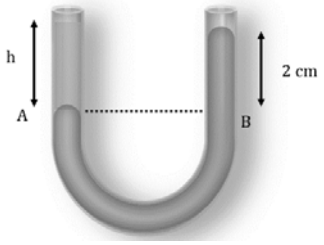
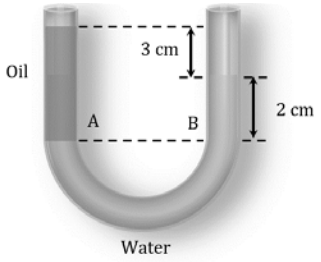
Q.1 The liquids shown in figure in the two arms are mercury (specific gravity 13.6) and water. If the heights of the mercury column and water column is as shown, find the height h of the water column.



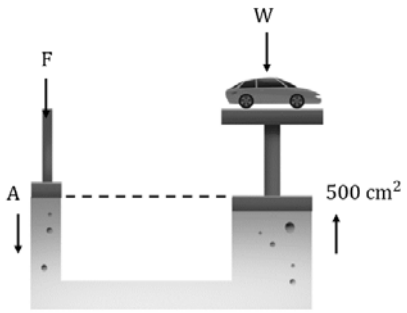
(A)27cm **(B)**12 cm **(C)**19 cm **(D)**8 cm

Q.2 Find the density of the oil inside the U-tube as shown in figure. (Take density of water $\rho_w = 1000\ kg/m^3$)



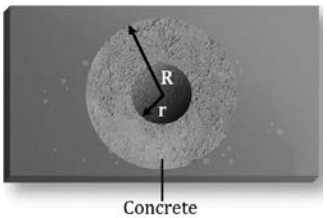
(A)600 kg /m^3 **(B)**400 kg /m^3 **(C)**300 kg /m^3 **(D)**500 kg /m^3

Q.3 A hydraulic automobile lift is designed to lift cars with a maximum mass of 300 kg. The area of cross-section of the piston carrying the load is 500 cm^2. What maximum pressure would smaller piston have to bear?



(A)2.94×10^4 Pa **(B)**11.66×10^4 Pa **(C)**5.88×10^4 Pa **(D)**8.55×10^4 Pa

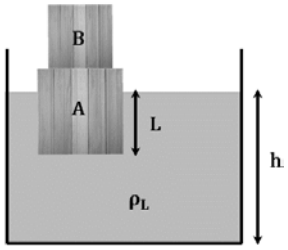
Q.4 A concrete sphere of radius R has a spherical cavity of radius r which is packed with sawdust. The specific gravities of concrete and sawdust are respectively 2.4and 0.3. For this sphere to float with its entire volume submerged under water, ratio of mass of concrete to the mass of sawdust will be.



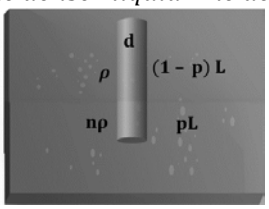
(A)8 **(B)**4 **(C)**3 **(D)**1

Q.5 Two wooden blocks A and B float in a liquid of density ρ_L as shown. The distance L and h are shown. After some time, block B falls into the liquid, so that L decreases and h increases. If density of block B is ρ_B then find the correct option.

(A)$\rho_L = \rho_B$ **(B)**$\rho_L > \rho_B$ **(C)**$\rho_L < \rho_B$ **(D)**unpredictable

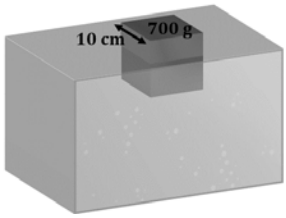


Q.6 Two non-mixing liquids of densities ρ and nρ (n > 1) are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length pL (p < 1) *in the denser liquid. The density* d is equal to:



(A) $[1 + (n + 1)p]\rho$ **(B)** $[2 + (n + 1)p]\rho$ **(C)** $[2 + (n - 1)p]\rho$ **(D)** $[1 + (n - 1)p]\rho$

Q.7 A 700 g solid cube having an edge of length 10 cm floats in water. How much volume of the cube is outside the water? Density of water= **1** g/cm^3.

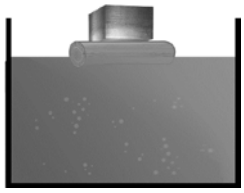


(A) 700 cm^3 **(B)** 300 cm^3 **(C)** 1000 cm^3 **(D)** 30 cm^3

Q.8 An iceberg is floating in an ocean. What fraction of its volume is above the water? (Given: density of ice = 900 kg/m^3 and density of ocean water =1030 kg/m^3)

(A) $\frac{90}{103}$ **(B)** $\frac{13}{103}$ **(C)** $\frac{10}{103}$ **(D)** $\frac{1}{103}$

Q.9 A piece of wood of mass 6 kg is floating in water with its $\frac{1}{3}$rd part inside the water. On this floating piece of wood, what maximum mass can be put such that the whole of the piece of wood gets drowned in the water?



