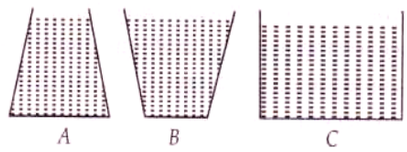
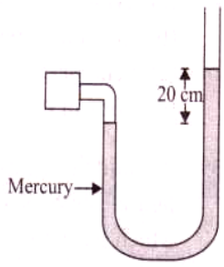
PRESSURE

1. Pressure applied to an enclosed fluid is transmitted undiminished to every point of the fluid and the walls of containing vessel. This law was first formulated by
   a) Reynolds b) Bernoulli
   c) Pascal d) Torricelli
2. Which of the following conversions is correct?
   a)
   b)
   c)
   d)
3. Pressure is a scalar quantity because
   a) It is the ratio of force to area and both force and area are vectors.
   b) It is the ratio of the magnitude of the force to area.
   c) It is the ratio of the component of the force normal to the area.
   d) It depends on the size of the area chosen.
4. Pressure at a point inside a liquid does not depend on
   a) the nature of the liquid.
   b) shape of the container
   c) the depth of point below the surface of the liquid.
   d) acceleration due to gravity at that point.
5. The two femurs each of cross-sectional area support the upper part of a human body of mass 40 kg. The average pressure sustained by the femurs is
   a) b)
   c) d)
6. A 50 kg girl wearing heel shoes balances on a single heel. The heel is circular with a diameter 1 cm. The pressure exerted by the heel on the horizontal floor is $(\text{Take } g = 10 \text{ms}^{-2})$
   a) $6.4 \times 10^4 \text{Pa}$ b) $6.4 \times 10^5 \text{Pa}$
   c) $6.4 \times 10^6 \text{Pa}$ d) $6.4 \times 10^7 \text{Pa}$
7. Two syringes of different cross section (without needle) filled with water are connected with a tightly fitted rubber tube filled with water. Diameters of the smaller piston and larger piston are 1 cm and 3 cm respectively. If a force of 10 N is applied to the smaller piston then the force exerted on the larger piston is
   a) 30 N b) 60 N
   c) 90 N d) 100 N
8. In question number 7, if the smaller piston is pushed in through 6 cm, how much does the longer piston move out?
   a) $\frac{2}{3}\text{cm}$ b) $\frac{3}{2}\text{cm}$
   c) $\frac{1}{3}\text{cm}$ d) $\frac{1}{2}\text{cm}$
9. To what height should a cylindrical vessel be filled with a homogenous liquid to make the force with which the liquid pressure on the sides of the vessel equal to the force exerted by the liquid on the bottom of the vessel?
   a) Equal to the radius
   b) Less than radius
   c) More than radius
   d) Four times of radius
10. A U tube contains water and methylated spirit separated by mercury. The mercury columns in the two arms are at the same level with 10 cm of water in one arm and 12.5 cm of spirit in the other as shown in figure. The relative density of the spirit is
    a) 0.6 b) 0.8
    c) 1.0 d) 1.25
11. In question number 10, if 15 cm of water and spirit each are further poured into the respective arms of the tube, difference in the level of mercury in the two arms is (Take, relative density of mercury =13.6)
    a) 0.20 cm b) 0.22 cm
    c) 0.27 cm d) 0.26 cm
12. In a wind tunnel experiment the pressures on the upper and lower surfaces of the wings are respectively. If the area of the wing is the net lifting force on the wing is
    a) b)
    c) d)
13. Three vessels A, B and C of different shapes contain a water upto the same height as shown in the figure. be the pressures exerted by the water at the bottom of the vessels A, B and C respectively. Then

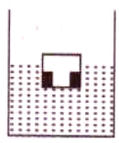


    a) $P_A > P_B > P_C$ b) $P_B > P_C > P_A$
    c) $P_C > P_B > P_A$ d) $P_A = P_B = P_C$
14. Which of the following instrument is used for measuring gauge pressure?
    a) Thermometer b) Barometer
    c) Manometer d) Hydrometer
15. A manometer reads the pressure of a gas in an enclosure as shown in the figure. The absolute and gauge pressure of the gas in cm of mercury is (Take atmospheric pressure =76 cm of mercury)



