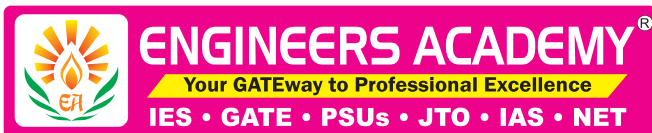


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PROPERTIES OF FLUIDS

OBJECTIVE QUESTIONS

CHAPTER**1**

1. An ideal fluid
 - (a) Is very viscous
 - (b) Obeys newton's law of viscosity
 - (c) Is assumed in conduit flow
 - (d) Frictionless and incompressible
 2. The density of air at 10°C is 1 MPa abs. in SI units is
 - (a) 12.31
 - (b) 1.231
 - (c) 118.4
 - (d) 65.0
 3. The viscosity of a fluid varies with
 - (a) Temperature
 - (b) Temperature and pressure
 - (c) Pressure
 - (d) Density
 4. A fluid is a substance that
 - (a) Is essentially incompressible
 - (b) Always moves when subjected to a shearing stress
 - (c) Has a viscosity that always increases with temperature
 - (d) Has a viscosity that always decreases with temperature
 5. With decrease in temperature, the viscosity in gases generally
 - (a) Increases linearly
 - (b) Increases exponentially
 - (c) Remain unaffected
 - (d) Decreases
 6. Viscosity of a fluid with specific gravity 1.3 is measured to be 0.0034 Ns/m². Its kinematic viscosity, in m²/s, is
 - (a) 2.6×10^{-6}
 - (b) 4.4×10^{-6}
 - (c) 5.8×10^{-6}
 - (d) 7.2×10^{-6}
 7. Viscosity is the most important property in the
 - (a) Travel of a bullet through air
 - (b) Water jet issuing from a fire air
 - (c) Formation of soap bubbles
 - (d) Flow of castor oil through a tube
 8. If the mass density of a liquid is 1000 kg/cum and its dynamic viscosity is 1 Ns/sq.m, then its kinematic viscosity (sq.m/s) will be :
 - (a) 0.1
 - (b) 1
 - (c) 0.001
 - (d) 0.01
 9. A fluid in which resistance to deformation is linerly dependent of the shear stress, is known as
 - (a) Bingham plastic fluid
 - (b) Pseudo plastic fluid
 - (c) Dilatant fluid
 - (d) Newtonian fluid
 10. Which of the following is not dimensionless quantity?
 - (a) Specific gravity
 - (b) Pressure coefficient
 - (c) Darcy weisbach friction factor
 - (d) Kinematic viscosity
- [DDA JE - 2018]**

11. One poise is equivalent to
 (a) 3600 kg/m-hr (b) 1 dyne sec/cm²
 (c) 10⁻¹ kg./m-sec (d) All the above
12. In a flowing fluid, a particles may posses
 (a) Inertial energy
 (b) Pressure energy
 (c) Kinetic energy
 (d) All of the above
13. When the rheogram for a fluid at any temperature and pressure is a straight line passing through origin, the fluid is said to be
 (a) Ideal plastic (b) Bingham
 (c) Newtonian (d) Non-newtonian
14. A pressure of 500 kPa applied to 2m³ of liquid results in a volume change of 0.004 m³. The bulk modulus, in MPa, is
 (a) 2.5 (b) 25
 (c) 250 (d) 2500
15. SI unit of kinematic viscosity is : –
 (a) N.s/m² (b) m²/s
 (c) N/m (d) N.s/m
[RPSC-VPITI, Haryana JE, ISRO - 2018]
16. A fluid, which satisfies the relations ' τ ' = μ (du/dy), where ' τ ' is shear stress, μ constant of proportionality and (du/dy) is the rate of deformation, is known as : –
 (a) Newtonian fluid
 (b) Non – Newtonian fluid
 (c) Thixotropic fluid/ substance
 (d) Plastic
[RPSC-VPITI]
17. Which of the following fluids can be classified as non-newtonian ?
 (a) Kerosene oil and Diesel oil
 (b) Human blood and Toothpaste
 (c) Diesel oil and water
 (d) Kerosene oil and water
[LMRC-JE]
18. Which of the following fluid is incompressible and is having no viscosity?
 (a) Real fluid
 (b) Non-Newtonian fluid
 (c) Ideal fluid
 (d) Newtonian fluid
[PEB-SUB ER. - 2017, Haryana JE - 2018]
19. Poise is a unit for which of the following?
 (a) Specific volume
 (b) Viscosity
 (c) Kinematic viscosity
 (d) Mass density
[PEB-SUB ER. - 2017]
20. Specific gravity is also called as _____.
 (a) Relative density (b) Mass density
 (c) Specific weight (d) Weight density
[PEB-SUB ER. - 2017]
21. In CGS system, the unit of kinematic viscosity is stoke, where 1 stoke = _____.
 (a) 10⁶cm³/s (b) 10⁻²m²
 (c) 10⁴cm³/s (d) 10⁻⁴m²/s
[PEB-SUB ER. - 2017]
22. The ratio of the mass of a fluid to its volume is known as _____.
 (a) Mass density (b) Viscosity
 (c) Specific weight (d) Weight density
[PEB-SUB ER. - 2017]
23. Dynamic viscosity (μ) has the dimension as :
 (a) MLT⁻² (b) ML⁻¹T⁻¹
 (c) ML⁻¹T⁻² (d) M⁻¹L⁻¹T⁻¹
[MPSC - 2012, AEC - 2017]
24. The drag on a very small sphere falling in a highly viscous fluid varies
 (a) Inversely with the velocity
 (b) Directly with the velocity
 (c) As the square root of the velocity
 (d) As the square of the velocity
[LBS-ASST.PROF. - 2017]

