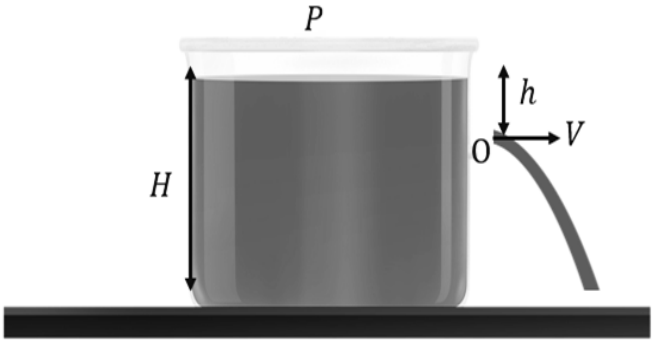
Q.1 Speed of liquid coming out through a hole at depth h below the free surface depends on



(A) pressure at point P
(B) pressure at point O
(C) depth h
(D) all of these

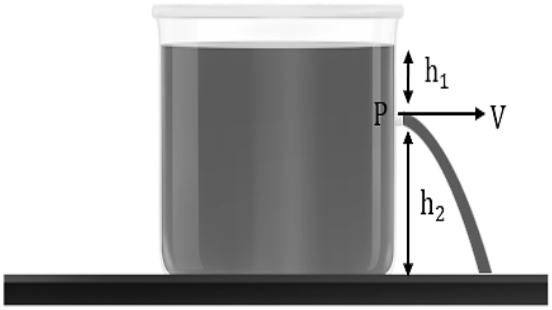
Q.2 Viscous drag force depends on

(A) size of the body
(B) velocity with which it moves
(C) viscosity of fluid
(D) all the above

Q.3 The volume of a homogenous fluid passing per unit time through a pipe is

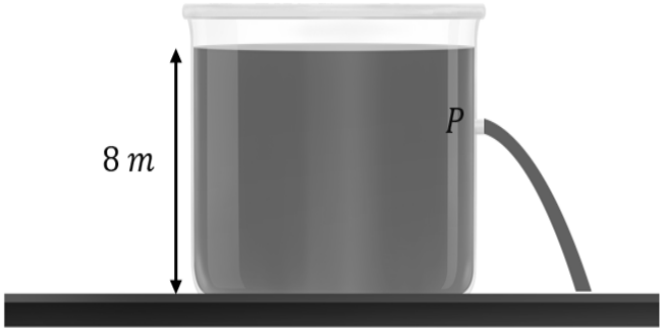
(A) directly proportional to the pressure difference between its ends.
(B) directly proportional to the fourth power of its internal radius.
(C) inversely proportional to its length and to the viscosity of the fluid.
(D) all the above

Q.4 Water is allowed to come out of a hole P in one of the walls at a depth h_1 below the surface of water. Express the horizontal distance covered by water jet in terms of h_1 and h_2.



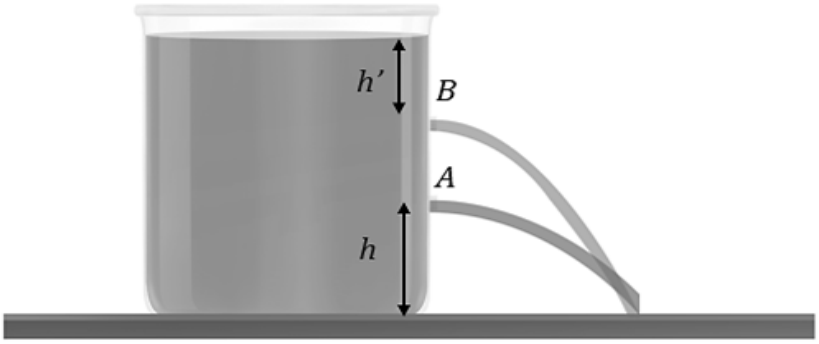
(A) $\sqrt{h_1 h_2}$ **(B)** $2\sqrt{h_1 h_2}$ **(C)** $\sqrt{\frac{h_1}{h_2}}$ **(D)** $2\sqrt{\frac{h_1}{h_2}}$

Q.5 A tank is filled with water up to a height of 8 m. A hole P is made in the wall of tank such that water coming out of it travels maximum horizontal distance. Find the speed of water coming out of hole P.



