1. Meter which is not associated with viscosity

A. Red wood
B. Say bolt
C. Engler
D. Orsat

Ans. D

Sol. Orsat apparatus is used in flue gas analysis in power plants.

2. The velocity of sound depends on the medium through which it is traveling. The velocity of sound in air at temperature -49°C is closest to

A. 280 m/s
B. 300 m/s
C. 350 m/s
D. 341 m/s

Ans. B

Sol. Given,

Air is a diatomic gas having γ=1.4, therefore by formula

$C = \sqrt{\gamma \times R \times T}$

where R is the characteristic gas constant and

T is the temperature in Kelvin that is 225 K here,

R for air is 0.287 kJ/kg·K =287 J/kg-k

$C = \sqrt{1.4 \times 287 \times 224} = 300.46$

After calculating, we get 300.46 m/s

3. Volume of a stone weighing 400 N in air and 100 N in water is

A. 0.0306 m^3
B. 0.0408 m^3
C. 0.0102 m^3
D. 0.054 m^3

Ans. A

Sol. Given,

Weight of stone in air = 400N,

Weight if stone in water = 100N,

Weight of water displaced=Weight of stone in air – Weight of stone in water = 300 N

Volume of water displaced=Volume of stone = $\frac{300}{9.8 \times 1000}$ = 0.03061 m^3

4. Dead weight pressure gauge tester works on the principle of

A. Dalton's law of partial pressure
B. Newton's law of viscosity
C. Pascal's law
D. Avogadro's hypothesis

Ans. C

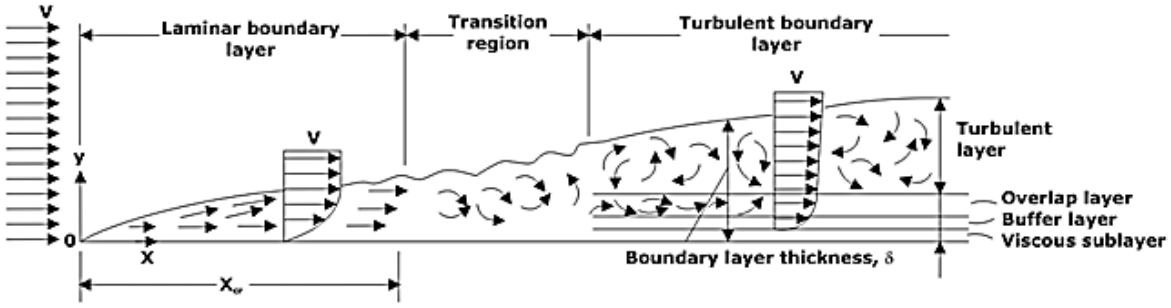
Sol. The working principle of dead weight pressure gauge tester is based on Pascal's law.

5. The velocity distribution in the turbulent boundary layer follows

A. straight line law
B. parabolic law
C. hyperbolic law
D. logarithmic law or Power law

Ans. D

Sol.



6. Consider a soap film bubble of diameter D. If the external pressure is P_0 and the surface tension of the soap film is σ, the expression for the pressure inside the bubble is.

A. P_0

B. $P_0 + \frac{2\sigma}{D}$

C. $P_0 + \frac{4\sigma}{D}$

D. $P_0 + \frac{8\sigma}{D}$

Ans. D

Sol. Soap bubble having two surface in contact to air i.e., inner and outer surface. Cut the soap bubble into half and apply the force balance equation, we get,

ΔP × projected surface area of the bubble = σ × Perimeter of the cutted half of the bubble in contact to air

$$\Rightarrow \Delta P \times \frac{\pi}{4} D^2 = \sigma \times (2 \times \pi D)$$

$$\Rightarrow \Delta P = \frac{8\sigma}{D}$$

and ΔP is the excess pressure

Pressure inside the soap bubble, P

$$\Rightarrow \Delta P = P - P_0 = \frac{8\sigma}{D}$$

$$P = P_0 + \frac{8\sigma}{D}$$

$$P = P_0 + \frac{4\sigma}{r} = P_0 + \frac{8\sigma}{D}$$

7. Mercury is used in barometer because

A. It has high density

B. It has negligible capillarity effect

C. It has very low vapour pressure

D. It has low compressibility

Ans. C

Sol. Mercury is used in barometer because of its low vapour pressure.

