Q1. The rise or fall of head ‘h’ in a capillary tube of diameter ‘d’ and liquid surface tension σ and specific weight w is equal to
(a) 4σ\wd
(b) 4dσ/w
(c) 4wd\σ
(d) 4wσ\d

Q2. As per law of fluid friction for steady streamline flow, the frictional resistance;
(a) Varies proportionally to pressure
(b) varies in inverse proportion to pressure
(c) does not depend on pressure
(d) first increase then decreases

Q3. Pseudo-plastic substance are non-Newtonian fluids for which:
(a) dynamic viscosity increases as the rate of shear increases
(b) Dynamic viscosity decreases with the time for which shearing forces applied
(c) Dynamic viscosity increases with time for which shearing force applied.
(d) Dynamic viscosity decreases as the rate of shear increases

Q4. The velocity distribution for flow over a flat plate is given by $u = (y\text{-}y^2)$ in which u is velocity in meters per second at a distance ‘y’ meters above the plate. What is the shear stress value at y = 0.15m? the dynamic viscosity of fluid is 8.0 poise.
(a) 12.4N/m^2
(b) 1.24 N/m^2
(c) 0.56 N/m^2
(d) 5.6 N/m^2

Q5. One stokes is equal to
(a) 1 cm^2/s
(b) 1 m^2/s
(c) 1 mm^2/s
(d) 10 m^2/s

Q6. What torque in Nm is required to give 3m^3/s of water, a moment of momentum, so that it has a tangential velocity of 3 m/s at a distance of 1.8 m from the axis?
(a) 16200
(b) 157
(c) 2624
(d) 8138

Q7. Hydrometer is used to determine-
(a) density of liquids
(b) flow of liquids
(c) relative humidity
(d) specific gravity of the liquid

Q8. Newton’s law of viscosity is a relationship between-

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

Q9. In Redwood viscometer _____.
(a) absolute value of viscosity is determined
(b) Part of the head of fluid is utilized in overcoming friction
(c) fluid discharges through orifice with negligible velocity
(d) comparison of viscosity is done

Q10. Property of a fluid by which molecules of different kind of fluids are attracted to each other is called _____.
(a) adhesion
(b) cohesion
(c) viscosity
(d) compressibility

Q11. Property of a fluid at zero temperature is referred to as _____.
(a) Stagnation property
(b) Standard property
(c) Simple property
(d) None of these

Q12. The stress, which is responsible for retaining water in a capillary tube 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

Q13. A liquid compressed in cylinder has a volume of 0.04 m^3 at 50 N/cm^2 and a volume of 0.039 m^3 at 150 N/cm^2. The bulk modulus of elasticity of liquid is:
(a) 400 N/cm^2
(b) 4000 N/cm^2
(c) 40000 N/cm^2
(d) 40 N/cm^2

Q14. The viscosity of a gas
(a) decreases with increase in temperature
(b) increases with increases in temperature
(c) is independent of temperature
(d) is independent of pressure for very high pressure intensities

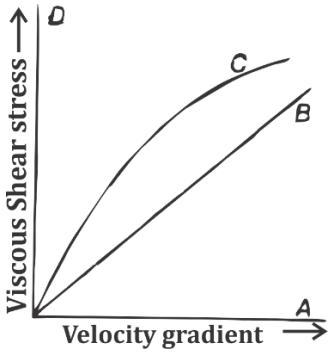
Q15. A fluid in which resistance to deformation is independent of the shear stress, is called _____.
(a) Bingham plastic fluid

(b) Pseudo plastic fluid
(c) dilatant fluid
(d) Newtonian fluid

Q16. Specific weight of sea water is more than that of pure water because it contains
(a) dissolved air
(b) Dissolved salt
(c) Suspended matter
(d) all options are correct

Q17. The property of a fluid which enables it to resist tensile stress is known as
(a) compressibility
(b) surface tension
(c) cohesion
(d) adhesion

