EXERCISE-I

Pressure and Density

1. The height of a mercury barometer is 75 *cm* at sea level and 50 *cm* at the top of a hill. Ratio of density of mercury to that of air is 10^4. The height of the hill is

(A) 250 *m* (B) 2.5 *km*
(C) 1.25 *km* (D) 750 *m*

2. Density of ice is ρ and that of water is σ. What will be the decrease in volume when a mass *M* of ice melts

(A) $\frac{M}{\sigma-\rho}$ (B) $\frac{\sigma-\rho}{M}$
(C) $M\left[\frac{1}{\rho}-\frac{1}{\sigma}\right]$ (D) $\frac{1}{M}\left[\frac{1}{\rho}-\frac{1}{\sigma}\right]$

3. Equal masses of water and a liquid of density 2 are mixed together, then the mixture has a density of

(A) 2/3 (B) 4/3
(C) 3/2 (D) 3

4. A body of density d_1 is counterpoised by Mg of weights of density d_2 in air of density *d*. Then the true mass of the body is

(A) *M* (B) $M\left(1-\frac{d}{d_2}\right)$
(C) $M\left(1-\frac{d}{d_1}\right)$ (D) $\frac{M(1-d/d_2)}{(1-d/d_1)}$

5. The pressure at the bottom of a tank containing a liquid does not depend on

(A) Acceleration due to gravity
(B) Height of the liquid column
(C) Area of the bottom surface
(D) Nature of the liquid

6. When a large bubble rises from the bottom of a lake to the surface. Its radius doubles. If atmospheric pressure is equal to that of column of water height *H*, then the depth of lake is

(A) *H* (B) 2*H*
(C) 7*H* (D) 8*H*

7. The volume of an air bubble becomes three times as it rises from the bottom of a lake to its surface. Assuming atmospheric pressure to be 75 *cm* of *Hg* and the density of water to be 1/10 of the density of mercury, the depth of the lake is

(A) 5 *m* (B) 10 *m*
(C) 15 *m* (D) 20 *m*

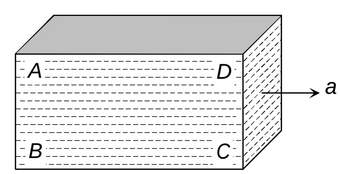
8. The value of *g* at a place decreases by 2%. The barometric height of mercury

(A) Increases by 2%
(B) Decreases by 2%
(C) Remains unchanged
(D) Sometimes increases and sometimes decreases

9. A barometer kept in a stationary elevator reads 76 *cm*. If the elevator starts accelerating up the reading will be

(A) Zero (B) Equal to 76 *cm*
(C) More than 76 *cm* (D) Less than 76 *cm*

10. A closed rectangular tank is completely filled with water and is accelerated horizontally with an acceleration *a* towards right. Pressure is (i) maximum at, and (ii) minimum at



(A) (i) B (ii) D
(B) (i) C (ii) D
(C) (i) B (ii) C
(D) (i) *B* (ii) *A*

11. If two liquids of same masses but densities ρ_1 and ρ_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) $\rho=\frac{\rho_1\rho_2}{\rho_1+\rho_2}$

12. If two liquids of same volume but different densities ρ_1 and ρ_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) $\rho = \frac{\rho_1\rho_2}{\rho_1 + \rho_2}$

13. The density ρ of water of bulk modulus *B* at a depth *y* in the ocean is related to the density at surface ρ_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) $\rho = \rho_0\left[1 - \frac{B}{\rho_0 gy}\right]$

14. 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) $\rho = \rho_0 / \gamma d\theta$

15. Three liquids of densities $d, 2d$ and $3d$ are mixed in equal volumes. Then the density of the mixture is

(A) *d* (B) 2*d*

(C) 3*d* (D) 5*d*

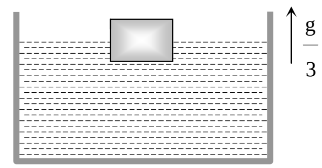
Pascal's Law and Archmidies Principle

16. A metallic block of density 5 *gm* cm^{-3} and having dimensions 5 *cm* × 5 *cm* × 5 *cm* is weighed in water. Its apparent weight will be

(A) 5 × 5 × 5 × 5 *gf* (B) 4 × 4 × 4 × 4 gf

(C) 5 × 4 × 4 × 4 gf (D) 4 × 5 × 5 × 5 gf

17. A cubical block is floating in a liquid with half of its volume immersed in the liquid. When the whole system accelerates upwards with acceleration of *g/3*, the fraction of volume immersed in the liquid will be



(A) $\frac{1}{2}$

(B) $\frac{3}{8}$

(C) $\frac{2}{3}$

(D) $\frac{3}{4}$

18. A silver ingot weighing 2.1 *kg* is held by a string so as to be completely immersed in a liquid of relative density 0.8. The relative density of silver is 10.5. The tension in the string in *kg-wt* is