So, the correct option is (c).

8. If the pressure at any point in the liquid approaches the vapor pressure, liquid starts vaporizing and creates pockets or bubbles of dissolved gases and vapours. This phenomenon is _____.

A. Surface tension

B. Adhesion

C. Capillarity

D. Cavitation

Ans. D

Sol. The phenomenon of cavitation consists in the disruption of continuity in the liquid where there is considerable local reduction of pressure.

The formation of bubbles within liquids (cavitation) begins even in the presence of positive pressures that are equal to or close to the pressure of saturated vapor of the fluid at the given temperature.

9. For a partially submerged body with centre of gravity (G), centre of buoyancy (B), metacentre (M), the condition of stability will be

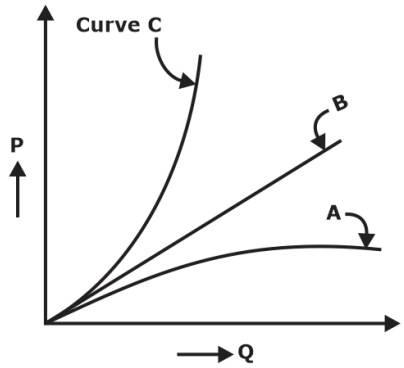
A. B above G
B. M above G
C. B coincides G
D. M below G

Ans. B

Sol. For a partially submerged body, metacentre comes in picture.

For stabile equilibrium, metacenter should liw above the centre of gravity.

10. The figure given below shows the relationship between power (P) and discharge (Q) for different vane exit angles of centrifugal pump. In the figure given below, curve C holds good for.



A. Vane exit angle of 90°
B. Vane exit angle of less than 90°
C. Vane exit angle of more than 90°
D. any vane exit angle

Ans. C

Sol. In the above diagram,

(i) Curve (A) holds good when $\beta<90^{o}$

(ii) Curve (B) holds good when $\beta = 90^{o}$

(iii) Curve (C) holds good when $\beta>90^{o}$

Where β = Vane Exit Angle

So, Option C explains very clearly here and it is correct answer.

11. Navier-Stokes equation, Bernoulli's Principle and Continuity equation, respectively work on the principles of conservation of

A. Mass, Energy, and Momentum
B. Energy, Momentum, and Mass
C. Momentum, Energy, and Mass
D. Momentum, Mass and Energy

Ans. C

Sol. Navier-Stokes equation, Bernoulli's Principle and Continuity equation work on the principles of conservation of momentum, energy, and mass respectively.

12. In the Laminar flow, if the velocity is doubled then the head loss due to friction is

A. Twice
B. Half
C. Four times
D. One-fourth time

Ans. A

Sol. For laminar flow,

$$h_f = \frac{32\mu\bar{u}L}{\rho g d^2} \Rightarrow h_f \propto \bar{u}$$

$$\frac{h_{f2}}{h_{f1}} = \frac{\bar{u}_2}{\bar{u}_1} \Rightarrow \frac{h_{f2}}{h_{f1}} = \frac{2\bar{u}_1}{\bar{u}_1} = 2$$

So on doubling the velocity of flow, head loss will be doubled.

13. A device which increases intensity of pressure by means of hydraulic energy available from large amount of water at low pressure is _____.

A. Jet pump
B. Hydraulic intensifier
C. Draft tube
D. Fluid coupling

Ans. B

Sol. Hydraulic intensifier is machine for increasing the intensity of pressure by utilizing the energy of a large quantity of water available at low pressure.

Such a device is needed when the hydraulic machines such as hydraulic press requires water at very pressure which cannot be obtained from main supply directly.

