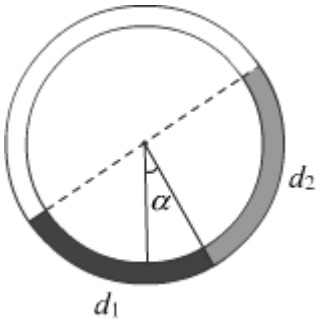
Mechanical Properties of Fluids

Q.No.1: There is a circular tube in a vertical plane. Two liquids that do not mix, and of densities d_1 and d_2, are filled in the tube. Each liquid subtends an angle of 90° at the centre. The radius joining their interface makes an angle α with vertical. The ratio $\frac{d_1}{d_2}$ is

JEE



A. $\frac{1+\tan\alpha}{1-\tan\alpha}$

B. $\frac{1+\sin\alpha}{1-\cos\alpha}$

C. $\frac{1+\sin\alpha}{1-\sin\alpha}$

D. $\frac{1+\cos\alpha}{1-\cos\alpha}$

Q.No.2: 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 then closed and sealed and the tube is raised vertically by additional 46 cm. What will be length of the air column above mercury in the tube now? (Atmospheric pressure = 76 cm of Hg)

A. 38 cm

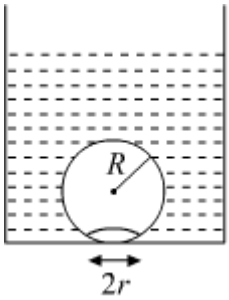
B. 6 cm

C. 16 cm

D. 22 cm

Q.No.3: On heating water, bubbles being formed at the bottom of the vessel

detach and rise. Consider 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 the bubbles detach is (density of water is ρ_w)



A. $R^2\sqrt{\frac{\rho_w g}{T}}$

B. $R^2\sqrt{\frac{3\rho_w g}{T}}$

C. $R^2\sqrt{\frac{\rho_w g}{3T}}$

D. $R^2\sqrt{\frac{\rho_w g}{6T}}$

Q.No.4:

Assume that a drop of liquid evaporates by decrease in its surface energy, so that its temperature remains unchanged. What should be the minimum radius of the drop of this to be possible? The surface tension is T, density of liquid is ρ and L is its latent heat of vaporization.

JEE 2013

A. ρL/T

B. $\sqrt{T/\rho L}$

C. T/ρL

D. 2T/ρL

Q.No.5: A liquid of density ρ is coming out of a hose pipe of radius a with horizontal speed v and hits a mesh. 50% of the liquid passes through the mesh unaffected. 25% looses all of its momentum and 25% comes back with the same speed. The resultant pressure on the mesh will be: **JEE 2019**

A. $\frac{1}{4}\rho v^2$

B. $\frac{3}{4}\rho v^2$

C. $\frac{1}{2}\rho v^2$

D. ρv^2

Q.No.6: A hydraulic press can lift 100 kg when a mass 'm' is placed on the smaller piston. It can lift _____ kg when the diameter of the larger piston is increased by 4 times and that of the smaller piston is decreased by 4 times keeping the same mass 'm' on the smaller piston. **JEE 2021**

Q.No.7: A large number of water drops, each of radius r, combine to have a drop of radius R. If the surface tension is T and mechanical equivalent of heat is J, the rise in heat energy per unit volume will be **JEE 2021**

A. $\frac{2T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

B. $\frac{3T}{rJ}$

C. $\frac{3T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

D. $\frac{2T}{rJ}$

Q.No.8: In order to determine the Young's Modulus of a wire of radius 0.2 cm (measured using a scale of least count = 0.001 cm) and length 1 m (measured using a scale of least count = 1 mm), a weight of mass 1 kg (measured using a scale of least count = 1 g) was hanged to get the elongation of 0.5 cm (measured using a scale of least count 0.001 cm). What will be the fractional error in the value of Young's Modulus determined by this experiment? **JEE 2021**

A. 1.4%

B. 0.14%

C. 9%

D. 0.9%

Q.No.9: What will be the nature of flow of water from a circular tap, when its flow rate increased from 0.18 L/min to 0.48 L/ min? The radius of the tap and viscosity of water are 0.5 cm and 10^{-3} Pa s, respectively.
(Density of water : 10^3 kg/m^3) **JEE 2021**

A. Steady flow to unsteady flow
B. Remains turbulent flow
C. Unsteady to steady flow
D. Remains steady flow

Q.No.10: Consider a water tank as shown in the figure. It's cross-sectional area is 0.4 m^2. The tank has an opening B near the bottom whose cross-section area is 1 cm^2. A load of 24 kg is applied on the water at the top when the height of the water level is 40 cm above the bottom, the velocity of water coming out the opening B is v ms^{-1}.
The value of v, to the nearest integer, is _____.
[Take value of g to be 10 ms^{-2}] **JEE 2021**