CPP
REVISION-2

FLUID DYNAMICS

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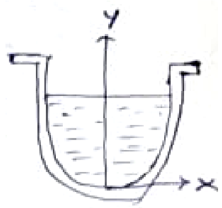
Single Correct Answer Type:

1. Power required to rise 300 litres of water per minute through a height of 6 m using a pipe of diameter 2.4 cm is ________ $\left(g = 10\ ms^{-2}\right)$

(A) 600 W (B) 400 W (C) 1000 W (D) 2000 W

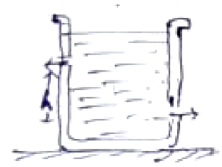
2. A small hole is made at the bottom of a symmetrical jar as shown. A liquid is filled into the jar upto a certain height. The rate of descension of liquid is independent of the level of liquid in the jar. Then the surface of jar is a surface of revolution of the curve



(A) $y = Kx^4$ (B) $y = Kx^2$

(C) $y = Kx^3$ (D) $y = Kx^5$

3. There are two identical small holes of area of cross section 'a' on the opposite sides of a tank containing a liquid of density 'ρ'. The difference in height between the holes is 'h'. Tank is resting on a smooth horizontal surface. Horizontal force which will has to be applied on the tank to keep it in equilibrium is ________



(A) $gh\rho a$ (B) $\frac{2gh}{\rho a}$ (C) $2\rho agh$ (D) $\frac{\rho gh}{a}$

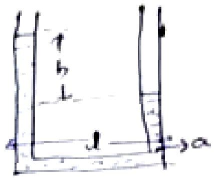
4. The height of a mercury barometer is 75 cm at sea level and 50 cm at the top of a hill. Ratio of density of mercury to that of air is 10^4. The height of the hill is

(A) 250 m (B) 2.5 km (C) 1.25 km (D) 750 m

5. A pump draws water from a reservoir and sends if through a horizontal pipe with speed v. The power of the pump is proportional to ________

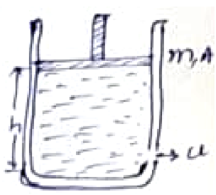
(A) v (B) v^2 (C) v^3 (D) $v^{3/2}$

6. When at rest, a liquid stands at the same level in the tubes shown in fig. But a indicated a height difference 'h' occurs when the system is given an acceleration 'a' towards the right. Here 'h' is equal to



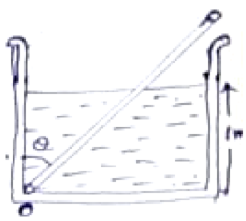
(A) $\frac{aL}{2g}$ (B) $\frac{gL}{2a}$ (C) $\frac{gL}{a}$ (D) $\frac{aL}{g}$

7. 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 ______



(A) $\sqrt{2gh}$ (B) $\sqrt{2\left(gh + \frac{mg}{\rho A}\right)}$ (C) $\sqrt{2\left(gh + \frac{mg}{A}\right)}$ (D) $\sqrt{2gh + \frac{mg}{A}}$

8. A uniform rod of length 2m specific gravity 0.5 and mass 2 kg is hinged at one end to the bottom of a tank of water filled upto a height 1 m as shown. Taking the case $\theta \neq 0°$ the force exerted by the hinge on the rod is ______ $\left(g = 10\ ms^{-2}\right)$



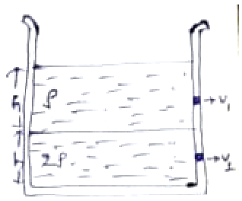
(A) 10.2 N Up (B) 4.2 N down

(C) 8.2 N down (D) 6.2 N Upwards

9. A cylindrical block of wood of mass 'm' and area of cross section 'A' is floating in water (density $= \rho$) with its axis vertical. When depressed a little and then released the block starts oscillating. The period of oscillations is _________