14. Reynold's number when flow pass through between fixed plates

A. Laminar if $R_e < 2000$
B. Laminar if $R_e < 500$
C. Laminar if $R_e < 4000$
D. Laminar if $R_e < 1000$

Ans. D

Sol. Critical value of Reynold's number when flow takes place between plates is 1000.

If $R_e < 1000$; laminar

$1000 < R_e < 2000$; transition

$R_e > 2000$ turbulent

15. The capillary rise at 20 °C in clean glass tube of 1 mm diameter containing water is approximately

A. 15 mm
B. 50 mm
C. 20mm
D. 30mm

Ans. D

Sol. At 20°C, surface tension of water (contact with air) = 0.0736 N/m

$\therefore$ Capillary rise, $h = \frac{4 \times 0.0736}{9.81 \times 10^3 \times 10^{-3}}$

= 0.030 m

= 30 mm

16. A jet of water discharging from a 80 mm diameter orifice has a diameter of 64 mm at its vena-contracta. The coefficient of contraction is

A. 0.80
B. 0.46
C. 0.64
D. 0.75

Ans. C

Sol. The coefficient of contraction is defined as the ratio of the area of the jet at vena-contracta to the area of the orifice.

$$\text{coefficient of contraction} = \frac{A_{\text{venacontracta}}}{A_{\text{orifice}}} = \frac{d_c^2}{d_0^2}$$

$$\text{coefficient of contraction} = \frac{64^2}{80^2} = 0.64$$

17. When can a Piezometer not be used for pressure measurement in pipes ?

A. The pressure difference is low
B. The velocity is high
C. The fluid in the pipe is a gas
D. The fluid in the pipe is highly viscous

Ans. C

Sol. Piezometer is one of the simplest forms of manometers (A simple manometer is one which consists of a glass tube, whose one end is connected to a point where pressure is to be measured and the other end is open to atmosphere).

It is ideal for measuring moderate pressures of liquids only. It can not measure the pressure of gas or vacuum.

18. For best hydraulic rectangular cross-section of an open channel, its depth should be equal to

A. width
B. two times the width
C. half of the width
D. three-eighth of the width

Ans. C

Sol. For best hydraulic rectangular cross-section of an open channel, its depth should be equal to half of the width.

19. Capillarity is due to

A. Surface tension
B. Cohesion of liquid particles
C. Adhesion of liquid particles to surface
D. Cohesion and adhesion both

Ans. D

Sol. Capillarity is due to Cohesion and adhesion both

20. Which of the following represents unsteady non-uniform flow

A. flow through an expanding tube at an increasing rate
B. flow through an expanding tube at constant rate
C. flow through a long pipe at decreasing rate
D. flow through a long pipe at constant rate

Ans. A

Sol. Increasing rate give an idea about unsteady flow while expanding tube (means discharge and area are varying, therefore velocity is also varying) give an idea for non-uniform flow.

21. According to Bernoulli's principle in fluid dynamics, for inviscid flow, increase in speed of fluid leads to which of the following?

A. Increase in pressure and/or increase in fluid's potential energy

B. Decrease in pressure and/or increase in fluid's potential energy

C. Increase in pressure and/or decrease in fluid's potential energy

D. Decrease in pressure and/or decrease in fluid's potential energy

Ans. D

Sol. According to Bernoulli's principle sum of pressure energy, potential energy and kinetic energy is constant.

and, increase in speed of fluid is only when if both pressure and potential energy decrease or one is constant and other is decrease.

22. Match the List – 1 with List – 2 and select the correct answer using the codes given below

List-1		**List-2**	
P.	Froude number	1.	Pressure force
Q.	Euler number	2.	Gravity force
R.	Mach number	3.	Viscous force
S.	Webber number	4.	Surface tension
		5.	Elastic force

A. P – 3 Q – 2 R – 4 S – 5

B. P – 2 Q – 3 R – 4 S – 5

C. P – 2 Q – 1 R – 5 S – 4

D. P – 1 Q – 2 R – 3 S – 4

Ans. C

Sol.