a) 76, 20 b) 20, 76
c) 96, 20 d) 20, 96

16. The pressure at depth h below the surface of a liquid of density ρ open to the atmosphere is
    a) greater than the atmospheric pressure by ρgh
    b) less than the atmospheric pressure by ρgh
    c) equal to the atmospheric pressure
    d) increases exponentially with depth
17. The force acting on a window of area $50\text{cm}\times 50\text{cm}$ of a submarine at a depth of 2000 m in an ocean, the interior of which is maintained at sea level atmospheric pressure is (Density of sea water= $10^3 \text{kgm}^{-3}, g = 10\ \text{m s}^{-2}$)
    a) $5\times 10^5 \text{N}$ b) $25\times 10^5 \text{N}$
    c) $5\times 10^6 \text{N}$ d) $25\times 10^6 \text{N}$
18. A tank with a square base of area $2\ \text{m}^2$ is divided into two compartments by a vertical partition in the middle. There is a small hinged door of face area $20\ \text{cm}^2$ at the bottom of the partition. Water is filled in one compartment and an acid of relative density $1.53\times 10\ \text{kg m}^{-3}$ in the other, both to a height of 4 m. The force necessary to keep the door closed is (Take $g = 10\ \text{m s}^{-2}$) .
    a) 10 N b) 20 N
    c) 40 N d) 80 N
19. Some iron beads are embedded in wax ball which is just floating in water. The volume of ball is 18cm^3 and relative density of wax is 0.9. Then mass of the iron trapped in the ball is
    a) 1.8 g b) 2.7 g
    c) 16.8 g d) 8.1 g
20. Hydraulic brakes are based on
    a) Pascal's law b) Torricelli's law
    c) Newton's law d) Boyle's law
21. A piece of solid weighs 120 g in air, 80 g in water and 60 kg in a liquid. The relative density of the solid and that of the liquid are respectively
    a) $2, \frac{1}{2}$ b) $2, \frac{3}{2}$
    c) $3, \frac{1}{2}$ d) $3, \frac{3}{2}$
22. A block of wood floats in water with $\left(\frac{4}{5}\right)^{\text{th}}$ of its volume submerged. If the same block just floats in a liquid, the density of the liquid (in kg m^{-3}) is
    a) 1250 b) 600
    c) 400 d) 800
23. Iceberg floats in sea water with a part of it submerged. The percentage fraction of the ice berg submerged is (Density of ice $= 0.9\ \text{g cm}^{-3}$, density of sea water $= 1.1\ \text{gcm}^{-3}$)
    a) 18% b) 12%
    c) 10% d) 8%
24. A body of mass 100 kg and density $500\ \text{kgm}^{-3}$ floats in water. The additional mass should be added to the body so that the body will sink is
    a) 80 kg b) 100 kg
    c) 150 kg d) 200 kg
25. A man is sitting in a boat which is floating in a period. If the man drinks some water from the pond, the level of water in the pond
    a) increases
    b) decreases
    c) remains unchanged
    d) increases or decreases depends upon the weight of man
26. An ice block having two similar metallic pieces is floating in water in a vessel as shown in figure. After sometime the ice melts completely then



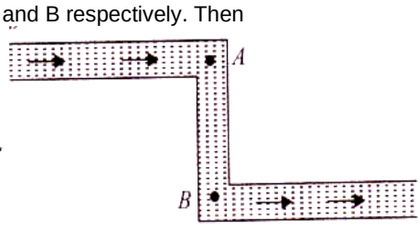
    a) the water level rises in the vessel
    b) the water level falls in the vessel
    c) the water level does not change in vessel
    d) the water level may rise or fall depending upon the ratio of masses of ice and metallic pieces.
27. An adulterated sample of milk has a density $1032\ \text{kg m}^{-3}$, while pure milk has a density of 1080kg m^{-3}. Then the volume of pure milk in a sample of 10 litres of adulterated milk is
    a) 1 litre b) 2 litre
    c) 3 litre d) 4 litre
28. A body is just floating on the surface of liquid. The density of the body is same as that of the liquid. The body is slightly pushed down. Then it will
    a) come back slowly to its earlier position
    b) remain submerged where it is left.
    c) sink in liquid
    d) come out vigoursly

STREAMLINE FLOW

29. Streamline flow is more likely for liquids with
    a) high density and high viscosity
    b) low density and low viscosity
    c) high density and low viscosity
    d) low density and high viscosity
30. When the flow parameters of any given instant remain same at every point, then flow is said to be
    a) Laminar b) steady state

c) turbulent d) quasistatic

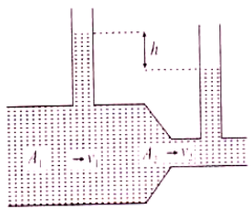
31. An ideal flow of any fluid must satisfy
    a) Pascal law
    b) Stokes'law
    c) continuity equation
    d) Bernoulli's theorem
32. Water is flowing continuously from a tap having an internal diameter $8\times10^{-3}\text{m}$. The water velocity as it leaves the tap is $0.4\,\text{m s}^{-1}$. The diameter of the water stream at a distance $2\times10^{-1}\text{m}$ below the tap is close to
    a) $5.0\times10^{-3}\text{m}$ b) $7.5\times10^{-3}\text{m}$
    c) $9.6\times10^{-3}\text{m}$ d) $3.6\times10^{-3}\text{m}$
33. In the figure shown an ideal liquid is flowing through the tube which is of uniform area of cross-section. The liquid has velocities v_A and v_B, and pressures P_A and P_B at points A and B respectively. Then



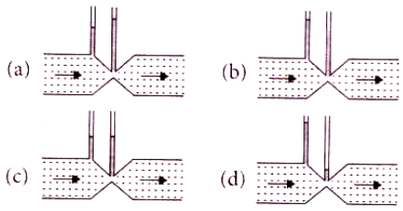
    a) $v_B > v_A$ b) $v_B = v_A$
    c) $P_B < P_A$ d) $P_B = P_A$
34. An ideal fluid flows through a pipe of circular cross-section made of two sections with diameters 2.5 cm and 3.75 cm. The ratio of the velocities in the two pipes is
    a) 9 : 4 b) 3 : 2
    c) $\sqrt{3}:\sqrt{2}$ d) $\sqrt{2}:\sqrt{3}$
35. The cylindrical tube of a spray pump has a cross-section of $6\,\text{cm}^2$ one of which has 50 holes each of diameter 1 mm. If the liquid flow inside the tube is 1.2 m per minute, then the speed of ejection of the liquid through the holes is
    a) $2.1\,\text{ms}^{-1}$ b) $0.31\ \text{ms}^{-1}$
    c) $0.96\ \text{m s}^{-1}$ d) $3.4\ \text{ms}^{-1}$

