  
 (c) It will fall (d) It may rise or fall depending on the density of block
18. A ball whose density is  $0.4 \times 10^3 \text{ kg/m}^3$  falls into water from a height of 9 cm. To what depth does the ball sink  
 (a) 9 cm (b) 6 cm (c) 4.5 cm (d) 2.25 cm
19. Two solids A and B float in water. It is observed that A floats with  $\frac{1}{2}$  of its body immersed in water and B floats with  $\frac{1}{4}$  of its volume above the water level. The ratio of the density of A to that of B is  
 (a) 4 : 3 (b) 2 : 3 (c) 3 : 4 (d) 1 : 2

## GRAVITY CLASSES

20. A boat carrying steel balls is floating on the surface of water in a tank. If the balls are thrown into the tank one by one, how will it affect the level of water
- (a) It will remain unchanged (b) It will rise (c) It will fall (d) First it will rise and then fall
21. Two pieces of metal when immersed in a liquid have equal upthrust on them; then
- (a) Both pieces must have equal weights (b) Both pieces must have equal densities  
(c) Both pieces must have equal volumes (d) Both are floating to the same depth
22. A wooden cylinder floats vertically in water with half of its length immersed. The density of wood is
- (a) Equal of that of water (b) Half the density of water  
(c) Double the density of water (d) The question is incomplete
23. If  $W$  be the weight of a body of density  $\rho$  in vacuum then its apparent weight in air of density  $\sigma$  is
- (a)  $\frac{W\rho}{\sigma}$  (b)  $W\left(\frac{\rho}{\sigma}-1\right)$  (c)  $\frac{W}{\sigma}\sigma$  (d)  $W\left(1-\frac{\sigma}{\rho}\right)$
24. A block of ice floats on a liquid of density 1.2 in a beaker then level of liquid when ice completely melt
- (a) Remains same (b) rises (c) Lowers (d) (A), (B) or (C)
25. If two liquids of same masses but densities  $\rho_1$  and  $\rho_2$  respectively are mixed, then density of mixture is given by
- (a)  $\rho = \frac{\rho_1 + \rho_2}{2}$  (b)  $\rho = \frac{\rho_1 + \rho_2}{2\rho_1\rho_2}$  (c)  $\rho = \frac{2\rho_1\rho_2}{\rho_1 + \rho_2}$  (d)  $\rho = \frac{\rho_1\rho_2}{\rho_1 + \rho_2}$
26. If two liquids of same volume but different densities  $\rho_1$  and  $\rho_2$  are mixed, then density of mixture is given by
- (a)  $\rho = \frac{\rho_1 + \rho_2}{2}$  (b)  $\rho = \frac{\rho_1 + \rho_2}{2\rho_1\rho_2}$  (c)  $\rho = \frac{2\rho_1\rho_2}{\rho_1 + \rho_2}$  (d)  $\rho = \frac{\rho_1\rho_2}{\rho_1 + \rho_2}$
27. The density  $\rho$  of water of bulk modulus  $B$  at a depth  $y$  in the ocean is related to the density at surface  $\rho_0$  by the relation
- (a)  $\rho = \rho_0\left[1 - \frac{\rho_0 gy}{B}\right]$  (b)  $\rho = \rho_0\left[1 + \frac{\rho_0 gy}{B}\right]$  (c)  $\rho = \rho_0\left[1 + \frac{B}{\rho_0 hgy}\right]$  (d)  $\rho = \rho_0\left[1 - \frac{B}{\rho_0 gy}\right]$
28. With rise in temperature, density of a given body changes according to one of the following relations
- (a)  $\rho = \rho_0[1 + \gamma d\theta]$  (b)  $\rho = \rho_0[1 - \gamma d\theta]$  (c)  $\rho = \rho_0 \gamma d\theta$  (d)  $\rho = \rho_0 / \gamma d\theta$
29. Three liquids of densities  $d, 2d$  and  $3d$  are mixed in equal volumes. Then the density of the mixture is
- (a)  $d$  (b)  $2d$  (c)  $3d$  (d)  $5d$
30. Three liquids of densities  $d, 2d$  and  $3d$  are mixed in equal proportions of weights. The relative density of the mixture is
- (a)  $\frac{11d}{7}$  (b)  $\frac{18d}{11}$  (c)  $\frac{13d}{9}$  (d)  $\frac{23d}{18}$
31. Water is flowing through a tube of non-uniform cross-section ratio of the radius at entry and exit end of the pipe is 3 : 2. Then the ratio of velocities at entry and exit of liquid is
- (a) 4 : 9 (b) 9 : 4 (c) 8 : 27 (d) 1 : 1
32. Water is flowing through a horizontal pipe of non-uniform cross-section. At the extreme narrow portion of the pipe, the water will have
- (a) Maximum speed and least pressure (b) Maximum pressure and least speed  
(c) Both pressure and speed maximum (d) Both pressure and speed least
33. A liquid flows in a tube from left to right as shown in figure.  $A_1$  and  $A_2$  are the cross-sections of the portions of the tube as shown. Then the ratio of speeds  $v_1 / v_2$  will be
- (a)  $A_1 / A_2$  (b)  $A_2 / A_1$   
(c)  $\sqrt{A_2} / \sqrt{A_1}$  (d)  $\sqrt{A_1} / \sqrt{A_2}$