Froude number	Gravity force
Euler number	Pressure force
Mach number	Elastic force
Webber number	Surface tension

23. Lagrangian approach of fluid flow involves

A. Tracking fluid particles through a fixed control volume

B. Tracking fluid particles of fixed identity

C. Tracking fluid particles for a period of time in a fixed coordinate system

D. None of these

Ans. B

Sol. In the Lagrangian approach, the individual fluid particles of fixed identity are traced.

In Eulerian approach, there is the consideration of flow domain of fixed control volume/coordinate system.

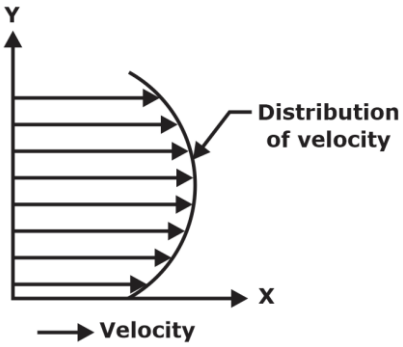
24. Vertical distribution of velocity in an open channel for laminar flow can be assumed as

A. logarithmic B. parabolic

C. straight line D. hyperbolic

Ans. B

Sol. Distribution of velocity in open channel is parabolic nature because of viscosity.



25. If no resistance is encountered by displacement, such a substance is known as _____.

A. fluid
B. water
C. gas
D. ideal fluid

Ans. D

Sol. Inviscid or ideal flow has no resistance for relative motion between fluid layers.

26. The coefficient of discharge (Cd) of an orifice varies with _____.

A. Reynold number
B. Weber number
C. Froude number
D. Mach number

Ans. A

Sol. coefficient of discharge (Cd) of an orifice is define as ratio of actual discharge to theoretical discharge.

$Q_{act} = C_d \times Q_{th}$

And, $R_e = 4Q_{act}/\pi d_1 v$where d1 and v is pipe diameter and kinematics viscosity.

27. If a mouthpiece is running full at the outlet, the vacuum at vena-contracta _____.

A. increases velocity of jet
B. decreases velocity of jet
C. decreases the discharge
D. decreases the value of coefficient of contraction

Ans. A

Sol. The vacuum at vena- contracta will result in pressure drop in that region and leads to the increase velocity of jet.

28. The centre of pressure of surface subject to fluid pressure is the point___.

A. On the surface at which resultant pressure acts
B. On the surface at which gravitational force acts
C. At which all hydraulic forces meet
D. None of these

Ans. A

Sol. Centre of pressure is defined as the point of application of the total pressure force on the surface.

Point of center of pressure is always below the center of gravity.

29. A jet of water of velocity 40 m/s impinges normally on a flat plate moving towards it at 10 m/s. The cross-sectional area of the jet is 0.01 m^2, the force developed on the plate is _____.

A. 1 kN
B. 9 kN
C. 25 kN
D. 16 kN

Ans. C

Sol. Given,

Absolute velocity of water jet: V_w = 40 m/s

Absolute velocity of plate V_p = 10 m/s (Towards jet)

Density of water: ρ = 1000 kg/m^3

Cross sectional area of jet : A = O.1 m^2

Relative velocity of water jet wrt to Plate: V = [Vw − (−V_p)] = [40−(−10)] = 50 m/s

(Since plate is moving towards jet so here both velocity will be added.)

The Force on plate (F) = ρAv^2

F = 1000 x 0.01 x $(10 + 40)^2$ = 25 kN

30. Working of a dead weight pressure gauge tester is based on

A. Dalton's law of partial pressure
B. Newton's law of viscosity
C. Pascal's law
D. Avogadro's hypothesis

Ans. C

Sol. According to Pascal's law, a pressure applied at any point in a liquid at rest is transmitted equally and undiminished in all directions to every other point in liquid.

31. If we increase the temperature, the viscosity of the gas will

A. Increase
B. Decrease
C. Remain constant
D. Decrease then increase

Ans. A

Sol. The viscosity of gas will increase with increase in temperature because as the temperature increases the kinetic energy of molecule increase, thus resulting in the increase of frequency of collision between molecules.