25. A fluid in equilibrium can't sustain
(a) Shear stress (b) Compressive stress
(c) Tensile stress (d) Bending stress
[ISRO - 2015]
26. One kilo Pascal is equivalent to :
(a) 10 N/mm² (b) 1000 N/m²
(c) 100 N/mm² (d) 1000 N/cm²
[NBCC - 2017]
27. Fluids undergo volume change under external pressure due to
(a) Plasticity (b) Viscosity
(c) Tenacity (d) Compressibility
[ISRO - 2018]
28. 1 centipoise = _____ poise.
(a) 1/10 (b) 1/100
(c) 1/50 (d) 1/25
[Haryana JE - 2018]
29. The viscosity of water at 20°C is
(a) 0.05 poise (b) 0.1 poise
(c) 0.01 poise (d) 0.1 centipoise
[Haryana JE - 2018]
30. A vessel of 4 m³ contains oil which weight 30 kN. The specific weight of the oil is
(a) 4.5 kN/m³ (b) 6 kN/m³
(c) 7.5 kN/m³ (d) 10 kN/m³
[ISRO - 2017]
31. The variation in the volume of a liquid with the variation of pressure is called its
(a) Surface tension (b) Compressibility
(c) Capillarity (d) Viscosity
[ISRO - 2017]
32. Newton's law of viscosity is a relationship between
(a) Pressure, velocity and temperature
(b) Shear stress and rate of shear strain
(c) Shear stress and velocity
(d) Rate of shear strain and temperature
[ISRO - 2017]
33. Pascal-sec is the unit of
(a) Pressure
(b) Kinematic viscosity
(c) Dynamic viscosity
(d) Surface tension
[PMB JE - 2018]
34. If the volume of a liquid weighing 3000 kg is 4 cubic metres, 0.75 is its
(a) Specific weight (b) Specific mass
(c) Specific gravity (d) Specific volume
[ISRO - 2013]
35. The property of a fluid which offers resistance to the movement of one layer to another adjacent layer is called _____.
(a) Viscosity (b) Slip
(c) Opacity (d) Velocity
[DMRC - 2018]
36. "Eddy Viscosity" means that it is
(a) Physical property of the fluid
(b) Same as the kinematic viscosity
(c) Always associated with laminar flow
(d) An apparent viscosity due to turbulent flow
[HPSC - 2014]
37. When a matter resists applied shear stress by static deformation, it is :
(a) Liquid (b) Gas
(c) Fluid (d) Solid
[DDA JE - 2018]
38. Surface tension has the dimensions
(a) FL⁻¹ (b) F
(c) FL⁻² (d) FL⁻³
[UK Combined AE - 2012, SSC JE - 2011]
39. If salt is added in water, the surface tension of water will :
(a) Increase (b) Decrease
(c) Will not change (d) None of the above
[UPSSSC JE - 2015]

40. The weight per unit volume of a liquid at standard temperature and pressure is called :
 (a) Specific weight (b) Specific mass
 (c) Mass density (d) Specific gravity
[F.C.I. JE - 2015]
41. Surface tension of water
 (a) Increases with decreases in temperature
 (b) Decreases with decreases in temperature
 (c) Independent of temperature
 (d) None of these
[MP SUB Eng. - 2016]
42. The stress, which is responsible for retaining water in a capillary tube above the free water surface of the water body in which the capillary tube is inserted, is called the
 (a) Capillary compression
 (b) Capillary tension
 (c) Capillary pore pressure
 (d) None of these
[MP SUB Eng. - 2016]
43. Rheology is the study of
 (a) Newtonian fluids
 (b) Ideal fluids
 (c) Non-Newtonian fluids
 (d) None of these
[H.P. SSC - 2015]
44. If the mass density of a fluid is 789 kg/m^3 Taking $g = 9.806 \text{ m/sec}^2$. Specific volume will be
 (a) $0.126 \text{ m}^3/\text{kN}$ (b) $0.122 \text{ m}^3/\text{kN}$
 (c) $0.129 \text{ m}^3/\text{kN}$ (d) $0.132 \text{ m}^3/\text{kN}$
[UK Combined AE - 2012]
45. With an increase in the radius of the tube, the rise of liquid in the tube due to surface tension will _____
 (a) Decrease
 (b) Increase
 (c) Remains unchanged
 (d) Cannot be said
[UK Combined AE - 2012]
46. If pipes of too small diameter are used, the power required may _____.
 (a) Considerably increased
 (b) Considerably decreased
 (c) Be constant
 (d) Be null
[MP Draftman JE - 2017]
47. What shall be the pressure intensity inside a soap bubble of radius 4 cm? (Surface tension of water is 0.0736 N/m) :
 (a) 7.36 N/m^2
 (b) 1.84 N/m^2
 (c) 3.68 N/m^2
 (d) None of these
[UPSSSC JE - 2016]
48. Which of the following is not the unit of pressure?
 (a) Kg/cm^2 (b) Psi
 (c) Atmosphere (d) Newton
[UP Jal Nigam JE - 2016]
49. The expression for kinematic viscosity of a fluid is-
 (a) Dynamic viscosity $\times$ density
 (b) Dynamic viscosity / density
 (c) Dynamic viscosity $\times$ pressure
 (d) None of the above
[Uttarakhand AE - 2013]
50. Which of the following is dimensionless?
 (a) Specific volume (b) Specific weight
 (c) Specific gravity (d) Specific speed
[DMRC JE - 2017]
51. The region within which the effect of viscosity is confined, is known as
 (a) Cavitation (b) Stagnation layer
 (c) Boundary layer (d) Free layer
[UPRVUNL JE - 2015]
52. A fluid whose viscosity changes with the rate of deformation is known as :
 (a) Newtonian fluid (b) Laminar flow
 (c) Turbulent flow (d) Non-newtonian fluid
[MP SUB. Eng. - 2016]

53. Match List I with List II and choose the correct answer from the options given below :

List-I

(Physical quantity)

- A. Angular velocity
- B. Angular acceleration
- C. Discharge
- D. Kinematic viscosity

List-II

(Dimension)

- a. L^2T^{-1}
- b. T^{-1}
- c. T^{-2}
- d. L^3T^{-1}
- (a) A-a, B-b, C-d, D-a
- (b) A-b, B-c, C-d, D-a
- (c) A-c, B-d, C-a, D-b
- (d) A-b, B-d, C-a, D-c

[LMRC JE - 2015]

54. Match List-I with List-II and the correct answer from the options below.

List-I (Fluid property)

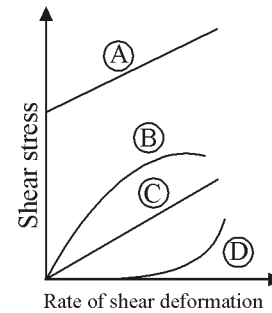
- A. Compressibility
- B. Gravity
- C. Viscosity
- D. Vapour pressure

List-II (Flow Phenomenon)

- a. Flow of real fluid past a tiny sphere
- b. Cavitation
- c. Hydraulic jump
- d. Flight of supersonic aircraft
- (a) A-c, B-d, C-b, D-a
- (b) A-c, B-d, C-b, D-a
- (c) A-d, B-c, C-a, D-b
- (d) A-d, B-c, C-b, D-a

[UPPCL JE - 2015]

