FLUID MECHANICS

1. The ice is floating on water. When it is completely melted, the level of water

1) Rises 2) decreases 3) remains same 4) none

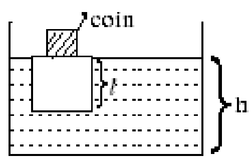
2. A boat with stones is floating on the water. When the stones are thrown into water; the level of water in the pond:

1) Rises 2) decreases 3) remains same 4) may rise or fall

3. A boat in the river enter into the sea water, then it

1) Sinks 2) rises 3) remains same 4) none

4. A wooden block with a coin placed on its, top floats in water as shown. After some time the coin falls into water. Then



1) l decreases and h increases
2) l increases and h decreases
3) both l and h increase
4) both l and h decrease

5. A): A needle placed carefully on the surface of water may float, whereas a ball of the same material will always sinks.

R): The buoyancy of an object depends both on the material and shape of the object.

1) Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

2) Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

3) 'A' is true and 'R' is false
4) 'A' is false and 'R' is true

6. **A): For a floating body to be in stable equilibrium, its centre of buoyancy must be located above the centre of gravity.**

R): the torque required by the weight of the body and the up thrust will restore body back to its normal position, after the body is disturbed.

1) Both ‘A’ and ‘R’ are true and ‘R’ is the correct explanation of ‘A’

2) Both ‘A’ and ‘R’ are true and ‘R’ is not the correct explanation of ‘A’

3) ‘A’ is true and ‘R’ is false 4) ‘A’ is false and ‘R’ is true

7. **A body is carrying a bucket of water in one hand and a piece of plastic in the other hand. After transferring the plastic piece to the bucket, the boy will carry**

1) more load than before 2) less load than before

3) same load as before 4) either less or more load depending on the density of the plastic

8. **It is easier to swim in sea water than in ordinary water because**

1) Atmospheric pressure is highest at sea level

2) Sea water contains salt

3) Density of sea water is greater than that of ordinary water

4) Density of sea water is less than that of ordinary water

9. **A body is floating in a liquid. The upthrust on the body is**

1) zero

2) less than the weight of the liquid displaced

3) the difference of the weight of the body and the weight of the liquid displaced

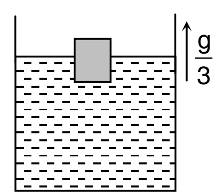
4) equal to the weight of the liquid displaced

10. **A body floats with one third of its volume being outside water and three-fourth of its volume being outside another liquid. The density of the other liquid is**

1) 9/4 grams/cm^3 2) 4/9 grams/cm^3

3) 8/3 grams/cm^3 4)8/9 gram/cm^3

11. **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**



1) 1/2 2) 3/8 3) 2/3 4) ¾

12. A body of density d' is left free in a liquid of density d (where d'>d), what is the downward acceleration of the body while sinking in the liquid?

1) $\left(1-\frac{d}{d'}\right)g$ 2) $\left(1-\frac{d'}{d}\right)g$ 3) $\left(\frac{d'}{d}-1\right)g$ 4) $\left(\frac{d}{d'}-1\right)g$

13. [A]: When a body is partially or fully dipped into a fluid at rest, the fluid exerts an upward force of buoyancy.

[R]: Archimedes principle may be deduced from Newton's laws of motion.

1. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
2. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
3. If Assertion is true but Reason is false.
4. If both Assertion and Reason are false.

14. [A]: When an ice block floating on water melts, the level of water remains the same.

[R]: Density of ice is less than that of water.

1. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
2. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
3. If Assertion is true but Reason is false.
4. If both Assertion and Reason are false.

15. [A]: A balloon stops ascending after it reaches a certain height.

[R]: When balloon reaches certain height, the density of gas inside the balloon is equal to that outside.

1. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
2. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
3. If Assertion is true but Reason is false.
4. If both Assertion and Reason are false.