BERNOULLI'S PRINCIPLE

36. Bernoulli's equation for steady, non-viscous, incompressible flow expresses the
    a) conservation of linear momentum
    b) conservation of angular momentum
    c) conservation of energy
    d) conservation of mass
37. In old age arteries carrying blood in the human body become narrow resulting in an increase in the blood pressure. This follows from
    a) Pascal's law
    b) Stoke's law
    c) Bernoulli's principle
    d) Archimede's principle
38. Applications of Bernoulli's theorem can be seen in
    a) dynamic lift of aeroplane
    b) hydraulic press
    c) helicopter
    d) none of these
39. A liquid flows through a horizontal tube as shown in figure. The velocities of the liquid in the two sections, which have areas of cross-section A_1 and A_2, are v_1 and v_2, respectively. The difference in the levels of the liquid in the two vertical tubes is h. Then



    a) $v_2^2 - v_1^2 = 2gh$ b) $v_2^2 + v_1^2 = 2gh$
    c) $v_2^2 - v_1^2 = gh$ d) $v_2^2 + v_1^2 = gh$
40. Which of the following figure shown below is correct regarding the steady flow of a non viscous liquid?



41. An aircraft of mass $4\times10^5\text{kg}$ with total wing area $500\ \text{m}^2$ in level flight at a speed of $720\ \text{km h}^{-1}$. The density of air at its height is $1.2\ \text{kg m}^{-3}$. The fractional increase in the speed of the air on the upper surface of its wings relative to the lower surface is $(\text{Take g} = 10\ \text{ms}^{-2})$
    a) 0.04 b) 0.08
    c) 0.17 d) 0.34
42. A plane is in level flight at constant speed and each of its two wings has an area of $25\ \text{m}^2$. If the speed of the air on the upper and lower surfaces of the wing are $70\ \text{km h}^{-1}$ and $234\ \text{km h}^{-1}$ respectively, then the mass of the plane is (Take the density of the air $=1\ \text{kgm}^{-3}$)
    a) 1550 kg b) 1750 kg
    c) 3500 kg d) 3200 kg
43. A tank filled with fresh water has a hole in its bottom and water is flowing out of it. If the size of the hole is increased, then
    a) the volume of water flowing out per second will decrease
    b) the velocity of outflow of water remains unchanged
    c) the volume of water flowing out per second remains zero
    d) Both (b) and (c)
44. A water barrel stands on a table of height h. If a small hole is punched in the side of the barrel at its base, it is found that the resultant stream of water strikes the ground at a horizontal distance

R from the table. What is the depth of water in the barrel?

a) $\frac{R^2}{h}$ b) $\frac{R^2}{2h}$

c) $\frac{R^2}{4h}$ d) $\frac{4R^2}{h}$

45. Torricelli's barometer used mercury but Pascal duplicated it using French wine of density $984\,kgm^{-3}$. In that case, the height of the wine column for normal atmospheric pressure is

$(\text{Take the density of mercury} = 13.6\times10^3 kg\,m^{-3})$

a) 5.5 m b) 10.5 m

c) 9.8 m d) 15 m

46. A cylinder of height 20 m is completely filled with water. The velocity of efflux of water through a hole on the side wall of the cylinder near its bottom is $(\text{Take} g = 10\ ms^{-2})$

a) $10\ ms^{-1}$ b) $20\ ms^{-1}$

c) $25.5\ m\ s^{-1}$ d) $5\ ms^{-1}$

47. At what velocity does water emerge from an orifice in a tank in which gauge pressure is $3\times10^5 Nm^{-2}$ before the flow starts?
(Take the density of water $= 1000\ kg\ m^{-3}$.)

a) $24.5\ m\ s^{-1}$ b) $14.5\ ms^{-1}$

c) $34.5\ ms^{-1}$ d) $44.5\ ms^{-1}$

48. Which of the following device is used to measure the rate of flow of liquid through a pipe?

a) Thermometer b) Barometer

c) Manometer d) Venturimeter

49. The flow of blood in a large artery of an anesthetised dog is diverted through a venturimeter. The wider part of the meter has a cross-sectional area equal to that of the artery, ie., $10\,mm^2$. The narrower part has an area $5\ mm^2$. The pressure drop in the artery is 22 Pa. (Take the density of the blood $= 1.06\times10^3 kg\ m^{-3}$.) The speed of the blood in the artery is

a) $0.12\ m\,s^{-1}$ b) $0.62\ ms^{-1}$

c) $0.24\ ms^{-1}$ d) $0.42\ ms^{-1}$

50. Dynamic lift due to spinning is

a) Magnus effect b) Doppler effect

c) Pascal effect d) Torricelli's effect

VISCOSITY

51. With increase in temperature the viscosity of

a) liquids increases and of gases decreases

b) liquids decreases and of gases increases

c) both liquids and gases increases

d) both liquids and gases decreases

52. Spherical balls of radius R are falling in a viscous fluid of velocity v. The retarding viscous force acting on the spherical ball is

a) directly proportional to R but inversely proportional to v.

b) directly proportional to both radius R and velocity v.

c) inversely proportional to both radius R and velocity v.

d) inversely proportional to R but directly proportional to velocity v.

