Q.1 The Reynolds number ofaflow is the ratio of

(A) Gravity force to viscous force **(B)** Gravity force to pressure force

(C) Inertia force to viscous force **(D)** Viscous force to pressure force

Q.2 Match the following.

Column 1	Column 2
A. Compressible fluid	i. Internal friction adjacent layers is absent
B. Incompressible fluid	ii. Has variable density
C. Viscous Fluid	iii. Internal friction between adjacent layers is present.
D. Non-viscous fluid	iv. Has constant density.

(A) A → (ii); B → (iv); C → (iii); D → (i) **(B)** A → (iv); B → (ii); C → (iii); D → (i)

(C) A → (ii); B → (i); C → (iv); D → (iii) **(D)** A → (iii); B → (iv); C → (i); D → (ii)

Q.3 We have three beakers containing glycerin, water and kerosene separately. They are stirred vigorously and placed on a table. The liquid which comes to rest at the earliest is

(A) Glycerin **(B)** Water

(C) Kerosene **(D)** All of them at the same time

Q.4 A body floats in water with one-third of its volume above the surface of water. If it is placed in oil, it floats with half of its volume above the surface of the oil. The relative density of the oil is

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

Q.5 A piece of solid weighs 120 g in air and 80 g when completely immersed in water. The relative density of solid is

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

Q.6 The volume of a 500 g sealed packet is 350 cm^3. Will the packet float or sink in a saturated salt solution, if the density of the solution is 1.2 g/cm^3?

(A) The packet will sink **(B)** The packet will float

(C) The packet will float submerged **(D)** None of these

Q.7 A vessel contains oil (density = 0.8 g/cm^3) over mercury (density = 13.6 g/cm^3). A homogeneous sphere floats with half of its volume immersed in mercury and the other half in oil. The density of the material of the sphere in $g/cm^3$is.

(A) 3.3 **(B)** 6.4 **(C)** 7.2 **(D)** 12.8

Q.8 The velocity of water in a river is 18 km/hr at the surface. If the river is 5 m deep, find the shearing stress between the horizontal layers of water. The viscosity of water is 10^{-2} Poise.

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

Q.9 A plate of area 2 m^2 is made to move horizontally with a speed of 2 m/s by applying a horizontal tangential force over the free surface of a liquid having depth of 1 m. If the coefficient of viscosity of liquid is 0.01 Poise, find the tangential force needed to move the plate.

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

Q.10 Calculate Reynolds number, if a fluid having viscosity of 0.5 Ns/m^2 and density of 450 kg/m^3 , flows through a pipe of 20 mm diameter with an average velocity of 2.5 m/s.

(A) 225 **(B)** 90 **(C)** 45 **(D)** 144

WORK SHEET

Q.1 A man moving with velocity 5 m/s along a straight line observes rain falling vertically at the rate of 10 m/s. Find the speed of rain with respect to ground, and angle (θ) made from vertical by the rain as seen from ground.

(A) $5\sqrt{5}$ m/s, $\theta = \frac{\tan^{-1} 4}{2}$ **(B)** $5\sqrt{5}$ m/s, $\theta = \tan^{-1}\frac{1}{2}$

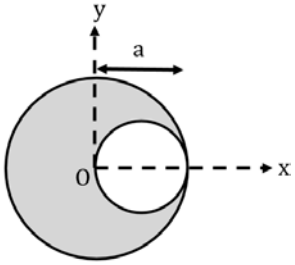
(C) 10 m/s, $\theta = \tan^{-1} 2$ **(D)** 10 m/s, $\theta = \tan^{-1}\frac{1}{2}$

Q.2 A string breaks under the load of 50 kg. A mass of 1 kg is attached to one end of the string 10 m long is rotated in a horizontal circle while the other end is attached to the ceiling. Calculate the greatest number of revolutions that the mass can make per second without breaking the string. (Take g = 10 m/s^2)

(A) $\frac{100}{\pi}$ Revolutions per second **(B)** $\frac{10\sqrt{2}}{\pi}$ revolutions per second

(C) $\frac{\sqrt{50}}{2\pi}$ Revolutions per second **(D)** $\frac{100}{\sqrt{\pi}}$ revolutions per second

Q.3 From a uniform circular sheet of radius a units, a circular portion of diameter a units has been removed as shown in the figure. Find, the coordinates of center of mass of the remaining part.