16. [A]: It is easier to swim in sea water than in fresh water.

[R]: Density of sea water is less than that of fresh water.

1. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
2. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
3. If Assertion is true but Reason is false. 4 . If both Assertion and Reason are false.

17. If an incompressible liquid flows through a pipe at the steady rate, then velocity of liquid at any point in \ the pipe is

1) directly proportional to the cross-section of the pipe
2) inversely proportional to the cross-section of the pipe
3) independent of the area of cross-section of the pipe
4) directly proportional to the square of the cross-section of the pipe

18. Bernoulli's equation includes as a special case

1) Archimedes' 2) Pascal's law
3) Torricelli's law 4) Hooke's law

19 Match the following.

List – I	**List – II**
a) $P_2 - P_1 =$	**e) Flow from orifice pg($h_1 - h_2$)**
b) $v = \sqrt{2gh}$	**f) Lift**
c) $Q = A\sqrt{2gh}$	**g) Torricelli's theorem**
d) $(P_1 - P_2)A = \frac{1}{2}\rho A(v_2^2 - v_1^2)$	**f) Liquid at rest**

1) a – f, b – h, c – g, d – e 2) a – g, b – e, c – f, d – h
3) a – f, b – g, c – e, d – h 4) a – h, b – g, c – e, d – f

20. Match the following.

List – I	**List – II**
a) $\frac{2}{9}g\frac{r^2(\rho-\sigma)}{\eta}$	**e) Pressure head**
b) $\frac{P}{\rho}$	**f) Terminal Velocity**
c) $\frac{\pi p r^4}{8\eta\ell}$	**g) Reynold's number**
d) $\frac{\rho v D}{\eta}$	**h) Poiseculle's equation**

1) a – g, b – f, c – e, d – h 2) a – f, b – e, c – g, d – h
3) a – f, b – e, c – h, d – g 4) a – h, b – f, c – g, d – e

21. Match the following.

List - I	**List - II**
(a) $\frac{2}{9}g\frac{r^2(\rho-\sigma)}{\eta}$	**(e) Pressure head**
(b) $\frac{p}{\rho g}$	**(f) Terminal Velocity**
(c) $\frac{\pi pr^4}{8\eta l}$	**(g) Reynolds's**
(d) $\frac{\rho vD}{\eta}$	**(h) Poiseuille's equation**

(1) a-g, b-f, c-e, d-h (2) a-f, b-e, c-g, d-h (3) a-f, b-e, c-h, d-g (4) a-h, b-f, c-g,d-e

22. Match the following formulae with their application

Formula	**Application**
(a) F = $6\pi\eta rv$	(e) Millikan's oil drop experiment
(b) $v=\sqrt{2gh}$	(f) Capillary tube experiment
(c) $p+\rho gh+\frac{1}{2}\rho v^2$ = constant	(g) Torricelli's theorem
(d) $Q=\frac{\pi \Pr^4}{8\eta l}$	(h) Design of aero plane wings

(1) a-e,b-g,c-h,d-f (2) a-f,b-e,c-g,d-h (3) a-h,b-f,c-e,d-g (4) a-g,b-e,c-f,d-e

23. Assertion (A): Bernoulli's equation is relevant to the Laminar flow of incompressible, viscous fluids.

Reason (R): Only under such assumptions the equation can be derived.

1) Both A and R are true, and R is the correct explanation of A

2) Both A and R are true, but R is not the correct explanation of A

3) A is true but R is false

4) R is true but R is false

24. Concentration of stream lines at any place indicates

1) greater velocity of the fluid

2) smaller velocity of the fluid

3) greater density of the fluid

4) smaller density of the fluid

25. Stream line flow is more likely for liquids with

1) high density and low viscosity
2) low density and high viscosity
3) high density and high viscosity
4) low density and low viscosity