55. In the given figure which nature of fluid is represented by curve A?



- (a) Newtonian
- (b) Pseudo-plastic
- (c) Dilatant
- (d) Ideal Bingham plastic

[UPPCL JE - 2015]

56. Which of the following statements is correct?
- (a) For water at 100°C at sea level, the vapour pressure is equal to the atmospheric pressure
 - (b) Air is 50,000 times more compressible than water
 - (c) Viscosity of the molecules is the property exhibited by them in both static and dynamic conditions
 - (d) Surface energy is caused by the force of adhesion between liquid molecules

[UPPCL JE - 2015]

57. From the options given below, in which situations, the viscous force is unimportant?

- (a) Incompressible fluids in closed pipes
- (b) Motion of aeroplanes
- (c) Capillary waves in channels
- (d) Resistance to motion of ship

[MP SUB Eng. - 2016]

58. When a ship moving on sea water enters river and moves inland, it is expected to

- (a) Rise a little
- (b) Sink a little
- (c) Maintain the same level of draft
- (d) Rise or fall depending on whether it is made of wood or steel

[MP SUB ENG - 2016]

59. A plate of thickness 0.010 mm, distant from a fixed plate, moves at 10 cm/s and requires a force of 1 N per unit area i.e. 1 N/mm² to maintain this speed. What would be the fluid viscosity between the plates?
(a) 10⁻³ poise (b) 10⁻⁴ poise
(c) 2 × 10⁻³ poise (d) None of these
[HPSSSB JE - 2017]
60. Milk mixes with water due to
(a) Very good cohesion
(b) Very good adhesion
(c) Very good surface tension
(d) Very good vapour pressure
[RRB JE - 2015]
61. A liquid forms an interface with another liquid or gas; the surface energy per unit area of the interface is known as :
(a) Surface tension (b) Specific energy
(c) Specific heat (d) Suction energy
[RRB SSE - 2015]
62. Spherical shape of droplets of mercury is due to-
(a) High density (b) High surface tension
(c) High adhesion (d) Water
[RRB JE - 2015]
63. Falling drops of water become spheres due to the property of :
(a) Compressibility of water
(b) Surface tension of water
(c) Capillarity of water
(d) Viscosity of water
[RRB JE - 2014]
64. The capillary rise at 20°C in clean glass tube of 1 mm diameter, containing water is :
(a) 15 mm (b) 50 mm
(c) 20 mm (d) 30 mm
[RRB JE - 2015]
65. Cavitation is primarily associated with of the following fluid properties
(a) Specific gravity (b) Surface tension
(c) Viscosity (d) Vapour pressure
[RRB SSE - 2015]
66. The intensity of pressure developed by surface tension of 0.075 N/m in a droplet of water of 0.075 mm diameter is-
(a) 0.8 N/cm² (b) 0.6 N/cm²
(c) 0.4 N/cm² (d) 400 N/cm²
[RRB JE - 2015]
67. Capillarity of liquid in small-diameter tubes is due to molecular attraction. In case of Mercury, the following occurs in terms of capillarity
(a) Capillary rise (b) Capillary depression
(c) Capillary flattening (d) Compressibility
[RRB SSE - 2015]
68. The density of water is :
(a) 10⁻³ kg/m³ (b) 1 kg/m³
(c) 10² kg/m³ (d) 10³ kg/m³
[RRB JE - 2014]
69. Water has its maximum density at :
(a) 0°C (b) 100°C
(c) 50°C (d) 4°C
[RRB JE - 2014]
70. If cohesion between molecules of fluid is greater than adhesion between fluid and glass, then the free level of fluid in a dipped glass tube will be
(a) Higher than the surface of liquid
(b) The same as the surface of liquid
(c) Lower than the surface of liquid
(d) Unpredictable
71. Dynamic viscosity of the liquids with rise in temperature
(a) Does not show any change
(b) Increases
(c) Decreases
(d) None of these

83. Which of the following statements is INCORRECT about thixotropic fluids?
 (a) Apparent viscosity depends on the time of shearing
 (b) Thixotropy is an irreversible process
 (c) Thixotropic fluid shows shear thinning behavior
 (d) Thixotropic fluids are in general non-Newtonian fluids
[CEPTM - 2009]
84. The mass density of one litre of diesel of relative density 0.6 is :
 (a) 1000 kg/m³ (b) 6000 kg/m³
 (c) 60 kg/m³ (d) 600 kg/m³
[WRD B. Tech - 2013]
85. The excess pressure in a droplet of 0.002 m diameter a fluid with surface tension of 0.01 N/m is
 (a) 10 (b) 20
 (c) 4π (d) 0.00004π
[AEM - 2017]
86. Surface tension is a phenomenon due to
 (a) Cohesion only
 (b) Viscous force only
 (c) Adhesion between liquid and solid molecules
 (d) Difference in magnitude between the forces due to adhesion and cohesion
87. Newton's law of viscosity is given by the relation
 (a) $\tau = \mu^2 \frac{du}{dy}$ (b) $\tau = \mu \frac{du}{dy}$
 (c) $\tau = \mu \frac{dy}{du}$ (d) $\tau = \mu^2 \frac{dy}{du}$
[CEMPM - 2018]
88. Compressibility is the reciprocal of
 (a) Bulk modulus of elasticity
 (b) Shear modulus of elasticity
 (c) Young's modulus of elasticity
 (d) Viscosity
[CEMPM - 2018]
89. Which one of the following is defined as force per unit length –
 (a) Surface tension (b) Compressibility
 (c) Capillarity (d) Viscosity
[RRB JE - 2015]
90. For a fluid at rest–
 (a) The shear stress is zero only on the horizontal plane
 (b) The shear stress is zero
 (c) The shear stress is maximum on a plane inclined at 45° to the horizontal
 (d) The shear stress depends upon the coefficient of viscosity
[UPSSC JE - 2015]
91. Match List-I (fluid properties) with List-II (related terms) and select the correct answer using the given lists:
- | List-I | List-II |
|---------------------|---------------------|
| A. Capillarity | a. Cavitation |
| B. Vapour pressure | b. Density of water |
| C. Viscosity | c. Shear forces |
| D. Specific gravity | d. Surface tension |
- (a) A-a, B-d, C-b, D-c
 (b) A-a, B-d, C-c, D-b
 (c) A-d, B-a, C-b, D-c
 (d) A-d, B-a, C-c, D-b
[UPRVUNL JE - 2015]
92. A liquid compressed in a cylinder has initially a volume of 20 m³ at a pressure of 100 Pa. If the new volume is 40 m³ at a pressure of 50 Pa, the bulk modulus of elasticity would be :
 (a) 20 Pa (b) –20 Pa
 (c) 50 Pa (d) –50 Pa
[UPRVUNL AE - 2014]
93. A glass tube of 3 mm diameter is immersed in water which is at 20°C. The surface tension for water is 0.0736 N/m. The contact angle for water is 0°. How much will be the capillary rise or depression?
 (a) 20 mm (b) 10 mm
 (c) 0.492 cm (d) 0.56 cm
[MP SE - 2016]

