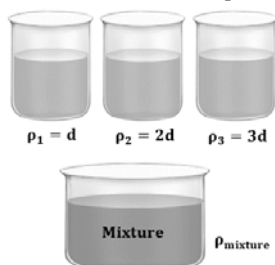


Chapter 14

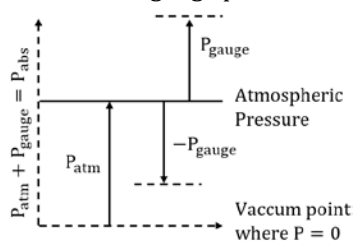
Fluid Mechanics

Exercise

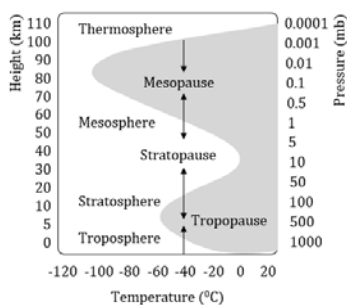
- Q.1** Three liquids of densities d , $2d$ and $3d$ are mixed in equal volumes. Then the density of the mixture is



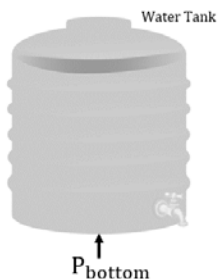
- Q.2** Which of the following options hold true for gauge pressure?



- Q.3** With increase in altitude, atmospheric pressure



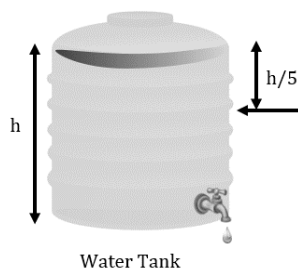
- Q.4** The pressure at the bottom of a tank containing a liquid does not depend on:



- (A) Acceleration due to gravity
(C) Area of the bottom surface

- (B) Height of the liquid column
(D) Nature of the liquid

Q.5 The pressure at the bottom of a tank of water is $3P$ where P is the atmospheric pressure. If the water is drawn out till the level of water is lowered by one-fifth, the pressure at the bottom of the tank will now be:

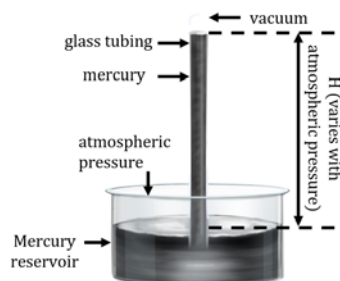


- (A) $2P$ (B) $\frac{13}{5}P$ (C) $\frac{8}{5}P$ (D) $\frac{4}{5}P$

Q.6 At a depth of 1000 m in an ocean, what is the gauge pressure when density of sea water is given as $1.03 \times 10^3 \text{ kg/m}^3$? (Take $g = 10 \text{ m/s}^2$)

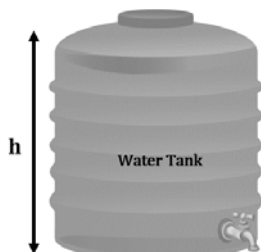
- (A) $1.04 \times 10^7 \text{ Pa}$ (B) $1.03 \times 10^7 \text{ Pa}$ (C) $1.02 \times 10^7 \text{ Pa}$ (D) $1.00 \times 10^7 \text{ Pa}$

Q.7 Torricelli's barometer uses mercury of density $13.6 \times 10^3 \text{ kg/m}^3$. If mercury is replaced by wine of density 984 kg/m^3 , then determine the height of the wine column for normal atmospheric pressure.



- (A) 760 m (B) 76 cm (C) 10.5 m (D) 105 cm

Q.8 If the gauge pressure at the bottom of a water tank is 2.7 kPa, then what is the depth of the water in the tank? [Take $g = 10 \text{ m/s}^2$]



- (A) 0.27 cm (B) 2.7 cm (C) 27 cm (D) 270 cm

Q.9 If pressure at half depth of a lake is equal to $\frac{2}{3}$ rd pressure at the bottom of the lake, then what is the depth of the lake? (Take atmospheric pressure as 10^5 Pa , density of water as 1000 kg/m^3 and $g = 10 \text{ m/s}^2$)

- (A) 6.67 m (B) 60 m (C) 10 m (D) 20 m

Q.10 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) 1.25 km

(B) 2.5 km

(C) 250 m

(D) 750 m

WORK SHEET

Q.1 If $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, then the angle between \vec{A} and \vec{B} is(A) π (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{4}$

Q.2 Choose the incorrect statement from statements given below:

(A) Friction is an electromagnetic force.

