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CLASS 11 PHYSICS · NCERT CHAPTER 9 · IMU CET PRACTICE

Mechanical Properties of Fluids

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Questions: 45 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 The pressure at a depth h in a liquid of density ρ (open to atmosphere P_o) is
(A) $P_o + \rho gh$ (B) $P_o - \rho gh$
(C) $P_o \rho gh$ (D) ρgh
- 2 The gauge pressure at a depth of 10 m in water is ($\rho = 1000 \text{ kg/m}^3$, $g = 10 \text{ m/s}^2$)
(A) 10^3 Pa (B) $2 \times 10^5 \text{ Pa}$
(C) 10^4 Pa (D) 10^5 Pa
- 3 Pascal's law is the working principle of
(A) hydraulic lift (B) venturimeter
(C) aeroplane wing (D) barometer
- 4 In a hydraulic lift, the areas of the pistons are 10 cm^2 and 1000 cm^2 . A force of 50 N on the smaller piston can lift a load of
(A) 0.5 N (B) 50 N
(C) 500 N (D) 5000 N
- 5 Atmospheric pressure is about
(A) $1.01 \times 10^3 \text{ Pa}$ (B) $1.01 \times 10^5 \text{ Pa}$
(C) $1.01 \times 10^7 \text{ Pa}$ (D) 76 Pa
- 6 Bernoulli's theorem is based on the conservation of
(A) angular momentum (B) energy
(C) mass (D) momentum
- 7 The equation of continuity $A_1 v_1 = A_2 v_2$ is based on the conservation of
(A) momentum (B) energy
(C) mass (D) charge
- 8 Water flows through a pipe of cross-section 4 cm^2 at 2 m/s. At a section of 1 cm^2 , the speed is
(A) 4 m/s (B) 0.5 m/s
(C) 8 m/s (D) 2 m/s



- 9 The velocity of efflux of a liquid from an orifice at a depth h below the free surface is
(A) $2gh$ (B) $\sqrt{2gh}$
(C) $\sqrt{gh/2}$ (D) $\sqrt{gh}$
- 10 Water flows out of a hole 5 m below the water surface in a tank. The speed of efflux is ($g = 10 \text{ m/s}^2$)
(A) 5 m/s (B) 100 m/s
(C) 50 m/s (D) 10 m/s
- 11 The lift of an aeroplane wing is explained by
(A) Bernoulli's principle (B) Pascal's law
(C) Hooke's law (D) Archimedes' principle
- 12 The SI unit of coefficient of viscosity is
(A) N m^{-1} (B) poise
(C) N m (D) Pa s (N s m^{-2})
- 13 The viscosity of liquids ___ with increase in temperature.
(A) increases (B) remains constant
(C) decreases (D) first increases then decreases
- 14 The viscosity of gases ___ with increase in temperature.
(A) becomes zero (B) remains constant
(C) increases (D) decreases
- 15 According to Stokes' law, the viscous drag on a sphere of radius r moving with speed v is
(A) $6\pi\eta r/v$ (B) $6\pi\eta r v$
(C) $6\pi\eta r^2 v$ (D) $4\pi\eta r v$
- 16 The terminal velocity of a small sphere falling through a viscous liquid is proportional to
(A) r^2 (B) r
(C) r^3 (D) $1/r$
- 17 If the radius of a falling raindrop is doubled, its terminal velocity becomes
(A) 2 times (B) half
(C) 4 times (D) 8 times
- 18 Eight identical drops each falling with terminal velocity 5 cm/s coalesce to form a single drop. The new terminal velocity is
(A) 5 cm/s (B) 40 cm/s
(C) 10 cm/s (D) 20 cm/s
- 19 The Reynolds number for flow of a fluid is given by
(A) $\eta v d / \rho$ (B) $\rho \eta / v d$
(C) $v d / \rho \eta$ (D) $\rho v d / \eta$
- 20 Flow is usually streamlined (laminar) when Reynolds number is
(A) greater than 2000 (B) less than about 1000
(C) exactly 3000 (D) infinite