105. The increase in pressure of a liquid

- (a) Lowers the boiling point of a liquid
- (b) Raises the boiling point of a liquid
- (c) Does not effect the boiling point of a liquid
- (d) Reduces its volume

[MP SE - 2016]

106. One liter of water occupies a volume of :

- (a) 100 m³
- (b) 1000 cm³
- (c) 10000 cm³
- (d) 100000 m³

[MP SE - 2016]

107. The desirable properties for an practical fluids :

- (a) Should be viscous
- (b) Should posses surface tension
- (c) Should be compressible
- (d) All of the above

[MP SE - 2016]

108. Find the surface tension in soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m² above atmospheric pressure.

- (a) 0.860 N/m
- (b) 1.265 N/m
- (c) 0.0125 N/m
- (d) 0.0064 N/m

[RSMSSB-JE-2020]

109. Pressure inside a water droplet is given by relation

- (a) $P = \frac{3\sigma}{d}$
- (b) $P = \frac{8\sigma}{d}$
- (c) $P = \frac{16\sigma}{d}$
- (d) $P = \frac{4\sigma}{d}$

[RSMSSB-JE-2020]

110. Newton's Law of Viscosity is a relationship between

- (a) Shear stress and velocity
- (b) Rate of shear strain and velocity
- (c) Pressure, velocity and temperature
- (d) Shear stress and rate of shear strain

[RSMSSB-JE-2020]

111. Dimension of dynamic viscosity is

- (a) MLT^{-2}
- (b) ML^2T^{-1}
- (c) MLT^{-1}
- (d) $ML^{-1}T^{-1}$

[RSMSSB-JE-2020]

112. With rise in pressure, the bulk modulus of liquid

- (a) Remains constant
- (b) Increases
- (c) Decreases
- (d) None of the above

[UPPSC-AE-2020]

ANSWERS SHEET1. *Ans. (d)*

Ideal fluid is non viscous, frictionless and incompressible.

2. *Ans. (a)*3. *Ans. (a)*

Viscosity is a function of temperature.

4. *Ans. (b)*

Fluid has zero or very less shear strength and always moves when subjected to shearing stress.

5. *Ans. (d)*

With increase in temperature viscosity of liquid decreases while for gases it increases.

6. *Ans. (a)*

$$\nu = \frac{\mu}{\rho} = \frac{3.4 \times 10^{-3}}{1300} = 2.6 \times 10^{-6} \text{ m}^2/\text{s}$$

7. *Ans. (d)*8. *Ans. (c)*

$$\rho = 1000 \text{ kg/m}^3$$

$$\mu = 1 \frac{\text{N-s}}{\text{m}^2} \text{ then}$$

$$\nu = \frac{1}{10^3} = 10^{-3} \text{ m}^2/\text{s}$$

9. *Ans. (d)*

For newtonian fluid,

$$\tau = \frac{\mu du}{dy}$$

10. *Ans. (d)*

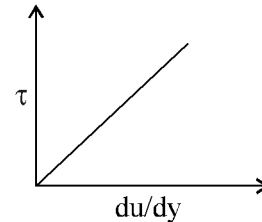
Kinematic viscosity is not a dimensionless quantity its unit is m^2/sec .

11. *Ans. (d)*12. *Ans. (d)*

Total energy consist of inertial energy, pressure energy and kinetic energy.

13. *Ans. (c)*

Reheogram for Newtonian fluid is a straight line passing through origin

14. *Ans. (c)*

$$K = \frac{\partial P}{\partial V} = \frac{500 \times 2}{4 \times 10^{-3}} = 250 \times 10^3 \text{ KPa} = 250 \text{ MPa}$$

15. *Ans. (b)*

$$\nu = \frac{\mu}{\rho} = \frac{\text{kg}}{\frac{\text{m} - \text{sec}}{\text{kg} / \text{m}^3}} = \frac{\text{m}^2}{\text{sec}}$$

16. *Ans. (a)*

For newtonian fluid, stress is directly proportional to velocity gradient.

$$\tau = \frac{\mu du}{dy}$$

17. *Ans. (b)*

Human blood $\rightarrow$ Pseudo plastic fluid

Toothpaste $\rightarrow$ Bingham plastic fluid

Air, water, petrol, Diesel, Kerosene, mercury $\rightarrow$ Newtonian fluids

18. *Ans. (c)*

Ideal fluid is the fluid which is incompressible and have no viscosity.

19. *Ans. (b)*

Poise is the unit of dynamic viscosity or viscosity

$$1 \text{ poise} = 0.1 \text{ N-s/m}^2$$

20. *Ans. (a)*

Specific gravity is also called as relative density.

21. *Ans. (d)*

Stoke's is the unit of kinematic viscosity in CGS

$$1 \text{ stoke} = 10^{-4} \text{ m}^2/\text{sec}$$

22. *Ans. (a)*

$$\rho = \frac{M}{V}$$

23. *Ans. (b)*

$$\begin{aligned} \text{Dimension of viscosity} &= \frac{\text{N-s}}{\text{m}^2} \\ &= \frac{(\text{MLT}^{-2})\text{T}}{\text{L}^2} = \text{ML}^{-1}\text{T}^{-1} \end{aligned}$$

24. *Ans. (d)*

$$\text{Drag force} = \frac{1}{2} C_D \rho A V^2$$

Clearly drag force is directly proportional to square of velocity.

25. *Ans. (a)*

Fluid has zero or very less shear resistance that's why can't sustain shear stress.

26. *Ans. (b)*

$$1 \text{ KPa} = 1 \times 10^3 \text{ Pa} = 10^3 \frac{\text{N}}{\text{m}^2}$$

27. *Ans. (d)*

Compressibility is property by virtue of which fluid undergo volume change under external pressure.

28. *Ans. (b)*

$$1 \text{ centipoise} = 10^{-2} \text{ poise}$$

29. *Ans. (c)*

Viscosity of water at 20°C is 10^{-2} poise.

