1. A block of mass 4 kg and volume 5×10^{-4} m^3 is suspended by a spring balance in a lift which is accelerating. The apparent weight shown by the spring balance is 3 kg. Now the block is immersed in water in a container inside the lift. The apparent weight in kg shown by the spring balance is
   (a) 2.375 (b) 2.625
   (c) 2.5 (d) 3.125

2. A ball of mass 1 kg falls from a height of 5m above the free surface of water. The relative density of the solid ball is $s = \frac{2}{3}$. The ball travels a distance of 2m under water and becomes stationary. The work done by the resistive forces of water is
   (a) −50 J (b) −20 J
   (c) −40 J (d) −30 J

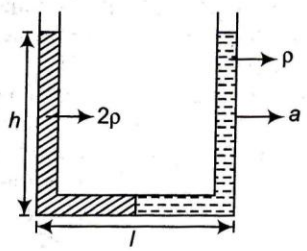
3. A cubical block of wood of specific gravity 0.5 and chunk of concrete of specific gravity 2.5 are fastened together. The ratio of the mass of wood to the mass of concrete, which makes the combination to float with its entire volume submerged under water is
   (a) 1/5 (b) 1/3 (c) 3/5 (d) 2/3

4. A cylinder of mass M and density d_1 hanging from a string, is lowered into a vessel of cross-sectional area A, containing a liquid of density d_2 ($d_2 < d_1$) until it is fully immersed. The increase in pressure at the bottom of the vessel is
   (a) $\frac{Md_2g}{d_1A}$ (b) $\frac{Mg}{A}$ (c) $\frac{Md_1g}{d_2A}$ (d) zero

5. Two identical cylindrical vessels, each of base area A, have their bases at the same horizontal level. They contain a liquid of density ρ. In one vessel the height of the liquid is h_1 and in the other h_2 ($> h_1$). When the two vessels are connected, the word done by gravity in equalizing the levels is
   (a) $2\rho Ag(h_2 - h_1)^2$ (b) $\rho Ag(h_2 - h_1)^2$
   (c) $\frac{1}{2}\rho Ag(h_2 - h_1)^2$ (d) $\frac{1}{4}\rho Ag(h_2 - h_1)^2$

6. A small ball of density ρ is immersed in a liquid of density $\sigma(\sigma > \rho)$ to a depth h and then released. The height above the surface of water up to which the ball will jump is
   (a) $\frac{\sigma h}{\rho}$ (b) $\left(\frac{\sigma h}{\rho} - 1\right) h$
   (c) $\left(1 - \frac{\sigma h}{\rho}\right) h$ (d) $\frac{\rho h}{\sigma}$

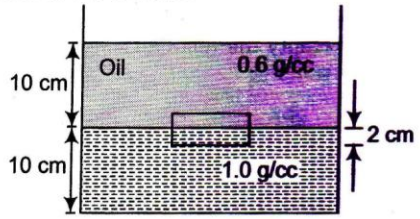
7. A U-tube of base length l filled with same volume of two liquids of densities ρ and 2ρ is moving with an acceleration a on the horizontal plane. If the height difference between the two surfaces (open to atmosphere) becomes zero, then height h is given by



   (a) $\frac{al}{g}$ (b) $\frac{3al}{2g}$
   (c) $\frac{2al}{3g}$ (d) $\frac{al}{2g}$

8. A body of volume V and density ρ is initially submerged in a nonviscous liquid of density $\sigma(>\rho)$. If it is rises by itself through a height h in the liquid. Its kinetic energy will
   (a) increase by $hV(\sigma - \rho)g$
   (b) increase by $hV(\rho + \sigma)g$
   (c) increase by $\frac{hV\rho g}{\sigma}$
   (d) decrease by $\frac{hV\rho g}{\sigma}$

9. A cubical block of side 10 cm floats at the interface of an oil and water. The pressure above that of atmosphere at the lower face of the block is

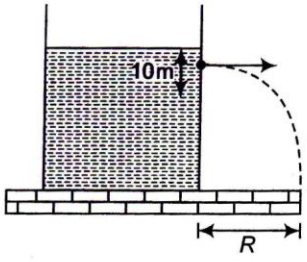


   (a) 200 N/m^2 (b) 680 N/m^2
   (c) 400 N/m^2 (d) 800 N/m^2

10. A sphere of solid material of specific gravity 8 has a concentric spherical cavity and just sinks in water. Then the ratio of the radius of the cavity to the outer radius of the sphere must be
    (a) $\frac{\sqrt[3]{3}}{2}$ (b) $\frac{\sqrt[3]{5}}{2}$
    (c) $\frac{\sqrt[3]{7}}{2}$ (d) $\frac{2}{\sqrt[3]{7}}$