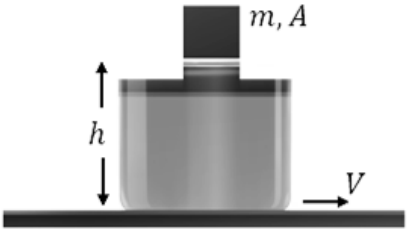
(A) $\sqrt{2g}$ m/s **(B)** $\sqrt{2}$ m/s **(C)** $2\sqrt{2g}$ m/s **(D)** $3\sqrt{g}$ m/s

Q.6 A tank is filled with water and two holes A and B are made in it. For getting same range, ratio of $\frac{h'}{h}$ is



(A) 1 : 2 **(B)** 1 : 1 **(C)** 2 : 1 **(D)** 3 : 2

Q.7 A cylindrical vessel contains a liquid of density ρ up to 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 (m/s) with which the liquid comes out of the hole is

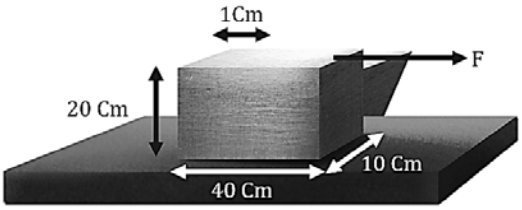


(A) $\sqrt{2gh}$ **(B)** $\sqrt{2\left(gh+\frac{mg}{\rho A}\right)}$ **(C)** $\sqrt{2\left(gh+\frac{mg}{A}\right)}$ **(D)** $\sqrt{2gh+\frac{mg}{A}}$

Q.8 Two balls A and B are flowing through water with same velocity as shown in figure. If radius of ball A is twice the radius of ball B, then find the ratio of drag force acting on A and B. Assume that Stokes law is valid.

(A) 4: 1 **(B)** 3: 2 **(C)** 2: 1 **(D)** 2: 3

Q.9 Eight equal drops of water are falling through air with a steady velocity of 5 cm/s. If smaller drops combine to form a single large drop, then the terminal velocity (in cm/s) of this large drop is.



(A) 5 **(B)** 20 **(C)** 10 **(D)** 15

Q.10 Pipe 1 has the radius and length of $0.2m$ and $50m$ respectively connected with the pipe 2 having radius and length of $0.4m$ and $100m$,respectively. Find the total resistance offered to the flow of water by the system of pipes, ignoring the resistance offered by the joint. (η is the viscosity of water)

(A) $8.95 \times 10^4\eta$ **(B)** $5.5 \times 10^5\eta$ **(C)** $4.56 \times 10^5\eta$ **(D)** $2.86 \times 10^6\eta$

WORK SHEET

Q.1 A projectile is fired with initial speed of 10 m/s making an angle 30°with horizontal. Which of the following option is correct?

(A) Range of projectile is $5\sqrt{3}$ m

(B) Maximum height attained by projectile is 1.25 m

(C) Time of flight of projectile is 1 sec

(D) All of these

Q.2 Two person A and B start running from same initial point and in same direction along a circular path with speed of 5 km/hr and 2 km/hrrespectively. If the length of circular path is 24 km, after what time they will meet again?

(A)8 hr **(B)**6 hr **(C)**3 hr **(D)**2hr

Q.3 A biker is performing stunt in a cylindrical death well of radius 16 m. If speed of biker is constant and coefficient of friction of well's surface is 0.2, find the minimum speed required to perform the stunt safely.

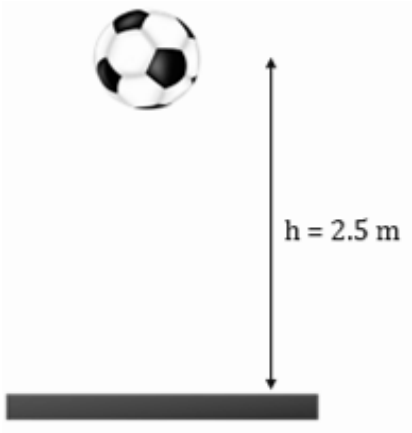
(A)24 m/s **(B)**28 m/s **(C)** 16 m/s **(D)**49 m/s

Q.4 If net force acting on system of particles is zero, choose an incorrect option regarding the motion of the center of mass of the system.

(A) Acceleration of COM will always be zero. **(B)**Velocity of COM will always be zero.

(C) Both (a) and (b) **(D)**None of these

Q.5 A ball initially at rest falls from a height $h = 2.5\,m$. After collision with surface having value of coefficient of restitution $e = 0.6$, it rebounds back. Find the rebound velocity of ball.



(A) 2 m/s **(B)**4.2 m/s **(C)**6 m/s **(D)**11.66 m/s

Q.6 A solid sphere of mass M and radius R is rotating about its diameter. A hollow sphere of same mass and same external radius is also rotating with an angular speed twice that of solid sphere. The ratio of their kinetic energies of rotation $(E_S : E_H)$ will be

(A) 3: 20 **(B)** 1: 10 **(C)** 20: 3 **(D)** 10: 1

Q.7 A disc of mass m and radius r is rolling purely on rough surface with velocity v. If initially the spring was in natural state, then maximum compression in spring is

(A) $\sqrt{\frac{3mv}{2r}}$ **(B)** $\sqrt{\frac{3mv^2}{2k}}$ **(C)** $\sqrt{\frac{3mv}{2k}}$ **(D)** $\sqrt{\frac{3v^2}{2r}}$

Q.8 A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to its lower end. If the weight stretches the wire by 1 mm, then elastic energy stored in the wire is

(A) 0.1 J **(B)** 0.2 J **(C)** 10 J **(D)** 20 J

Q.9 If a uniform rod made of material having Poisson's ratio 0.5, suffers longitudinal strain of 2×10^{-3}, what is the percentage increase in volume?