30. *Ans. (c)*

$$\text{Volume} = 4\text{m}^3$$

$$\text{Total weight} = 30 \text{ kN}$$

$$\text{Weight} = mg = (V\rho)g = 30 \times 10^3 \text{ N}$$

$$(\rho g = \text{weight density})$$

$$4\rho g = 30$$

$$(\rho g) = 7.5 \text{ kN/m}^3$$

$$\text{Specific weight} = 7.5 = 7.5 \text{ kN/m}^3$$

31. *Ans. (b)*

The property by virtue of which fluid undergo volume under pressure is compressibility

32. *Ans. (b)*

Newton's law of viscosity

$$\tau = \frac{\mu du}{dy}$$

here

$$\tau = \text{shear stress}$$

$$\mu = \text{dynamic viscosity}$$

$$\frac{du}{dy} = \text{rate of shear strain}$$

33. *Ans. (c)*

Pascal-second = N-s/m^2 = unit of dynamic viscosity.

34. *Ans. (c)*

$$\text{Mass} = \text{Volume} \times \text{density}$$

$$3000 = 4 \times \rho$$

$$\text{Density } (\rho) = 750$$

$$\begin{aligned} \text{Specific gravity} &= \frac{750}{\text{density of water}} = \frac{750}{1000} \\ &= 0.75 \end{aligned}$$

35. *Ans. (a)*

Viscosity is the resistance to flow offered by one layer of fluid on another.

36. *Ans. (d)*

Eddy viscosity is due to turbulent flow.

37. *Ans. (d)*

Solid resist applied shear stress by static deformation neither liquid nor gases.

38. *Ans. (a)*

$$F = (\sigma)L$$

$$\sigma = \frac{F}{L} = FL^{-1} \left[\begin{array}{l} \sigma = \text{surface tension} \\ F = \text{Force} \\ L = \text{Length} \end{array} \right]$$

39. *Ans. (a)*

With increase in turbidity in water such as salt, surface tension of water will increase.

FLUID STATICS

OBJECTIVE QUESTIONS

CHAPTER

2

1. The line of action of force exerted by a liquid on a plane area passes through the
 - (a) Centre of pressure
 - (b) Centre of buoyancy
 - (c) Centre of gravity
 - (d) Centre of inertia
 2. The depth of centre of pressure in rectangular lamina of height h with one side in the liquid surface is at
 - (a) h
 - (b) $\frac{h}{3}$
 - (c) $\frac{2h}{3}$
 - (d) $\frac{h}{2}$
 3. A closed cubical box 0.8 m on each side, is half filled with water and the other half being filled with oil of specific gravity 0.75. Then the pressure difference at the bottom and top layers in pascal.
 - (a) 7678
 - (b) 5800
 - (c) 8628
 - (d) 6867
 4. 1 N/m^2 pressure is equivalent to
 - (a) 1 pascal
 - (b) 10^{-5} bar
 - (c) Both (a) and (b)
 - (d) None of these
 5. The total force on the surface of a vertical sluice gate $2 \text{ m} \times 1 \text{ m}$ with its top 2 m, surface being 0.5 m below the water level will be
 - (a) 500 kN
 - (b) 1000 kN
 - (c) 1500 kN
 - (d) 2000 kN
 6. The point in the immerse body through which the resultant pressure of the liquid may be taken to act is known as
 - (a) Metacentre
 - (b) Centre of pressure
 - (c) Centre of buoyancy
 - (d) Centre of gravity
 7. A piezometer cannot be used for pressure measurement in pipes when
 - (a) Pressure difference is low
 - (b) Velocity is high
 - (c) Fluid in the pipe is a gas
 - (d) Fluid is highly viscous
 8. The location of resultant force acting on a body submerged in water (i.e. depth of centre of pressure) will be
 - (a) $h_G + \frac{I_G}{h_G A}$
 - (b) $h_G + \frac{h_G A}{I_G}$
 - (c) $h_G - \frac{I_G}{h_G A}$
 - (d) $h_G + \frac{h_G}{I_G A}$
- where h_G = depth of centroid of the surface,
 A = area
 I_G = M.I. of the surface about an axis lying in the surface, passing through its centroid and parallel to the free surface.

9. If a surface is inclined at angle θ with the liquid surface, then total pressure on the immersed surface will be
 (a) $wA\bar{x}$ (b) $wA\bar{x}\cos\theta$
 (c) $wA\bar{x}\sin\theta$ (d) $wA\bar{x}\tan\theta$
10. A barometer is used to measure
 (a) Very low pressures
 (b) Very high pressures
 (c) Pressure of fluid in a pipe line
 (d) Atmospheric pressure
11. Vertical component of pressure force on a sub-merged curved surface is equal to
 (a) Its horizontal component
 (b) The force on a vertical projection of the curved surface
 (c) The product of pressure at centroid and surface area
 (d) The weight of liquid vertically above the curved area
12. 1 atm. pressure is equivalent to
 (a) $1.01325 \times 10^5 \text{ N/m}^2$
 (b) 760 mm Hg
 (c) 1.01325 bar
 (d) All the above
13. If a barometer carries water instead of mercury, the height of column for a pressure equivalent to 75 cm of mercury will be
 (a) 1020 cm (b) 1000 cm
 (c) 1034 cm (d) 1040 cm
14. A vertical wall is subjected to liquid (of specific weight 'w') pressure on one side. If h be the height of liquid surface, then total pressure on wall per unit length is
 (a) wh (b) $\frac{wh}{2}$
 (c) $\frac{wh^2}{2}$ (d) $\frac{2}{3}wh$
15. The horizontal component of force on a curved surface is equal to the
 (a) Weight of liquid vertically above the curved surface
 (b) Weight of liquid retained by the curved surface
 (c) Product of pressure at its centroid and area
 (d) Force on a projection of the curved surface into a vertical plane
16. What shall be pressure head of a liquid of specific gravity 0.8 for a pressure head of 100 m of water: –
 (a) 80 m (b) 125 m
 (c) 160 m (d) 64 m
- [RPSC-VPITI]**
17. Which one of the following pressure units represents the least pressure?
 (a) Millibar (b) mm of Mercury
 (c) N/mm^2 (d) kgf/cm^2
18. Atmospheric pressure is measured by ____.
 (a) Altimeter (b) Piezometer
 (c) Barometer (d) Spectrometer
- [PEB-SUB ER. - 2017]**
19. Differential manometers are used to measure
 (a) Pressure in water channels
 (b) Pressure in water pipes
 (c) Difference of pressure between any two points
 (d) Atmospheric pressure
20. The position of centre of pressure on a plane surface immersed vertically in a static mass of fluid is
 (a) At the centre of submerged area
 (b) Always above the centre of gravity
 (c) Always below the centre of gravity
 (d) Has no relation with centre of gravity
- [TSPSC-AE - 2015]**

