PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

MECHANICAL PROPERTIES OF FLUIDS

Physics

1. The density of water at the surface of ocean is ρ . If the bulk modulus of water is B, then the density of ocean water at depth, when the

pressure at a depth is αp_0 and p_0 is the atmospheric pressure is

A. $\frac{\rho B}{B-(n-1)P_0}$

B. $\frac{\rho B}{B+(n-1)P_0}$

C. $\frac{\rho B}{B-nP_0}$

D. $\frac{\rho B}{B+nP_0}$

Answer:

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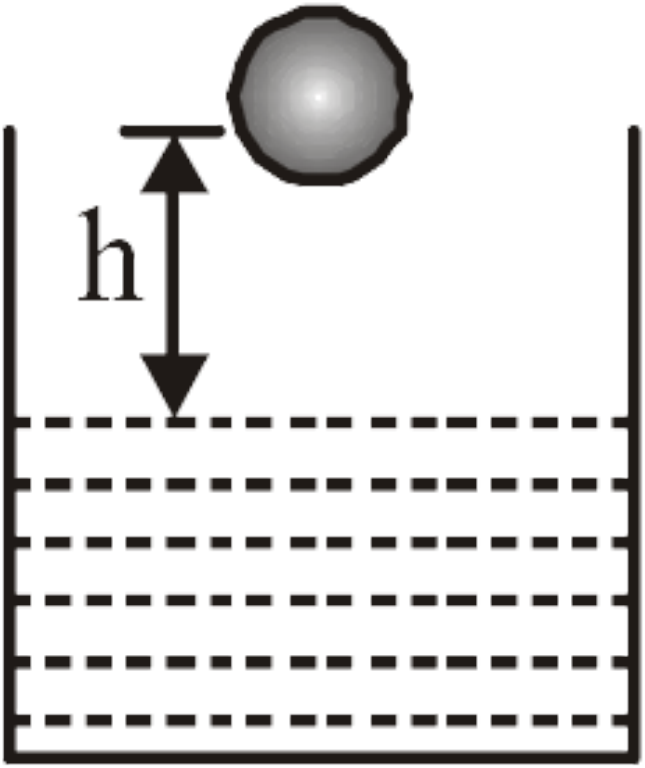
2. A ball of radius r and density r falls freely under gravity through a distance h before entering water. Velocity of ball does not change even on entering water. If viscosity of

water is η the value of h is given by



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A. $\frac{2}{9}r^2\left(\frac{1-\rho}{\eta}\right)g$

B. $\frac{2}{81}r^2\left(\frac{\rho-1}{\eta}\right)g$

C. $\frac{2}{81}r^4\left(\frac{\rho-1}{\eta}\right)g$

D. $\frac{2}{9}r^4\left(\frac{\rho-1}{\eta}\right)g$

Answer:

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3. Two parallel glass plates are dipped partly in the liquid of denstiy 'd' keeping them vertical. If the distance between the plates is 'x', Surface tension is T and angle of contact is θ then ries of liquid between the plates due to capillary will be

A. $\frac{\mathrm{T}\cos\theta}{xd}$

B. $\frac{2\mathrm{T}\cos\theta}{xdg}$

C. $\frac{2\mathrm{T}}{xd\cos\theta}$

D. $\frac{\mathrm{T}\cos\theta}{xdg}$

Answer:

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4. A liquid is allowed to flow into a tube of truncated cone shape. Identify the correct statement from the following

A. The speed is high at the wider end and high at the narrow end

B. The speed is low at the wider end and high at the narrow end

C. The speed is same at both ends in a streamline flow

D. The liquid flows with uniform velocity in the tube

Answer:

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5. A wide vessel with small hole in the bottom is filled with water and kerosene, Neglecting viscosity, the velocity of water flow v, if the thickness of water layer is H_1 and that of kerosene layer is H_2 is (density of water ρ_1 / and that of kerosene is ρ_2 /.