Q18. The figure below shows four curves A, B, C, D on a plot of viscous shear stress versus velocity gradient for three fluids, viz., Newtonian, non- Newtonian and ideal; and an ideal solid. For ideal solid, the curve applicable is:



(a) A
(b) B
(c) C
(d) D

Q19. If cohesion between molecules of a 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

Q20. V= 0.00022t- $\frac{1.8}{t}$ is the equation to determine kinematic viscosity of liquid by
(a) Redwood viscometer
(b) Engler viscometer
(c) Say bolt universal viscometer
(d) Newton viscometer

Q21. A fluid in equilibrium can’t sustain

(a) tensile stress
(b) compressive stress
(c) shear stress
(d) bending stress

Q22. Fluid is a substance which offers no resistance to change of
(a) Pressure
(b) Flow
(c) Shape
(d) Volume

Q23. Match List -I with List -II and select the correct answer using the codes given below the lists.

List -I

A. Dynamic viscosity
B. Moment of momentum
C. Power
D. Volume modules of elasticity

List -II

1. $[ML^2T^{-3}]$
2. $[ML^{-1}T^{-1}]$
3. $[ML^2T^{-1}]$
4. $[ML^{-1}T^{-2}]$

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

Q24. Match List -I with List -II and select the correct answer using the codes given below the lists:

A. Lubrication	1. Surface tension
B. Rise of sap in trees	2. Vapour pressure
C. Formation of droplets	3. Viscosity
D. Cavitation	4. Surface tension

Codes:

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

Q25. If the surface of the liquid is convex, then
(a) Cohesion pressure is negligible
(b) Cohesion pressure is decreased
(c) Cohesion pressure is increased
(d) None of these

Q26. For very great pressures, viscosity of most gases and liquids
(a) remains same
(b) increases
(c) decreases
(d) shown erratic behavior

Q27. Pressure inside a water droplet is given by the relation
(a) $P = \frac{4\sigma}{d}$
(b) $P = \frac{3\sigma}{d}$
(c) $P = \frac{8\sigma}{d}$
(d) $P = \frac{16\sigma}{d}$

Q28. What happens to the specific volume of water when it is heated at 0°C?
(a) Decreases steadily
(b) Increases steadily
(c) first increases then decreases
(d) First decreases then increases

Q29. The surface tension of mercury at normal temperature compared to that of water is
(a) more
(b) less
(c) same
(d) More or less depending on size of glass tube

Q30. Velocity of pressure waves due to pressure disturbances imposed in a fluid is equal to (E is bulk modulus and ρ is density)
1. $\sqrt{\frac{E}{\rho}}$ 2. $\sqrt{E\rho}$
3. $\sqrt{\frac{\rho}{E}}$ 3. $\sqrt{\frac{1}{\rho E}}$
(a) Only 1
(b) Only 2
(c) Only 3
(d) Only 4

Q31. Capillary action is due to the
(a) Surface tension
(b) Cohesion of the liquid
(c) adhesion of the liquid molecules and the molecules on the surface of a solid
(d) All options are correct

Q32. The angle of contact in case of a liquid depends upon;
A. The nature of the liquid and the solid
B. The material which exists above the free surface of the liquid.
(a) Only A
(b) Only B

(c) Both A and B
(d) Neither A nor B

Q33. Alcohol is used in manometer because
(a) it has low vapor pressure
(b) it is clearly visible
(c) it has low surface tension
(d) it can provide longer column due to low density

Q34. _____ will exhibit viscoelastic behavior.
(a) Steel
(b) Diamond
(c) Organic polymers
(d) Neoprene

Q35. In an experiment, the following shear stress-time rate of shear strain values are obtained for a fluid:

Time rate of shear strain (1/S)	0	2	3	4
Shear stress (kPa)	0	1.4	2.6	4

How can the fluid be classified?
(a) Newtonian fluid
(b) Bingham plastic
(c) Pseudo plastic
(d) Dilatant

Q36. Free surface of a liquid behaves like a sheet and tends to contract to smallest possible area due to the
(a) force of adhesion
(b) force of cohesion
(c) force of friction
(d) force of diffusion

Q37. The vapor pressure over the concave surface is
(a) less than the vapor pressure over the plane surface
(b) equal to the vapor pressure over the plane surface
(c) greater than the vapor pressure over the plane surface
(d) zero

Q38. Consider the following statements;
1. Piezometer is used to measure small variation of pressure above or below ambient pressure.
2. Thixotropic fluid exhibits decrease in viscosity with time.