26. In the equation of continuity the conservation law associated is that of

1) energy 2) mass 3) momentum 4) none

27. Atomizer works on the

1) Principle of continuity
2) Bernoulli is principle
3) Stokes law
4) Archimedes's principle

28. When the wind blows at a high speed, the roof of a house is blown off because:

1) The pressure under the roof increases
2) Pressure above the roof increases
3) Pressure above the roof decreases
4) The wind pushes off the roof

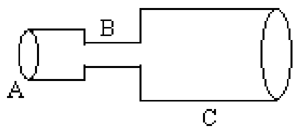
29. $v^2 / 2g$ is called :

1) Pressure head 2) gravitational head 3) both 4) none

30. Bernoulli's theorem is a consequence of

1) Law of conservation of energy
2) Law of conservation of mass
3) Law of conservation of linear momentum
4) None

31. **Water flows through a non-uniform tube. Areas of cross -section of parts A,B and C are 25, 5 and 35cm^2 respectively. Which part has the highest velocity?**



1) A 2) B
3) C 4) All have same velocity

32. **Section - A** **Section - B**

a) Equation of continuity **e) Less than critical velocity**

b) Bernoulli's theorem **f) Formation of eddies & vortices**

c) Turbulent flow **g) Law of conservation of mass**

d) Stream line flow **h) Law of conservation of energy**

1) a – h; b – f; c – e; d – g
2) a – g; b – e; c – g; d – f
3) a – f; b – g; c – h; d – e
4) a – g; b – h; c – f; d – e

33. **Match the following**

Section - A **Section - B**

a) Incompressible liquid **e)Density constant**

b) Turbulent flow **f) Stream lines**

c) Tube of flow **g) Constant**

d) Fluid flux rate in laminar flow **h) Reynold's no. >2000**

1) a – f; b –e; c – g; d – h
2) a – e; b – h; c – f; d – g
3) a – g; b – f; c – e; d – h
4) a – h; b – g; c – e; d – f

34. **Match the following**

Section - A **Section - B**

a) Kinematic viscosity **e)** $\frac{1}{2}\rho\left(v_2^2 - v_1^2\right)A$

b) Dynamic lift **f)** $\frac{\eta}{\rho}$

c) Bernoulli's theorem **g) av= constant**

d) Equation of continuity **h)** $p + \frac{1}{2}\rho v^2 + \rho gh = const.$

1) a – f; b – e; c – h; d – g
2) a – f; b – e; c – g; d – h

3) a – g; b – f; c – e; d – h   4) a – h; b – g; c – f; d – e

35. A) : Pascal law is working principle of a hydraulic lift.

R) : Pressure is equal to thrust per unit area.

1) Both ‘A’ and ‘R’ are true and ‘R’ is the correct explanation of ‘A’

2) Both ‘A’ and ‘R’ are true and ‘R’ is not the correct explanation of ‘A’

3)‘A’ is true and ‘R’ is false   4)‘A’ is false and ‘R’ is true

36. A): All the raindrops hit the surface of the earth with the same constant velocity

R): An object falling through a viscous medium eventually attains a terminal velocity.

1) Both ‘A’ and ‘R’ are true and ‘R’ is the correct explanation of ‘A’

2) Both ‘A’ and ‘R’ are true and ‘R’ is not the correct explanation of ‘A’

3) ‘A’ is true and ‘R’ is false   4) ‘A’ is false and ‘R’ is true

37. A): A spinning cricket ball moving through air is not deflected from its normal trajectory

R): Magnus effect is an application of Bernoulli’s principle

1) Both ‘A’ and ‘R’ are true and ‘R’ is the correct explanation of ‘A’

2) Both ‘A’ and ‘R’ are true and ‘R’ is not the correct explanation of ‘A’

3) ‘A’ is true and ‘R’ is false   4) ‘A’ is false and ‘R’ is true

38. A) : When air is blown between two ping pong balls which are suspended freely they move closer

R) : When air is blown between two ping pong balls the pressure between the balls decreases