A. $[2g(h_1 + h_2)]^{1/2}$

B. $[2g(h_1\rho_1 + h_2\rho_2)]^{1/2}$

C. $[2g(h_1 + h_2(\rho_2/\rho_1))]^{1/2}$

D. $[2g(h_1 + h_2(\rho_1 / \rho_2))]^{1/2}$

Answer:

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6. A capillary tube of radius r is immersed vertically in a liquid such that liquid rises in it to height h (less than the length of the tube). Mass of liquid in the capillary tube is m. If radius of the capillary tube is increased by

50%, then mass of liquid that will rise in the tube, is

A. $\frac{2}{3}\mathrm{m}$

B. $\frac{4}{9}\mathrm{m}$

C. $\frac{3}{2}\mathrm{m}$

D. $\frac{9}{4}\mathrm{m}$

Answer:

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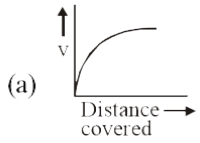
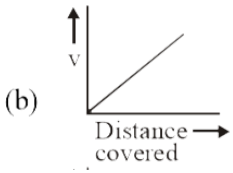
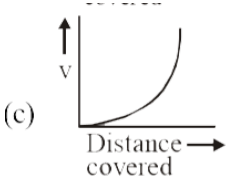
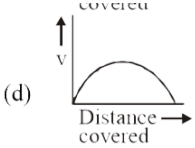
7. A lead shot of a 1mm diameter falls through a long column of glycerine.The variation of its velocity v with distance covered is represented by,

A. 

B. 

C. 

D. 

Answer:

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8. Two mercury drops (each of radius r) merge to form a bigger drop. The surface energy of the bigger drop, if T is the surface tension is

A. $4\pi r^2 T$

B. $2\pi r^2 T$

C. $2^{8/3}\pi r^2 T$

D. $2^{5/3}\pi r^2 T$

Answer:

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9. Wax is coated on the inner wall of a capillary tube and the tube is then dipped in water. Then, compared to the unwaxed capillary, the angle of contact θ and the height h upto which water rises change. These changes are :

A. θ increases and h also increases

B. θ decreases and h also decreases

C. θ increases and h decreases

D. θ decreases and h increases

Answer:

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10. A rain drop of radius 0.3 mm has a terminal velocity in $\text{air} = 1\text{m/s}$. The viscosity of air is 8×10^{-5} poise. The viscous force on it is

A. $45.2 \times 10^{-4}\text{dyne}$

B. 101.73×10^{-5}dyne

C. 16.95×10^{-4}dyne

D. 16.95×10^{-5}dyne

Answer:

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11. A water tank of height $10m$, completely filled with water is placed on a level ground. It has two holes one at $3m$ and the other at $7m$ form its base. The water ejecting from

A. both the holes will fall at the same spot

B. upper hole will fall farther than that from the lower hole

C. upper hole will fall closer than that from the lower hole

D. more information is required

Answer: A

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12. Two capillary of length L and 2L and of radius R and 2R are connected in series. The net rate of flow of fluid through them will be (given rate to the flow through single capillary, $\left(\mathrm{X}=\frac{\pi \mathrm{PR}^4}{8 \eta \mathrm{L}}\right)$

A. $\frac{8}{9} X$

B. $\frac{9}{8} X$

C. $\frac{5}{7} X$

D. $\frac{7}{5} X$

Answer:

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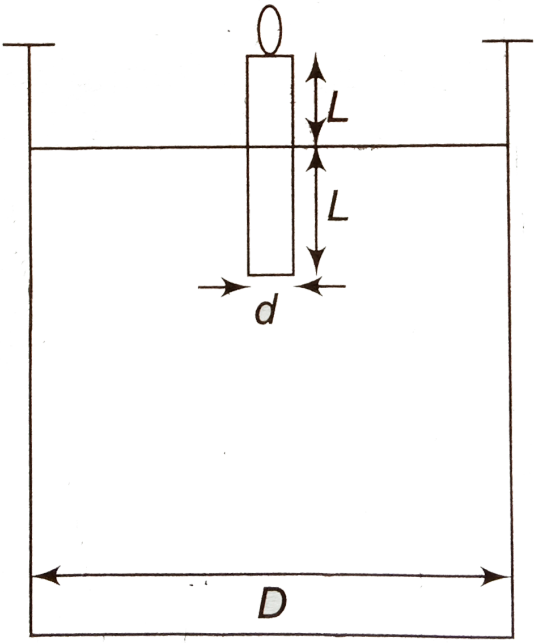
13. A candle of diameter d is floating on a liquid in a cylindrical container of diameter $D(D << d)$ as shown in figure. If is burning at the rate of $2cm/h$ then the top of the

candle will :



A. remain at the same height

B. fall at the rate of $1\ \mathrm{cm/hour}$

C. fall at the rate $2\ \mathrm{cm/hour}$

D. go up at the rate of $1\ \ \mathrm{cm/hour}$

Answer:

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14. An isolated and charged spherical soap bubble has a radius 'r' and the pressure inside is atmospheric. If 'T' is the surface tension of soap solution, then charge on drop is:

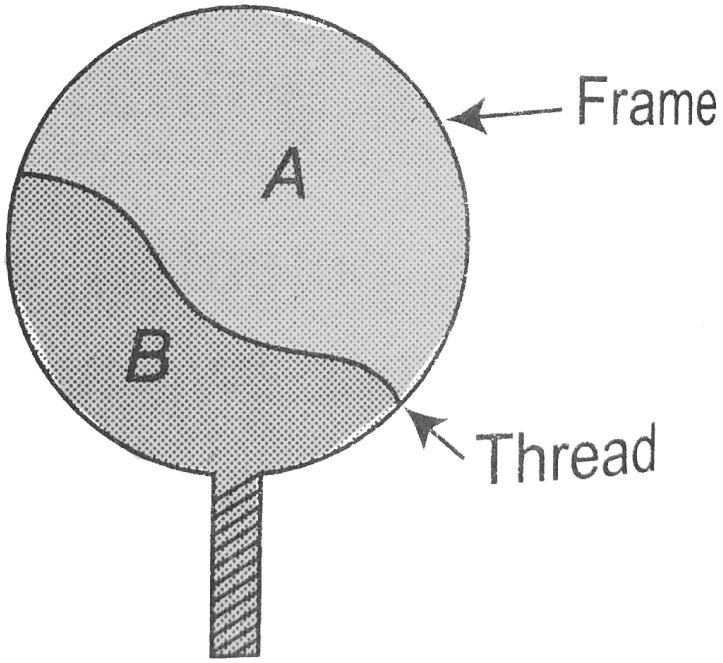
A. 8

B. 9

C. 7

D. 2

Answer:



15.

A thread is tied slightly loose to a wire frame as in figure and the frame is dipped into a soap solution and taken out . The frame is comletely covered with the film. When the portion A puntured with a pin The thread.

A. becomes concave towards A

B. becomes convex towards A

C. remains in the initial position

D. either (a) or (b) depending on the size of

A w.r. t. B

Answer:

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16. Which of the following expressions represents the excess of pressure inside the soap bubble?

A. $P_i - P_\circ = \frac{s}{r}$

B. $P_i - P_\circ = \frac{2s}{r}$

C. $P_i - P_\circ = \frac{2s}{r} + h\rho g$

D. $P_i - P_\circ = \frac{4s}{r}$

Answer:

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17. A spherical solild of volume V is made of a material of density ρ_1. It is falling through a liquid of density $\rho_2(\rho_2 < \rho_1)$. Assume that the liquid applies a viscous froce on the ball that is proportional ti the its speed v, i.e., $F_{viscous} = -kv^2(k > 0)$. The terminal speed of the ball is

A. $\sqrt{\frac{Vg(\rho_1 - \rho_2)}{k}}$

B. $\frac{\mathrm{Vg}\rho_1}{k}$

C. $\sqrt{\left(V\frac{g(\rho_1)}{k}\right)}$

D. $\frac{Vg(\rho_1 - \rho_2)}{k}$

Answer:

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18. Select the correct statements from the following.

A. Bunsen burner and sprayers work on Bernoulli's principle

B. Blood flow in arteries is explained by Bernoulli's principle

C. A siphon works on account of atmospheric pressure

D. All are correct

Answer:

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19. The wattability of a surface by a liquid depends primarily on

A. surface tension

B. density

C. angle of contact between the surface and the liquid

D. viscosity

Answer:

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20. The relative velocity of two parallel layers of water is 8 cm/sec. If the perpendicular distance between the layers is 0.1 cm, then velocity gradient will be

A. $80/\text{sec}$

B. $60/\text{sec}$

C. $50/\text{sec}$

D. $40/\text{sec}$

Answer:

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21. Choose the correct statement

A. Terminal velocities of rain drops are proportional to square of their radii

B. Water proof agents decrease the angle of contact between water and fibres

C. Detergents increase the surface tension of water

D. Hydraulic machines work on the principle of Torricelli's law

Answer:

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22. When a ball is released from rest in a very long column of viscous. Liquid its downwards acceleration is a (just after release). Then its acceleration when it has acquired two third of the maximum velocity:

A. 2

B. 3

C. 4

D. 5

Answer:

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23. A ring is cut from a platinum tube $8.5cm$ internal and $8.7cm$ external diameter. It is supported horizontally from the pan of a

balance, so that it comes in contact with the water in a glass vessel. If an extra $3.103g.\ f.$ is required to pull it away from water, the surface tension of water is