(A) 1.6 (B) 1.94

(C) 3.1 (D) 5.25

19. Two solids *A* and *B* float in water. It is observed that *A* floats with half its volume immersed and *B* floats with 2/3 of its volume immersed. Compare the densities of *A* and *B*

(A) 4 : 3 (B) 2 : 3

(C) 3 : 4 (D) 1 : 3

20. The fraction of a floating object of volume V_0 and density d_0 above the surface of a liquid of density *d* will be

(A) $\frac{d_0}{d}$ (B) $\frac{dd_0}{d + d_0}$

(C) $\frac{d - d_0}{d}$ (D) $\frac{dd_0}{d - d_0}$

21. 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

22. A block of steel of size 5 *cm* × 5 *cm* × 5 *cm* is weighed in water. If the relative density of steel is 7, its apparent weight is

(A) 6 × 5 × 5 × 5 *gf* (B) 4 × 4 × 4 × 7 *gf*

(C) 5 × 5 × 5 × 7 *gf* (D) 4 × 4 × 4 × 6 *gf*

23. 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

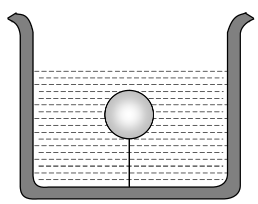
(D) It will come out violently

24. 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

25. A solid sphere of density η (> 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) ηmg

(C) $\frac{mg}{\eta-1}$

(D) $(\eta-1)mg$

26. 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 first rise and then fall

27. 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

28. A wooden cylinder floats vertically in water with half of its length immersed. The density of wood is

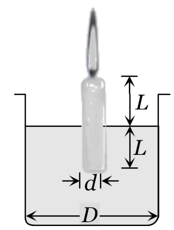
(A) Equal of that of water

(B) Half the density of water

(C) Double the density of water

(D) The question is incomplete

29. A candle of diameter d is floating on a liquid in a cylindrical container of diameter D (D>>d) as shown in figure. If it is burning at the rate of 2*cm*/*hour* then the top of the candle will



(A) Remain at the same height

(B) Fall at the rate of 1 *cm/hour*

(C) Fall at the rate of 2 *cm/hour*

(D) Go up the rate of 1*cm/hour*

30. An ice block contains a glass ball when the ice melts within the water containing vessel, the level of water

(A) Rises

(B) Falls

(C) Unchanged

(D) First rises and then falls

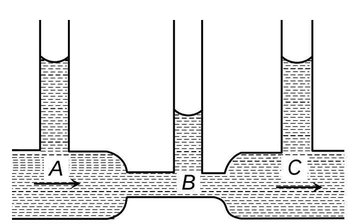
Fluid Flow

31. The velocity of kerosene oil in a horizontal pipe is 5 m/s. If $g = 10 m/s^2$ then the velocity head of oil will be

(A) 1.25 *m* (B) 12.5 *m*

(C) 0.125 *m* (D) 125 *m*

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



(A) Height of the liquid in the tube A is maximum
(B) Height of the liquid in the tubes A and B is the same
(C) Height of the liquid in all the three tubes is the same
(D) Height of the liquid in the tubes A and C is the same

33. A manometer connected to a closed tap reads $3.5 \times 10^5\ N/m^2$. When the valve is opened, the reading of manometer falls to $3.0 \times 10^5\ N/m^2$, then velocity of flow of water is
(A) 100 m/s (B) 10 m/s
(C) 1 m/s (D) $10\sqrt{10}$ m/s

34. Air is streaming past a horizontal air plane wing such that its speed in 120 m/s over the upper surface and 90 m/s at the lower surface. If the density of air is 1.3 kg per metre^3 and the wing is 10 m long and has an average width of 2 m, then the difference of the pressure on the two sides of the wing of
(A) 4095.0 *Pascal* (B) 409.50 *Pascal*
(C) 40.950 *Pascal* (D) 4.0950 *Pascal*

35. A large tank filled with water to a height 'h' is to be emptied through a small hole at the bottom. The ratio of time taken for the level of water to fall from h to $\frac{h}{2}$ and from $\frac{h}{2}$ to zero is
(A) $\sqrt{2}$ (B) $\frac{1}{\sqrt{2}}$
(C) $\sqrt{2}-1$ (D) $\frac{1}{\sqrt{2}-1}$

36. A cylinder of height 20 m is completely filled with water. The velocity of efflux of water (in m/s) through a small hole on the side wall of the cylinder near its bottom is
(A) 10 (B) 20
(C) 25.5 (D) 5

37. There is a hole in the bottom of tank having water. If total pressure at bottom is 3 atm (1 atm = $10^5 N/m^2$) then the velocity of water flowing from hole is
(A) $\sqrt{400}$ m / s (B) $\sqrt{600}$ m / s
(C) $\sqrt{60}$ m / s (D) None of these

38. There is a hole of area A at the bottom of cylindrical vessel. Water is filled up to a height h and water flows out in t second. If water is filled to a height $4h$, it will flow out in time equal to
(A) t (B) $4t$
(C) $2\ t$ (D) $t/4$