53. When cooking oil is heated in a frying pan, the oil moves around in the pan more easily when it is hot. The main reason for this is that with rise in temperature, there is a decrease in

a) density b) surface tension

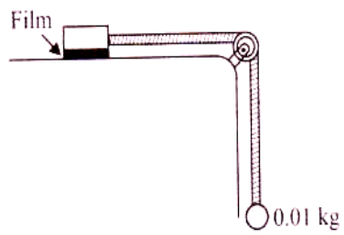
c) viscosity d) angle of contact

54. The velocity of water in river is $180 km\,h^{-1}$ near the surface. If the river is 5 m deep, then the Shearing stress between the surface layer and the bottom layer is (coefficient of viscosity of water, $\eta = 10^{-3} Pa\ s$)

a) $10^{-2} Nm^{-2}$ b) $10^{-3} N\ m^{-2}$

c) $10^{-4} N\,m^{-2}$ d) $10^{-5} N\,m^{-2}$

55. A metal block of area $0.10\ m^2$ is connected to a 0.1 kg mass via a string that passes over a massless and frictionless pulley as shown in figure. A liquid with a film thickness of 0.3 mm is placed between the block and the table. When released the block moves to the right with a constant speed of $0.085\ ms^{-1}$. The coefficient of viscosity of the liquid is
(Take $g = 10\,ms^{-2}$)



a) $2.5\times10^{-3} Pa\ s$ b) $3.5\times10^{-3} Pa\ s$

c) $4.5\times10^{-3} Pa\ s$ d) $6.5\times10^{-3} Pa\,s$

56. A square plate 0.1 m side moves parallel to second plate with a velocity of $0.1\ ms^{-1}$, both plates being immersed in water. If the viscous force is 0.002 N and the coefficient of viscosity 0.001 poise, distance between the plates is

a) 0.1 m b) 0.05 m

c) 0.005 m d) 0.0005 m

57. A gas bubble of 2 cm diameter rises through a liquid of density $1.75\ gm\ cm^{-3}$ with a fixed speed of $0.35\ cm\ s^{-1}$. Neglect the density of the gas. The coefficient of viscosity of the liquid is

a) 870 poise b) 1120 poise

c) 982 poise d) 1089 poise

58. A rain drop of radius 0.3 mm falls through air with a terminal velocity of $1\ ms^{-1}$. The viscosity of air is 18×10^{-5} poise. The viscous force on the rain drop is

a) $1.018\times10^{-2} dyne$ b) $2.018\times10^{-2} dyne$

c) $3.018\times10^{-2}\text{dyne}$ d) $4.018\times10^{-2}\text{dyne}$

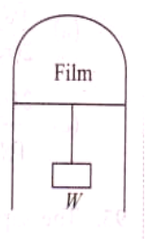
59. A solid sphere falls with a terminal velocity v in air. If it is allowed to fall in vacuum.
    a) terminal velocity of sphere $=\text{v}$
    b) terminal velocity of sphere $<\text{v}$
    c) terminal velocity of sphere $>\text{v}$
    d) sphere never attains terminal velocity
60. After terminal velocity is reached, the acceleration of a body falling through a viscous fluid is
    a) zero b) equal to g
    c) less than g d) more than g
61. A metallic sphere of mass m falls through glycerine with a terminal velocity v. If we drop a ball of mass 8 M of same metal into a column of glycerine, the terminal velocity of the ball will be
    a) 2v b) 4v
    c) 8v d) 16v
62. A metal ball $\text{B}_1(\text{density } 3.2\,\text{gcm}^{-3})$ is dropped in water while another metal ball $\text{B}_2(\text{density } 6.0\,\text{gcm}^{-3})$ is dropped in a liquid of density $1.6\,\text{gcm}^{-3}$. If both the balls have the same diameter and attain the same terminal velocity, the ratio of viscosity of water to that of the liquid is
    a) 2.0
    b) 0.5
    c) 4.0
    d) indeterminate due to insufficient data
63. Eight drops of water, each of radius 2 mm are falling through air at a terminal velocity of $8\,\text{cms}^{-1}$. If they coalesce to form a single drop, then the terminal velocity of combined drop will be
    a) 32 cm s^{-1} b) 30 cm s^{-1}
    c) 28 cm s^{-1} d) 24 cm s^{-1}
64. A drop of water of radius 0.0015 mm is falling in air. If the coefficient of viscosity of air is $2.0\times10^{-5}\text{kgm}^{-1}\text{s}^{-1}$, the terminal velocity of the drop will be
    (The density of water $=10^3\text{kg m}^{-3}$ and $\text{g}=10\text{ms}^{-2}$)
    a) $1.0\times10^{-4}\text{ms}^{-1}$ b) $2.0\times10^{-4}\text{ms}^{-1}$
    c) $2.5\times10^{-4}\text{ms}^{-1}$ d) $5.0\times10^{-4}\text{ms}^{-1}$
65. Water is conveyed through a uniform tube of 8 cm in diameter and 3140 m in length at the rate $2\times10^{-3}\text{m}^3$ per second. The pressure required to maintain the flow is (Viscosity of water $=10^{-3}$)
    a) $6.25\times10^3\text{Nm}^{-2}$ b) 0.625 N m^{-2}
    c) 0.0625N m^{-2} d) 0.00625 Nm^{-2}