Which of the above statements is/are correct?
(a) only 1
(b) only 2

(c) Both 1 and 2
(d) Neither 1 nor 2

Q39. A fluid is defined as one which;
(a) cannot withstand shear
(b) can withstand elongation
(c) Deforms continuously when subjected to shear stress
(d) is solid-like when there is no motion

Q40. The most important property of a lubricant is its:
(a) viscosity
(b) pour point
(c) flash point
(d) thermal stability

Q41. The _____ forces on fluid elements are caused by agencies such as gravity and magnetic fields.
(a) Velocity
(b) Pressure
(c) Surface
(d) Body

Q42. Piezometer is used to measure:
(a) Pressure in pipe, channels etc.
(b) Atmospheric pressure
(c) Very low pressure
(d) Difference of pressure between two points

Q43. One torr pressure is equivalent to:
(a) 1 atmosphere
(b) 1 mm of mercury
(c) 10 m of water
(d) 1 Pascal

Q44. In manometer a better liquid combination is one having
(a) High viscosity
(b) Lower surface tension
(c) Low viscosity
(d) Higher surface tension

Q45. 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

Q46. Pressure intensifier increases the pressure in proportion to _____.

(a) ratio of diameters
(b) square of ratio of diameters
(c) inverse ratio of diameters
(d) square of inverse ratio of diameters

Q47. Hydraulic accumulator is used for
(a) accumulating oil
(b) supplying large quantities of oil for very short duration
(c) generally high pressures to operate hydraulic machines
(d) supplying energy when main supply fails

Q48. The pressure at point in a fluid will not be same in all the directions when the fluid is
(a) moving
(b) viscous
(c) viscous and static
(d) viscous and moving

Q49. In an isothermal atmosphere, the pressure
(a) decreases linearly with elevation
(b) remains constant
(c) varies in the same way as the density
(d) increases exponentially with elevation

Q50. The pressure in Pascals at a depth of 1 m below the free surface of a body of water will be equal to
(a) 1 Pa
(b) 98.1 Pa
(c) 981 Pa
(d) 9810 Pa

solutions

S1. Ans.(a)
Sol. Capillary rise or fall

$$h = \frac{4\sigma\cos\theta}{\rho g d}$$

But ω (Weight density) = ρg,
and cos θ for water and glass = 1

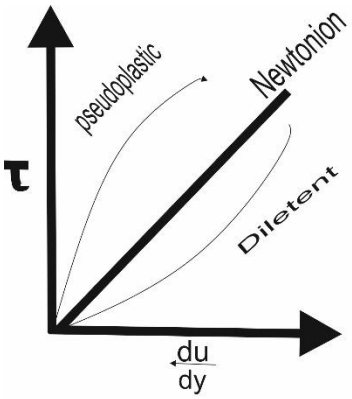
$$\because \boxed{h = \frac{4\sigma}{\omega d}}$$

S2. Ans.(c)
Sol. The frictional resistance as per law of fluid friction for steady streamline flow, depends on viscosity which causes the viscous forces between two adjacent layers. There is no relation between pressure and frictional resistance.

S3. Ans.(d)

Sol. For pseudoplastic fluid follows power law

$$\tau = B + k\left(\frac{dV}{dy}\right)^n$$



$$\tau = k\left(\frac{dV}{dy}\right)^n \text{ if } B = 0$$

$$\tau = \left[k\left[\frac{dV}{dy}\right]^{n-1}\right].\frac{dV}{dy}$$

$$\tau = \mu_{app}.\frac{dV}{dy} \text{ [Where } \mu_{app} = k\left[\frac{dV}{dy}\right]^{n-1}]$$

$$\boxed{\tau = B + \mu_{app}\left(\frac{dV}{dy}\right)}$$

from figure we can see that pseudo − plastic follows decreasing slope

Which indicates that as the rate of shear increases than dynamic viscosity is decreases.