39. A cylindrical tank has a hole of 1 cm^2 in its bottom. If the water is allowed to flow into the tank from a tube above it at the rate of 70 cm^3/sec. then the maximum height up to which water can rise in the tank is
(A) 2.5 cm (B) 5 cm
(C) 10 cm (D) 0.25 cm

40. A square plate of 0.1 m side moves parallel to a second plate with a velocity of 0.1 m/s, both plates being immersed in water. If the viscous force is 0.002 N and the coefficient of viscosity is 0.01 *poise*, distance between the plates in m is
(A) 0.1 (B) 0.05
(C) 0.005 (D) 0.0005

41. A liquid is flowing in a horizontal uniform capillary tube under a constant pressure difference P. The value of pressure for which the rate of flow of the liquid is doubled when the radius and length both are doubled is
(A) P (B) $\frac{3P}{4}$
(C) $\frac{P}{2}$ (D) $\frac{P}{4}$

42. We have two (narrow) capillary tubes T_1 and T_2. Their lengths are l_1 and l_2 and radii of cross-section are r_1 and r_2 respectively. The rate of flow of water under a pressure difference P through tube T_1 is $8 cm^3/sec$. If $l_1 = 2l_2$ and $r_1 = r_2$, what will be the rate of flow when the two tubes are connected in series and pressure difference across the combination is same as before (= P)
(A) 4 cm^3/sec (B) (16/3) cm^3/sec
(C) (8/17) cm^3/sec (D) None of these

43. In a laminar flow the velocity of the liquid in contact with the walls of the tube is
(A) Zero
(B) Maximum
(C) In between zero and maximum
(D) Equal to critical velocity

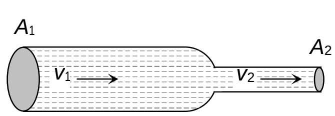
44. In a turbulent flow, the velocity of the liquid molecules in contact with the walls of the tube is
(A) Zero
(B) Maximum
(C) Equal to critical velocity
(D) May have any value

45. The Reynolds number of a flow is the ratio of
(A) Gravity to viscous force
(B) Gravity force to pressure force
(C) Inertia forces to viscous force
(D) Viscous forces to pressure forces

46. 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

47. 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

48. 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) $\sqrt{A_1} / \sqrt{A_2}$



49. In a streamline flow
(A) The speed of a particle always remains same
(B) The velocity of a particle always remains same
(C) The kinetic energies of all the particles arriving at a given point are the same
(D) The moments of all the particles arriving at a given point are the same

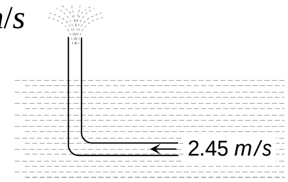
50. An application of Bernoulli's equation for fluid flow is found in
(A) Dynamic lift of an aeroplane
(B) Viscosity meter
(C) Capillary rise
(D) Hydraulic press

51. At what speed the velocity head of a stream of water be equal to 40 *cm* of *Hg*
(A) 282.8 *cm/sec* (B) 432.6 *cm/sec*
(C) 632.6 *cm/sec* (D) 832.6 *cm/sec*

52. The weight of an aeroplane flying in air is balanced by
(A) Upthrust of the air which will be equal to the weight of the air having the same volume as the plane
(B) Force due to the pressure difference between the upper and lower surfaces of the wings, created by different air speeds on the surface
(C) Vertical component of the thrust created by air currents striking the lower surface of the wings
(D) Force due to the reaction of gases ejected by the revolving propeller

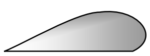
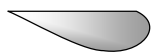
53. A sniper fires a rifle bullet into a gasoline tank making a hole 53.0 *m* below the surface of gasoline. The tank was sealed at 3.10 *atm*. The stored gasoline has a density of 660 kgm^{-3}. The velocity with which gasoline begins to shoot out of the hole is
(A) $27.8\,ms^{-1}$ (B) $41.0\,ms^{-1}$
(C) $9.6\,ms^{-1}$ (D) $19.7\,ms^{-1}$

54. An L-shaped tube with a small orifice is held in a water stream as shown in fig. The upper end of the tube is 10.6 *cm* above the surface of water. What will be the height of the jet of water coming from the orifice? Velocity of water stream is 2.45 *m/s*



(A) Zero
(B) 20.0 *cm*
(C) 10.6 *cm*
(D) 40.0 *cm*

55. Fig. represents vertical sections of four wings moving horizontally in air. In which case the force is upwards

(A) 
(B) 
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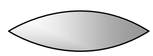
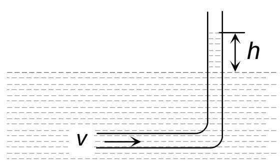
(D) 

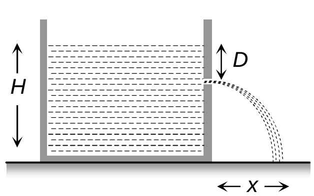
56. An L-shaped glass tube is just immersed in flowing water such that its opening is pointing against flowing water. If the speed of water current is *v*, then