(A) 15 kg **(B)** 14 kg **(C)** 10 kg **(D)** 12 kg

Q.10 A sphere of solid material of specific gravity **8** has a concentric spherical cavity and just sinks in water. The ratio of radius of cavity to that of outer radius of the sphere must be

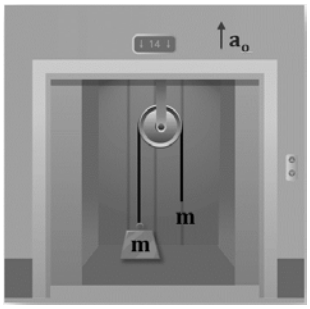
(A) $\frac{7^{1/3}}{2}$ **(B)** $\frac{5^{1/3}}{2}$ **(C)** $\frac{9^{1/3}}{2}$ **(D)** $\frac{3^{1/3}}{2}$

WORK SHEET

Q.1 A particle moving in a straight line covers half the distance with a speed of 3 m/s. The other half of the distance is covered in two equal time intervals with speed of 4.5 m/s and 7.5 m/s respectively. The average speed of the particle during this motion is

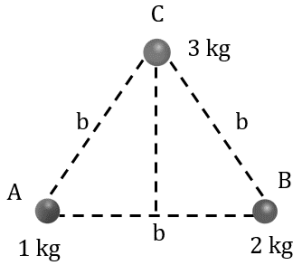
(A)4.0 m/s **(B)**5.0 m/s **(C)**5.5 m/s **(D)**4.8 m/s

Q.2 A light and smooth pulley is attached to the ceiling of a lift moving upward with acceleration $a_o = 2\ m/s^2$ as shown in the figure. Two blocks of equal masses (m = 3 kg) are attached to the two ends of a massless string passing over the pulley. Find the tension in the string. (Take $g = 10\ m/s^2$)



(A)12 N **(B)**24 N **(C)**10 N **(D)**36 N

Q.3 Three particles of masses 1 kg, 2 kg and 3 kg are situated at the corners of an equilateral triangle of side b. The (x, y) coordinates respectively for the centre of mass of the system of particles will be:



(A)$[\frac{7b}{12}, \frac{\sqrt{3}b}{12}]$ **(B)**$[\frac{3\sqrt{3}b}{12}, \frac{7b}{12}]$ **(C)**$[\frac{7b}{12}, \frac{3\sqrt{3}b}{12}]$ **(D)**$[\frac{7b}{12}, \frac{3\sqrt{3}b}{4}]$

Q.4 Consider two observers moving with respect to each other at a constant speed v along a straight line. They observe a block of mass m moving a distance l on a rough surface. then which of the following quantities will be same as observed by the two observers:

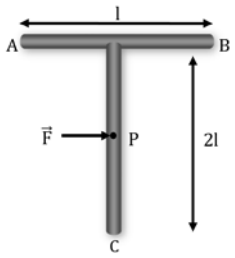
(A) Kinetic energy of the block at time t **(B)**Work done by friction
(C) Total work done on the block **(D)**Acceleration of the block

Q.5 A bullet with mass 200 g and velocity v_b m/s hits a ballistic pendulum bob of mass 800 g and rises along with pendulum to a heighth $= 0.2$ m. Determine the value of v_b. Take $g = 10\ m/s^2$

(A)100 m/s **(B)**10 m/s **(C)**8 m/s **(D)**6 m/s

Q.6 A uniform 'T' shaped object with dimensions as shown in the figure, is lying on a smooth floor. A force $\vec{F}$ is applied at the point P parallel to limb AB, such that the object has only the translational motion without rotation. Find the distance of point P from C

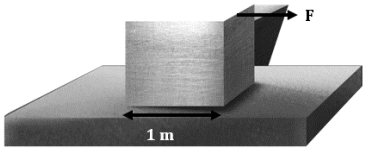
(A) $\frac{2l}{3}$ **(B)** $\frac{3l}{2}$ **(C)** $\frac{4l}{3}$ **(D)** l



Q.7 A hollow spherical ball rolls on a table without slipping. Ratio of its rotational kinetic energy to its total kinetic energy is.

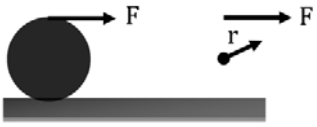
(A) 5: 2 **(B)** 2: 7 **(C)** 2: 5 **(D)** 7: 2

Q.8 A cube of side 1 m fixed at the lower face is acted upon by a tangential force F on its upper surface. If shearing strain is 10^{-2} due to force F, find the distance that the upper face is sheared with respect to lower face.