REYNOLDS NUMBER

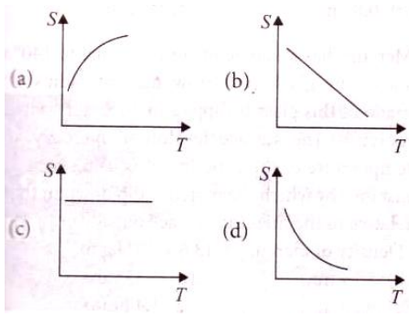
66. The onset of turbulence in a liquid is determined be
    a) Pascal's law
    b) Reynolds number
    c) Torricell's law
    d) Bernoulli's principle
67. The ratio of inertial force to viscous force represents
    a) Magnus effect b) Reynolds number
    c) Torricelli's law d) Relative density
68. For turbulent flow, the value of Reynolds number is
    a) $\text{R}_\text{e}<2000$ b) $\text{R}_\text{e}>2000$
    c) $1000<\text{R}_\text{e}<2000$ d) $\text{R}_\text{e}=1000$
69. The flow rate of water from a tap of diameter 1.25 cm is 3 L per min. The coefficient of viscosity of water is 10^{-3}Pa s. The nature of the flow is
    a) Unsteady b) Turbulent
    c) Laminar d) None of these

SURFACE TENSION

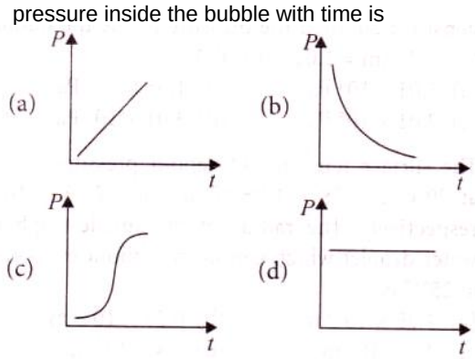
70. Which of the following is associated with liquid only and not for gases?
    a) Pressure b) Volume
    c) Density d) Surface tension
71. The rain drops are in spherical shape due to
    a) Viscosity b) Surface tension
    c) Thrust on drop d) Both (a) and (b)
72. Which of the following statements is not true about surface tension?
    a) A small liquid drop takes spherical shape due to surface tension.
    b) Surface tension is a vector quantity.
    c) Surface tension of liquid is a molecular phenomenon.
    d) Surface tension of liquid depends on length but not on the area.
73. For a surface molecule,
    a) the net force on it is non zero
    b) the net force on it zero
    c) there is net downward force
    d) there is net upward force
74. Mercury does not wet glass. This is the property of liquid known as
    a) adhesion b) surface tension
    c) viscosity d) compressibility
75. A thin liquid film formed between a U shaped wire and a light slider supports a weight of $1.5\times10^{-2}\text{N}$, as shown in the figure. The length of the slider is 30 cm and its weight negligible. The surface tension of the liquid film is



    a) 0.0125N m^{-1} b) 0.1 N m^{-1}
    c) 0.05 N m^{-1} d) 0.025 N m^{-1}
76. Which of the following graph shows the variation of surface tension with temperature over small temperature ranges for water?



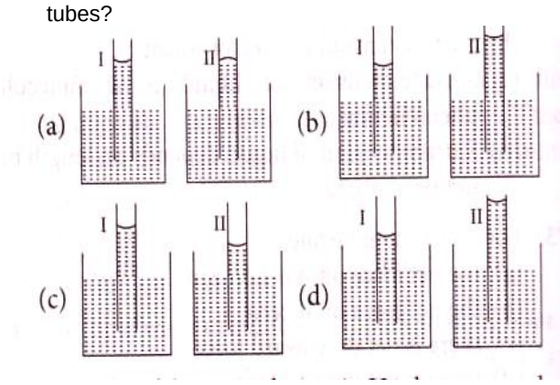
77. Angle of contact of a liquid with a solid depends on
    a) solid only
    b) liquid only
    c) both on solid and liquid
    d) orientation of the solid surface in liquid
78. Which of the following statement is not true about angle of contact?
    a) The value of angle of contact for pure water and glass is zero.
    b) Angle of contact increases with increase in temperature of liquid.
    c) If the angle of contact of a liquid and a solid surface is less than 90^o, then the liquid spreads on the surface of solid.
    d) Angle of contact depend upon the inclination of the solid surface to the liquid surface.
79. Which of the following statements is correct?
    a) Viscosity is a vector quantity
    b) Surface tension is a vector quantity
    c) Reynolds number is a dimensionless quantity
    d) Angle of contact is a vector quantity
80. A liquid does not wet the solid surface if the angle of contact is
    a) zero b) equal to 45^o
    c) equal to 90^o d) greater than 90^o
81. A soap bubble formed at the end of the tube is blown very slowly. The graph between excess of pressure inside the bubble with time is