So, the correct option is (a).

32. The initial velocity of an object is 10 m/s. Acceleration a= 0.1V where V is the instantaneous velocity of the body. What will be the velocity after 10 seconds?

A. 14.23 m/s
B. 27.18 m/s
C. 10.12 m/s
D. 50 m/s

Ans. B

Sol. Given,

V_1 = 10 m/s.

Acceleration,a = 0.1V

time, t = 10 seconds

$$a = \frac{dV}{dt} \Rightarrow 0.1V = \frac{dV}{dt}$$

$$0.1dt = \frac{dV}{V} \Rightarrow \int_0^{10} 0.1dt = \int_{10}^{V_2} \frac{dV}{V}$$

$$0.1(10 - 0) = \ln \frac{V_2}{10}$$

$$\frac{V_2}{10} = e^1 = V_2 = 27.18 m/s$$

33. Which one of the following is correct?

For flow of an ideal fluid over a cylinder, from the front stagnation point,

A. pressure first decreases then increases

B. velocity first, decreases then increases

C. pressure remains the same

D. velocity remains the same

Ans. A

Sol. Since at stagnation point, pressure is maximum, hence for flow past ideal fluid over a cylinder from front stagnation point, pressure first decreases then increases.

34. A fluid flowing through a circular pipe of radius R with a maximum velocity U_{max}, considering the flow to be laminar, what will be the velocity of the fluid at radius $\frac{R}{\sqrt{2}}$

A. $\frac{U_{max}}{2}$

B. U_{max}

C. $2U_{max}$

D. $\frac{U_{max}}{4}$

Ans. A

Sol. For laminar pipe flow

$$U = U_{max}\left[1 - \frac{r^2}{R^2}\right]$$

$$r = \frac{R}{\sqrt{2}}$$

$$U = \frac{U_{max}}{2}$$

35. The velocity distribution in a turbulent boundary layer is given by $u/U = (y/\delta)^{1/6}$. The displacement thickness δ^*

A. $\delta/6$

B. $\delta/7$

C. $5\delta/6$

D. None of these

Ans. B

Sol.

$$\delta^* = \int_0^{\delta}\left(1-\frac{u}{U}\right)dy = \int_0^{\delta}\left(1-\left(\frac{y}{\delta}\right)^{\frac{1}{6}}\right)dy$$

$$\delta^* = \delta - \frac{6}{7\delta^{\frac{1}{6}}}\delta^{\frac{7}{6}}$$

$$\delta^* = \frac{\delta}{7}$$

36. A rotameter is a device used to measure _____.

A. Velocity of fluid in pipes
B. Velocity of gauges
C. Votex flow
D. Flow of fluids

Ans. D

Sol. Rotameters (variable area meter) is a flow meter that measures volumetric flow of liquids and gases in volume/sec.

37. The type of turbine recommended for a head of 10 m is _____.

A. Francis turbine
B. Kaplan
C. Pelton wheel
D. None of these

Ans. B

Sol. Given head is low head range 10m -70m. This range comes under Kaplan turbine.

38. 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

Ans. D

Sol. An accumulator enables a hydraulic system to cope with extremes of demand using a less powerful pump, to respond more quickly to a temporary demand, and to smooth out pulsations. It is a type of energy storage device.

39. Dimensions of weight density (or specific weight) in terms of fundamental dimensions (M,L,T, θ) is given by

A. $ML^{-2}T^{-2}\theta$
B. $ML^{-1}T^{-2}\theta^0$
C. $M^{-1}L^{-2}T^{-2}\theta$
D. $ML^{-2}T^{-2}\theta^0$

Ans. D

Sol. Weight density is given by weight/volume = mg/V
dimensions of m = M
dimensions of g = LT^{-2}
dimensions of V = L^3
Hence dimensions of specific weight are $ML^{-2}T^{-2}$

40. Hydraulic ram works on the principle of

A. reciprocating action
B. centrifugal action
C. positive displacement action
D. inertia forces of water in the supply line

Ans. D

Sol. Hydraulic ram is pump that lifts small quantities of water to greater heights from large quantities of water available at smaller heights.

