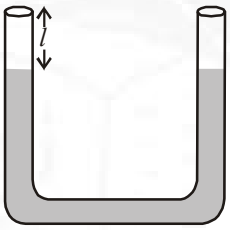
PHYSICS

1. The three vessels shown in figure have same base area. Equal volumes of a liquid are poured in the three vessels. The force on the base will be

1) Maximum in vessel A 2) Maximum in vessel B

3) Maximum in vessel C 4) Equal in all the vessels

2. A U tube having identical limbs contains mercury (density ρ_m) to a level as shown in the figure. If the left limb is filled to the top with water (ρ_w), then the rise of mercury level in the right limb will be



1) $\frac{l}{2\rho_m}$ 2) $\frac{l\rho_w}{2\rho_m+\rho_w}$ 3) $\frac{\rho_m l}{\rho_w}$ 4) $\frac{l\rho_w}{2\rho_m-\rho_w}$

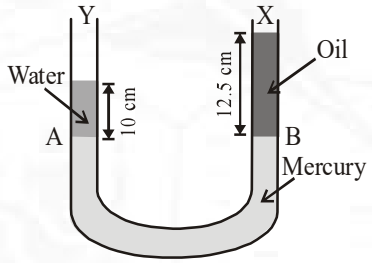
3. The height of mercury column in a simple barometer is h. As the tube is inclined with the vertical at an angle α, the length of mercury column along the length of the tube will become

1) $h\cos\alpha$ 2) $\frac{h}{\cos\alpha}$ 3) $h\sin\alpha$ 4) $\frac{h}{\sin\alpha}$

4. A U-tube having identical limbs is partially filled with water. An immiscible oil having density 0.8 g/cc is poured into one side until water rises by 25 cm on the other side. Find the difference in the levels of the free surfaces of the liquids

1)125 cm 2)75cm 3)22.5 cm 4)12.5 cm

5. A U-tube contains water and oil 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 oil in the other as shown. What is the relative density of oil ?



1) 0.8 2)1.0 3)1.25 4)1.5

6. A tank with a square base of area 2 m^2 is divided into two compartments by a vertical partition in the middle. There is a small hinged door of face area 20 cm^2 at the bottom of the partition. Water is filled in one compartment and an acid of relative density 1.5 in the other, both to a height of 4m. If g = 10 m/s^2, the force on hinged door by fluids is (nearly)

   1) 10 N 2)20N 3)40 N 4)80 N

7. A wooden cube just floats inside water when a 0.2 kg mass is placed on it. When the mass is removed, the cube is 2 cm above the water level, what is the edge of the cube ?

   1) 0.5 cm 2)12.4cm 3)10 cm 4)12 cm

8. A body floats with one-third of its volume outside the water. In another liquid, it floats with one-fourth of its volume inside the liquid. If density of water is 1 g/cc, then the density of the liquid is

   1) $\frac{5}{4}g/cc$ 2) $\frac{3}{5}g/cc$ 3) $\frac{7}{3}g/cc$ 4) $\frac{8}{3}g/cc$

9. An object of specific gravity ρ is hung from a massless string. The tension in string is T. The object is immersed in water so that one half of its volume is submerged. The new tension in the string is

   1) $\left(\frac{2\rho+1}{2\rho}\right)T$ 2) $\left(\frac{2\rho-1}{2\rho}\right)T$ 3) $\left(\frac{\rho-1}{\rho}\right)T$ 4) $\left(\frac{\rho+1}{\rho}\right)T$