- 21 Surface tension is defined as
(A) force per unit length
(B) work per unit length
(C) force per unit area
(D) energy per unit volume
- 22 The SI unit of surface tension is
(A) N/m
(B) N/m²
(C) N m
(D) J m
- 23 The surface tension of a liquid ___ with increase in temperature.
(A) remains constant
(B) increases
(C) first increases then decreases
(D) decreases
- 24 The excess pressure inside a liquid drop of radius r is
(A) $4S/r$
(B) S/r
(C) $S/2r$
(D) $2S/r$
- 25 The excess pressure inside a soap bubble of radius r is
(A) $4S/r$
(B) S/r
(C) $2S/r$
(D) $8S/r$
- 26 The work done in blowing a soap bubble of radius r (surface tension S) is
(A) $8\pi r^2 S$
(B) $2\pi r^2 S$
(C) $16\pi r^2 S$
(D) $4\pi r^2 S$
- 27 The height to which a liquid rises in a capillary tube is given by
(A) $h = r\rho g/(2S)$
(B) $h = 2S \cos \theta/(r\rho g)$
(C) $h = S \cos \theta/(r\rho g)$
(D) $h = 2Sr\rho g/\cos \theta$
- 28 If the radius of a capillary tube is halved, the height of water rise becomes
(A) four times
(B) double
(C) unchanged
(D) half
- 29 For mercury in a glass capillary, the angle of contact is
(A) 0°
(B) acute
(C) obtuse
(D) 90°
- 30 Water rises in a capillary tube while mercury falls because
(A) water's angle of contact with glass is acute while mercury's is obtuse
(B) water is denser than mercury
(C) water has higher viscosity
(D) mercury has lower surface tension
- 31 Detergents help in cleaning clothes because they
(A) increase the surface tension of water
(B) reduce the surface tension of water
(C) increase viscosity
(D) increase the angle of contact



- 32** Small liquid drops are spherical because
(A) of viscosity
(B) of air pressure
(C) of gravity
(D) a sphere has the minimum surface area for a given volume
-
- 33** A U-tube contains water and oil in its two arms without mixing. Oil column of 12 cm balances 10 cm of water. The density of oil is
(A) 833 kg/m^3
(B) 1200 kg/m^3
(C) 1000 kg/m^3
(D) 750 kg/m^3
-
- 34** A body floats with $\frac{3}{4}$ of its volume submerged in water. Its density is
(A) 750 kg/m^3
(B) 1333 kg/m^3
(C) 1000 kg/m^3
(D) 250 kg/m^3
-
- 35** The height of a mercury barometer column under standard atmospheric pressure is
(A) 100 cm
(B) 76 cm
(C) 7.6 cm
(D) 10.3 m
-
- 36** The height of a water barometer column under standard atmospheric pressure would be about
(A) 1.03 m
(B) 103 m
(C) 10.3 m
(D) 76 cm
-
- 37** The principle of a venturimeter is based on
(A) Archimedes' principle
(B) Bernoulli's theorem
(C) Pascal's law
(D) Stokes' law
-
- 38** In streamline flow, two streamlines
(A) always intersect
(B) intersect at right angles
(C) never intersect
(D) intersect at 45°
-
- 39** Two soap bubbles of radii 2 cm and 4 cm are connected by a tube. Air will flow
(A) in neither direction
(B) from the larger bubble to the smaller bubble
(C) from the smaller bubble to the larger bubble
(D) alternately in both directions
-
- 40** A spherical ball falls through a viscous medium. At terminal velocity, its acceleration is
(A) $g/2$
(B) g
(C) increasing
(D) zero
-
- 41** The excess pressure inside a soap bubble of radius 1 cm ($S = 0.03 \text{ N/m}$) is
(A) 24 Pa
(B) 6 Pa
(C) 3 Pa
(D) 12 Pa
-
- 42** The rise of water in a capillary of radius 0.5 mm ($S = 0.07 \text{ N/m}$, $\theta = 0^\circ$, $g = 10 \text{ m/s}^2$) is
(A) 0.7 cm
(B) 2.8 cm
(C) 5.6 cm
(D) 1.4 cm
-



- 43** Water flows horizontally in a pipe. At a point A the speed is 2 m/s and pressure 4×10^4 Pa. At B the speed is 4 m/s. The pressure at B is
- (A) 4.6×10^4 Pa (B) 2×10^4 Pa
(C) 3.4×10^4 Pa (D) 4×10^4 Pa
-
- 44** The angle of contact for pure water and clean glass is approximately
- (A) 140° (B) 180°
(C) 0° (D) 90°
-
- 45** Buoyant force on a body immersed in a fluid equals
- (A) the weight of the fluid displaced (B) the volume of the body
(C) the mass of the fluid displaced (D) the weight of the body
-

Answer Key

1	2	3	4	5	6	7	8	9	10
A	D	A	D	B	B	C	C	B	D
11	12	13	14	15	16	17	18	19	20
A	D	C	C	B	A	C	D	D	B
21	22	23	24	25	26	27	28	29	30
A	A	D	D	A	A	B	B	C	A
31	32	33	34	35	36	37	38	39	40
B	D	A	A	B	C	B	C	C	D
41	42	43	44	45					
D	B	C	C	A					