41. The Bernoulli's equation refers to conservation of

A. Mass
B. Momentum
C. Force
D. Energy

Ans. D

Sol. Bernoulli's equation refers to conservation of energy.

42. The kinetic energy correction factor α is_____?

Where, V average velocity in cross section area A

A. $\frac{1}{AV^3}\int v^3\,dA$
B. $\frac{1}{A^3V^3}\int v^3\,dA$
C. $\frac{1}{AV^2}\int v^2\,dA$
D. $\frac{1}{AV}\int v\,dA$

Ans. A

Sol. The kinetic energy correction factor α

$$\alpha = \frac{1}{AV^3}\int v^3 dA$$

43. In case of laminar flow through pipes, the radial distance from the pipe wall at which local velocity is equal to average velocity is given by

(where R is the radius of the pipe)

A. r = R/2
B. r = R/3
C. $r = \frac{R}{\sqrt{2}}$
D. $r = \frac{R}{\sqrt{3}}$

Ans. C

Sol. Radial distance at which local velocity is equal to average velocity, i.e. U = $\bar{U}$

Therefore, $U_{max}\left(1-\frac{r^2}{R^2}\right) = 0.5\,U_{max}$

or $\frac{r^2}{R^2} = 0.5$ or $r = R/\sqrt{2}$

44. A turbine generates the power of 400 kW while working at the speed of 30 rpm at the head of 1 m. The specific speed of the turbine is

A. 425
B. 500
C. 600
D. 625

Ans. C

Sol. Power, P = 400kW

speed, N = 30 rpm , head, H = 1m.

$$N_S = \frac{N\sqrt{P}}{(H)^{\frac{5}{4}}} = \frac{30\sqrt{400}}{(1)^{\frac{5}{4}}} = 600$$

In the above expression P must be in kW and H in meter

45. Which of the following is correct

A. The body will float if buoyant force is less than weight of liquid.

B. The body will float if buoyant force is equal to weight of liquid.

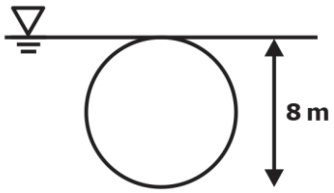
C. The body will float if buoyant force is greater than weight of liquid.

D. None of these

Ans. C

Sol. The body will float if buoyant force is greater than weight of liquid.

46. The figure shown below, disc of diameter 8 m inside the fluid, the centre of pressure lie from the free surface of water.



A. 3 m

B. 4 m

C. 5 m

D. 6 m

Ans. C

Sol. Centre of pressure $\bar{h} = \frac{5d}{8} = \frac{5 \times 8}{8} = 5\,m$ from the free surface.

47. In case of depressed nape the pressure of air below the nape is

A. less than atmospheric

B. more than atmospheric

C. equal to atmospheric

D. None of these

Ans. A

Sol. Depressed nape have the negative pressure or below atmospheric

48. For manometer, a better liquid combination is one having

A. higher surface tension

B. lower surface tension

C. surface tension is no criterion

D. high density and viscosity

Ans. A

Sol. For manometer, a better liquid combination is one having higher surface tension And Surface tension is a function of cohesion. More the cohesion, more is surface tension for a particular fluid.

49. Point about which a floating body oscillates when the body is tilted by a small angle is called_____.

A. Centre of buoyancy

B. Meta-centre

C. Centre of gravity

D. Centre of pressure

Ans. B

Sol. Meta-centre is the point at which the line of action of buoyancy force will meet the normal axis of the body when the body is given a small angular displacement. Thus, the body oscillates about this point when given such a displacement.