(A) 10^{-3}m **(B)** 10^{-2}m **(C)** 10^{-4}m **(D)** 10^{-1}m

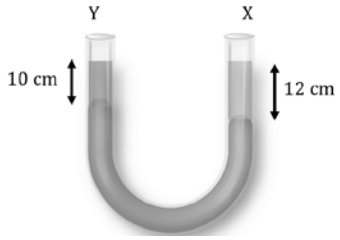
Q.9 A force F acts tangentially at the highest point of a hollow sphere of mass m kept on a rough horizontal plane. If the sphere rolls without slipping then,



(A) Static friction will act on the sphere towards left.
(B) Kinetic friction will act on the sphere toward right.
(C) Static friction will act on the sphere toward right.
(D) Kinetic friction will act on the sphere toward left.

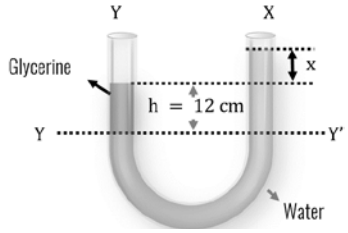
Q.10 Ultimate tensile strength of a metallic wire depends on its
(A) Length **(B)** Area of cross−section
(C) Material **(D)** None of these

Q.11 A liquid X of density 4.2 g/cm^3 is poured up to a height of 12 cm in the right limb of an $U-$tube which contains mercury. Another liquid Y is poured in the left arm with height 10 cm. If upper level of Xand Y. (Take density of mercury $\rho_{Hg} = 13.6$ g/cm^3)



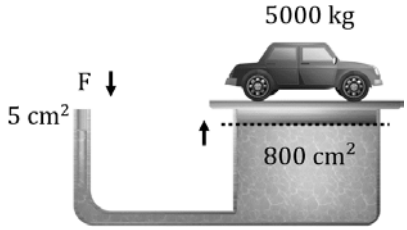
(A)5.76 g/cm^3 **(B)**23.2 g/cm^3 **(C)**4.64 g/cm^3 **(D)**2.32 g/cm^3

Q.12 A vertical U−tube of uniform cross-section contains water in both the arms. A 12 cmglycerin column (Relative density = 1.2) is added to one of the limbs. The level difference between the two surfaces of both the limbs will be.



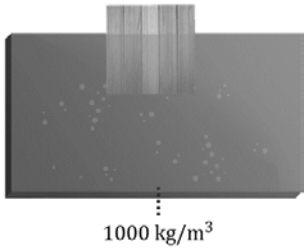
(A)2 cm **(B)**1.2 cm **(C)**2.4 cm **(D)**4.8 cm

Q.13 To lift an automobile of 5000 kg, a hydraulic lift with a large piston 800 cm^2 in area is employed. Calculate the force that must be applied to the small piston of area 5 cm^2 to achieve it.



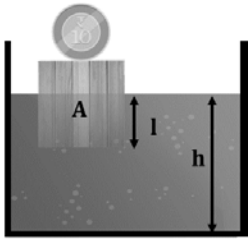
(A)612.5 N **(B)**306.25 N **(C)**153.12 N **(D)**408.56 N

Q.14 A block of wood floats in water $\left(\frac{4}{5}\right)^{\text{th}}$ of its volume submerged. If the same block just floats in a liquid, the density of liquid in kg/m^3 is (Take density of water as 1000 kg/m^3)



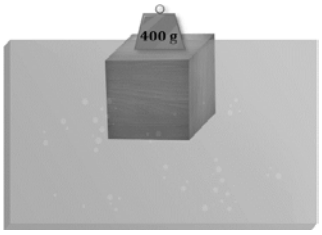
(A)900kg/m^3 **(B)**400 kg/m^3 **(C)**1250 kg/m^3 **(D)**800 kg/m^3

Q.15 A wooden block, with a coin placed on its top, floats in water as shown in figure. The distance l and h are shown there. After some time the coin falls into the water. Then

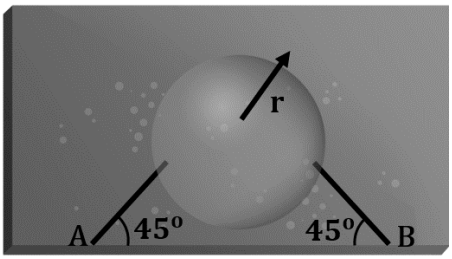


(A) l decreases and h increases **(B)** l increases and h decrease
(C) Both l and h increases **(D)** Both l and h decreases

Q.16 The wooden cube just floats inside water with a 400 g mass placed on it. When the mass is removed, the cube floats with its top surface 4 cm above the water level. What is the side of the cube?
(A) 6 cm **(B)** 8 cm **(C)** 10 cm **(D)** 12 cm



Q.17 A hollow sphere of mass M = 50 kg and radius r = $\left(\frac{3}{40\pi}\right)^{\frac{1}{3}}$ m is immersed in a tank of water (density $\rho_\omega = 10^3$ kg/m^3). The sphere is tied to the bottom of a tank by two wires *A* and *B* as shown. Tension in wire *A* is (g = 10 m/s^2)



(A) $125\sqrt{2}$ N **(B)** 125 N **(C)** $250\sqrt{2}$ N **(D)** 250 N

ANSWER KEY

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