A. 72dyne cm^{-1}

B. 70.80dyne cm^{-1}

C. 63.35dyne cm^{-1}

D. 60dyne cm^{-1}

Answer:

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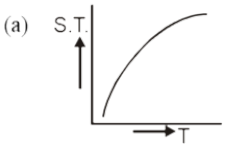
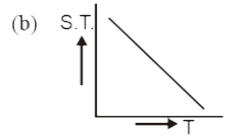
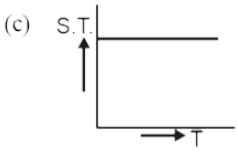
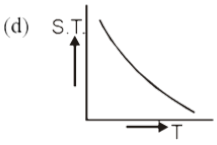
24. Which graph represents the variation of surface tension with temperature over small temperature ranges for water?

A. 

B. 

C. 

D. 

Answer:

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25. When a large bubble rises from the bottom of a lake to the surface its radius doubles. If atmospheric pressure is equal to that of column of water height H then the depth of lake is

A. H

B. 2H

C. 7H

D. 8H

Answer: C

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26. What is the velocity v of a metallic ball of radius r falling in a tank of liquid at the instant when its acceleration is one-half that of a freely falling body ? (The densities of metal

and of liquid are r and s respectively, and the viscosity of the liquid is η).

A. $\frac{r^2 g}{9\eta}(\rho - 2\sigma)$

B. $\frac{r^2 g}{9\eta}(2\rho - \sigma)$

C. $\frac{r^2 g}{9\eta}(\rho - \sigma)$

D. $\frac{2r^2 g}{9\eta}(\rho - \sigma)$

Answer:

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27. Two pieces of metals are suspended from the arms of a balance and are found to be in equilibrium when kept immersed in water. The mass of one piece is 32 g and its density $8\mathrm{g\,cm^{-3}}$. The density of the other is $5\mathrm{g\ per\ cm^3}$. Then the mass of the other is

A. 28g

B. 35g

C. 21g

D. 33.6g

Answer:

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28. A block of material of specific gravity 0.4 is held submerged at a depth of 1m in a vessel filled with water. The vessel is accelerated upwards with acceleration of $a_o = g/5$. If the block is released at t = 0, neglecting viscous effects, it will reach the water surface at t equal to $\left(g = 10\frac{m}{s^2}\right)$:

A. 0.60s

B. 0.33s

C. 3.3s

D. 1.2s

Answer:

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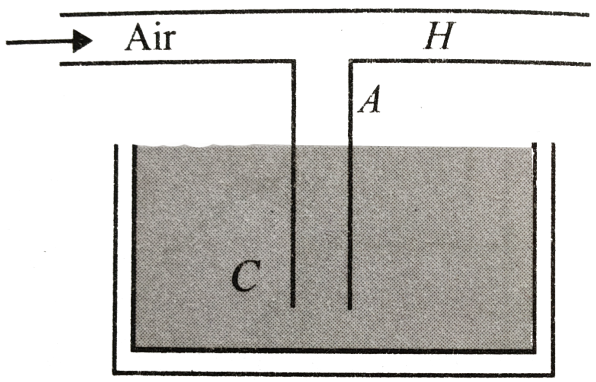
29. Figure shows a capillary tube C dipped in a liquid that wets it. The liquid rises to a point A . If we blow air through the horizontal tube H,

what will happen to the liquid column in the capillary tube?



A. $= H$

B. $> H$

C. $< H$

D. zero

Answer:

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30. A small spherical ball falling through a viscous medium of negligible density has terminal velocity v. Another ball of the same mass but of radius twice that of the earlier falling through the same viscous medium will have terminal velocity

A. v

B. $v/4$

C. $v/2$

D. 2v

Answer:

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31. Two non-mixing liquids of densities ρ and $(n > 1)$ are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The

cylinder floats with its axis vertical and length $pL(p < 1)$ in the denser liquid. The density d is equal to :

A. $\{1 + (n + 1)p\}\rho$

B. $\{2 + (n + 1)p\}\rho$

C. $\{2 + (n - 1)p\}\rho$

D. $\{1 + (n - 1)p\}\rho$

Answer:

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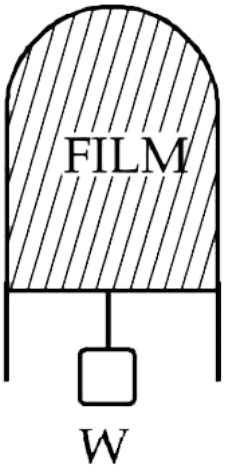
32. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of $1.5 \times 10^{-2} N$ (see figure). The length of the slider is 30cm and its weight negligible. The surface tension of the liquid film is



A. $0.0125 \mathrm{Nm}^{-1}$

B. $0.1\mathrm{Nm}^{-1}$

C. $0.05\mathrm{Nm}^{-1}$

D. $0.025\mathrm{Nm}^{-1}$

Answer:

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33. Two liquids of densities d_1 and d_2 are flowing in identical capillaries under same pressure difference. If t_1 and t_2 are the time taken for the flow of equal quantities of liquid,

then the ratio of coefficients of viscosities of liquids must be

A. $\frac{d_1 t_1}{d_2 t_2}$

B. $\frac{t_1}{t_2}$

C. $\frac{d_2 t_2}{d_1 t_1}$

D. $\sqrt{\frac{d_1 t_1}{d_2 t_2}}$

Answer:

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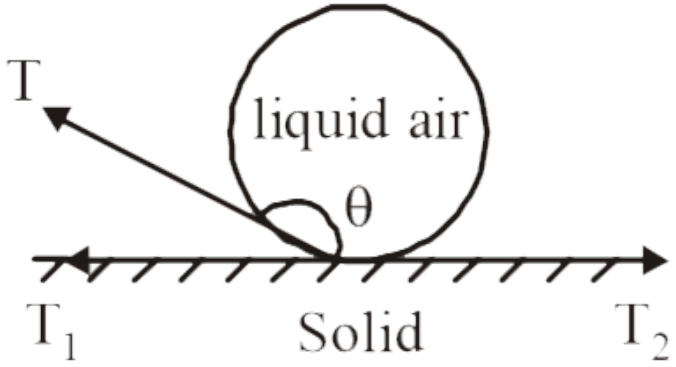
34. Let T_1 be surface tension between solid and air, T_2 be the surface tension between solid and liquid and T be the surface tension between liquid and air. Then in equilibrium, for a drop of liquid on a clean glass plate, the correct relation is (θ is angle of contact)



A. $\cos\theta = \dfrac{T}{T_1 + T_2}$

B. $\cos\theta = \frac{T}{T_1 - T_2}$

C. $\cos\theta = \frac{T_1 + T_2}{T}$

D. $\cos\theta = \frac{T_1 - T_2}{T}$

Answer:

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35. A uniform rod of density ρ is placed in a wide tank containing a liquid of density $\rho_0 (\rho_0 > \rho)$. The depth of liquid in the tank is half the length of the rod. The rod is in

equilibrium, with its lower end resting on the bottom of the tank. In this position the rod makes an angle θ with the horizontal.

A. $\sin\theta = \frac{1}{2}\sqrt{\rho_0/\rho}$

B. $\sin\theta = \frac{1}{2}.\frac{\rho_0}{\rho}$

C. $\sin\theta = \sqrt{\rho_0/\rho}$

D. $\sin\theta = \rho_0/\rho$

Answer: A

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36. A spherical ball of iron of radius 2 mm is falling through a column of glycerine. If densities of glycerine and iron are respectively $1.3 \times 103 \mathrm{kg/m}^3$ and$8 \times 103 \mathrm{kg/m}^3$. η for glycerine = $0.83 \mathrm{Nm}^{-2}$ sec, then the terminal velocity

A. 0.7m/s

B. 0.07m/s

C. 0.007m/s

D. 0.0007m/s

Answer:

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37. A film of water is formed between two straight parallel wires each $10cm$ long and at a seperation of $0.5cm$. Calculate the work required to increase $1mm$ distance between the wires. Surface tension of water $= 72 \times 10^{-3} N/m.$

A. 36erg

B. $288 \mathrm{erg}$

C. $144 \mathrm{erg}$

D. $72 \mathrm{erg}$

Answer:

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38. A water proofing agent chages the angle of contact from

A. from obtuse to acute.

B. from acute to obtuse

C. from obtuse to $\frac{\pi}{2}$.

D. from acute to $\frac{\pi}{2}$.

Answer:

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39. A thin metal disc of radius r floats on water surface and bends the surface downwards along the perimeter making an angle θ with vertical edge of the disc of the disc. If the disc

dispplaces a weight of water W and surface tension of water is T, then the weight of metal disc is