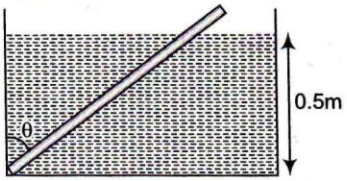
11. A large block of ice 10 cm thick with a vertical hole drilled through it is floating in a lake. The minimum length of the rope required to scoop out a bucket full of water through the hole is (density of ice = 0.9 g/cm^3)
    (a) 0.5 m (b) 1.0 m
    (c) 1.2 m (d) 1.8 m

12. A large tank is filled with water (density = 10^3 kg/m^3). A small hole is made at a depth 10 m below water surface. The range of water issuing out of the hole is R on groung. What extra pressure must be applied on the water surface so that the range become $2R$ (take 1 atm = 10^5 Pa and $g = 10$ m/s^2)



(a) 1 atm (b) 2 atm
(c) 4 atm (d) 3 atm

13. A wooden plank of length 1m and uniform cross-section is hinged at one end to the bottom of a tank as shown. The tank is filled with water upto a height of 0.5m. The specific gravity of the plank is 0.5. The angle θ made by the plank in equilibrium position is

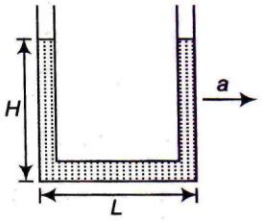


(a) 30° (b) 45°
(c) 60° (d) 90°

14. An open U-tube contains mercury. When 11.2 cm of water is poured into one of the arms of the tube, how high does the mercury rise in the other arm from its initial level?
(a) 0.82 cm
(b) 1.35 cm
(c) 0.41 cm
(d) 2.32 cm

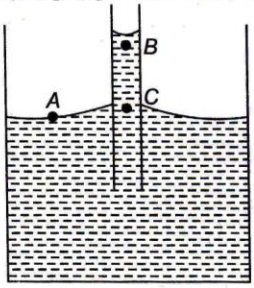
15. A body of density ρ is dropped from rest from a height h into a lake of density $\sigma(\sigma > \rho)$. The maximum depth the body sinks inside the liquid is (neglect viscous effect of liquid)
(a) $\frac{h\rho}{\sigma-\rho}$ (b) $\frac{h\sigma}{\sigma-\rho}$
(c) $\frac{h\rho}{\sigma}$ (d) $\frac{h\sigma}{\rho}$

16. A liquid stands at the plane level in U-tube when at rest. If areas of cross-section of both the limbs are equal, what will be the difference in heights h of the liquid in the two limbs of U-tube, when the system is given an acceleration a in horizontal direction towards right as shown?



(a) $\frac{g}{a}\frac{L^2}{H}$ (b) $\frac{La}{g}$
(c) $\frac{L^2}{H}\frac{a}{g}$ (d) $\frac{Lg}{a}$

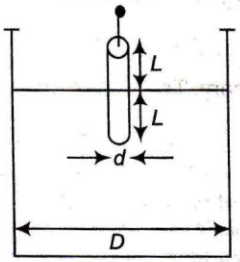
17. A capillary tube is dipped in a liquid. Let pressure at point A, B and C be p_A, p_B, p_C respectively then



(a) $p_A = p_B = p_C$ (b) $p_A = p_B < p_C$
(c) $p_A = p_C < p_B$ (d) $p_A = p_C > p_B$

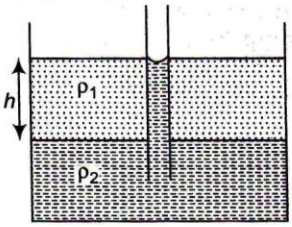
18. A small ball (mass m) falling under gravity in a viscous medium experiences a drag force proportional to the instantaneous speed u such that $F_{drag} = ku$. Then the terminal speed of ball within viscous medium is
(a) $\frac{k}{mg}$ (b) $\frac{mg}{k}$
(c) $\sqrt{\frac{mg}{k}}$ (d) None of these

19. 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/h, then the top of the candle will



(a) remain at the same height
(b) fall at the rate 1 cm/h
(c) fall at the rate of 2 cm/h
(d) go up at the rate of 1 cm/h

20. A container has two immiscible liquids of densities ρ_1 and ρ_2 ($> \rho_1$). A capillary tube of radius r is inserted in the liquid so that its bottom reaches upto the denser liquid. The denser liquid rises in the capillary and attains a height h from the interface of the liquids, which is equal to the column length of the lighter liquid. Assuming angle of contact to be zero, the surface tension of heavier liquid is