82. When a drop of water splits up is to number of drops
    a) area increases
    b) volume increases
    c) energy is absorbed
    d) both (a) and (c)
83. The excess pressure inside a soap bubble is three times than excess pressure inside a second soap bubble, then the ratio of their surface area is
    a) 9 : 1 b) 1 : 3
    c) 1 : 9 d) 3 : 1
84. If W_1 be the work to be done to from a bubble of volume V from solution. The work required to be done to form a bubble of volume 2V is
    a) $4^{2/3}W_1$ b) $4^{1/3}W_1$
    c) $2^{1/2}$ W_1 d) $2^{3/2}W_1$
85. The work done in blowing a soap bubble of surface tension 0.06N m^{-1} from 2cm radius to 5 cm radius is
    a) 3.1 mJ b) 1.25 mJ
    c) 2.51mJ d) 4.55 mJ
86. The surface tension of soap solution is $0.03Nm^{-1}$. The work done in blowing to from a soap bubble of surface area 40cm^2 is
    a) $2.4\times10^{-4}J$ b) $1.2\times10^{2}J$
    c) $3.6\times10^{-4}J$ d) $4.2\times10^{-2}J$
87. Surface tension of mercury is $0.465\mathrm{Nm}^{-1}$. The excess pressure inside a mercury drop of diameter 6mm is
    a) 310 Pa b) 410 Pa
    c) 510Pa d) 610 Pa
88. The surface tension of soap solution at a temperature 20°C is $2.5\times10^{-2}Nm^{-1}$. The excess pressure inside a by bubbled of soap solution of radius 6mmis
    a) 12.5 Pa b) 14.2Pa
    c) 15.5 Pa d) 16.7 Pa
89. In question number 88, if an air bubble of the same dimensions were formed at depth of 30cm inside a contained containing the soap solution of relative density 1.20, then the pressure inside the bubble is (Take 1 atm=1.01×10^5 Pa)
    a) 1.01×10^4Pa b) 1.05×10^5Pa
    c) 2.01×10^4Pa d) 3.01×10^4Pa
90. The surface tension and vapour pressure of water at $20°C$ is $7.28\times10^{-2}Nm^{-1}$and 2.33×10^3Pa respectively. The radius of the smallest spherical water droplet which can from without evaporating at $25°C$ is
    a) $1.25\times10^{-5}m$ b) $6.25\times10^{-5}m$
    c) 4.3×10^8m d) 3.4×10^3m
91. When a capillary tube is dipped in a liquid , the liquid raises to height h in the tube. The free liquid surface inside the tube is hemispherical in shape. The tube is now pushed down so that the height of the tube outside the liquid is less than h. Then the
    a) liquid will come out of the tube like in a small fountain
    b) liquid will ooze out of the tube slowly
    c) free liquid surface inside the tube is hemispherical
    d) the liquid will fill the tube but not come out of its upper end

92. A capillary tube is taken from the earth to the surface of the moon. The rise of the liquid column on the moon. If acceleration due to gravity on the earth is 6 times that of the moon is
    a) six times that on the earth's surface
    b) 1/6 that on the earth's surface
    c) equal to that on the earth's surface
    d) zero

93. A capillary tube (I) is dipped in water. Another identical tube (II) is dipped in a soap-water solution. Which of the following shows the relative nature of the liquid columns in the two tubes?



94. The radii of the two columns is U tube are r_1 and r_2. When a liquid of density ρ (angle of contact is 0°) is filled in it the level difference of liquid in two arms is h. The surface tension of liquid is (g = acceleration due to gravity)
    a) $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$ b) $\frac{\rho g h (r_1 - r_2)}{2 r_1 r_2}$
    c) $\frac{2(r_2 - r_1)}{\rho g h r_1 r_2}$ d) $\frac{\rho g h}{2(r_2 - r_1)}$

95. The sap in tree rises in a system of capillaries of radius $2.5 \times 10^{-5} m$. The surface tension of sap is $7.28 \times 10^{-2} Nm^{-1}$ and the angle of contact is 0°. The maximum height to which sap can rise in a tree through capillarity is $\rho_{sap} = 10^3 kgm^{-3}$)
    a) 0.21 m b) 0.59 m
    c) 0.87 m d) 0.91m

96. Mercury has an angle of contact equal to 140° with soda lime glass. A narrow tube of radius 1 man made of this glass is dipped in a through containing mercury. The surface tension of mercury at the temperature of the experiment is 0.465Nm^{-1}. The distance by which the mercury dip down in the tube relative to the mercury surface outside is
    (density of mercury = $13.6 \times 10^3 kgm^{-3}$)
    a) 5.34 mm b) 2.35 mm
    c) 6.25 mm d) 1.44 mm

97. 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) 4.9m
    c) 0.49 m d) 0.94m

98. If the surface tension of water is 0.06Nm^{-1}, then the capillary rise in a tube of diameter 1mm is (Take $\theta = 0°$)
    a) 1.22cm b) 2.44cm
    c) 3.12cm d) 3.86cm

99. The rise in the water level in a capillary tube of radius 0.07 cm when dipped vertically in a beaker containing water surface tension $0.07 Nm^{-1}$ is ($g = 10 ms^{-2}$)
    a) 2cm b) 4cm
    c) 1.5cm d) 3cm

100. A capillary tube of radius r is immersed in water and water rises in it to a height h. The mass of water in the capillary tube is 5g. another capillary tube of radius 2r is immersed in water. The mass of water that will rise in this tube is
    a) 2.5g b) 5.0g
    c) 10 g d) 20g