S4. Ans.(c)

Sol. We know that the shear stress is

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

$$\because \left[\frac{dv}{dy}\right]_{y=0.15} = \frac{d}{dy}[y - y^2]$$

$$= [1 - 2y]^{0.15}$$

$$= 1 - 2[0.15 - 0]$$

$$= 1 - 030$$

$$= 0.70$$

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

$$\tau = (8 \times 10^{-1}) \times 0.70$$

$$= 0.56 \text{ N/m}^2$$

S5. Ans.(a)

Sol. We know that (stoke is the unit of kinematic viscosity)

1 stoke = 10^{-4} m²/sec

1 stoke = $10^{-4} \times 10^{4} \frac{cm^2}{sec}$

1 stoke = 1 cm²/sec

S6. Ans.(a)

Sol. We know that the momentum of water is

$F = \rho aV^2$

$F = \rho QV$

$F = 1000 \times 3 \times 3$

$= 9000$ N.

Moment of momentum i.e. torque required

$\tau = f \times y$

$\tau = 9000 \times 1.8$

$\tau = 16200\ Nm$

S7. Ans.(d)

Sol. Hydrometer = it is an instrument which is used to measure the density of liquid with reference of water i.e. specific gravity.

S8. Ans.(b)

Sol. Newton's law states that the shear stress is directly proportional to the rate of shear strain for Newtonian fluid.

$$\tau \alpha \frac{dv}{dy}$$

$$\boxed{\tau = \mu . \frac{dv}{dy}}$$

S9. Ans.(a)

Sol. A redwood viscometer is used to measure redwood viscosity which is further converted into kinematic viscosity. It is used to measure the flow of different fluids like petrol, glycol, engine oil and further find out kinematic viscosity with help of constant.

S10. Ans.(a)

Sol. It is defined as-

Cohesion – an attractive force between same kind of fluid molecules.

Adhesion – an attractive force between different kind of fluid molecules.

S11. Ans.(a)

Sol. The property at which it's all energy measured at its static condition. When a fluid having zero velocity is the condition of stagnation. then its K.E, is zero and K.E. is function of absolute temp. so at zero absolute temp. property of fluid is known as stagnation property.

S12. Ans.(b)

Sol. Surface tension enhance the greater amount of adhesive force between the water and glass meniscus so the water level reached above the water surface.

S13. Ans.(b)
Sol. Bulk modulus

$$K = -\frac{\Delta P}{\Delta V/V}$$

$$K = -\left[\frac{0.04 \times [150 - 50]}{0.039 - 0.04}\right] = 4000\ N/cm^2$$

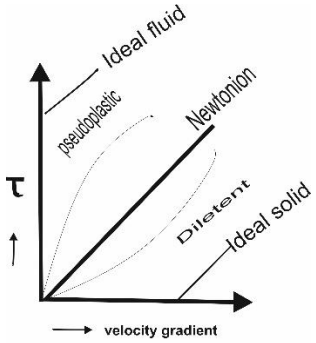
S14. Ans.(b)
Sol. As we know that
⇒ With increasing temp. viscosity of liquid decrease because as we increase the temperature which cause decreases the cohesive forces between modulus so that viscosity is decrease
⇒ with increasing temp. viscosity of gas increases because as we increase the temp. which cause increase the rate of molecules momentum transfer which is the main reason of viscous forces within the gases. So that viscosity in increase.

S15. Ans.(d)
Sol. For Newtonian fluid there is constant viscosity for different fluid at particular temp which resist the deformation without any influence of shear stress.
In other word dynamic viscosity is constant for particular fluid at particular temp.

