FLUIDS AND PROPERTIES OF MATERIAL

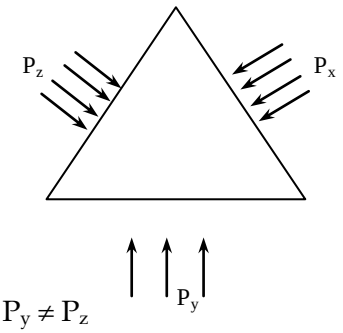
1. A cylinder is filled with liquid of density d up to a height h. If the beaker is at rest the mean pressure at the walls is:
   (a) zero (b) hdg
   (c) hdg/2 (d) 2hdg
2. A body weight 160 g in air 130 g in water and 13.6 g in oil. The specific gravity of oil is:
   (a) 0.8 (b) 1.6
   (c) 1.3 (d) 3.2
3. The working principle of pressure gauges for measuring static pressure of a field flowing in a pipe is based on:
   (a) Bernoulli's theorem
   (b) Poiseuille's law
   (c) Stokes' law
   (d) Hooke's law
4. A body in immersed in water filled in a beaker if the system falls freely, the upthrust on the body is equal to:
   (a) zero
   (b) weight of body in air
   (c) weight of body in water
   (d) half the weight of body in air
5. A piece of solid weight 120 g in air, 80 g in water and 60 g in a liquid, then the relative density of the solid and that of liquid are respectively:
   (a) 3, 2 (b) 2, $\frac{3}{4}$
   (c) 3, $\frac{3}{2}$ (d) 4, 3
6. A 700 g solid cube having an edge of length 10 cm floats in water. The volume of cube outside water is:
   (a) 2.4 cm^3 (b) 4.8 cm^3
   (c) 300 cm^3 (d) 500 cm^3
7. An object of density of 12 g/cm^3 is weighted with brass weights of density of 8g/cm^3 by a physical balance. If the density of air is 12×10^{-3} g/cm^3 then the percentage error in weighting is:
   (a) 0.005% (b) 0.001%
   (c) 0.05% (d) 0.01%
8. A body weighs 40 g in air. If its volume is 10 cc in water it will weigh:
   (a) 30 g (b) 40 g
   (c) 50 g (d) none of the above
9. A hydrogen balloon released on the moon would:
   (a) climb up with an acceleration of 9.8 m/s^2
   (b) climb up with an acceleration of 9.8×6 m/s^2
   (c) neither climb nor fall
   (d) fall with an acceleration of $\frac{9.8}{6}$ m/s^2
10. Between layers of liquid in relative motion viscosity introduces:
    (a) tangential forces
    (b) radial forces
    (c) intermolecular forces
    (d) adhesive forces
11. The surface tension of a liquid is 10^8 dyne/cm. It is equivalent to:
    (a) 10^4 N/m (b) 10^5 N/m
    (c) 10^7 N/m (d) 10^6 N/m
12. When a drop of oil is allowed to touch the surface of water drop of oil will:
    (a) mix with water
    (b) retain its spherical shape
    (c) spread out in very thin film over the surface
    (d) spread out in very thin film at the bottom

13. When a soap bubble is charged then:
(a) it contracts
(b) it expands
(c) it does not undergo any change in size
(d) none of the above

14. If two soap bubbles of different radii are connected by a tube:
(a) air flows from the bigger bubble to the smallest bubble till the size become equal
(b) air flows from bigger bubble to the surface bubble till the sizes are interchanged
(c) air flows from the smaller bubble to the bigger
(d) there is no flow of air

15. Which of the following is/are correct about pressure?
(a) Pressure at a point acts equally in all directions
(b) Liquid at rest exerts lateral pressure which decreases with depth
(c) Pressure acts normally on any area whatever orientation the area may be held
(d) Both (a) and (c) are correct