21. The pressure in metres of oil (specific gravity 0.8) equivalent to 80 m of water is
(a) 64 (b) 80
(c) 100 (d) 88
[LBS-ASST.PROF. - 2017]
22. The atmospheric pressure head is ____ mm of mercury.
(a) 9.81 (b) 760
(c) 10.33 (d) 9810
[Haryana JE - 2018]
23. The rise of liquid in manometers gives the
(a) Mercury level at that point.
(b) Discharge capacity at that point.
(c) Pressure head at that point.
(d) Density of water at that point.
[Haryana JE - 2018]
24. The distance of centre of pressure from the surface of liquid is _____ of the density of the liquid.
(a) Dependent
(b) Independent
(c) Inversely proportional
(d) Directly proportional
[Haryana JE - 2018]
25. A vertical triangular area with vertex downward and altitude 'h' has its base lying on the free surface of a liquid. The centre of pressure below the free surface is at a distance
(a) $h/4$ (b) $h/3$
(c) $h/2$ (d) $2h/3$
[TSPSC-AE - 2015, Chandigarh JE - 2016]
26. 1 bar = _____ N/m²
(a) 10^2 (b) 10^3
(c) 10^4 (d) 10^5
[Haryana JE - 2018]
27. The pressure or intensity of pressure at a point in a static fluid is equal in all directions states by
(a) Pascal's Law (b) Newton's Law
(c) Euler's Law (d) Reynold's Law
[Haryana JE - 2018]
28. The pressure which is measured with reference to absolute zero pressure is
(a) Gauge pressure
(b) Absolute pressure
(c) Atmospheric pressure
(d) None of the above
[Haryana JE - 2018]
29. The pressure of a liquid measured with the help of piezometer tube is
(a) Vacuum pressure
(b) Atmospheric pressure
(c) Absolute pressure
(d) Gauge pressure
[ISRO - 2017]
30. Which is the simplest form of manometer used for measuring gauge pressures?
(a) U-tube Manometer
(b) Simple Manometer
(c) Differential Manometer
(d) Piezometer
[Haryana JE - 2017]
31. Select the correct statement
(a) Absolute pressure = (Gauge pressure - Atmospheric pressure)
(b) Gauge pressure = (Absolute pressure - Atmospheric pressure)
(c) Absolute pressure = (Atmospheric pressure + Vacuum pressure)
(d) Gauge pressure = (Atmospheric pressure + Vacuum pressure)
[PMB JE - 2018]
32. Centre of pressure of a vertically immersed surface is always below the centre of gravity of the area by the distance of
(a) $\frac{I_G}{A\bar{x}}$ (b) $\frac{I_G}{\bar{x}}$
(c) $\frac{\bar{x}}{2}$ (d) $\bar{x}$
[DMRC - 2018]

45. When metacenter and center of gravity of any floating body coincide, the floating body will be:
- Floating equilibrium
 - Unstable equilibrium
 - Neutral equilibrium
 - Stable equilibrium

[UPSSSC JE - 2015]

46. Pascal's law states that pressure at a point is equal in all directions, in a
- Static solid
 - Static fluid
 - Static gas
 - Moving fluid

[Uttarakhand JE - 2015]

47. The ratio of pressure between the points A and B located at depths 0.5m and 2.0m respectively below a constant level of water in tank is
- $1:\sqrt{2}$
 - $1:2$
 - $1:4$
 - $1:16$

[Uttarakhand JE - 2015]

48. The total pressure on a plane surface submerged in a liquid and inclined at an angle θ with the horizontal will be
- $\rho \cdot A \cdot g \bar{x}$
 - $\rho \cdot A \sin \theta$
 - $\rho \cdot A \cdot \cos \theta$
 - $\rho \cdot A \cdot \tan \theta$

[Uttarakhand JE - 2015]

49. The centre of pressure of a submerged plainular region is?
- Free from orientation of region
 - In the centroid of Region
 - Always below the centroid
 - Point where the resultant force act on the region due to pressure

[LMRC JE - 2016]

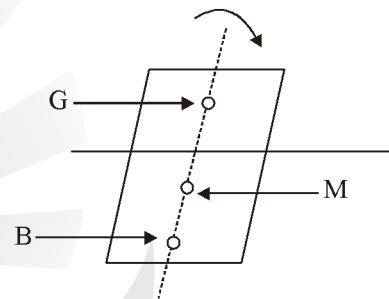
50. In order to avoid sliding of masonry dam, the force of friction between the dam and soil should be at least _____ the total water pressure per meter length.
- Equal to
 - 1.5 times
 - Double
 - 2.5 times

[UPSSSC JE - 2015]

51. An increase in meta centric height
- Increase stability
 - Decreases stability
 - Increases comfort for passengers
 - Decreases comfort for passengers
- (i) and (iii)
 - (i) and (iv)
 - (ii) and (iii)
 - (ii) and (iv)

[HPSSSB JE - 2017]

52. A body is floating as shown in the given figure. The centre of buoyancy, centre of gravity and metacentre are labelled respectively as B, G and M. The body is



- Vertically stable
- Vertically unstable
- Rotationally stable
- Rotationally unstable

[UPRVUNL AE - 2015]

53. Which one of the following pressure unit represents the least pressure?
- millibar
 - mm of mercury
 - N/mm^2
 - kgf/cm^2

[UK Combined AE - 2012, RJC Exam - 2016]

54. The pressure less than the atmospheric pressure is known as
- Suction pressure
 - Vacuum pressure
 - Negative pressure
 - All the above

[UK Combined AE - 2012]

67. A vertical rectangular plane surface is submerged in water such that its top and bottom surfaces are 1.5 m and 6.0 m respectively below the free surface. The position of centre of pressure below the free surface will be at a distance of

(a) 3.8 m (b) 4.0 m
(c) 4.2 m (d) 4.5 m

[CGPSC]

68. Match List I with List II and select the correct answer :

List I		List II	
A	Centroid	1	Always positive
B	Centre of pressure	2	Area moment zero
C	Free surface	3	Constant area
D	Second moment of area	4	Constant pressure
		5	Resultant force

(a) A-2, B-4, C-5, D-3
(b) A-4, B-2, C-3, D-1
(c) A-2, B-5, C-4, D-1
(d) A-5, B-3, C-2, D-4

[CGPSC]

69. Which of the following relation is true for pressure intensities at different points A, B, C as shown in Figure (1) :

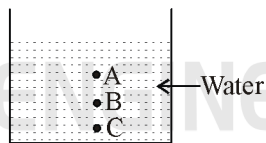


Figure 1

(a) $P_A > P_B > P_C$ (b) $P_B > P_C > P_A$
(c) $P_C > P_B > P_A$ (d) $P_A > P_C > P_B$

[WRD B. Tech - 2013]

70. The forces being deal with in fluid statics are
- (a) Gravity forces and surface tension
(b) Gravity forces and viscous forces
(c) Gravity forces and pressure forces
(d) None of these

71. Which of the following is a Mechanical Gauge?

(a) Diaphragm gauge
(b) Dead weight pressure gauge
(c) Bourdon tube pressure gauge
(d) All of the above

72. An oil of specific gravity 0.9 is contained in a vessel. At a point the height of oil is 40 m. Find the corresponding height of water at the point.