(A) $(-\frac{a}{6}, 0)$ **(B)** $(-\frac{a}{3}, 0)$ **(C)** $(-\frac{a}{4}, 0)$ **(D)** $(-\frac{a}{6}, \frac{a}{2})$

Q.4 Which of the following statements is incorrect regarding a partially inelastic collision?

(A) Impulse of reformation is equal to the impulse of deformation

(B) Momentum remains conserved if other external forces are absent on the colliding object.

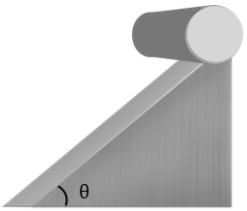
(C) Total mechanical energy is not conserved during inelastic collision

(D) Coefficient of restitution lies in the range $(0 < e < 1)$

Q.5 A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. Find the value of α for which angular momentum about origin is conserved.

(A) 0 **(B)** 1 **(C)** –1 **(D)** 2

Q.6 A drum of radius R and mass M rolls down without slipping along an inclined plane of inclination θ. Then identify the correct statement.



(A) Frictional force acting on drum will dissipate energy as heat

(B) Frictional force acting on drum will oppose the rotational motion of the drum.

(C) Frictional force acting on drum will oppose the translational as well as the rotational motion of drum.

(D) Gravitational Potential energy of drum is 100% transformed into translation and rotational K.E of drum.

Q.7 Find the ratio of radii of gyration of a circular disc and a circular ring of same mass and radius, about an axis passing through their center and perpendicular to their planes.

(A) $1:\sqrt{2}$ **(B)** 3:2 **(C)** 2:1 **(D)** $\sqrt{2}:1$

Q.8 Copper of fixed volume V is drawn into wire of length l. When this wire is subjected to a constant force F, the extension produced in the wire is Δl. Which of the following graphs will be a straight line?

(A) Δl versus $\frac{1}{l}$ **(B)** Δl versus l^2 **(C)** Δl versus $\frac{1}{l^2}$ **(D)** Δl versus l

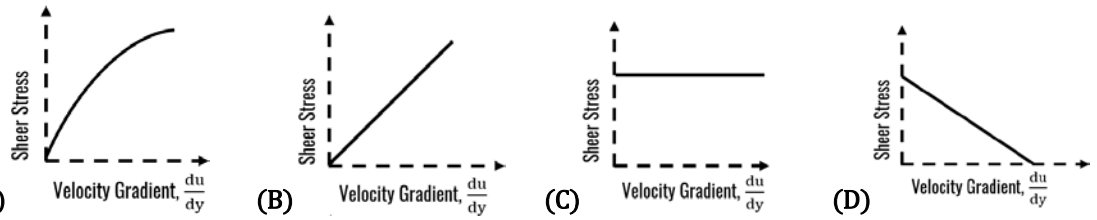
Q.9 The bulk modulus of a sphere is 'K'. If it is subjected to uniform pressure 'P' then fractional decrease in its radius is.

(A) $\frac{K}{3P}$ **(B)** $\frac{3p}{K}$ **(C)** $\frac{p}{3K}$ **(D)** $\frac{p}{K}$

Q.10 What will be the modulus of rigidity for water, considering it to be ideal fluid?

(A) ∞ **(B)** 0 **(C)** 1 **(D)** –0.75

Q.11 Which of the following graph shows the relation between shear stress and velocity gradient for a non-Newtonian fluid?



(A) **(B)** **(C)** **(D)**

Q.12 In which of the following cases will the liquid flow in a pipe be most streamlined

(A) Liquid of high viscosity and high density flowing through a pipe of small radius
(B) Liquid of high viscosity and low density flowing through a pipe of small radius
(C) Liquid of low viscosity and low density flowing through a pipe of large radius
(D) Liquid of low viscosity and high density through a pipe of large radius.