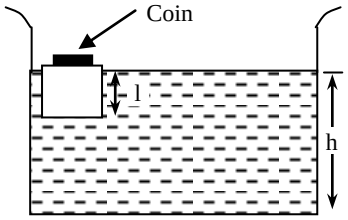
16. A triangular element of the liquid is shown in the figure. P_x, P_y and P_z represent the pressures on the element of the liquid. Then:



(a) $P_x = P_y \neq P_z$
(b) $P_x = P_y = P_z$
(c) $P_x \neq P_y \neq P_z$
(d) $P_x^2 + P_y^2 + P_z^2 =$ constant

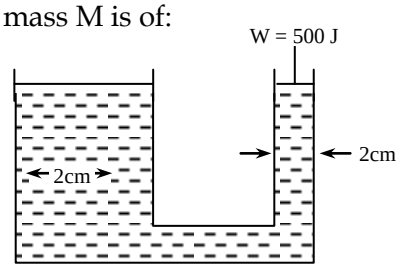
17. The pressure at the bottom of a tank of liquid is not proportional to:
(a) the density of the liquid
(b) the area of the liquid surface
(c) the height of the liquid
(d) the acceleration

18. A wooden block with a coin placed on its top, floats in water as shown in figure. The distance l and h are shown there. After sometime the coin falls into the water. Then:



(a) l decreases and h increase
(b) l increases and h decreases
(c) both l and h increases
(d) both l and h decrease

19. The hydraulic press shown in the figure is used or raise the mass M through a height of 5.0 mm by performing 500 J of work at the small piston. The diameter of the large piston is 10 cm while that of the smaller one is 2 cm. The mass M is of:



(a) 10^4 kg (b) 10^3 kg
(c) 100 kg (d) 10^5 kg

20. In each heart beat, a heart pumps 80 ml of blood at an average pressure of 100 mm of Hg. What will be the power output of the heart? (Assume 60 heart beats per minute)
(a) 1 W (b) 2.75 W
(c) 1.06 W (d) 0.5 W

21. A liquid is contained in a vertical U-tube. The total length of the liquid column inside the tube is l. When the liquid is in equilibrium, the liquid is just pushed down slightly. If one of the arms of U-tube are released, the entire liquid column will starts a periodic motion. Then:

(a) the motion is the SHM

(b) the motion is SHM

(c) if it undergoes SHM, the time period will be $2\pi\sqrt{\left(\frac{l}{g}\right)}$

(c) If it undergoes SHM, the timer period will be $2\pi\sqrt{\left(\frac{l}{2g}\right)}$

22. When equal volumes of two substances are mixed, the specific gravity of mixture is 4. When equal weight of the same substances are mixed, the specific gravity of the mixture is 3. The specific gravity of the two substances would be:

(a) 6 and 2 (b) 3 and 4

(c) 2.5 and 3.5 (d) 5 and 3

23. If the weight of a body in vacuum is w and w_1 and w_2 are weight when it is immersed in liquids of specific gravities ρ_1 and ρ_2 respectively, then the relation among w, w_1 and w_2 is:

(a) $w = \frac{w_1\rho_2 + w_2\rho_1}{w_1 + w_2}$ (b) $w = \frac{w_1\rho_2 - w_2\rho_1}{\rho_2 - \rho_1}$

(c) $w = \frac{w_1\rho_1 + w_2\rho_2}{\rho_1 + \rho_2}$ (d) $w = \frac{w_1\rho_2 + w_2\rho_1}{\rho_1 + \rho_2}$

24. On a horizontal surface, an open vessel containing water is given a constant acceleration a. Due to accelerated motion, the free surface of water gets sloped with horizontal at an angle θ given by:

(a) $\theta = \tan^{-1}\left(\frac{a}{g}\right)$ (b) $\theta = \tan^{-1}\left(\frac{g}{a}\right)$

(c) $\theta = \sin^{-1}\left(\frac{a}{g}\right)$ (d) $\theta = \cos^{-1}\left(\frac{g}{a}\right)$

25. The force of buoyancy on an immersed body is:

(a) due to weight of the body

(b) due to the pressure difference between upper surface and lower surface of the body

(c) due to atmosphere pressure

(d) both (a) and (c) are correct

26. A body weight 5 N in air and 2 N when immersed a liquid. The buoyant force is:

(a) 2 N (b) 3 N

(c) 5 N (d) 7 N

27. In air, a metallic sphere with an internal cavity weighs 40 g and in water it weight 20 g. What is the volume of cavity if the density of material with cavity be 8 g/cm^3?