(B) Value of static friction is always greater than kinetic friction.

(C) Coefficient of static friction is greater than coefficient of kinetic friction.

(D) None of these

Q.3 A force $\vec{F} = (5\hat{i} + 3\hat{j} + 2\hat{k})$ N is applied over a particle which displaces it from origin to the point $\vec{r} = (2\hat{i} - \hat{j})$ m. The work done on the particles

(A) +5 J

(B) +7 J

(C) +10 J

(D) +13 J

Q.4 Two bodies of masses of 1 kg and 3 kg initially at rest are moving with velocities 30 m/s and 10 m/s towards each other due to mutual force of attraction. What is the velocity of the center of mass of system?



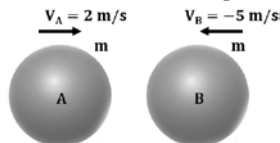
(A) 8 m/s

(B) 0 m/s

(C) 2 m/s

(D) 4 m/s

Q.5 Two balls A and B having equal masses and moving along the same straight line with velocities +2 m/s and -5 m/s respectively, collide elastically. If rightwards direction is considered as +ve x-axis, then their velocities after the collision will be respectively

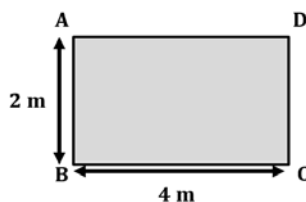


(A) -5 m/s and +2 m/s

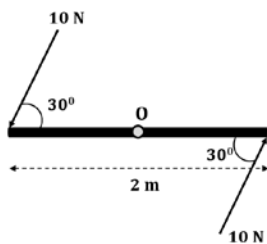
(B) 3 m/s for both

(C) 5 m/s and 1 m/s

(D) None of these

Q.6 A rectangular lamina ABCD of mass $m = 3$ kg and sides $AB = 2$ m and $BC = 4$ m is shown in the figure. Find its moment of inertia about an axis passing through point A and perpendicular to the plane of lamina.(A) 5 kg m²(B) 20 kg m²(C) 15 kg m²(D) 10 kg m²

Q.7 A couple of 10 N acting on a rod of length 2 m pivoted about its center O as shown in figure. Find the magnitude of resultant torque acting on rod about point O.



- (A) 10 Nm (B) 30 Nm (C) 20 Nm (D) can't be determine

Q.8 A small object of uniform density rolls up a curved surface without slipping, with an initial velocity v m/s. It reaches up to a maximum height of $\frac{v^2}{g}$ m with respect to the initial position. The object is

- (A) Ring (B) Solid sphere (C) Hollow sphere (D) Disc

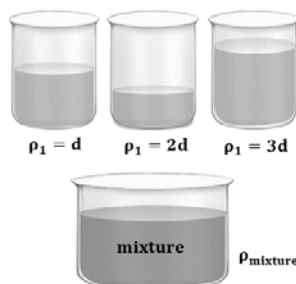
Q.9 The length of a metal wire is Z_1 , when the longitudinal strain in it is T_1 and when the longitudinal strain be T_2 then length of wire is Z_2 . The un stretched length of the wire is.

- (A) $\sqrt{Z_1 Z_2}$ (B) $\frac{Z_1 + Z_2}{2}$ (C) $\frac{T_1 Z_2 - T_2 Z_1}{T_1 - T_2}$ (D) $\frac{Z_1 T_2 + Z_2 T_1}{T_2 + T_1}$

Q.10 A metal wire is stretched beyond its elastic limit and released, then wire

- (A) Loses its elastic property completely and it will not contract.
 (B) Will contract to its original length.
 (C) Will contract till it achieves its elastic limit.
 (D) Will contract but its final length will be greater than original length

Q.11 Three liquids of densities d , $2d$ and $3d$ are mixed in equal proportions of weights. What is the relative density of the mixture, if d is the density of water?

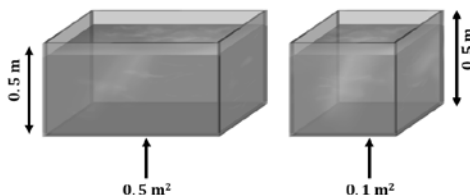


- (A) $\frac{11}{7}$ (B) $\frac{18}{11}$ (C) $\frac{13}{9}$ (D) $\frac{23}{18}$

Q.12 At the same depth, atmospheric pressure is _____ water pressure.