1) Both ‘A’ and ‘R’ are true and ‘R’ is the correct explanation of ‘A’

2) Both ‘A’ and ‘R’ are true and ‘R’ is not the correct explanation of ‘A’

3) ‘A’ is true and ‘R’ is false   4) ‘A’ is false and ‘R’ is true

39. **The speeds of air-flow on the upper and lower surfaces of a wing of an aero plane are v_1 and v_2 respectively. It A is the cross-sectional area of the wing and ' ρ ' is the density of air, then the upward lift is**

1) 1/2 ρ A (V_1–V_2)
2) 1/2 ρ A (V_1+V_2)
3) 1/2 ρ A ($V^2{}_1$–$V^2{}_2$)
4) 1/2 ρ A ($V^2{}_1$+$V^2{}_2$)

40. Two solids A and B float in water. It is observed that A floats with half of its volume immersed and B floats with 2/3 of its volume immersed. The ratio of their densities is

1) 4: 3
2) 3: 4
3) 2: 3
4) 3: 2

41. A block of solid insoluble in water weighs 24gm in air and 21gm when completely immersed in water. Its weight when completely immersed in liquid of specific gravity 1.1 is

1) 20.7gm
2) 27.3gm
3) 24gm
4) 3.3gm

42. Volume of the liquid flowing per second through a pipe of diameter d is V. At a point where the radius is d, the velocity of flow is

1) $\frac{V}{d^2}$
2) $\frac{V}{\pi d^2}$
3) $\frac{4V}{\pi d^2}$
4) $\frac{V}{4\pi d^2}$

43. Air streams horizontally across an aeroplane wing of area 3m^2 weighing 250 kg. The air speed is 60 m/s and 45 m/s over the top surface and under the bottom surface respectively. What is the lift on the wing? (Density of air 1.293 g/l)

1) 3000 N
2) 3500N
3) 4000 N
4) 3054 N

44. A large water tank has a hole in its wall near the bottom. the water level above the hole is 4.9m. The horizontal distance from the hole at which the water touches the ground, if the bottom of water tank is 4.9m above the ground

1) 9.8 cm
2) 98 m
3) 9.8 m
4) 980 m

45. A tank full of water has a small hole at its bottom. If one fourth of the tank is emptied in t_1 seconds and the remaining three-fourths of the tank is emptied in t_2 seconds. Then the ratio (t_1/t_2) is

1) $\sqrt{3}$ 2) $\sqrt{2}$ 3) $\frac{1}{\sqrt{2}}$ 4) $\left[\frac{2}{\sqrt{3}}-1\right]$

46. A large tank filled with water to a height "h" is to be emptied through a small hole at the bottom. The ratio of the time taken for the level to fall from h to h/2 and that taken for the level to fall from h/2 to 0 is

1) $\sqrt{2}-1$ 2) $\frac{1}{\sqrt{2}}$ 3) $\sqrt{2}$ 4) $\frac{1}{\sqrt{2}-1}$

47. A large open tank has two holes in the wall. One is a square hole of side L at a depth Y from the top and the other one is a circular hole of radius R at a depth 4Y from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then R is equal to

1) $\frac{L}{\sqrt{2\pi}}$ 2) $2\pi L$ 3) L 4) $\frac{L}{2\pi}$

48. A tank with vertical wall is mounted so that its base is at a height H above the horizontal ground. The tank is filled with water to a depth 'h'. A hole is punched in the side wall of the tank at a depth 'X' below the water surface. To have maximum range of the emerging stream, the value of X is

1) $\frac{H+h}{4}$ 2) $\frac{H+h}{2}$ 3) $\frac{H+h}{3}$ 4) $\frac{3(H+h)}{4}$

49. A water barrel having water upto a depth'd' is placed on a table of height 'h'. A small hole is made on the wall of the barrel at its bottom. If the stream of water coming out of the hole falls on the ground at a horizontal distance 'R' from the barrel, then the value of 'd' is.