A. $2\pi rT + W$

B. $2\pi rT\cos\theta - W$

C. $2\pi rT\cos\theta + W$

D. $W - 2\pi rT\cos\theta$

Answer:

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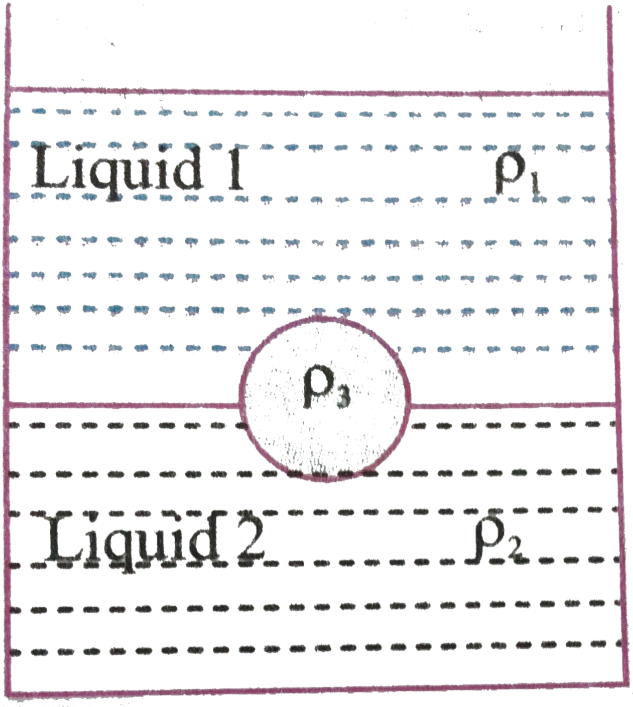

40.

A jar filled with two non-mixing liquid 1 and 2 having densities ρ_1 and ρ_2 respectively. A solid ball, made of a material of density ρ_3 is dropped in the jar. It come to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_2 and ρ_3?

A. $\rho_3 < \rho_1 < \rho_2$

B. $\rho_1 > \rho_3 > \rho_2$

C. $\rho_1 < \rho_2 < \rho_3$

D. $\rho_1 < \rho_3 < \rho_2$

Answer: D

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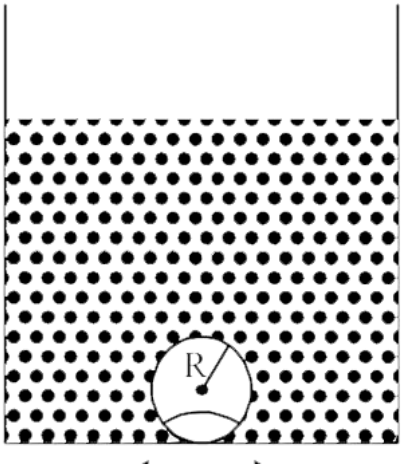
41. On heating water, bubbles being formed at the bottom of the vessel detach and rise. Take the bubbles to be spheres of radius R and

making a circular contact of radius r with the bottom of the vessel. If $r << R$ and the surface tension of water is T, value of r just before bubbles detach is: (density of water is ρ_w)



A. $R^2\sqrt{\frac{2\rho wg}{3T}}$

B. $R^2\sqrt{\frac{\rho wg}{6T}}$

C. $R^2\sqrt{\frac{\rho wg}{T}}$

D. $R^2\sqrt{\frac{3\rho wg}{T}}$

Answer:

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42. The lift of an air plane is based on

A. Torricelli's theorem

B. Bernoulli's theorem

C. Law of gravitation

D. conservation of linear momentum

Answer:

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43. The cylindrical tube of a spray pump has radius R, one end of which has n fine holes, each of radius r. If the speed of the liquid in the tube is V, the speed of the ejection of the liquid through the holes is:

A. $\frac{VR^2}{nr^2}$

B. $\frac{VR^2}{n^3r^2}$

C. $\frac{V^2R}{nr}$

D. $\frac{VR^2}{n^2r^2}$

Answer:

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44. A drop of liquid of density ρ is floating half-immersed in a liquid of density d. If σ is the surface tension the diameter of the drop of the liquid is

A. $\sqrt{\frac{3T}{g(3\rho-\sigma)}}$

B. $\sqrt{\frac{6T}{g(2\rho-\sigma)}}$

C. $\sqrt{\frac{3T}{g(2\rho-\sigma)}}$

D. $\sqrt{\frac{3T}{g(4\rho-3\sigma)}}$

Answer:

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