(a) 900 m (b) 36 m
(c) 10.33 m (d) 18 m

[CEMPM - 2018]

73. In an isothermal atmosphere, the pressure

(a) Varies with temperature
(b) Varies linearly with density
(c) Remains constant
(d) Decreases with elevation

74. A gauge indicated 15 kPa as the fluid pressure while, the ambient pressure is 160 kPa. The absolute pressure of the fluid in kgf/cm^2 is

(a) 1.68 (b) 1.78
(c) 1.73 (d) 1.83

[CGPSC]

75. The pressure gradient along any free surface is

(a) Always negative
(b) Always positive
(c) May be positive or negative depending upon acceleration
(d) Zero

[CGPSC]

76. In a differential manometer, a head of 1.8 m of fluid A in limb 1 is found to balance a head of 0.9 m of fluid B in limb 2. The ratio of specific gravities of A to B is

(a) 2 (b) 0.5
(c) 3 (d) 0.18

[CGPSC]

- 103.** Determine the values of absolute pressure if the gauge pressure is 21 bar and atmospheric pressure is 1.013 bar.
- (a) 21 bar (b) 22.013 bar
(c) 20 bar (d) None of the above
- [MP Sub Engineer - 2016]**
- 104.** The reading of the pressure gauge fitted on a vessel is 25 bar. The atmospheric pressure is 1.03 bar and the value of g is 9.81 m/s^2 . The absolute pressure in the vessel is
- (a) 23.97 bar (b) 25.00 bar
(c) 26.03 bar (d) 34.84 bar
- [UPRVUNL JE - 2015]**
- 105.** What is the total pressure on a plane surface inclined at an angle θ with the horizontal?
- (a) $PA \tan \theta$ (b) $PA \sin \theta$
(c) $PA \cos \theta$ (d) PA
- [RSMSSB-JE-2020]**
- 106.** The pressure measured above the absolute zero of pressure is termed as
- (a) Absolute pressure
(b) Vacuum pressure
(c) Atmospheric pressure
(d) Gauge pressure
- [RSMSSB-JE-2020]**
- 107.** The ratio of pressures between the two points A and B located respectively at depth 0.25 m and 0.75 m below a constant level of water in a tank is
- (a) 1 : 2 (b) 1 : 3
(c) 1 : 4 (d) 1 : 5
- [UPPSC-AE-2020]**
- 108.** A circular plate 1 m in diameter is submerged vertically in water such that its upper edge is 8 m below the free surface of water. The total hydrostatic pressure force on one side of the plate is
- (a) 6.7 kN (b) 65.4 kN
(c) 45.0 kN (d) 77.0 kN
- [UPPSC-AE-2020]**
- 109.** As the depth of immersion of a vertical plane surface increase, the location of centre of pressure
- (a) Moves apart from the centre of gravity of the area
(b) Comes closer to the centre of gravity of the area
(c) Coincides with the centre of gravity of the area
(d) Remains unaffected
- [UPPSC-AE-2020]**

ANSWERS SHEET

1. *Ans. (a)*

The line of action of force exerted by a liquid on a plane area passes through the centre of pressure.

2. *Ans. (c)*

$$h_{cp} = \bar{h} + \frac{I_{xx} \sin^2 \theta}{A\bar{h}}$$

$$\bar{h} = \frac{h}{2}, I_{xx} = \frac{bh^3}{12}, \theta = 90, \sin^2$$

$$\theta = 1^2 = 1, A = bh, \bar{h} = \frac{h}{2}$$

$$h_{cp} = \frac{h}{2} + \frac{bh^3}{12} \times 1 \times \frac{2}{bh \times h}$$

$$= \frac{h}{2} + \frac{h}{6} = \frac{4h}{6} = \frac{2h}{3}$$

3. *Ans. (d)*

Side of cube = 0.8m

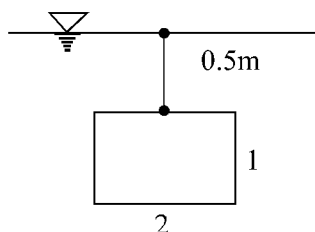
Pressure at bottom – pressure at top = $\rho_1 g h_1 + \rho_2 g h_2$

$$= 1000 \times 9.81 \times 0.4 + 750 \times 9.81 \times 0.4$$

$$= 6867 \text{ Pa}$$

4. *Ans. (c)*

$$1 \frac{\text{N}}{\text{m}^2} = 1 \text{ Pa} = 10^{-5} \text{ Bar}$$

5. *Ans. (d)*

$$F = \rho g A \bar{h}$$

$$= 1000 \times 10 \times (2 \times 1) (0.5 + 0.5)$$

$$= 2000 \text{ kN}$$

6. *Ans. (b)*

The point in the immersed body through which the resultant pressure of the liquid may be taken to act is known as centre of pressure.

7. *Ans. (c)*

Piezometer cannot be used for pressure measurement in pipes when fluid in the pipe is a gas, it works for fluid.

8. *Ans. (a)*

$$h_{cp} = \bar{h}_G + \frac{I_{xx} \sin^2 \theta}{A\bar{h}_G}$$

9. *Ans. (a)*

If a surface is inclined at angle θ with the liquid surface, then total pressure on the immersed surface will be = $w A \bar{x}$.

10. *Ans. (d)*

Barometer is used to measure atmospheric pressure.

11. *Ans. (d)*

Vertical component of pressure force on a sub-merged curved surface is equal to the weight of liquid vertically above the curved area.