S16. Ans.(d)
Sol. All options are correct, we all are aware already with this fact that sea water contains dissolved salt, dissolved air and some suspended matters which increase its specific weight as compare to pure water.

S17. Ans.(b)
Sol. Surface tension – It is the property of fluid which enables that it will resist external tensile stress because of cohesive forces of molecules of a fluid.

S18. Ans.(d)



Sol. Ideal solid have zero deformation at any value of shear stress.
⇒ Newtonian fluid follows newton's law of viscosity i.e. shear stress is directly proportional to rate of shear strain
⇒ pseudo plastic fluid follows the power law of viscosity i.e. it will increase the rate of shear strain as we decrease shear stress
⇒ ideal fluid is incompressible and in-viscous fluid which is deform continuously without of any applied shear stress.

S19. Ans.(c)
Sol. It will shows the non-wetting phenomenon and making obtuse angle at contact. This phenomenon will show by mercury and Glass. In that case fluid will fall in the meniscus below the level of free surface of fluid.

S20. Ans.(c)
Sol. Say-bolt universal viscometer: - the fluid whose viscosity is to be measured is filled in a vertical cylindrical chamber. A capillary tube is attached at the bottom of the chamber and it is maintained at constant temp.

$$\boxed{v = 0.00022\,t - \frac{1.8}{t}}$$

S21. Ans.(c)
Sol. There is no shear force because shear force comes in picture only when fluid is in motion. i.e. fluid is not in equilibrium.

S22. Ans.(c)
Sol. Fluid is always taking the shape of the vessels in which fluids are filled because its molecules are not so closely packed as solid. so fluids do not give any resistance to change its shape.

S23. Ans.(d)
Sol.
S24. Ans.(d)
Sol.

S25. Ans.(c)
Sol. If cohesion force b/w fluid particles is more than adhesive force b/w fluid molecules and solid surface then convex shape is formed. Eg, water and glass.

S26. Ans.(a)
Sol. Pressure variation does not affect viscosity of most of the gases and liquids.

S27. Ans.(a)
Sol.

S28. Ans.(d)
Sol. As, density of water is maximum at 4°C so when temperature of water is increased then upto 4°C specific volume decrease due to density increase and after that specific volume increase.

S29. Ans.(a)
Sol. Surface tension of water air interface is 72.86 MN/m and of mercury-air interface is 486.5 MN/m at room temperature 20°C.

S30. Ans.(a)
Sol. We know, velocity of pressure wave in a fluid is given by' C = $\sqrt{\frac{dp}{d\rho}}$ ---------- (1)

But,

Bulk modulus E = $\frac{-dp}{\frac{dv}{v}}$ ---------- (A)

And mass m = constant

ρV = C ----------(1)

By differentiating $'eq^n$ --------- (2)

ρdv + vdρ = 0

$\frac{d\rho}{\rho} = \frac{-dv}{v}$ ---------- (B)

From eq^n (A) and (B)

$E = \frac{dp}{\frac{d\rho}{\rho}}$ ---------- (C)

From eq^n (1) and (2)

$$\boxed{C = \sqrt{\frac{E}{\rho}}}$$

S31. Ans.(d)

Sol. All three factors. i.e. surface tension of liquid, cohesion force in liquid and adhesive force b/w modulus of liquid and solid surface are responsible for capillary rise.

S32. Ans.(c)

Sol. The angle of contact depends upon both the cohesion force and adhesion force both.

S33. Ans.(d)

Sol. It is provided long column so error in pressure measurement is very less.

S34. Ans.(c)

Sol.

