ezyEXAMSolution

JEE MAINS LEVEL

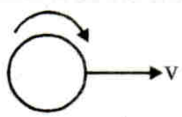
PHYSICS – Fluids

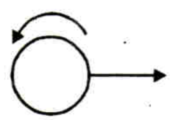
Practice Paper – 01

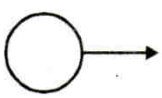
1. As a bubble comes from the bottom of a lake to the top, its radius

(A) Increases (B) Decreases (C) Does not change (D) Becomes zero

2. To get the maximum flight, a ball must be thrown as

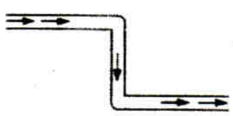
(A) 

(B) 

(C) 

(D) Any of (A), (B) and (C)

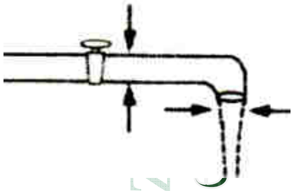
3. The tube shown is of uniform cross-section. Liquid flows through it at a constant speed in the direction shown by the arrows. The liquid exerts on the tube



(A) a net force to the right (B) a net force to the left

(C) a clockwise torque (D) an anticlockwise torque

4. Water coming out of the mouth of a tap and falling vertically in streamline flow forms a tapering column, i.e., the area of cross-section of the liquid column decreases as it moves down. Which of the following is the most accurate explanation for this?



(A) As the water moves down, its speed increase and hence its pressure decreases. It is then compressed by the atmosphere

(B) Falling water tries to reach a terminal velocity and hence reduces the area of cross-section to balance upward and downward force

(C) The mass of water flowing past any cross-section must remain constant. Also, water is almost incompressible. Hence, the rate of volume flow must remain constant. As this is equal to velocity × area, the area decreases as velocity increases

(D) The surface tension causes the exposed surface area of the liquid to decrease continuously.

5. A cylindrical drum, open at the top, contains 30 litres of water. It drains out through a small opening at the bottom. 10 litres of water comes out in time t, the next 10 litres in a further time t_2 and the last 10 litres in a 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) $t_2 > t_1 = t_3$

6. The valve V in the bent tube is initially kept closed. Two soap bubbles A (smaller) and B (larger) are formed at the two open ends of the tube. V is now opened, and air can flow freely between the bubbles.

V

A B

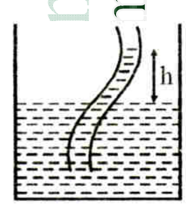
(A) There will be no changes in the sizes of the bubbles

(B) The bubbles will become of equal size

(C) A will become smaller and B will become larger

(D) The sizes of the two bubbles will become interchanged

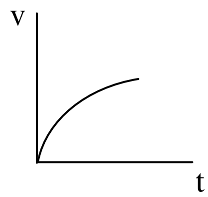
7. Water rises in a straight capillary tube upto a height of 5 cm when held vertical in water. If the tube is bent as shown in figure then the height of water column in it will be

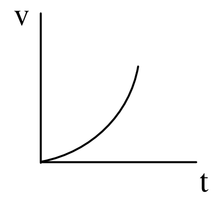


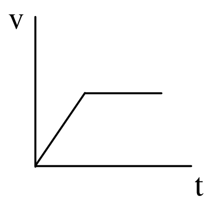
(A) 5 cm (B) less than 5 cm

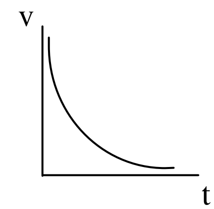
(C) more than 5 cm (D) 5 cos α

8. A piece of cork starts from rest at the bottom of a lake and floats up. Its velocity v is plotted against time t. Which of the following best represents the resulting curve?

(A) 

(B) 

(C) 

(D) 

9. When cooking oil is heated in frying pan, the oil moves around in the pan more easily when it is hot. The main reason for this is that with rise in temperature, there is a decrease in

(A) surface tension (B) viscosity

(C) angle of contact (D) density

10. A tank with vertical walls is mounted so that its base is at a height H above the horizontal ground. The tank is filled with water to the depth h. A hole is punched in the side wall of the tank at a depth x below the water surface. To have maximum range of the emerging stream, the value of x is

(A) $\frac{H+h}{4}$ (B) $\frac{H+h}{2}$ (C) $\frac{H+h}{3}$ (D) $\frac{3(H+h)}{4}$