1) $\frac{4h}{R^2}$ 2) $4hR^2$ 3) $\frac{R^2}{4h}$ 4) $\frac{h}{4R^2}$

50. A large open top container of negligible mass and uniform cross sectional area A has a small hole of cross sectional area a in its side wall near the bottom. The container is kept over a smooth horizontal floor and contains a liquid of density ρ and mass m_o. Assuming that the liquid starts flowing through the hole A, the acceleration of the container will be

1) $\frac{2ag}{A}$ 2) $\frac{ag}{A}$ 3) $\frac{2Ag}{a}$ 4) $\frac{Ag}{a}$

51. A large block of ice 5 m thick has a vertical hole drilled in it and is floating in a lake. the minimum length of the rope required to draw a bucketful of water through the hole is (density of ice = 900 kg/m^3)

1) 0.5 m 2) 1m 3) 4 m 4) 4.5 m

52. Tanks A and B open at the top contain two different liquids up to certain height in them. A hole is made to the wall of each tank at a depth 'h' from the surface of the liquid. The area of the hole in A is twice that of in B. If the liquid mass flux through each hole is equal, then the ratio of the densities of the liquids respectively, is

1) $\frac{2}{1}$ 2) $\frac{3}{2}$ 3) $\frac{2}{3}$ 4) $\frac{1}{2}$

53. A wind-powered generator converts wind energy into electrical energy. Assume that the generator converts a fixed fraction of the wind energy intercepted by its blades into electrical energy. For wind speed V, the electrical power output will be proportional to

1) V 2) V^2 3) V^3 4) V^4

55. There are two holes one each along the opposite sides of a wide rectangular tank. The cross section of each hole is 0.01 m^2 and the vertical distance between the holes is one meter. The tank is filled with water. The net force on the tank in Newton when the water flows out of the holes is: (density of water is 1000 kg/m^3)

1) 100 2) 200 3) 300 4) 400

56. An ice berg of density 900 kg/m^3 is floating in water of density 1000 kg/m^3. The percentage of volume of ice cube out side the water is

1) 20% 2) 35 % 3) 10% 4) 25%

57. **A piece of copper having an internal cavity weighs 264 gm in air and 221gm in water. The volume of the cavity is (Density of copper = 8.8gm/cc)**

1) 43cc 2) 30cc 3) 13cc 4) 70cc

58. **A hemispherical portion of radius R is removed from the bottom of a cylinder of radius R. The volume of the remaining cylinder is V and its mass is M. It is suspended by a string in a liquid of density ρ where it stays vertical. The upper surface of the cylinder is at a depth h below the liquid surface. The force on the bottom of the cylinder by the liquid is**

1) Mg 2) Mg - V ρ **g** 3) Mg+R^2h ρ g 4) $\rho g(\pi R^2 h + V)$

59. **A vessel of large uniform cross - sectional area resting on a horizontal surface holds two immiscible, non - viscous and incompressible liquids of densities d and 2d each of height H/2. If a small hole is punched on the vertical side of the container at a height h $\left(h < \frac{H}{2}\right)$, the efflux speed of the liquid at the hole is**

1) $\sqrt{2g(H-h)}$ 2) $\sqrt{2g(H-h)}$

3) $\sqrt{\frac{g}{2}(3H-4h)}$ 4) $\sqrt{\frac{g}{2}(4H-3h)}$

60. **Water from a tap emerges vertically down with an initial speed of 1.0ms^{-1}. The cross sectional area of tap is 10x 10^{-5} m^2. Assume that the pressure is constant throughout the stream of water, and that the flow is a steady, the cross sectional area of the steam 0.15m below the tap is**