(a) zero

(b) 15 cm^3

(c) 5 cm^3

(d) 20 cm^3

28. A dog is sitting in a boat which is floating in a point. If the dog drinks some water from the pond then:

(a) the level of water in the pond decreases

(b) the level of water in the pond increases

(c) the level of water in the pond first increases, then decreases

(d) the level of water in the pond remains unchanged

29. A piece of ice is floating in water. The fraction of volume of the piece of ice outside the water is:

(Given : density of ice = 900 kg/m^3 and density of water = 1000 kg/m^3)

(a) 0.21 (b) 0.01

(c) 0.1 (d) 0.9

30. A block weighs 15 N and 12 N in air and water respectively. When it is immersed in another liquid, it weighs 13 N, then the relative density of the block is:

(a) 5 (b) 6

(c) 10 (d) 2

31. If the potential energy of the molecule is given by $U = \frac{A}{r^6} - \frac{B}{r^{12}}$. Then at equilibrium position its potential energy is equal to

(a) $-A^2/4B$ (b) $A^2/4B$

(c) $2A/B$ (d) $A/2B$

32. Two wires of the same material and length but diameter in the ratio 1 : 2 are stretched by the same force. The ratio of potential energy per unit volume for the two wires when stretched will be

(a) 1 : 1 (b) 2 : 1

(c) 4 : 1 (d) 16 : 1

33. The density of ice is x gram/litre and that of water is y gram/litre. What is the change in volume when m gram of ice melts ?

(a) mx y (x – y) (b) m/(y – x)

(c) $m\left(\frac{1}{y} - \frac{1}{x}\right)$ (d) (y – x)/x

34. 100 drops of water each of radius r, density ρ, surface tension S join together to form a single drop and the energy released raises the temperature of the drop. If J is the Joule's mechanical equivalent of heat, what is the rise in temperature ?

(a) 100 S/Jr (b) 10 S/Jr

(c) S/Jr (d) none of these

35. 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) $7.6 \times 10^{-6}\ \pi$ J (b) $15.2 \times 10^{-6} \times \pi$ J

(c) $1.9 \times 10^{-6} \times \pi$ J (d) $1 \times 10^{-4} \times \pi$ J

36. Soap solution bubbled having radius $\frac{1}{\sqrt{\pi}}$ cm is expanded to a bubble of radius $\frac{2}{\sqrt{\pi}}$ cm. If the surface tension of soap solution is 30 dyne/cm, the work done is

(a) 180 ergs (b) 360 ergs

(c) 720 ergs (d) 960 ergs

37. The radius of a soap bubble is r. The surface tension of soap solution is T. Keeping temp. constant, the radius or the soap bubble is doubled. The energy necessary for this will be

(a) $24\ \pi\ r^2\ T$ (b) $8\ \pi\ r^2\ T$

(c) $12\ \pi\ r^2\ T$ (d) $16\ \pi\ r^2\ T$

38. A film of water is formed between two parallel wires each 10 cm long and at separation 0.5 cm. The work required to increase the distance between them by 1 mm will be (surface tension of water = 72 dyne/cm)

(a) 1.44×10^{-2} J (b) 1.44×10^{-5} J

(c) 1.44×10^{-3} J (d) 1.44×10^{-7} J

39. A capillary tube of radius R and length L is connected in series with another tube of radius R/2 and length L/4. If the pressure difference across the two tubes takes together is P, then the ratio of pressure difference across the first tube to that across the second tube is