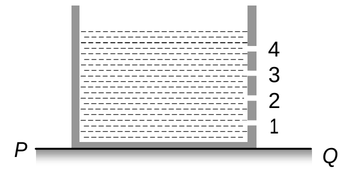
(A) The water in the tube rises to height $\frac{v^2}{2g}$
(B) The water in the tube rises to height $\frac{g}{2v^2}$
(C) The water in the tube does not rise at all
(D) None of these

57. A tank is filled with water up to a height *H*. Water is allowed to come out of a hole *P* in one of the walls at a depth *D* below the surface of water. Express the horizontal distance *x* in terms of *H* and *D*

(A) $x = \sqrt{D(H-D)}$
(B) $x = \sqrt{\frac{D(H-D)}{2}}$
(C) $x = 2\sqrt{D(H-D)}$
(D) $x = 4\sqrt{D(H-D)}$



58. 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

59. 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*

60. A streamlined body falls through air from a height *h* on the surface of a liquid. If *d* and *D*(*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) $\sqrt{\frac{2h}{g}}\left(\frac{d}{D-d}\right)$

61. 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

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

(A) $\propto \sqrt{h}$
(B) $\propto h$
(C) $\propto (1/h)$
(D) Almost independent of *h*

63. 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 η is coefficient of the viscosity and *Q* is

(A) 8 (B) $\frac{1}{8}$

(C) 16 (D) $\frac{1}{16}$

64. In Poiseuilli'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

65. 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

66. 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 *m* of water, the pressure difference across first capillary is

(A) 9.4 *m* (B) 4.9 *m*

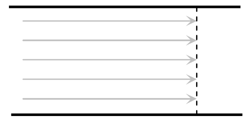
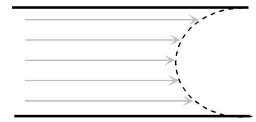
(C) 0.49 *m* (D) 0.94 *m*

67. 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 2*P*, the rate of flow becomes

(A) 4Q (B) *Q*

(C) $\frac{Q}{4}$ (D) $\frac{Q}{8}$

68. A viscous fluid is flowing through a cylindrical tube. The velocity distribution of the fluid is best represented by the diagram

(A)  (B) 

(C)  (D) None of these

69. Water is flowing in a pipe of diameter 4 *cm* with a velocity 3 *m/s*. The water then enters into a tube of diameter 2 *cm*. The velocity of water in the other pipe is

(A) 3 *m/s* (B) 6 *m/s*

(C) 12 *m/s* (D) 8 *m/s*

70. Two capillary of length *L* and 2*L* and of radius *R* and 2*R* are connected in series. The net rate of flow of fluid through them will be (given rate of the flow through single capillary, $X = \pi P R^4 / 8\eta L$)

(A) $\frac{8}{9}X$ (B) $\frac{9}{8}X$

(C) $\frac{5}{7}X$ (D) $\frac{7}{5}X$

VISCOSITY

71. An oil drop falls through air with a terminal velocity of 5×10^{-4} m/s. The radius of the drop will be :

(A) 2.5×10^{-6} m (B) 2×10^{-6} m

(C) 3×10^{-6} m (D) 4×10^{-6} m

72. The terminal velocity of a sphere moving through a viscous medium is :

(A) directly proportional to the radius of the sphere

(B) inversely proportional to the radius of the sphere

(C) directly proportional to the square of the radius of sphere

(D) inversely proportional to the square of the radius of sphere

73. A sphere is dropped gently into a medium of infinite extent. As the sphere falls, the force acting downwards on it

(A) remains constant throughout

(B) increases for sometime and then becomes constant

(C) decreases for sometime and then becomes zero

(D) increases for sometime and then decreases.

74. A solid sphere falls with a terminal velocity of 10 m/s in air. If it is allowed to fall in vacuum,

(A) terminal velocity will be more than 10 m/s

(B) terminal velocity will be less than 10 m/s

(C) terminal velocity will be 10 m/s

(D) there will be no terminal velocity

Surface Tension

75. A small air bubble is at the inner surface of the bottom of a beaker filled with cold water. Now water of the beaker is heated. The size of bubble increases. The reason for this may be

(A) Increase in the saturated vapour pressure of water

(B) Root mean square velocity of air molecules inside the bubble increases

(C) Decrease in surface tension of water

(D) All of the above

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

(A) Elastic membrane is formed on water due to property of surface tension

(B) Spiders and insects are lighter

(C) Spiders and insects swim on water

(D) Spider and insects experience upthrust

77. Small droplets of a liquid are usually more spherical in shape than larger drops of the same liquid because

(A) Force of surface tension is equal and opposite to the force of gravity

(B) Force of surface tension predominates the force of gravity

(C) Force of gravity predominates the force of surface tension

(D) Force of gravity and force of surface tension act in the same direction and are equal