Hints & Solutions

- (A) Hydrostatic pressure adds to atmospheric pressure: $P = P_0 + \rho gh$.
- (D) $P_g = \rho gh = 1000 \times 10 \times 10 = 10^5 \text{ Pa}$.
- (A) A pressure applied to an enclosed fluid is transmitted undiminished — used in hydraulic lifts and brakes.
- (D) $F_2 = F_1(A_2/A_1) = 50 \times 100 = 5000 \text{ N}$.
- (B) $1 \text{ atm} = 1.013 \times 10^5 \text{ Pa} = 76 \text{ cm of Hg}$.
- (B) $P + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$ expresses energy conservation per unit volume.
- (C) For an incompressible fluid, mass flow rate is constant.
- (C) $v_2 = A_1 v_1 / A_2 = 4 \times 2/1 = 8 \text{ m/s}$.
- (B) Torricelli's law: $v = \sqrt{2gh}$.
- (D) $v = \sqrt{2 \times 10 \times 5} = 10 \text{ m/s}$.
- (A) Faster air above the wing produces lower pressure than below, giving upward lift.
- (D) $\eta = F/(A \, dv/dx) \rightarrow \text{N s m}^{-2} = \text{Pa s}$. (Poise is CGS.)
- (C) Intermolecular cohesion weakens with heating, so liquid viscosity decreases. (For gases it increases.)
- (C) In gases, momentum transfer by faster molecules increases with temperature, raising viscosity.
- (B) $F = 6\pi\eta r v$.
- (A) $v_t = 2r^2(\rho - \sigma)g/(9\eta) \propto r^2$.
- (C) $v_t \propto r^2 \rightarrow 4 \text{ times}$.
- (D) Volume $8\times \rightarrow R = 2r \rightarrow v \propto r^2 \rightarrow 4 \times 5 = 20 \text{ cm/s}$.
- (D) $\text{Re} = \rho v d / \eta$.
- (B) $\text{Re} < \sim 1000 \rightarrow \text{laminar}$; $\text{Re} > \sim 2000 \rightarrow \text{turbulent}$.
- (A) $S = F/L$, numerically equal to surface energy per unit area.
- (A) Force per unit length $\rightarrow \text{N/m}$ (also J/m^2).
- (D) Cohesive forces weaken on heating, so surface tension decreases (zero at critical temperature).



24. (D) A drop has one free surface: $\Delta P = 2S/r$.
25. (A) A soap bubble has two surfaces: $\Delta P = 4S/r$.
26. (A) Two surfaces: $\Delta A = 2 \times 4\pi r^2 \rightarrow W = 8\pi r^2 S$.
27. (B) Jurin's law: $h = 2S \cos \theta / (r\rho g)$.
28. (B) $h \propto 1/r \rightarrow$ doubles.
29. (C) Mercury does not wet glass ($\theta \approx 140^\circ$), so it shows capillary depression.
30. (A) $h \propto \cos \theta$; $\cos \theta > 0$ for water (rise), $\cos \theta < 0$ for mercury (depression).
31. (B) Lower surface tension lets water wet fabrics and lift off grease.
32. (D) Surface tension tends to minimise surface energy, hence surface area.
33. (A) $\rho_{\text{oil}} \times 12 = 1000 \times 10 \rightarrow \rho_{\text{oil}} \approx 833 \text{ kg/m}^3$.
34. (A) $\rho_{\text{body}} V = \rho_w (3V/4) \rightarrow \rho = 750 \text{ kg/m}^3$.
35. (B) $P_o = \rho_{\text{Hg}} g h \rightarrow h \approx 76 \text{ cm of Hg}$.
36. (C) $h = P_o / (\rho g) = 1.013 \times 10^5 / (1000 \times 9.8) \approx 10.3 \text{ m}$.
37. (B) In the constriction, speed increases and pressure drops; the pressure difference gives the flow rate.
38. (C) If they intersected, a fluid particle would have two velocities at a point, which is impossible.
39. (C) $\Delta P = 4S/r$ is larger in the smaller bubble, so air flows into the larger one (smaller shrinks).
40. (D) At terminal velocity, weight = buoyancy + viscous drag, so net force and acceleration are zero.
41. (D) $\Delta P = 4S/r = 4 \times 0.03/0.01 = 12 \text{ Pa}$.
42. (B) $h = 2S / (r\rho g) = 2 \times 0.07 / (5 \times 10^{-4} \times 1000 \times 10) = 0.028 \text{ m} = 2.8 \text{ cm}$.
43. (C) $P_B = P_A + \frac{1}{2}\rho(v_A^2 - v_B^2) = 4 \times 10^4 + 500(4 - 16) = 4 \times 10^4 - 6000 = 3.4 \times 10^4 \text{ Pa}$.
44. (C) Water wets clean glass completely, giving $\theta \approx 0^\circ$.
45. (A) Archimedes' principle.

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