11. The work done in increasing the volume of a soap bubble of radius r to 27 times will be, if the surface tension of soap solution is T

(A) $27\pi r^2 T$ (B) $54\pi r^2 T$ (C) $32\pi r^2 T$ (D) $64\pi r^2 T$

12. The excess pressure inside first soap bubble is 3 times that inside the second bubble. Then the ratio of volumes of the first and the second bubbles is

(A) 1 : 3 (B) 1 : 9 (C) 1 : 27 (D) 3 : 1

13. Water is rises to a height h_1 in a capillary tube in a stationary lift. If the lift moves up with uniform acceleration it rises to a height h_2, then acceleration of the lift is

(A) $\left[\frac{h_2 - h_1}{h_2}\right]g$ (B) $\left[\frac{h_2 - h_1}{h_1}\right]g$ (C) $\left[\frac{h_1 - h_2}{h_1}\right]g$ (D) $\left[\frac{h_1 - h_2}{h_2}\right]g$

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

(A) (1/r) only (B) m/r (C) $(m/r)^{1/2}$ (D) m only

15. Viscosity is the property by virtue of which a liquid

(A) occupies minimum surface area

(B) offers resistance for the relative motion between its layers

(C) becomes spherical in shape

(D) tends to gain its deformed position

16. For an ideal fluid, viscosity is

(A) zero (B) infinity (C) finite but small (D) unity

17. A liquid of density ρ and coefficient of viscosity η, flows with velocity v through a tube of diameter D. A quantity $R = \frac{\rho VD}{\eta}$ determines whether the flow will be streamlined or turbulent. R has the dimension of

(A) velocity (B) acceleration (C) force (D) none of these

18. Coefficient of viscosity of a gas

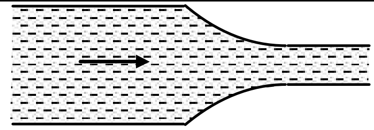
(A) increases with increase of temperature

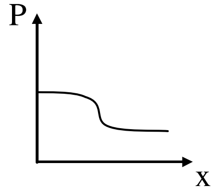
(B) decreases with increase of temperature

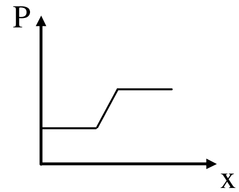
(C) remains constant with increase of temperature

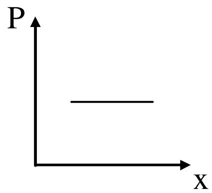
(D) may increase or decrease with increase of temperature

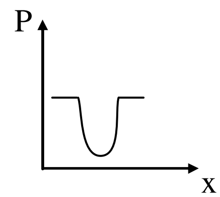
19. Water flows through a frictionless duct with a cross-section varying as shown in figure. Pressure P at points along the axis is represented by (Assume water to be non-viscous)



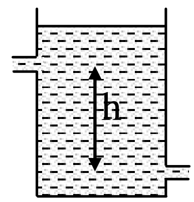
(A) 

(B) 

(C) 

(D) 

20. There are two identical small holes on the opposite sides of a tank containing a liquid. The tank is open at the top. The difference in height between the two holes is h. As the liquid comes out of the two holes, the tank will experience a net horizontal force proportional to



(A) $\sqrt{h}$ (B) h (C) $h^{3/2}$ (D) h^2

21. n drops of liquid, each with surface energy E, join to form a single drop. In this process

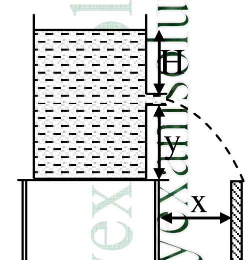
(A) some energy will be absorbed (B) energy absorbed is $E(n - n^{2/3})$

(C) energy released will be $E(n - n^{2/3})$ (D) energy released will be $E(2^{2/3} - 1)$

22. Two spherical soap bubbles of radii R_1 and R_2 combine under isothermal condition to form a single bubble. The radius of the resultant bubble is

(A) $R = \frac{R_1 + R_2}{2}$ (B) $R = R_1R_2$ (C) $R = \sqrt{R_1^2 + R_2^2}$ (D) $R = R_1^2 + R_2^2$

23. For the arrangement shown in figure, the time interval after which the water jet ceases to cross the wall (area of cross section of tank is A and orifice is 'a')