78. Hairs of shaving brush cling together when it is removed from water due to

(A) Force of attraction between hair

(B) Surface tension

(C) Viscosity of water

(D) Characteristic property of hairs

79. A square frame of side L is dipped in a liquid. On taking out, a membrane is formed. If the surface tension of the liquid is T, the force acting on the frame will be

(A) 2 TL (B) 4 TL

(C) 8 TL (D) 10 TL

80. Water does not wet an oily glass because

(A) Cohesive force of oil>> adhesive force between oil and glass

(B) Cohesive force of oil > cohesive force of water

(C) Oil repels water

(D) Cohesive force for water > adhesive force between water and oil molecules

81. A water drop takes the shape of a sphere in a oil while the oil drop spreads in water, because (A.F. = adhesive force C.F. = cohesive force)

(A) C.F. for water > A.F. for water and oil

(B) C.F. for oil > A.F. for water and oil

(C) C.F. for oil < A.F. for water and oil

(D) None of the above

82. Which of the fact is not due to surface tension
(A) Dancing of a camphor piece over the surface of water
(B) Small mercury drop itself becomes spherical
(C) A liquid surface comes at rest after stirring
(D) Mercury does not wet the glass vessel

83. In the glass capillary tube, the shape of the surface of the liquid depends upon
(A) Only on the cohesive force of liquid molecules
(B) Only on the adhesive force between the molecules of glass and liquid
(C) Only on relative cohesive and adhesive force between the atoms
(D) Neither on cohesive nor on adhesive force

84. Force necessary to pull a circular plate of 5 *cm* radius from water surface for which surface tension is 75 *dynes*/*cm*, is
(A) 30dyne (B) 60 *dynes*
(C) 750 *dynes* (D) 750 π *dynes*

85. When a drop of water is dropped on oil surface, then
(A) It will mix up with oil
(B) It spreads in the form of a film
(C) It will deform
(D) It remains spherical

86. Two pieces of glass plate one upon the other with a little water in between them cannot be separated easily because of
(A) Inertia (B) Pressure
(C) Surface tension (D) Viscosity

87. Small liquid drops assume spherical shape because
(A) Atmospheric pressure exerts a force on a liquid drop
(B) Volume of a spherical drop is minimum
(C) Gravitational force acts upon the drop
(D) Liquid tends to have the minimum surface area due to surface tension

88. A thin metal disc of radius *r* floats on water surface and bends the surface downwards along the perimeter making an angle θ with vertical edge of the disc. If the disc displaces a weight of water *W* and surface tension of water is *T*, then the weight of metal disc is
(A) $2\pi rT + W$ (B) $2\pi rT\cos\theta - W$
(C) $2\pi rT\cos\theta + W$ (D) $W - 2\pi rT\cos\theta$

89. A 10 *cm* long wire is placed horizontally on the surface of water and is gently pulled up with a force of 2×10^{-2} *N* to keep the wire in equilibrium. The surface tension, in Nm^{-1}, of water is
(A) 0.1 (B) 0.2
(C) 0.001 (D) 0.002

90. It is easy to wash clothes in hot water because its
(A) Surface tension is more
(B) Surface tension is less
(C) Consumes less soap
(D) None of these

91. Due to which property of water, tiny particles of camphor dance on the surface of water
(A) Viscosity (B) Surface tension
(C) Weight (D) Floating force

92. The force required to separate two glass plates of area $10^{-2}\,m^2$ with a film of water 0.05 *mm* thick between them, is (Surface tension of water is 70×10^{-3} *N*/*m*)
(A) 28 *N* (B) 14 *N*
(C) 50 *N* (D) 38 *N*

93. Oil spreads over the surface of water whereas water does not spread over the surface of the oil, due to
(A) Surface tension of water is very high
(B) Surface tension of water is very low
(C) Viscosity of oil is high
(D) Viscosity of water is high

94. Cohesive force is experienced between
(A) Magnetic substances
(B) Molecules of different substances
(C) Molecules of same substances
(D) None of these

Surface Energy

95. The surface tension of a liquid is 5 *N*/*m*. If a thin film of the area 0.02 m^2 is formed on a loop, then its surface energy will be

(A) 5×10^{2} J (B) 2.5×10^{-2} J
(C) 2×10^{-1} J (D) 5×10^{-1} J

96. If work *W* is done in blowing a bubble of radius *R* from a soap solution, then the work done in blowing a bubble of radius 2*R* from the same solution is

(A) W/2 (B) 2W
(C) 4W (D) $2\frac{1}{3}$W

97. A spherical drop of oil of radius 1 *cm* is broken into 1000 droplets of equal radii. If the surface tension of oil is 50 *dynes*/*cm*, the work done is