(A) $2\pi\sqrt{\frac{m}{\rho A g}}$ (B) $2\pi\sqrt{\frac{mg}{\rho A}}$ (C) $2\pi\sqrt{\frac{\rho A g}{m}}$ (D) $2\pi\sqrt{\frac{\rho A}{mg}}$

10. Equal volumes of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in fig. Two small holes are punched at depth $\frac{h}{2}$ and $\frac{3h}{2}$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then $\frac{v_1}{v_2}$ is ________



(A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{\sqrt{2}}$

11. Water is flowing through two horizontal pipes of different diameters which are connected together. In the first pipe the speed of water is 4 m/s and the pressure is $2\times10^4\ Nm^{-2}$. Calculate the speed and pressure of water in the second pipe. The diameters of the pipes are 3 cm and 6 cm respectively ______

(A) $2.75\times10^4\ Nm^{-2}$ (B) $27.5\times10^4\ Nm^{-2}$ (C) $0.275\times10^4\ Nm^{-2}$ (D) $275\ Nm^{-2}$

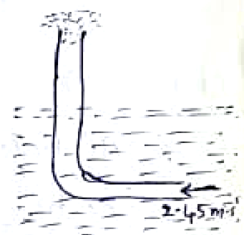
12. In a test experiment on a model aeroplane in a wind tunnel, the flow speeds on the upper and lower surfaces of the wings are $70\ ms^{-1}$ and $63\ ms^{-1}$ respectively. What is the lift on the wing if its area is $2.5\ ms^2$? (density of air $1.3 kg.m^{-3}$)

(A) 1.5×10^3 N (B) 1.5×10^4 N (C) 0.015×10^4 N (D) 15×10^5 N

13. A water tank resting on the floor has two small holes vertically one above the other. The holes are h_1 cm and h_2 cm above the floor. How heigh does water stand in the tank if the jets from the holes hit the floor at the same point

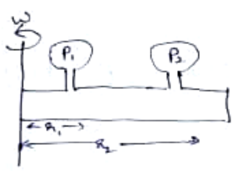
(A) $h_2 - h_1$ (B) $h_1 + h_2$ (C) $\frac{h_1^2 + h_2^2}{2}$ (D) $\frac{h_2^2 - h_1^2}{2}$

14. An L – shaped tube with a small orifice is held in a water stream as shown. The upper end of the tube is 10.6 cm above the surface of water. What will be the height of the jet of water coming from orifice? (Velocity of water stream is $2.45\ ms^{-1}$)



(A) zero (B) 20 cm
(C) 10.6 cm (D) 40 cm

15. A tube filled with water of density 'ρ' and closed at both ends uniformly rotates in a horizontal plane about a vertical axis. The monometers fixed in the tube at distances r_1 and r_2 from the axis indicate pressures P_1 and P_2 respectively. The angular velocity 'w' of rotation of the tube will be ________

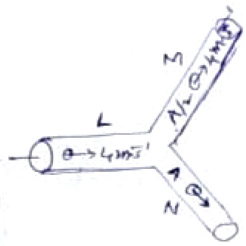


(A) $w = \sqrt{\frac{2(P_2 - P_1)}{\rho(r_2^2 - r_1^2)}}$ (B) $w = \sqrt{\frac{2(P_2 + P_1)}{\rho(r_2^2 + r_1^2)}}$ (C) $w = \sqrt{\frac{2}{\rho}\left(\frac{P_2}{r_2^2} - \frac{P_1}{r_1^2}\right)}$ (D) $w = \sqrt{\frac{2}{\rho}\left(\frac{P_2}{r^2} - \frac{P_1}{r^2}\right)}$

16. A liquid having area of free surface 'A' has an orifice at a depth 'h' with an area 'a' below the liquid surface, then the velocity 'v' of flow through the orifice is ______