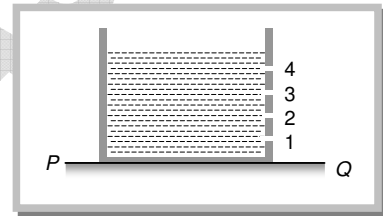
## GRAVITY CLASSES

34. An application of Bernoulli's equation for fluid flow is found in  
 (a) Dynamic lift of an aeroplane (b) Viscosity meter  
 (c) Capillary rise (d) Hydraulic press
35. The Working of an atomizer depends upon  
 (a) Bernoulli's theorem (b) Boyle's law (c) Archimedes principle (d) Newton's law of motion
36. The pans of a physical balance are in equilibrium. Air is blown under the right hand pan; then the right hand pan will  
 (a) Move up (b) Move down (c) Move erratically (d) Remain at the same level
37. According to Bernoulli's equation

$$\frac{P}{\rho g} + h + \frac{1}{2} \frac{v^2}{g} = \text{constant}$$

The terms  $A$ ,  $B$  and  $C$  are generally called respectively:

- (a) Gravitational head, pressure head and velocity head (b) Gravity, gravitational head and velocity head  
 (c) Pressure head, gravitational head and velocity head (d) Gravity, pressure and velocity head
38. At what speed the velocity head of a stream of water be equal to 40 cm of Hg  
 (a) 1032.6 cm/sec (b) 432.6 cm/sec (c) 632.6 cm/sec (d) 832.6 cm/sec
39. A cylindrical vessel of 90 cm height is kept filled upto the brim. It has four holes 1, 2, 3, 4 which are respectively at heights of 20 cm, 30 cm, 45 cm and 50 cm from the horizontal floor PQ. The water falling at the maximum horizontal distance from the vessel comes from
- (a) Hole number 4  
 (b) Hole number 3  
 (c) Hole number 2  
 (d) Hole number 1



40. A rectangular vessel when full of water takes 10 minutes to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water  
 (a) 9 minute (b) 7 minute (c) 5 minute (d) 3 minute
41. A vessel of area of cross-section  $A$  has liquid to a height  $H$ . There is a hole at the bottom of vessel having area of cross-section  $a$ . The time taken to decrease the level from  $H_1$  to  $H_2$  will be  
 (a)  $\frac{A}{a} \sqrt{\frac{2}{g}} [\sqrt{H_1} - \sqrt{H_2}]$  (b)  $\sqrt{2gh}$  (c)  $\sqrt{2gh(H_1 - H_2)}$  (d)  $\frac{A}{a} \sqrt{\frac{g}{2}} [\sqrt{H_1} - \sqrt{H_2}]$
42. A streamlined body falls through air from a height  $h$  on the surface of a liquid. If  $d$  and  $(D > d)$  represents the densities of the material of the body and liquid respectively, then the time after which the body will be instantaneously at rest, is  
 (a)  $\sqrt{\frac{2h}{g}}$  (b)  $\sqrt{\frac{2h}{g} \cdot \frac{D}{d}}$  (c)  $\sqrt{\frac{2h}{g} \cdot \frac{d}{D}}$  (d)  $\sqrt{\frac{2h}{g} \left( \frac{d}{D-d} \right)}$
43. The rate of flow of liquid in a tube of radius  $r$ , length  $l$ , whose ends are maintained at a pressure difference  $P$  is  $V = \frac{\pi Q P r^4}{\eta l}$  where  $\eta$  is coefficient of the viscosity and  $Q$  is  
 (a) 8 (b)  $\frac{1}{8}$  (c) 16 (d)  $\frac{1}{16}$
44. In Poiseuille's method of determination of coefficient of viscosity, the physical quantity that requires greater accuracy in measurement is  
 (a) Pressure difference (b) Volume of the liquid collected  
 (c) Length of the capillary tube (d) Inner radius of the capillary tube
45. Two capillary tubes of the same length but different radii  $r_1$  and  $r_2$  are fitted in parallel to the bottom of a vessel. The pressure head is  $P$ . What should be the radius of a single tube that can replace the two tubes so that the rate of flow is same as before  
 (a)  $r_1 + r_2$  (b)  $r_1^2 + r_2^2$  (c)  $r_1^4 + r_2^4$  (d) None of these

## GRAVITY CLASSES

46. Under a constant pressure head, the rate of flow of liquid through a capillary tube is  $V$ . If the length of the capillary is doubled and the diameter of the bore is halved, the rate of flow would become
- (a)  $V/4$                       (b)  $16V$                       (c)  $V/8$                       (d)  $V/32$
47. Two capillaries of same length and radii in the ratio  $1 : 2$  are connected in series. A liquid flows through them in streamlined condition. If the pressure across the two extreme ends of the combination is  $1\text{ m}$  of water, the pressure difference across first capillary is
- (a)  $9.4\text{ m}$                       (b)  $4.9\text{ m}$                       (c)  $0.49\text{ m}$                       (d)  $0.94\text{ m}$
48. Water flows in a streamlined manner through a capillary tube of radius  $a$ , the pressure difference being  $P$  and the rate of flow  $Q$ . If the radius is reduced to  $a/2$  and the pressure increased to  $2P$ , the rate of flow becomes
- (a)  $4Q$                       (b)  $Q$                       (c)  $\frac{Q}{4}$                       (d)  $\frac{Q}{8}$
49. The relative velocity of two consecutive layers is  $8\text{ cm/s}$ . If the perpendicular distance between the layers is  $0.1\text{ cm}$ , then the velocity gradient will be
- (a)  $8\text{ sec}^{-1}$                       (b)  $80\text{ sec}^{-1}$                       (c)  $0.8\text{ sec}^{-1}$                       (d)  $0.08\text{ sec}^{-1}$
50. We have three beakers  $A$ ,  $B$  and  $C$  containing glycerine, water and kerosene respectively. They are stirred vigorously and placed on a table. The liquid which comes to rest at the earliest is
- (a) Glycerine                      (b) Water                      (c) Kerosene                      (d) All of them at the same time