S35. Ans.(d)

Sol. We know that

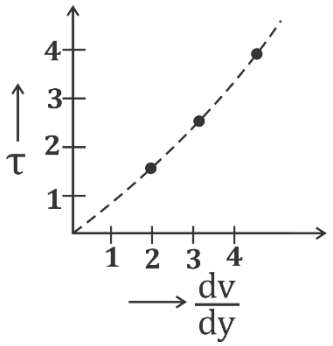
$$\tau = \mu\frac{dv}{dy}$$

$$\mu_1 = \frac{\tau}{dv/dy}$$

$$\mu_1 = \frac{1.4}{2} = 0.7pa.sec$$

$$\mu_2 = \frac{2.6}{3} = 0.866\ pa.\sec$$

$$\mu_3 = \frac{4}{4} = 1\ pa\ sec$$



We can see that μ_{app} is increasing which means $n > 1$ for power low of viscosity. This is the condition for dilatant fluid.

S36. Ans.(b)

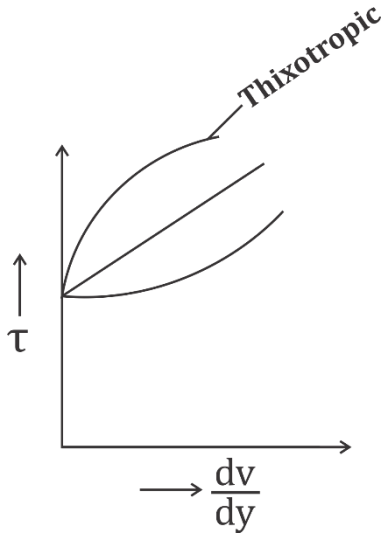
Sol. Free surface of liquid behave like a shunt this phenomenon gives by surface tension. Surface tension is nothing just unbalanced cohesive forces.

S37. Ans.(a)
Sol. There are two condition

(i) If curvature is convex, r is positive P > P_{sat}

(ii) If curvature is concave, r is negative P< P_{sat}.

S38. Ans.(b)
Sol. Piezometer is not able to measure pressure below ambient.
Thixotropic fluid- its viscosity decreases with time



S39. Ans.(c)
Sol. A fluid is defined as one which deforms continuously when subjected to shear stress.

S40. Ans.(a)
Sol.

S41. Ans.(d)
Sol. Electric fields, magnetic fields, gravity forces all are the body forces which acts throughout the volume of the body.