(a) $2\pi r\rho_2 gh$ (b) $\frac{\rho_2 rgh}{2}$
(c) $\frac{r}{2}(\rho_2 - \rho_1)gh$ (d) $2\pi r(\rho_2 - \rho_1)gh$

21. A spherical object of mass 1kg and radius 1m is falling vertically downward inside a viscous liquid in a gravity free space. At a certain instant the velocity of the sphere is 2 m/s. If the coefficient of viscosity of the liquid is $\frac{1}{6\pi}$ SI units, then velocity of ball will become 0.5 m/s after a time.
(a) ln 4 s (b) 2 ln 4 s
(c) 3 ln 4 s (d) 3 ln 2s

22. If a capillary tube of radius r is immerse in water, the mass of water risen in capillary is M. If the radius of capillary be doubles, the mass of water risen in the capillary will be
(a) $M/2$ (b) M (c) $2M$ (d) $4M$

23. A wooden block of mass 8 kg is tied to a string attached to the bottom of the tank. In the equilibrium the block is completely immersed in water. If relative density of wood is 0.8 and $g = 10\ ms^{-2}$, the tension T, in the string is
(a) 120 N (b) 100 N
(c) 80 N (d) 20 N

24. A metal ball immersed in alcohol weighs w_1 at 0°C and w_2 at 59°C. The coefficient of cubical expansion of the metal is less than that of alcohol. Assuming that the density of the metal is large compared to that of alcohol, it can be shown that
(a) $w_1 > w_2$ (b) $w_1 = w_2$
(c) $w_1 < w_2$ (d) $w_1 = (w_1/2)$

25. The volume of an air bubble becomes three times as it rises from the bottom of a lake to its surface. Assuming temperature to be constant and atmospheric pressure to be 75 cm of Hg and the density of water to be 1/10 of the density of the mercury, the depth of the lake is
(a) 5 m (b) 10 m
(c) 15 m (d) 20 m

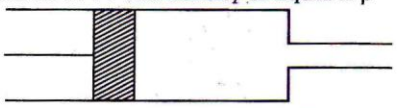
26. A barometer kept in an elevator reads 76 cm when it is at rest. If the elevator goes up with increasing speed, the reading will be
(a) zero (b) 76 cm
(c) > 76 cm (d) <76 cm

27. The surface energy of a liquid drop is E. It is sprayed into 1000 equal droplets. Then its surface energy becomes
(a) E (b) 10 E
(c) 100 E (d) 1000 E

28. An open tank containing nonviscous liquid to a height of 5 m is placed over the ground. A heavy spherical ball falls from height 40 m over the ground in the tank. Ignoring air resistance find the height to which ball will go back. Collision between ball and bottom of tank is perfectly elastic
(a) 45 m (b) 35 m
(c) 40 m (d) 20 m

29. 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 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 holes are the same. Then R is equal to
(a) $L/\sqrt{2\pi}$ (b) $2\pi L$ (c) L (d) $L/2\pi$

30. A pump is designed as a horizontal cylinder with a piston area A and an outlet orifice arranged near the axis of the cylinder. Find the velocity of outflow of liquid from pump, if the piston moves with a constant velocity under the action of a constant force F. The density of liquid is ρ



(a) $\sqrt{\frac{F}{A\rho}}$ (b) $\sqrt{\frac{2F}{A\rho}}$
(c) $\sqrt{\frac{A\rho}{F}}$ (d) $\sqrt{\frac{A\rho}{2F}}$

31. A tank is filled up to a height $2H$ with a liquid and is placed on a platform of height H from the ground. The distance x from the ground where a small hole is punched to get the maximum range R is
(a) H (b) 1.25 H
(c) 1.5 H (d) 2 H

32. A piece of steel has a weight w in air, w_1 when completely immersed in water and w_2 when completely immersed in an unknown liquid. The relative density (specific gravity) of liquid is
(a) $\frac{w - w_1}{w - w_2}$ (b) $\frac{w - w_2}{w - w_1}$
(c) $\frac{w_1 - w_2}{w - w_1}$ (d) $\frac{w_1 - w_2}{w - w_2}$

33. Two cylinders of same cross-section and length L but made of two materials of densities d_1 and d_2 are connected together to a form a cylinder of length $2L$. The combination floats in a liquid of density d with a length $L/2$ above the surface of the liquid. If $d_1 < d_2$, then
(a) $d_1 < \frac{3}{4}d$ (b) $\frac{d}{2} > d_1$
(c) $\frac{d}{4} > d_1$ (d) $d_1 > \frac{d}{4}d$