10. A metallic sphere has a cavity inside it. The sphere weighs 40 g wt in air and 20 g wt in water. If density of the material of the sphere is 8 g/cm^3 then the volume of the cavity will be
    1) 100 cm^3 2)15cm^3 3)25 cm^3 4)30 cm^3
11. A body having relative density 0.9 and volume 18 cc has some iron pieces pierced into it. If it floats just completely immersed in water, then the mass of iron pieces present in it is [Neglect the volume of iron pieces]
    1)4 g 2)3.2 g 3)2.4 g 4)1.8 g
12. 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 upward with an acceleration, the length of the spring
    1)Increases 2)Decreases
    3)Remains constant 4)May increase or decrease
13. When a large bubble rises from the bottom of a lake to the surface, its radius doubles. One atmosphere is equal to that of a column of water of height H. The depth of lake is (assume expansion of bubble to be an isothermal process)(neglect surface tension)
    1)H 2)2H 3)7H 4)8H

14. Let W be the work done, when a bubble of volume V when it is formed from a given solution. How much work is required to be done to form a new bubble of volume 2 V from same nature of solution?

1)W 2)2W 3)$2^{1/3}$ W 4)$4^{1/3}$ W

15. Two small drops of mercury, each of radius R, coalesce to form a single large drop. The ratio of the total surface energies before and after the change is

1)$1 : 2^{1/3}$ 2)$2^{1/3}:1$ 3)2 : 1 4)1 : 2

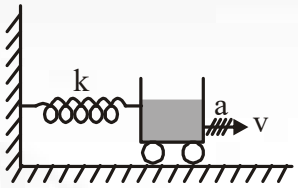
16. A 20 cm long capillary tube is dipped in water. The water raises upto 8 cm. If the entire arrangement is put in a freely falling elevator, the length of water column is capillary tube will be

1)8 cm 2)10cm 3)4 cm 4)20 cm

17. 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 other is a circular hole of radius R at a depth 4y from the top. When tank is completely filled with water, the quantities of water flowing out per second from both holes are same. Then R is equal to

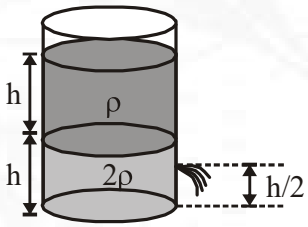
1)$\frac{L}{\sqrt{2\pi}}$ 2)$2\pi L$ 3)L 4)$\frac{L}{2\pi}$

18. Area of orifice is a. Due to ejection of water of density ρ at a constant speed, the equilibrium compression in spring is x. The speed of ejection of water is



1) $\sqrt{\frac{xk}{\rho a}}$ 2) $2\sqrt{\frac{xk}{\rho a}}$ 3) $\sqrt{\frac{xk}{2\rho a}}$ 4) $4\sqrt{\frac{xk}{\rho a}}$

19. A vessel is filled with two different liquids of densities ρ and 2ρ respectively as shown in the figure. The velocity of flow of liquid through a hole at height $\frac{h}{2}$ from bottom is



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

20. What is the barometric height of a liquid of density 3.4 g cm^{-3} at a place, where that for mercury barometer is 70 cm ? [Density of mercury is 13.6 g/cc]

1)70 cm 2)140cm 3)280 cm 4)340 cm

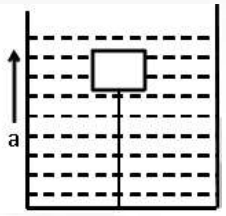
21. There is a horizontal film of soap solution. On it a thread is placed in the form of a loop. The film is pierce inside the loop and the thread becomes a circular loop of radius R. If the surface tension of the loop be T, then tension in the thread will be

1) $\pi R^2 T$ 2) $2RT$ 3) RT 4) $\frac{\pi R^2}{T}$

22. A solid spherical ball of radius r and relative density 0.5 is floating in equilibrium in a large tank of water. The work done in slowly pushing the ball down so that whole of it is just immersed in water is: (where ρ is the density of water)

1) $\frac{5}{12}\pi r^4 \rho g$ 2) $0.5\rho rg$ 3) $\frac{4}{3}\pi r^3 \rho g$ 4) $\frac{2}{3}\pi r^4 \rho g$

23. The tension in a string holding a solid block below the surface of a liquid (where $(\rho_{liquid} > \rho_{block})$ as in shown in the figure is T when the system is at rest.