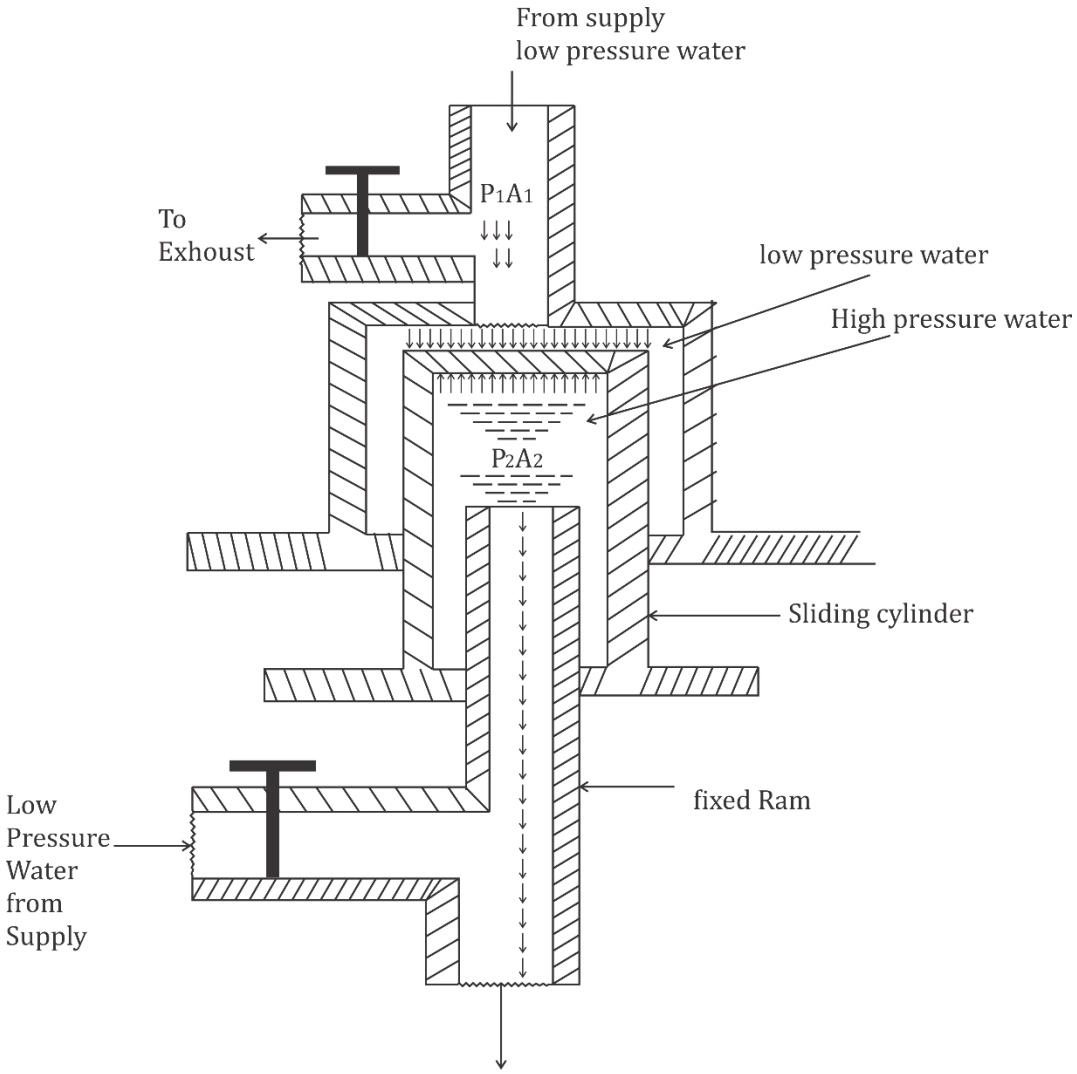
S42. Ans.(c)
Sol. Piezometer is a device which is used to measure low pressure it can only measure pressure of liquid only and not able to measure for gas. It could not able to measure pressure below ambient I.e. vacuum pressure.

S43. Ans.(b)
Sol. 760 torr = 1 atmospheric pressure
760 mm = 1 atmospheric pressure
i.e. 1 mm of mercury = 760 torr
it is on the name of Torricelli

S44. Ans.(c)
Sol. For a manometer a better liquid combination is one having low viscosity and lower surface tension but within the given option low viscosity is most appropriate option.

S45. Ans.(c)
Sol.

S46. Ans.(d)
Sol. It is a mechanical device which used large quantity of fluid at low pressure to increase the pressure of the fluid.



Pressure force are same for equilibrium

$\because$ F= $P_1A_1 = P_2A_2$

$$\frac{P_2}{P_1} = \frac{A_1}{A_2} = \frac{(\pi/4)D_1^2}{(\pi/4)D_2^2}$$

$\because P \propto \frac{1}{D^2}$

Where P_1 – Pressure at large area

A_1 – Area of large section

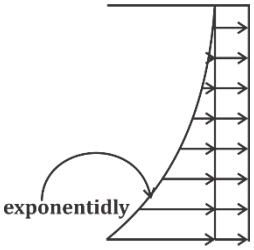
P_2 – Pressure at small area

A_2 – Area of small section

S47. Ans.(d)
Sol. It is an energy storage device in which a non-compressible fluid is compressed in storage with the help of spring weight or any kind of compressed gas and further this energy is used when main supply fails.

S48. Ans.(a)
Sol. Pascals law states that the pressure at a point is same in all direction when the fluid is stationary.

S49. Ans.(c)
Sol. The pressure decreases exponentially upward in an isothermal atmosphere.



$$\boxed{P = P_{atm}.e^{\frac{p}{RT}.h}}$$

$$\boxed{\rho = \frac{P}{RT}}$$

S50. Ans.(d)
Sol. Pressure (P) = ρ.gh
= 1000×9.81×1
= 9810 Pa.