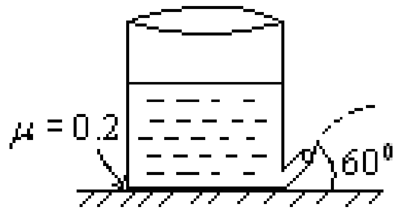
(A) $\frac{A}{a}\sqrt{\frac{2}{g}}\left(\sqrt{H} - \sqrt{\frac{x^2}{4y}}\right)$ (B) $\frac{A}{a}\sqrt{\frac{2}{g}}\left(\sqrt{H} - \sqrt{\frac{4y}{x^2}}\right)$

(C) $\frac{A}{a}\sqrt{\frac{2}{g}}\left(\sqrt{H} - \sqrt{\frac{4y^2}{x}}\right)$ (D) $\frac{A}{a}\sqrt{\frac{2}{g}}\left(\sqrt{H} - \sqrt{\frac{y^2}{4x}}\right)$

24. Two soap bubbles with radii r_1 and r_2 ($r_1 > r_2$) come in contact. Their common surface has a radius of curvature r. Then

(A) $r = \frac{r_1 + r_2}{2}$ (B) $r = \frac{r_1 r_2}{r_1 - r_2}$ (C) $r = \frac{r_1 r_2}{r_1 + r_2}$ (D) $r = \sqrt{r_1 r_2}$

25. A constant height of 20 cm maintained in the contains water of 1 kg as shown in figure. A small orifice area 10^{-2} m^2 is made at bottom to the vertical wall of container the ejected water is directed as shown in figure. Assuming mass of container is negligible, the net force on container is

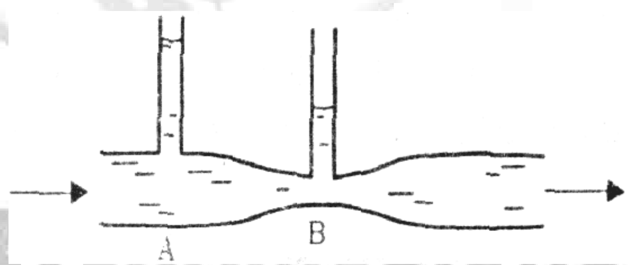


(A) zero (B) 2 N (C) 11 N (D) 17 N

26. The surface of water in a water tank on the top of a house is 4 m above the tap level. The pressure of water at the tap when the tap is closed is (Density of water = 1000 kg/m^3 and g = 10 m/s^2)

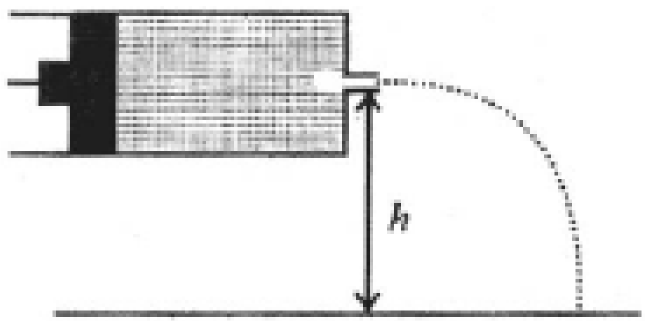
(A) 40000 N/m^2 (B) 20000 N/m^2 (C) 80000 N/m^2 (D) 10000 N/m^2

27. Water flows through a horizontal tube as shown in figure. If the difference of heights of water column in the vertical tubes is 60 m, and the areas of cross-section at A and B are 4m^2 and 2 m^2 respectively, find the rate of flow of water across any section is



(A) 80 m/s (B) 40 m/s (C) 20 m/s (D) 10 m/s

28. A tube has two area of cross-sections as shown in figure. The diameters of the tube are 8 mm and 2 mm. Find range of water falling on horizontal surface, if piston is moving with a constant velocity of 0.25m/s, h = 1.25 m (g = 10 m/s^2)



(A) 1 m (B) 2 m (C) 3 m (D) 4 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 both holes are the same. Then R is equal to

(A) $\frac{L}{\sqrt{2\pi}}$ (B) $2\pi L$ (C) L (D) $L/2\pi$

30. Water from a tap emerges vertically downwards with an initial speed of 1.0 m/s. The cross sectional area of the tap is 10^{-4} m^2. Assume that the pressure is constant throughout the steam of water, and that the flow is steady. The cross sectional area of the stream 0.15 m below the tap is

(A) 5.0×10^{-4} m^2 (B) 1.0×10^{-5} m^2 (C) 5.0×10^{-5} m^2 (D) 2.0×10^{-5} m^2