Q.13 Match the following.

Column 1	Column 2
A. Ideal fluid	i. Compressible and viscous
B. Non-uniform flow	ii. Incompressible and non- viscous
C. Uniform flow	iii. At any instant velocity is constant for all points
D. Real fluid	iv. Velocity changes from point to point at any given instant of time.

(A) A → (i); B → (ii); C → (iii); D → (iv) **(B)** A → (iv); B → (iii); C → (ii); D → (i)
(C) A → (ii); B → (iv); C → (iii); D → (i) **(D)** A → (iii); B → (i); C → (iv); D → (ii)

Q.14 A body weighs 50 g in air and 40 g when completely immersed in water. How much it will weigh when immersed completely in a liquid of relative density 1.5?

(A) 30 g **(B)** 35 g **(C)** 45 g **(D)** 25 g

Q.15 A hemisphere bowl just floats without sinking in a liquid of density 1.2×103 kg/m^3. If the outer diameter and the density of the bowl are 1 m and 2×104 kg/m^3 respectively, then the inner diameter of the bowl will be

(A) 0.92 m **(B)** 0.94 m **(C)** 0.96 m **(D)** 0.98 m

Q.16 A right circular cone of density ρ, floats just immersed with its vertex downwards, in a vessel containing two liquids of densities σ_1 and σ_2 respectively. The plane of separation of the two liquids cuts off from the axis of the cone at a friction z (taken from vertex) of its length. Find z.

(A) $h(\frac{\rho+\sigma_2}{\sigma_1+\sigma_2})^{1/3}$ **(B)** $h(\frac{\rho-\sigma_2}{\sigma_1-\sigma_2})^{1/3}$ **(C)** $h(\frac{\rho-\sigma_2}{\sigma_1+\sigma_2})^{1/2}$ **(D)** $h(\frac{\rho-\sigma_2}{\sigma_1-\sigma_2})$

Q.17 A square plate of 1 m side moves parallel to a second plate with velocity 4 m/s. A thin layer of water exist between plates. If the viscous force is 2 N and the coefficient of viscosity is 0.01 Poise, then find the distance between the plates.

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

Q.18 A Newtonian fluid fills the clearance between the shaft and the sleeve. When a force of 800 N is applied to the shaft, parallel to the sleeve, the shaft attains a speed of 1.5 cm/sec. If a force of 2.4 kN is applied instead, the shaft would move with a speed of

(A)15 cm/sec **(B)**13.5 cm/sec **(C)**4.5 cm/sec **(D)**None

Q.19 A man is rowing a boat with a constant velocity v0 in a river of depth 'D'. The contact area of boat is 'A' and coefficient of viscosity of water is η. Find the force required to row the boat.

(A) $\frac{\eta v_o}{D}$ **(B)** $\frac{\eta A^2 v_o}{D}$ **(C)** $\frac{\eta D^2 v_o}{A}$ **(D)** $\frac{\eta A v_o}{D}$

Q.20 A cubical block of side 'a' and density 'ρ' slides over a fixed inclined plane with constant velocity 'v'. There is a thin film of viscous fluid of thickness 't' between the plane and the block, Then the coefficient of viscosity of thin film will be

(A) $\frac{3\rho agt}{5v}$ **(B)** $\frac{4\rho agt}{5v}$ **(C)** $\frac{\rho agt}{v}$ **(D)**None of these

Q.21 If a fluid having viscosity 0.6 Ns/m^2 and density of 900 kg/m^3, flows through a pipe of diameter 40 mm, then find the maximum velocity of fluid (in m/s) inside the pipe for laminar flow.(Critical Reynold's number = 2100)

(A)35 **(B)**90 **(C)**46.6 **(D)**31.5

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(D)	(A)	(A)	(C)	(C)	(A)	(C)	(A)	(A)	(C)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(D)	(A)	(A)	(C)	(D)	(A)	(B)	(C)	(B)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(A)	(B)	(C)	(B)	(D)	(B)	(C)	(C)	(D)	(A)
Q.	21									
Sol.	(A)									