50. The flow of water in wash basin through a central opening is an example of:

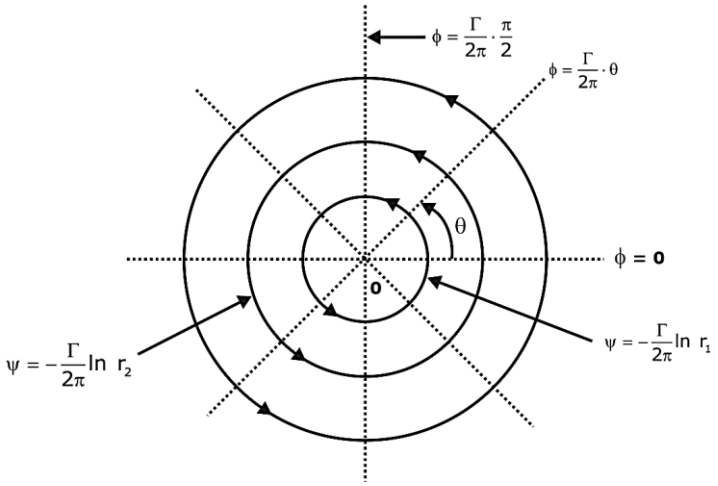
A. Ranking vortex
B. Free vortex
C. Forced vortex
D. Rotational vortex

Ans. B

Sol. Concept of Circulation in a Free Vortex Flow

Free Vortex Flow

- Fluid particles move in circles about a point.
- The only non-trivial velocity component is tangential.
- This tangential speed varies with radius r so that same circulation is maintained.
- Thus, all the streamlines are concentric circles about a given point where the velocity along each streamline is inversely proportional to the distance from the centre. This flow is necessarily irrotational.



Flownet for a vortex (free vortex)

51. Pressure at any point in a fluid at rest is

A. Depend on shape and cross section
B. Independent oF shape and cross section
C. Depends only on shape
D. No such relation

Ans. B

Sol. Hydrostatic pressure refers to the pressure exerted by a fluid (gas or liquid) at any point in space within that fluid, assuming that the fluid is incompressible and at rest.

Pressure within a liquid depends only on the density of the liquid, the acceleration due to gravity, and the depth within the liquid.

The pressure at any point in a fluid at rest is Independent on the shape and cross-section of the container in which fluid is kept. It depends only on the height of fluid.

52. Which of the following natural piezo-electrical crystals is used in modern pressure measuring devices

A. Gypsum
B. Mercury
C. Helium
D. Quartz

Ans. D

Sol. Quartz is an example of natural piezo-electrical crystal, it is used in modern pressure measuring devices.

53. 1 Torr is equivalent to

A. 1 mm of Hg
B. 14.7 psi
C. 760 mm of Hg
D. 1 Pa

Ans. A

Sol. 1 Torr = 1 mm of Hg; Torr is the unit of pressure and is name after 'Torricelli'.

54. The velocity of a water stream is being measured by an L-shaped Pitot-tube and the reading is 20 cm. Then, what is the approximate value of velocity___?(take g=10 m/s^2)

A. 19.6 m/s
B. 2.0 m/s
C. 9.8 m/s
D. 20 m/s

Ans. B

Sol. Given,

Height above free surface=h= 20 cm = 0.2m

$V = \sqrt{2 \times 10 \times 0.2} = 2m/s$

55. At higher altitude for airplane

A. Longer runway required
B. Shorter runway required
C. Same runway length as required for plane area
D. None

Ans. A

Sol. At higher altitude longer runway is required due to reduced drag and lift.

56. At a point on a streamline, the velocity is 3 m/sec and the radius of curvature is 9 m. If the rate of increase of velocity along the streamline at this point is 1/3 m/sec/m, then the total acceleration at this point would be _____.