(A) 18 π *ergs* (B) 180 π *ergs*
(C) 1800 π *ergs* (D) 8000 π *ergs*

98. The work done in blowing a soap bubble of radius *r* of the solution of surface tension *T* will be

(A) $8\pi r^2 T$ (B) $2\pi r^2 T$
(C) $4\pi r^2 T$ (D) $\frac{4}{3}\pi r^2 T$

99. If two identical mercury drops are combined to form a single drop, then its temperature will

(A) Decrease (B) Increase
(C) Remains the same (D) None of the above

100. If the surface tension of a liquid is *T*, the gain in surface energy for an increase in liquid surface by *A* is

(A) AT^{-1} (B) AT
(C) A^2T (D) A^2T^2

101. The surface tension of a soap solution is 2×10^{-2} N / m. To blow a bubble of radius 1 *cm*, the work done is

(A) $4\pi\times10^{-6}$ J (B) $8\pi\times10^{-6}$ J
(C) $12\pi\times10^{-6}$ J (D) $16\pi\times10^{-6}$ J

102. A mercury drop of 1 *cm* radius is broken into 10^6 small drops. The energy used will be (surface tension of mercury is 35×10^{-3} N / cm)

(A) 4.4×10^{-3} J (B) 2.2×10^{-4} J
(C) 8.8×10^{-4} J (D) 10^{4} J

103. The surface tension of a liquid at its boiling point

(A) Becomes zero
(B) Becomes infinity
(C) is equal to the value at room temperature
(D) is half to the value at the room temperature

104. Surface tension of a soap solution is 1.9×10^{-2} N / m.. Work done in blowing a bubble of 2.0 *cm* diameter will be

(A) $7.6\times10^{-6}\pi$ *joule* (B) $15.2\times10^{-6}\pi$ *joule*
(C) $1.9\times10^{-6}\pi$ *joule* (D) 1×10^{-4} *joule*

105. One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

(A) 1000 : 1 (B) 1 : 1000
(C) 10 : 1 (D) 1 : 10

106. The work done in increasing the size of a soap film from 10 *cm*× 6 *cm* to 10 *cm* × 11 *cm* is 3 $\times10^{-4}$ *joule*. The surface tension of the film is

(A) 1.5×10^{-2} N / m (B) 3.0×10^{-2} N / m
(C) 6.0×10^{-2} N / m (D) 11.0×10^{-2} N / m

107. 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) $Rn^{2/3}\sigma$ (B) $(n^{2/3}-1)R\sigma$
(C) $(n^{1/3}-1)R\sigma$ (D) $4\pi R^2(n^{1/3}-1)\sigma$

108. A big drop of radius *R* is formed by 1000 small droplets of water, then the radius of small drop is

(A) *R*/2 (B) *R*/5
(C) *R*/6 (D) *R*/10

109. When 10^6 small drops coalesce to make a new larger drop then the drop
(A) Density increases
(B) Density decreases
(C) Temperature increases
(D) Temperature decreases

110. 8000 identical water drops are combined to form a big drop. Then the ratio of the final surface energy to the initial surface energy of all the drops together is
(A) 1 : 10 (B) 1 : 15
(C) 1 : 20 (D) 1 : 25

111. The surface energy of liquid film on a ring of area $0.15\,m^2$ is (Surface tension of liquid $= 5Nm^{-1}$)
(A) 0.75 *J* (B) 1.5 *J*
(C) 2.25 *J* (D) 3.0 *J*

112. 8 mercury drops coalesce to form one mercury drop, the energy changes by a factor of
(A) 1 (B) 2
(C) 4 (D) 6

113. If work done in increasing the size of a soap film from $10\,cm \times 6\,cm$ to $10\,cm \times 11\,cm$ is $2 \times 10^{-4}\,J$, then the surface tension
(A) $2 \times 10^{-2}\,Nm^{-1}$ (B) $2 \times 10^{-4}\,Nm^{-1}$
(C) $2 \times 10^{-6}\,Nm^{-1}$ (D) $2 \times 10^{-8}\,Nm^{-1}$

114. A mercury drop of radius 1*cm* is sprayed into 10^6 drops of equal size. The energy expended in joules is (surface tension of Mercury is $460 \times 10^{-3}\,N/m$)
(A) 0.057 (B) 5.7
(C) 5.7×10^{-4} (D) 5.7×10^{-6}

Angle of Contact

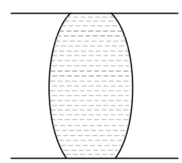
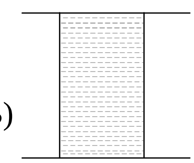
115. A liquid is coming out from a vertical tube. The relation between the weight of the drop *W*, surface tension of the liquid *T* and radius of the tube *r* is given by, if the angle of contact is zero
(A) $W = \pi r^2 T$ (B) $W = 2\pi rT$
(C) $W = 2r^2\pi T$ (D) $W = \frac{3}{4}\pi r^3 T$

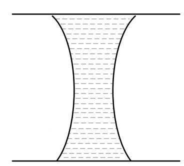
116. The parts of motor cars are polished by chromium because the angle of contact between water and chromium is
(A) 0^o (B) 90^o
(C) Less than 90^o (D) Greater than 90^o