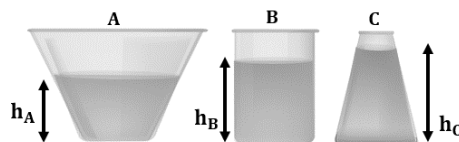
- (A) Greater than (B) Lesser than (C) Equal to (D) None of these

Q.13 There are two fish tanks each of depth 0.5 m filled up to the brim. Base area of one is 0.5 m^2 and that of another is 0.1 m^2 . At the depth of which tank will a fish feel larger pressure?



- (A) The tank of wider base area (B) The tank of smaller base area
 (C) Equal for both tanks (D) can't say

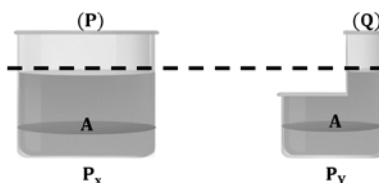
Q.14 The three vessels shown in figure have same base area. Equal volumes of a liquid are poured into the three vessels. The force on the base will be



- (A) Maximum in vessel A
(C) Maximum in vessel C

- (B) Maximum in vessel B
(D) Equal in all the vessels

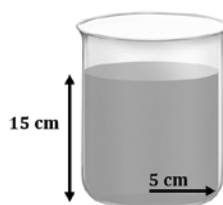
Q.15 Figure shows two containers P and Q with same base area A and each filled up to same height with same liquid. Select the correct alternative.



- (A) $P_x > P_y$
(C) $P_x = P_y$

- (B) $P_x < P_y$
(D) cannot be determined

Q.16 A beaker of circular cross-section of radius 5 cm is filled with mercury up to a height of 15 cm. Find the force exerted by the mercury on the bottom of the beaker. Take atmospheric pressure = 105 N/m², density of mercury = 13600 kg/m³, and $g = 10 \text{ m/s}^2$.



(A) 9425 N

(B) 942.5 N

(C) 94.25 N

(D) 785.4 N

Q.17 At a depth of 500 m under an ocean, what is the absolute pressure? Given density of sea water is $1.03 \times 10^3 \text{ kg/m}^3$. (Take $g = 10 \text{ m/s}^2$ & $1 \text{ atm} = 10^5 \text{ Pa}$)

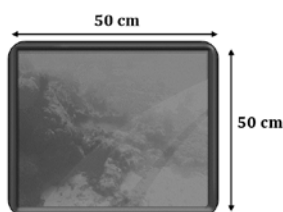
(A) 51.5 atm

(B) 53.5 atm

(C) 50.5 atm

(D) 52.5 atm

Q.18 The force acting on a window of area $50 \text{ cm} \times 50 \text{ cm}$ of a submarine at a depth of 2000 m in an ocean, interior of which is maintained at sea level atmospheric pressure is (Density of sea water = 10^3 kg/m^3 , $g = 10 \text{ m/s}^2$)



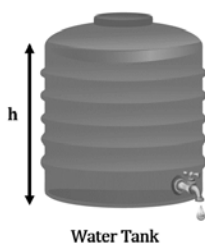
(A) 10^6 N

(B) $5 \times 10^5 \text{ N}$

(C) $25 \times 10^6 \text{ N}$

(D) $5 \times 10^6 \text{ N}$

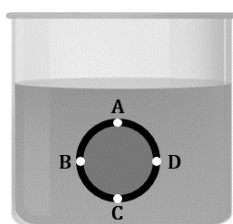
Q.19 The pressure at the bottom of a water tank is 6P, where P is the atmospheric pressure. If water is drawn out till the level decreases by $\frac{2}{5}$ th, then the pressure at the bottom of the tank is



Water Tank

(A) $2P$ (B) $4P$ (C) $6P$ (D) $5P$

Q.20 Figure shows a container filled with a liquid of density ρ . Four points A, B, C and D lie on the diametrically opposite points of a circle as shown. Point A and C lie on vertical and point B and D on horizontal line. The incorrect statement is (P_A , P_B , P_C , P_D) are absolute pressure of the respective points).

(A) $P_D = P_B$ (B) $P_D = P_B = \frac{P_C - P_A}{2}$ (C) $P_A < P_B$ (D) $P_B = P_D = \frac{P_C + P_A}{2}$ 

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(D)	(B)	(C)	(D)	(B)	(C)	(C)	(D)	(B)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(B)	(B)	(B)	(A)	(B)	(A)	(A)	(C)	(D)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(B)	(B)	(C)	(C)	(C)	(B)	(D)	(D)	(B)	(B)