(a) 1 : 4 (b) 1 : 1

(c) 4 : 1 (d) 2 : 1

40. A ball of mass m and radius r is released in a viscous liquid. The value of its terminal velocity is proportional

(a) $\frac{1}{r}$ (b) $\frac{m}{r}$

(c) $\sqrt{\frac{m}{r}}$ (d) m only

41. Two drops of the same radius are falling through air with a steady velocity of 5 cm per sec. If the two drops coalesce, the terminal velocity would be

(a) 10 cm per sec

(b) 2.5 cm per sec

(c) $5 \times (4)^{1/3}$ cm per sec

(d) $5 \times \sqrt{3}$ cm per sec

42. Water is flowing through a horizontal pipe. If pressure at one point is 2 cm of Hg and velocity of flow of the liquid is 32 cm/sec and at another point, velocity of flow is 40 cm/s, the pressure at this point is ?

(a) 1.45 cm of Hg (b) 1.98 cm of Hg

(c) 1.67 cm of Hg (d) 1.34 cm of Hg

43. A rain drop of radius 1.5 mm, experience a drag force $F = (2 \times 10^{-5} v)$ N, while falling through air from a height 2 km, with a velocity v. The terminal velocity of the rain drop will be nearly (use $g = 10$ m/s^2)

(a) 200 m/s (b) 80 m/s

(c) 7 m/s (d) 3 m/s

44. A cylindrical drum, open at the top, contains 15 litres of water. It drains out through a small opening at the bottom. 5 litres of water comes out in time t_1, the next 5 litres in further time t_2 and the least 5 litres in further time t_3. Then

(a) $t_1 < t_2 < t_3$ (b) $t_1 > t_2 > t_3$

(c) $t_1 = t_2 = t_3$ (d) $t_2 > t_1 = t_3$

45. Total area of cross-section is 0.25 m^2. If blood is flowing at the rate of 100 cm^3/s then the average velocity of flow of blood through capillaries (in mm/s) is

(a) 0.4 (b) 4

(c) 25 (d) 400

46. Water stands at a depth H in a tank whose side walls are vertical A hole is made on one of the walls at a depth h below the water surface. For what value of h, the emerging stream of water strikes the ground at the maximum range

(a) H/5 (b) H/4

(c) H/2 (d) H

47. A small sphere of mass m is dropped from a height. After it has fallen 100 m, it has attained its terminal velocity and continues of fall at that speed. The work done by air friction against the sphere during the first 100 m of fall is

(a) greater than the work done by air friction in the second 100 m

(b) less than the work done by air friction in the second 100 m

(c) equal to 100 mg

(d) greater than 100 mg

48. A length of wire increases by 1% on suspending 2 kg wt. from it. The linear strain in the wire is

(a) 0.01 (b) $\frac{1}{1000}$

(c) 0.1 (d) $\frac{1}{10000}$

49. Two water pipes P and Q having diametes 2×10^{-2} m and 4×10^{-2} m respectively are joined in series eith the main supply line of water. The velocity of water flowing in pipe P is

(a) 4 times that of Q (b) 2 times that of Q

(c) 1/2 times that of Q(d) 1/4 times that of Q

50. For maximum extension with given load for a wire with same value of Young's modulus of elasticity, which is true ?

(a) ℓ = 300 cm, d = 10 cm

(b) ℓ = 200 cm, d = 5 cm

(c) ℓ = 100 cm, d = 2 cm

(d) ℓ = 50 cm, d = 0.5 cm

ANSWERS KEY

1	C	11	B	21	D	31	C	41	B
2	A	12	C	22	A	32	D	42	D
3	A	13	A	23	B	33	A	43	C
4	A	14	C	24	A	34	D	44	C
5	C	15	D	25	B	35	A	45	B
6	C	16	B	26	B	36	A	46	C
7	A	17	B	27	B	37	D	47	A
8	A	18	D	28	D	38	A	48	B
9	D	19	A	29	C	39	A	49	A
10	A	20	C	30	A	40	B	50	B