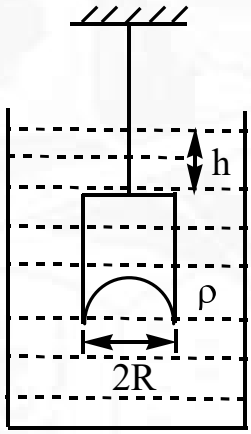
Then what will be the tension in the string if the system has upward acceleration a?

1) $T\left(1-\frac{a}{g}\right)$ 2) $T\left(1+\frac{a}{g}\right)$ 3) $T\left(\frac{a}{g}-1\right)$ 4) $\frac{a}{g}T$

24. A completely submerged solid sphere of volume V and density ρ floats at the interface of two immiscible liquids of densities ρ_1 and ρ_2 respectively. If $\rho_1 < \rho < \rho_2$, then the ratio of volume of the parts of the sphere in upper and lower liquid is,

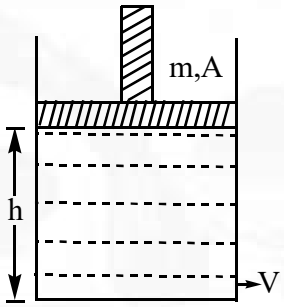
1) $\frac{\rho-\rho_1}{\rho_2-\rho}$ 2) $\frac{\rho_2-\rho}{\rho-\rho_1}$ 3) $\frac{\rho+\rho_1}{\rho+\rho_2}$ 4) $\frac{\rho+\rho_2}{\rho+\rho_1}$

25. 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) $Mg - V\rho g$ 3) $Mg + \pi R^2 h\rho g$ 4) $\rho g\left(V + \pi R^2 h\right)$

26. A cylindrical vessel contains a liquid of density ρ upto a height h. The liquid is closed by a piston of mass m and area of cross–section A. There is a small hole at the bottom of the vessel. The speed v with which the liquid comes out of the hole is:



1) $\sqrt{2gh}$ 2) $\sqrt{2\left(gh+\frac{mg}{\rho A}\right)}$ 3) $\sqrt{2\left(gh+\frac{mg}{A}\right)}$ 4) $\sqrt{2gh+\frac{mg}{A}}$

27. Air is streaming past a horizontal airplane wings such that its speed is $120 ms^{-1}$ at the upper surface and $90 ms^{-1}$ at the lower surface. If the wing is 10m long and 2m wide and density of air is $1.3 kgm^{-3}$, the net lift on wings will be (in N)

1) 8.19×10^{4} 2) 4.095×10^{5} 3) 4.095×10^{4} 4) 16.38×10^{4}

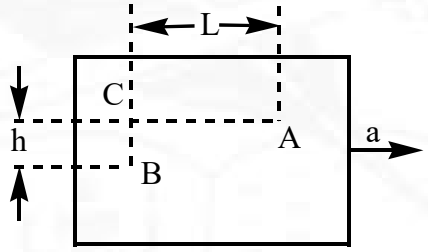
28. An open glass tube is immersed in mercury in such a way that a length of 8 cm extends above the mercury level. The open end of the tube is now closed and sealed. The tube is lifted vertically up by additional height of 46 cm. What will be the length of the air column above mercury in the tube now? (Atmospheric pressure = 76 cm of Hg)

1) 38 cm 2) 6 cm 3) 16 cm 4) 22 cm

29. If h is the height of capillary rise and r be the radius of capillary tube, then which of the following relation will be correct for a given liquid?

1) $hr = \text{constant}$ 2) $\frac{h}{r^2} = \text{constant}$ 3) $hr^2 = \text{constant}$ 4) $\frac{h}{r} = \text{constant}$

30. A completely filled sealed tank has a liquid of density ρ and moves with an acceleration 'a', as shown in the figure. The difference in pressure between the points A and B is:



1) $h\rho g$ 2) $L\rho a$ 3) $h\rho g - L\rho a$ 4) $h\rho g + L\rho a$