117. A glass plate is partly dipped vertically in the mercury and the angle of contact is measured. If the plate is inclined, then the angle of contact will
(A) Increase
(B) Remain unchanged
(C) Increase or decrease
(D) Decrease

118. The liquid meniscus in capillary tube will be convex, if the angle of contact is
(A) Greater than 90° (B) Less than 90°
(C) Equal to 90° (D) Equal to 0°

119. If a water drop is kept between two glass plates, then its shape

(A)  (B) 

(C)  (D) None of these

120. The value of contact angle for kerosene with solid surface
(A) 0° (B) 90^o
(C) 45^o (D) 33^o

121. Nature of meniscus for liquid of 0^o angle of contact
(A) Plane (B) Parabolic
(C) Semi-spherical (D) Cylindrical

122. A liquid wets a solid completely. The meniscus of the liquid in a sufficiently long tube
(A) Flat (B) Concave
(C) Convex (D) Cylindrical

123. What is the shape when a non-wetting liquid is placed in a capillary
(A) Concave upward
(B) Convex upward
(C) Concave downward
(D) Convex downward

124. For which of the two pairs, the angle of contact is same
(A) Water and glass; glass and mercury
(B) Pure water and glass; glass and alcohol
(C) Silver and water; mercury and glass
(D) Silver and chromium; water and chromium

Pressure Difference

125. A long cylindrical glass vessel has a small hole of radius '*r*' at its bottom. The depth to which the vessel can be lowered vertically in the deep water bath (surface tension *T*) without any water entering inside is
(A) $4T/\rho rg$ (B) $3T/\rho rg$
(C) $2T/\rho rg$ (D) $T/\rho rg$

126. If the surface tension of a soap solution is 0.03 *MKS* units, then the excess of pressure inside a soap bubble of diameter 6 mm over the atmospheric pressure will be
(A) Less than 40 N/m^2
(B) Greater than 40 N/m^2
(C) Less than 20 N/m^2
(D) Greater than 20 N/m^2

127. The excess of pressure inside a soap bubble than that of the outer pressure is
(A) $\frac{2T}{r}$ (B) $\frac{4T}{r}$
(C) $\frac{T}{2r}$ (D) $\frac{T}{r}$

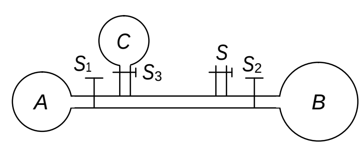
128. The pressure of air in a soap bubble of 0.7*cm* diameter is 8 *mm* of water above the pressure outside. The surface tension of the soap solution is
(A) 100dyne / cm (B) 68.66dyne / cm
(C) 137dyne / cm (D) 150dyne / cm

129. Pressure inside two soap bubbles are 1.01 and 1.02 atmospheres. Ratio between their volumes is
(A) 102 : 101 (B) $(102)^3 : (101)^3$
(C) 8 : 1 (D) 2 : 1

130. A capillary tube of radius *r* is dipped in a liquid of density ρ and surface tension *S*. If the angle of contact is θ, the pressure difference between the two surfaces in the beaker and the capillary
(A) $\frac{S}{r}\cos\theta$ (B) $\frac{2S}{r}\cos\theta$
(C) $\frac{S}{r\cos\theta}$ (D) $\frac{2S}{r\cos\theta}$

131. The radii of two soap bubbles are r_1 and r_2. In isothermal conditions, two meet together in vaccum. Then the radius of the resultant bubble is given by
(A) $R = (r_1 + r_2)/2$ (B) $R = r_1(r_1r_2 + r_2)$
(C) $R^2 = r_1^2 + r_2^2$ (D) $R = r_1 + r_2$

132. The adjoining diagram shows three soap bubbles *A*, *B* and *C* prepared by blowing the capillary tube fitted with stop cocks, S_1, S_2 and S_3. With stop cock *S* closed and stop cocks S_1, S_2 and S_3 opened



(A) B will start collapsing with volumes of A and C
increasing
(B) C will start collapsing with volumes of A and B increasing
(C) C and A both will start collapsing with the volume of B increasing
(D) Volumes of A, B and C will become equal at equilibrium

133. When a large bubble rises from the bottom of a lake to the surface, its radius doubles. If atmospheric pressure is equal to that of column of water height *H*, then the depth of lake is

(A) *H* (B) 2*H*
(C) 7*H* (D) 8*H*

134. A soap bubble in vacuum has a radius of 3 *cm* and another soap bubble in vacuum has a radius of 4 *cm*. If the two bubbles coalesce under isothermal condition, then the radius of the new bubble is

(A) 2.3 *cm* (B) 4.5 *cm*
(C) 5 *cm* (D) 7 *cm*

135. Two bubbles *A* and *B* $(A > B)$ are joined through a narrow tube. Then

(A) The size of *A* will increase
(B) The size of *B* will increase
(C) The size of *B* will increase until the pressure equals
(D) None of these