1) 5.0 x 10^{-4}m^2 2) 1.0 x 10^{-5}m^2 3) 5.0 x 10^{-5}m^2 4) 2.0 x 10^{-5}m^2

KEY

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

HINTS

40. $d = \frac{V_{in}}{V_{toatal}}\rho$

$$\frac{d_A}{d_B} = \frac{V_{in1}}{V_{in2}} = \frac{\frac{V}{2}}{\frac{2V}{3}} = 3:4$$

41. $\rho_l = \frac{W_1 - W_3}{W_1 - W_2}\rho_w$

$$1.1 = \frac{24 - W_3}{24 - 21}\times 1$$

$$1.1 = \frac{24 - W_3}{3}$$

$W_3 = 20.7$ gr

42. $a_1 \upsilon_1 = a_2 \upsilon_2$

$$V = \pi r_2^2 \upsilon_2$$

$$V = \pi d^2 \upsilon_2$$

$$\therefore \upsilon_2 = V / \pi d^2$$

43. $F=\frac{1}{2}\rho(v_2^2-v_1^2)A$

$=\frac{1}{2}\times 1.293(3600-2025)\times 3$

$=\frac{1}{2}\times 1.293\times 1575\times 3=3054$ N

44. $R=2\sqrt{h_1\ h_2}$

Where h_1= height of liquid above the hole

h_2= height of hole from ground

$\therefore R=2\sqrt{4.9\times 4.9}$ = 9.8 m

45. $t\propto\sqrt{h_1}-\sqrt{h_2}$

$t_1\propto\sqrt{h}-\sqrt{\frac{3}{4}h}$

$t_2\propto\sqrt{\frac{3}{4}h}-0$

$\therefore\frac{t_1}{t_2}=\frac{1-\frac{\sqrt{3}}{2}}{\frac{\sqrt{3}}{2}}=\left[\frac{2}{\sqrt{3}}-1\right]$

46. $t\propto\sqrt{h_1}-\sqrt{h_2}$

$t_1\propto\sqrt{h}-\sqrt{\frac{h}{2}}$

$t_2\propto\sqrt{\frac{h}{2}}-0$

$\therefore\frac{t_1}{t_2}=\frac{1-\frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{2}}}=(\sqrt{2}-1)$

47. $Q_1 = Q_2$

$$\therefore a_1 \upsilon_1 = a_2 \upsilon_2$$

$$L^2 \sqrt{2gh_1} = \pi R^2 \sqrt{2gh_2}$$

$$L^2 \sqrt{h_1} = \pi R^2 \sqrt{h_2}$$

$$L^2 \sqrt{y} = \pi R^2 \sqrt{4y}$$

$$\therefore R = \frac{L}{\sqrt{2\pi}}$$

48. Here range is maximum if

H + h - x = x

2x = H + h

$$\therefore x = \frac{H+h}{2}$$

49. $R = 2\sqrt{dh}$

$$R^2 = 4dh$$

$$d = \frac{R^2}{4h}$$

50. $F = a\rho\upsilon^2$

$$Acceleration = \frac{F}{m} = \frac{a\rho(2gl)}{(Al \times \rho)} = \frac{2ag}{A}$$

51. $d = \frac{V_{in}}{V_{total}} \rho$

$$d = \frac{L_{in}}{L_{total}} \rho$$

$$\therefore 900 = \frac{L_{in}}{5} \times 1000$$

L_{in} = 4.5 m and L_{out} = 0.5 m

$\therefore$ Length of rope required = 0.5 m

52. $\left(\frac{m_1}{t}\right)=\left(\frac{m_2}{t}\right)_B$

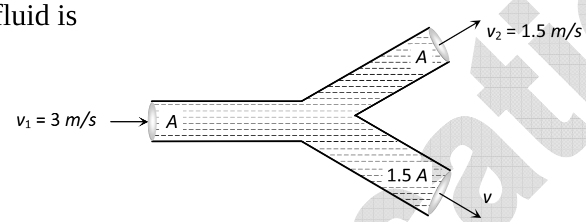
$\rho_1 2A.\upsilon=\rho_2 A.\upsilon$

$\frac{\rho_1}{\rho_2}=\frac{1}{2}$ $\left(\therefore \upsilon=\sqrt{2gh}\right)$