12. *Ans. (d)*

$$1 \text{ atm} = 1.01325 \times 10^5 \text{ N/m}^2$$

$$= 760 \text{ mm Hg} = 1.01325 \text{ bar}$$

13. *Ans. (a)*

$$\rho g h = \rho g h$$

 $\Rightarrow$

$$\rho_w g h_w = \rho_{Hg} g h_{Hg}$$

$$1000 h_w = 13.6 \times 1000 \times 75$$

$$h_w = 1020 \text{ cm}$$

14. *Ans. (c)*

Specific weight of liquid = $w = \rho g$

$$\text{Pressure at depth } h = \frac{\rho g h^2}{2} = \frac{w h^2}{2}$$

15. *Ans. (d)*

Horizontal component of force on a curved surface is equal to force on a projection of the curved surface into a vertical plane.

16. *Ans. (b)*

$$P = \rho gh$$

$$\Rightarrow \rho_1 gh_1 = \rho_2 gh_2$$

$$0.8 \times h_1 = 100$$

$$h_1 = \frac{100}{0.8} = 125 \text{ m}$$

$$h^* = \frac{h}{3} + \frac{\frac{bh^3}{36}}{\frac{1}{2}bh \times \frac{h}{3}}$$

$$h^* = \frac{h}{3} + \frac{h}{6}$$

17. *Ans. (a)*18. *Ans. (c)*

Atmospheric pressure is measured by barometer.

19. *Ans. (c)*

Differential manometers are used to measure difference of pressure between any two points.

20. *Ans. (c)*

Centre of pressure is always below the centre of gravity.

21. *Ans. (c)*

$$P = \rho gh$$

$$\Rightarrow \rho_1 gh_1 = \rho_2 gh_2$$

$$0.8 \times h_1 = 80$$

$$h_1 = \frac{80}{0.8} = 100 \text{ m}$$

22. *Ans. (b)*

$$1 \text{ atm} = 760 \text{ mm of Hg}$$

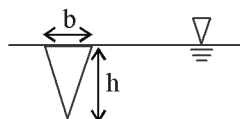
23. *Ans. (c)*

Rise of liquid in manometers gives the pressure head at that point.

24. *Ans. (b)*

$$h_{cp} = \bar{h} + \frac{I_{xx} \sin^2 \theta}{A\bar{h}}$$

h_{cp} is independent of density.

25. *Ans. (c)*

$$h^* = \bar{h} + \frac{I_G}{A\bar{h}}$$

26. *Ans. (d)*

$$1 \text{ bar} = 10^5 \text{ Pa} = 10^5 \text{ N/m}^2$$

27. *Ans. (a)*

Pascal's law states that the pressure intensity at a point in a static fluid is equal in all direction.

28. *Ans. (b)*

Pressure which is measured with reference to absolute zero pressure is absolute pressure.

29. *Ans. (d)*

Pressure of liquid measured with the help of piezometer tube is gauge pressure.

30. *Ans. (d)*

Simplest form of manometer is piezometer.

31. *Ans. (b)*32. *Ans. (a)*

$$x^* = \bar{x} + \frac{I_G}{A\bar{x}} \sin^2 \theta$$

For,

$$\theta = 90^\circ$$

$$x^* - \bar{x} = \frac{I_G}{A\bar{x}}$$

33. *Ans. (c)*

Liquid pressure on submerged surface is normal to the surface.

34. *Ans. (d)*

$$1 \text{ atm} = 101,325 \text{ Pa or N/m}^2$$

$$\gamma_w = 9.81 \times 10^3 \text{ N/m}^3$$

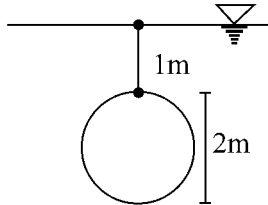
$$P = \gamma_w \times h$$

$$\Rightarrow \frac{101325}{9.81 \times 10^3} = 10.33 \text{ m}$$

35. *Ans. (b)*

Mercury is preferred in barometers as it has higher density and lower vapour pressure.

36. *Ans. (d)*



$$\begin{aligned}
 h_{cp} &= \bar{h} + \frac{I_{xx} \sin^2 \theta}{A\bar{h}} \\
 &= 2 + \frac{\pi d^4}{64} \times \frac{4}{\pi d^2 \times 2} \\
 &= 2 + \frac{d^2}{32} = 2 + \frac{1}{8} \\
 &= 2.125 \text{ m } [d = 2 \text{ m}]
 \end{aligned}$$

37. *Ans. (a)*

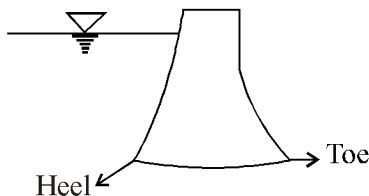
$$h_{cp} = \bar{h} + \frac{I_G \sin^2 \theta}{A\bar{h}}$$

38. *Ans. (a)*

Centre of gravity of the volume of the liquid displaced is called centre of buoyancy.

39. *Ans. (d)*

Maximum compressive force in a gravity dam exists at the toe.



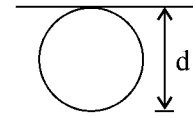
40. *Ans. (c)*

Hydrostatic pressure on a dam depends upon its depth.

41. *Ans. (a)*

For a body submerged in water, metacentric height for rolling condition will be less than metacentric height for pitching condition.

42. *Ans. (c)*



$$\begin{aligned}
 h_{cp} &= \bar{h} + \frac{I_{xx} \sin^2 \theta}{A\bar{h}} \\
 &= \frac{d}{2} + \frac{\pi d^4}{64} \times 1 \times \frac{4 \times 2}{\pi d^2 \times d} \\
 &= \frac{d}{2} + \frac{d}{8} = \frac{5d}{8}
 \end{aligned}$$

43. *Ans. (b)*

$$\rho_2 g_2 h_2 = p$$

$$1 \text{ kg/cm}^2 = 10^4 \text{ kg/m}^2 = 1000 \times h_2$$

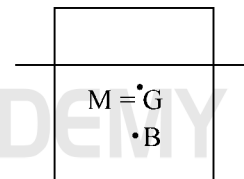
$$[\rho = 1000 \text{ kg/m}^3]$$

$$h_2 = 10 \text{ meters of water}$$

44. *Ans. (d)*

Total pressure = $\rho g \bar{h} A$ = (Intensity of pressure at centroid) area it is true for all orientation

45. *Ans. (c)*



This is neutral equilibrium

46. *Ans. (b)*

Pascal's law states pressure at a point is equal in all directions in a static fluid.

47. *Ans. (c)*

Pressure at a depth $h = \rho g h$

$$\frac{P_A}{P_B} = \frac{\rho g(0.5)}{\rho g(2)} = \frac{1}{4}$$