136. Two soap bubbles have different radii but their surface tension is the same. Mark the correct statement

(A) Internal pressure of the smaller bubble is higher than the internal pressure of the larger bubble
(B) Pressure of the larger bubble is higher than the smaller bubble
(C) Both bubbles have the same internal pressure
(D) None of the above

137. If the excess pressure inside a soap bubble is balanced by oil column of height 2 *mm*, then the surface tension of soap solution will be (r = 1 *cm* and density d = 0.8 *gm/cc*

(A) 3.9 *N/m* (B) 3.9×10^{-2} *N/m*
(C) 3.9×10^{-3} *N/m* (D) 3.9 *dyne/m*

138. In Jager's method, at the time of bursting of the bubble

(A) The internal pressure of the bubble is always greater than external pressure
(B) The internal pressure of the bubble is always equal to external pressure
(C) The internal pressure of the bubble is always less than external pressure
(D) The internal pressure of the bubble is always slightly greater than external pressure

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

(A) 1 : 3 (B) 1 : 9
(C) 27 : 1 (D) 1 : 27

Capillarity

140. It is not possible to write directly on blotting paper or newspaper with ink pen

(A) Because of viscosity
(B) Because of inertia
(C) Because of friction
(D) Because of capillarity

141. Two capillary tubes *P* and *Q* are dipped in water. The height of water level in capillary *P* is 2/3 to the height in *Q* capillary. The ratio of their diameters is

(A) 2 : 3 (B) 3 : 2
(C) 3 : 4 (D) 4 : 3

142. Two capillaries made of same material but of different radii are dipped in a liquid. The rise of liquid in one capillary is 2.2 *cm* and that in the other is 6.6 *cm*. The ratio of their radii is

(A) 9 : 1 (B) 1 : 9
(C) 3 : 1 (D) 1 : 3

143. Two capillaries made of the same material with radii $r_1 = 1\text{mm}$ and $r_2 = 2\text{mm}$. The rise of the liquid in one capillary ($r_1 = \text{mm}$) is 30 *cm*, then the rise in the other will be

(A) 7.5 *cm* (B) 60 *cm*
(C) 15 *cm* (D) 120 *cm*

144. When a capillary is dipped in water, water rises to a height h. If the length of the capillary is made less than h, then

(A) The water will come out

(B) The water will not come out

(C) The water will not rise

(D) The water will rise but less than height of capillary

145. The correct relation is

(A) $r = \dfrac{2T\cos\theta}{hdg}$ (B) $r = \dfrac{hdg}{2T\cos\theta}$

(C) $r = \dfrac{2T\,dgh}{\cos\theta}$ (D) $r = \dfrac{T\cos\theta}{2hdg}$

146. Water rises upto a height *h* in a capillary on the surface of earth in stationary condition. Value of h increases if this tube is taken

(A) On sun

(B) On poles

(C) In a lift going upward with acceleration

(D) In a lift going downward with acceleration

147. During capillary rise of a liquid in a capillary tube, the surface of contact that remains constant is of

(A) Glass and liquid (B) Air and glass

(C) Air and liquid (D) All of these

148. A shell having a hole of radius *r* is dipped in water. It holds the water upto a depth of *h* then the value of *r* is

(A) $r = \dfrac{2T}{hdg}$ (B) $r = \dfrac{T}{hdg}$

(C) $r = \dfrac{Tg}{hd}$ (D) None of these

149. In a capillary tube, water rises by 1.2 *mm*. The height of water that will rise in another capillary tube having half the radius of the first, is

(A) 1.2 *mm* (B) 2.4 *mm*

(C) 0.6 *mm* (D) 0.4 *mm*

150. The surface tension for pure water in a capillary tube experiment is

(A) $\dfrac{\rho g}{2hr}$ (B) $\dfrac{2}{hr\rho g}$

(C) $\dfrac{r\rho g}{2h}$ (D) $\dfrac{hr\rho g}{2}$

151. In a capillary tube experiment, a vertical 30 *cm* long capillary tube is dipped in water. The water rises up to a height of 10*cm* due to capillary action. If this experiment is conducted in a freely falling elevator, the length of the water column becomes

(A) 10 *cm* (B) 20 *cm*

(C) 30 *cm* (D) Zero

152. Radius of a capillary is 2×10^{-3} m. A liquid of weight 6.28×10^{-4} N may remain in the capillary then the surface tension of liquid will be

(A) 5×10^{-3} N/m (B) 5×10^{-2} N/m

(C) 5 N/m (D) 50 N/m

153. Two long capillary tubes *A* and *B* of radius $R_B > R_A$ dipped in same liquid. Then

(A) Water rise is more in *A* than *B*

(B) Water rises more in *B* than *A*

(C) Same water rise in both

(D) All of these according to the density of water

154. If water rises in a capillary tube upto 3 *cm*. What is the diameter of capillary tube (Surface tension of water = 7.2×10^{-2} *N/m*)

(A) 9.6×10^{-4} *m* (B) 9.6×10^{-3} *m*

(C) 9.6×10^{-2} *m* (D) 9.6×10^{-1} *m*