53. $F = A.d\,\upsilon^2$ $\upsilon=\frac{V_t}{A}$ $P=Ad\,\upsilon^3$

$\upsilon^3=\left(\frac{V_t}{A}\right)^3$ $p=Ad\left(\frac{V_t}{A}\right)^3$ $P\propto V_t^3$

54. An incompressible liquid flows through a horizontal tube as shown in the following fig. Then the velocity *v* of the fluid is



1) 3.0 *m/s* 2) 1.5 *m/s*
3) 1.0 *m/s* 4) 2.25 *m/s*

54. (c) If the liquid is incompressible then mass of liquid entering through left end, should be equal to mass of liquid coming out from the right end.

$\therefore M = m_1 + m_2 \Rightarrow Av_1 = Av_2 + 1.5A.v$

$\Rightarrow A\times 3 = A\times 1.5 + 1.5A.v \Rightarrow v = 1\ m/s$

55. $F_1 = 2P_1A = 2(P_0 + h_1\rho g)A$

$F_2 = 2P_2A = 2(P_0 + h_2\rho g)A$

$F = F_2 - F_1$

$F = 2(h_2 - h_1)\rho gA$

$= 2 \times 1 \times 10^{-3} \times 10 \times 0.01 = 200$ N

56. $d = \frac{V_{in}}{V_{total}} \rho$

$\therefore 900 = \frac{V_{in}}{V_{total}} \times 1000$

$\therefore 900 = \frac{V_{in}}{V_{total}} \times 1000$

$V_{out} = \frac{1}{10} V_{total}$

$\therefore$ Fraction $= \frac{1}{10}$

% vol of ice out side water = $\frac{1}{10} \times 100$ = 10 %

57. If a body of outer volume V has cavity volume V_0, then

$V = \frac{W_{air} - W_{wat}}{\rho_W g} \rightarrow 1$

$V - V_0 = \frac{m}{d} \rightarrow 2$

where ρ_w = density of water

m = mass of the body in air

d = density of material of body

$\therefore V = \frac{264g - 221g}{1g} = 43cc \rightarrow 3$

$V - V_0 = \frac{264}{8.8} = \frac{2640}{88} = 30cc \rightarrow 4$

$\therefore V_0 = 13cc$

58. $F_{bottom} - F_{upper\ surface}$ = buyont force

$F_{bottom} = F_{upper\ surface} + buyoutforce.$

= **PA** + $V \rho g$

$= (h\rho g).\pi R^2 + V \rho g$

$= \rho g (\pi R^2 h + V)$

59. From Bernoulli's theorm,

$$P_0 + 0 = P_0 + \frac{H}{2}dg + \left(\frac{H}{2} - h\right)2dg + \frac{1}{2}(2d)\upsilon^2$$

$$\therefore \upsilon^2 = \frac{Hg}{2} + Hg - 2hg$$

Or $\upsilon = \sqrt{\left(\frac{3H}{2} - 2h\right)g} = \sqrt{\frac{g}{2}(3H - 4h)}$

60. $P_1 + \frac{1}{2}\rho\upsilon_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho\upsilon_2^2 + \rho g h_2$

$$g(h_1 - h_2) = \frac{(\upsilon_2^2 - \upsilon_1^2)}{2}$$

$$\upsilon_2^2 - \upsilon_1^2 = 29(0.15)$$

$$\upsilon_2 = 2m/s$$

And $a_1\upsilon_1 = a_2\upsilon_2$

$$10 \times 10^{-5} \times 1 = a_2 \times 2$$

$a_2 = 5 \text{ x } 10^{-5} \text{ m}^2$