(A) $\sqrt{2gh}$ (B) $\sqrt{2gh}\sqrt{\frac{A^2}{A^2 - a^2}}$ (C) $\left(\sqrt{2gh}\right)\sqrt{\frac{A}{A-a}}$ (D) $v = \left(\sqrt{2gh}\right)\sqrt{\frac{A^2 - a^2}{A^2}}$

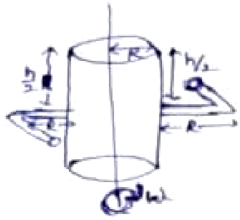
17. An incompressible liquid flows throws a horizontal tube LMN as shown. Then the velocity 'v' of the liquid through the tube 'N' is ________



(A) 1 ms^{-1} (B) 2 ms^{-1}

(C) 4.5 ms^{-1} (D) 6 ms^{-1}

18. A cylindrical container of radius 'R' and height 'h' is completely filled with a liquid. Two horizontal L-shaped pipes of small cross sectional area 'a' are connected to the cylinder as shown. Now the two pipes horizontally in opposite directions. Then the torque due to ejected liquid on the system is ______



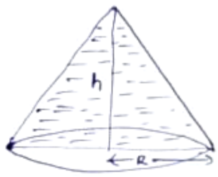
(A) 4 $agh\rho R$ (B) 8 $agh\rho R$

(C) 2 $agh\rho R$ (D) 6 $agh\rho R$

19. A cylindrical tank is filled with water to a level of 3m. A hole is opened at a height of 52.5 cm from bottom. The ratio of the area of the hole to that of cross sectional area of the cylinder is 0.1. Find the square of the velocity with which water is coming out? ($g = 10 ms^{-2}$)

(A) 50 m^2/s^2 (B) 40 m^2/s^2 (C) 51.5 m^2/s^2 (D) 50.5 m^2/s^2

20. A liquid of density 'ρ' is filled in a conical vessel as shown in, force exerted by liquid on side wall is ______



(A) $\frac{2}{3}\pi R^2 \rho g h$ (B) $\frac{1}{3}\pi R^2 \rho g h$ (C) $\pi R^2 \rho g h$ (D) zero

Numerical Based:

21. A liquid is kept in a cylindrical vessel which is rotated along its axis. The liquid rises at the side. If the radius of the vessel is 0.05 m and the speed of rotation is 2 rev/sec. Find the difference in the height of the liquid at the centre of the vessel and its sides in cm ________

22. Water level is maintained in a cylindrical vessel placed on horizontal floor upto a fixed height 'H'. A tiny hole of area 'A' punched in the side wall at a height from the bottom of the vessel equal to 'y'. The emerging stream strikes the ground at a horizontal distance $y(\neq 0)$ from cylinder. To maintain the level in the vessel at 'H', the rate (volume/sec) of addition of water is $A\sqrt{\frac{2gH}{n}}$. Find n?

23. One end of a glass capillary tube with a radius $r = 0.005$ cm is immersed into water to a depth of $h = 2$ cm. The gauge pressure required to below an air bubble of the same radius out of the lower end of the tube is $x \times 10^3$ Pa. Value of x is ______ ($T = 7 \times 10^{-2}$ N/m and $P_0 = 10^5$ Pa)

24. A uniform rope with length 'L' and mass 'm' is held at one end and whirled in a horizontal circle with angular velocity 'w'. You can ignore the force of gravity on the rope. The time required for a transverse wave to travel from one end of the rope to the other is $\frac{\pi}{\sqrt{nw}}$, then value of 'n' is______

25. A cube of wood supporting 200 gm mass just floats in water. When the mass is removed, the cube rises by 2 cm. What is the side of the cube is $(n)10^{-1}$m. Find 'n' ________

KEY

1.	A	2.	A	3.	C	4.	B	5.	C
6.	D	7.	B	8.	C	9.	A	10.	D
11.	A	12.	A	13.	B	14.	B	15.	A
16.	B	17.	B	18.	A	19.	A	20.	A
21.	2	22.	5	23.	3	24.	2	25.	1