HOTS

1. A glass capillary tube is of the shape of a truncated cone with an apex angle a so that its two ends have cross sections of different radii. When dipped in water vertically, water rises in it to a height h, where the radius of its cross section is b. If the surface tension of water is S, its density is p, and its contact angle with glass with glass is θ, the value of h will be (g is the acceleration due to gravity)
    a) $\frac{2S}{bpg}\cos(\theta - \alpha)$
    b) $\frac{2S}{bpg}\cos(\theta + \alpha)$
    c) $\frac{2S}{bpg}\cos(\theta - \alpha/2)$
    d) $\frac{2S}{bpg}\cos(\theta + \alpha/2)$

2. A uniform cylinder of length L and mass M having cross – sectional area A is suspended , with its length vertical, from a fixed point by a massless spring such that it is half submerged in a liquid of density σ at equilibrium position. The extension X_0 of the spring when it is in equilibrium is
    a) $\frac{Mg}{k}\left(1 + \frac{LA\sigma}{M}\right)$ b) $\frac{Mg}{k}$
    c) $\frac{Mg}{k}\left(1 - \frac{LA\sigma}{M}\right)$
    d) $\frac{Mg}{k}\left(1 - \frac{LA\sigma}{2M}\right)$
    (Here k is spring constant)

3. A tiny spherical oil drop carrying a net charge q is balanced in still air with a vertical uniform electric field of strength $\frac{81\pi}{7} \times 10^5 Vm^{-1}$. When the filed

is switched off, the drop is observed to fall with terminal velocity $2\times10^{-3}ms^{-1}$. The magnitude of q is (Given , $g=9.8ms^{-2}$, $\eta_{air}=1.8\times10^{-5}Nsm^{-2}$, $p_{vil}=900kgm^{-3}$, Electric force=charge x electric field)

a) $1.6\times10^{-19}C$ b) $3.2\times10^{-19}C$

c) $4.8\times10^{-19}C$ d) $8.0\times10^{-19}C$

4. A bubble having surface tension t and radius R is formed on a ring of radius $b(bb<R)$. Air is blown inside the tube with velocity v as shown. The air molecule collides perpendicularly with the wall of the bubble and stops. The radius at which the bubble separates from the ring is

a) $\frac{2T}{pv^2}$ b) $\frac{2T}{\rho v}$

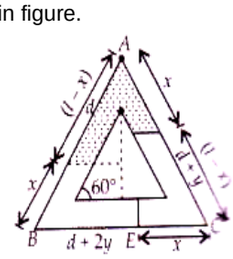
c) $\frac{4T}{\rho v^2}$ d) $\frac{4T}{\rho v}$

5. A vessel contains two immiscible liquids of density $\rho_1=1000kgm^{-3}$ and $\rho_2 1500kgm^{-3}$. A solid block of volume $V=10^{-3}m^3$ and density $d=800kgm^{-3}$ is tied to one end of a string and other end is tied to the bottom of the vessel. The block is immersed with $2/5^{th}$ of its volume in the liquid of hi9gher density and $3/5^{th}$ in the liquid of lower density. The entire system is kept in an elevator which is moving upwards with an acceleration of a=g/2. The tension in the string is (Take $g=10ms^{-2}$).

a) 8N b) 6 N

c) 10 N d) 12 N

6. A glass tube in the form of an equilateral triangle of uniform cross-section is as shown in figure. It lies in the vertical plane, with base horizontal. The tube is filled with equal volumes of three Immiscible liquids whose densities are in arithmetic progression. Determine the length x as shown in figure.



a) $3l$ b) $2l$

c) $l/3$ d) $l/2$

7. Two soap bubbles A and B are kept in a closed chamber where the air is maintained at pressure $8N/m^2$. The radii of bubbles A and B are 2 cm and 4cm respectively. Surface tension of the soap- water used to make bubbles is 0.04 N/m. The rate of n_B/n_A is (where n_A and n_B are the number of moles of air in bubbles A and B, Respectively.[Neglect the effect of gravity]

a) 2 b) 4

c) 6 d) 8

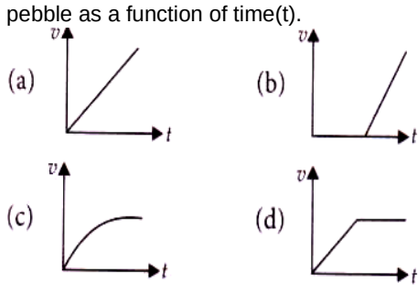
8. A cylindrical vessel of height 500 mm an orifice (small hole) at its bottom. The orifice is initially closed and water is filled in it upto height H. Now the top is completely sealed with a cap and the orifice at the bottom is opened. Some water comes out form the orifice and the water level in the vessel becomes steady with height of water column being 200 mm. The fall in height (in mm) of water level due to opening of the orifice is (Take atmosphere pressure=$1.0\times10^5N/m^2$, density of water =$1000kg/m^3$ and $g=10m/s^2$. Neglect any effect of surface tension.]

a) 6 b) 4

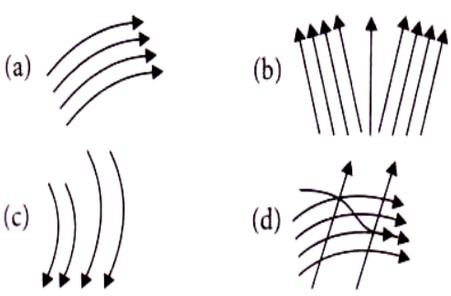
c) 2 d) 8

EXEMPLAR PROBLEMS

1. A tall cylinder is filled with viscous oil. A round pebble is dropped from the top with zero initial velocity. From the plots shown, indicate the one that represents the velocity (v) of the pebble as a function of time(t).