(A) 2% **(B)** 4 % **(C)** 0 % **(D)** 5 %

Q.10 The bulk modulus of rubber is 9.8×10^8 N/m^2. To what depth a rubber ball must be taken in a lake so that its volume is decreased by 0.1 %? (Neglect atmospheric pressure)

(A) 25 m **(B)** 100 m **(C)** 200 m **(D)** 500 m

Q.11 A spherical body falling through a viscous liquid of infinite extent ultimately attains terminal velocity, when

(A) Upthrust + Weight = Viscous drag **(B)** Weight + Viscous drag = Upthrust

(C) Viscous drag + Upthrust = Weight **(D)** Viscous drag + Upthrust > Weight

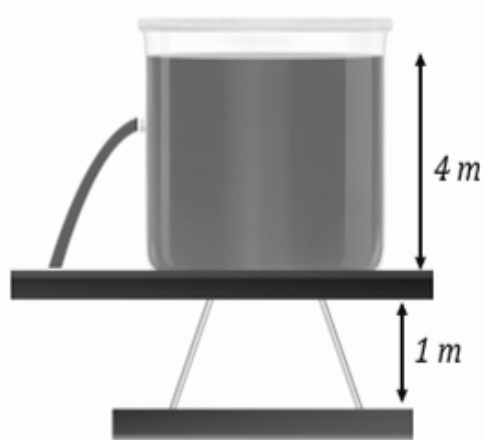
Q.12 The height of water level in a tank is H = 100 cm. The water stream is coming out of a hole at the depth of 20 cm from top surface of water. Find out the time taken by the water coming out of the hole to reach the ground and the horizontal range of water. (Take g = 1000 cm/s^2)

(A) 0.4 *sec*, 80 *cm* **(B)** 0.4 *sec*, 90 *cm* **(C)** 0.2 *sec*, 80 *cm* **(D)** 0.2 *sec*, 90 *cm*

Q.13 A vessel of area of cross-section A has liquid up to a height H. A hole is made in the wall of vessel such that water coming out of it travels maximum horizontal distance of 2 m. Find the value of H.

(A) 2 m **(B)** 1 m **(C)** 3m **(D)** 4 m

Q.14 Water is filled in a tank up to 4 m height. The base of the tank is at height 1 m above the ground. At what height should the hole be made from the ground, so that the water can be sprayed up to maximum horizontal distance on ground?



(A) 2 m **(B)** 2.5 m **(C)** 1.5 m **(D)** 3 m

Q.15 A spherical ball of radius 5 mm flowing through the glycerin as shown in figure. The velocity of ball at a particular instant is 0.6 m/s. Find the drag force on the ball due to the fluid. Assume that Stoke's law is valid. (Take viscosity of glycerin as 0.950 kg/m − s)

(A) 0.026 N **(B)**0.088 N **(C)** 0.107 N **(D)** 0.053 N

Q.16 An oil drop falls through air with a terminal velocity 5×10^{-4} m/sFind the radius of the drop. Neglect the density of air as compared to that of oil. (Take viscosity of air $= 3.6 \times 10^{-5}$ N − s/m^2 , g = 10 m/s^2 density of oil $\rho_o = 900$ kg/m^3

(A)2×10^{-6} m **(B)** $2.5 \times 10^{-6}\ m$ **(C)** 4×10^{-6} m **(D)**3×10^{-6} m

Q.17 If the terminal speed of a sphere of gold (density = 19.5 g/cm^3) is 0.2 m/s in a viscous liquid (density = 1.5 g/cm^3). Find the terminal speed of a sphere of silver (density = 10.5 g/cm^3) of the same size in the same liquid.

(A) $0.4\ m/s$ **(B)** $0.4\ m/s$ **(C)** $0.4\ m/s$ **(D)**$0.4\ m/s$

Q.18 By what factor will the flow rate of a viscous fluid through a pipe change, if the pipe radius is doubled, the fluid viscosity is doubled, the length is doubled and the pressure drop is reduced to a quarter of its previous value?

(A)4 **(B)**16 **(C)** 1/4 **(D)**Does not change

Q.19 When water (viscosity, $\eta_w = 0.01 poise$) and benzene (viscosity, $\eta_b = 0.0065\ poise$) are allowed to flow through a pipe, it was found that the same amount of liquids is collected in the same time but the pressure drop that caused the flow are different. If the pressure drop in water is 0.015 atm, then the pressure drop in benzene will be

(A)2.3×10^{-3} atm **(B)**975×10^{-5} atm **(C)**4.33×10^{-3} atm **(D)**2.3×10^{-5} atm

Q.20 What will be the total resistance offered to the flow of water by the system of pipe 1, pipe 2, pipe 3 and pipe 4 ignoring the joints? If all the pipes are of length 3 m and radius 2 m and η is viscosity of water. (Assume $\pi = 3$)

(A)1.25 η **(B)**3η **(C)**4.5η **(D)**9η

ANSWER KEY

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