2. Which of the following diagrams does not represent as streamline flow?



3. Along a streamline
   a) the velocity of a liquid particle remains constant
   b) the velocity of all fluid particles crossing a given position is constant.
   c) the velocity of all fluid particles at a given instant is constant.
   d) the speed of a fluid particle remains constant.

4. An ideal fluid flows through a pipe of circular cross section made of two sections with diameters 2.5 cm and 3.75 cm. The ratio of the velocities in the two pipes is

a) 9:4 b) 3:2

c) $\sqrt{3} : \sqrt{2}$ d) $\sqrt{2} : \sqrt{3}$

5. The angle of contact at the interface of water glass is 0^o. Ethylalcohol –glass is 0^o, mercury-glass is 140^o and Methyliodide-glass is 30^o. A glass capillary is put in a trough containing one of these four liquids. It is observed that the meniscus is convex. The liquid in the trough is

a) water b) ethylalcohol
c) mercury d) methyliodide.

Directions : In the following questions, a statement of assertion of reason. Mark the correct choice as:

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reason are false.

1. Assertion: If an object is submerged in fluid at rest, the fluid ex fluid at rest, the fluid exerts a force on its surface.
   Reason: The force exerted by the fluid at rest has to be parallel to the surface in contact with it.
2. Assertion: Liquids and gases are largely incompressible and densities are therefore, nearly constant at all pressures.
   Reason: Liquids exhibit a large variation in densities with pressure but gasses do not.
3. Assertion: Pascal's ;law is the working principle of hydraulic lift.
   Reason: Pressure= $\frac{thrust}{area}$
4. Assertion: An open- tube manometer is a useful instrument for measuring pressure differences.
   Reason : 1bar=$10^3 Pa$.
5. Assertion: A needle placed carefully on the surface of water may float while a ball of the same material will always sink.
   Reason: The buoyancy of an object depends both on the material and the shape of the object.
6. Assertion: The flow of fluid is said to be steady if at any given point , the velocity of each passing fluid particle remains constant.
   Reason: The path taken by a fluid particle under a steady flow is a streamline.
7. Assertion: Aeroplanes are made to run on the runway before taking off, so that they acquire the necessary lift.
   Reason: This is based on Bernoulli's principle.
8. Assertion: Bernoulli's equation hold for non-steady or turbulent flows.
   Reason: In these situation, velocity and pressure are constant with time.
9. Assertion: The viscosity of water is less than blood .
   Reason: The viscosity of liquids decreases with Increase in temperature.
10. Assertion: When fluids flow, there is some loss of energy due to friction.
    Reason: Different layers of the fluid exert forces on each other.
11. Assertion: The flow is turbulent for Reynolds number greater than 2000.
    Reason: Turbulence dissipates kinetic energy in the form of heat.
12. Assertion: The angle of contact of a liquid with a solid increases with increase in temperature of liquid.
    Reason: With increase in temperature, the surface tension of the liquid increase.
13. Assertion: The contact angle between water and glass is acute.
    Reason: The surface of water in the capillary as convex.
14. Assertion: A bubble comes from the bottom of a lake to the top.
    Reason: Its radius increase.
15. Assertion: When height of a tube is less than liquid rise in the capillary tube, the liquid does not overflow.
    Reason: Product of radius of meniscus and height of liquid in the capillary tube always remains constant.

MCQs CORNER

1. c) 2. b) 3. c) 4. b) 5. c)
6. c) 7. c) 8. a) 9. a) 10. b)
11. b) 12. b) 13. d) 14. c) 15. c)
16. a) 17. c) 18. c) 19. a) 20. a)
21. d) 22. d) 23. a) 24. b) 25. c)
26. b) 27. d) 28. c) 29. d) 30. b)
31. c) 32. d) 33. b) 34. a) 35. b)
36. c) 37. c) 38. a) 39. a) 40. a)
41. c) 42. c) 43. b) 44. c) 45. b)
46. b) 47. a) 48. d) 49. a) 50. a)
51. b) 52. b) 53. c) 54. b) 55. b)
56. d) 57. d) 58. a) 59. d) 60. a)
61. b) 62. b) 63. a) 64. c) 65. a)
66. b) 67. b) 68. b) 69. b) 70. d)
71. b) 72. b) 73. c) 74. a) 75. d)
76. b) 77. c) 78. d) 79. d) 80. d)
81. b) 82. d) 83. c) 84. b) 85. a)
86. a) 87. a) 88. d) 89. b) 90. b)
91. d) 92. a) 93. c) 94. a) 95. b)
96. a) 97.d) 98. b) 99. a) 100.c)

HOTS

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

NCERT EXEMPLAR PROBLEMS

1. c) 2. d) 3. b) 4. a) 5. c)

ASSERTION & REASON CORNER

1. c) 2. d) 3. b) 4. b) 5. c)
6. b) 7. a) 8. d) 9. b) 10. a)
11. b) 12. c) 13. c) 14. b) 15. a)