A. 1 m/sec^2
B. 3 m/sec^2
C. 1/3 m/sec^2
D. $\sqrt{2}$ m/sec^2

Ans. D

Sol. Radial acceleration →

ar = V2/r = 32/9

ar = 1m/s2

tangential acceleration →

velocity increase by 1/3 m/s after traveling every 1m

it given that the particles travels 3m in 1sec (3m/sec) or it travels 1m in 1/3sec

1/3 m/s after traveling every 1m or 1/3 m/s after traveling every 1/3 sec

$$a_t = \frac{1/3}{1/3} = 1 \text{ m/s}^2$$

$$a = \sqrt{a_r^2 + a_t^2} = \sqrt{2} \text{ m/s}^2$$

57. During the flow over a circular cylinder, the drag coefficient drops significantly at a critical Reyonlds Number of 2×10^5. This is due to

A. excessive momentum loss in the boundary layer.

B. separation point travelling upstream.

C. reduction in skin-friction drag.

D. the delay in separation due to transition to turbulence.

Ans. D

Sol. The drag coefficient remains practically constant until a Reynold's number of 2×10^5 is reached. At this stage the Cd drops steeply by a factor of 5.

This is due to the fact that the laminar boundary layer turns turbulent and stays unseparated over a longer distance, then reducing the wake considerably.

58. During the opening of a valve in a pipe line, the flow is

A. steady B. unsteady

C. uniform D. laminar

Ans. B

Sol. When fluid properties changes with respect to time, the flow is known as unsteady flow.

E.g. flow during opening of valve in pipe.

59. If a fluid jet discharging from a 30 mm diameter orifice has a 20 mm area at vena contracta, then its coefficient of contraction will be

A. 3/2 B. 2/3

C. 9/4 D. 4/9

Ans. D

Sol. Given,

Diameter of orifice (d_o) = 30 mm

Diameter of Vena Contracta (d_v) = 20 mm

Coefficient of contraction (C_c), is given by:

$$C_C = \frac{\text{Cross sectional area at Vena Contracta}}{\text{Orifice Cross sectional area}}$$

$$\Rightarrow C_C = \frac{\frac{\pi}{4} \times 20^2}{\frac{\pi}{4} \times 30^2} = \frac{4}{9}$$

60. The centre of pressure of any submerged plane vertical surface is _____

A. Always below the centroid of the surface

B. Always above the centroid of the surface

C. Always coincident with the centroid of the surface

D. Above or below the centroid depending on the area of the surface

Ans. A

Sol. The center of pressure is the point where the total sum of a pressure field acts on a body, causing a force to act through that point.

The centre of pressure of any submerged plane surface is always below the centroid of the surface.

61. The property of a fluid which enables it to resist tensile stress is known as

A. compressibility

B. surface tension

C. cohesion

D. adhesion

Ans. B

Sol. The inter-molecular attraction between like-molecules is cohesion. The property of cohesion make it possible for a liquid to resist tensile stress. Surface tension is due to cohesion between liquid molecule.

62. Equation of a stream line in a 2D flow is

A. (dy/u) = (dx/v)

B. (u/dx) = (dy/v)

C. u = (dx/t), (dy/t) = v

D. (dx/u) = (dy/v)

Ans. D

Sol. A streamline is defined as a line which is everywhere parallel or tangent to the local velocity vector V(x, y, z, t) = ui + vj + wk.

Define ds = dx i + dy j + dz k as an infinitesimal arc-length vector along the streamline. Since this is parallel to V, we must have

ds × V = 0

(w dy − v dz)i + (u dz − w dx) j + (v dx − u dy) k = 0

In 2-D, we have dz = 0 and w = 0, and only the k component of the equation above is non-trivial. It can be written as an Ordinary Differential Equation for the streamline shape y(x).

dy/dx =v/u

63. Two Pelton wheels P and Q are having same specific speed and working under the same head. Wheel P provides 1600 kW at 400 RPM. If wheel Q produces 100 kW, then its RPM will be

A. 6400

B. 4000

C. 1600

D. 400

Ans. C

Sol. Given same specific speed and working under the same head.

$N_1.P_1^{1/2}=N_2.P_2^{1/2}$

$400 \times (1600)^{1/2} = (100)^{1/2} \times N_2$

Therefore, $N_2=1600$ rpm

64. Capillary effect can be neglected by using

A. Small diameter tube

B. Sufficiently large diameter tube

C. Low density fluid

D. None

Ans. B

Sol. Diameter of capillary tube should be sufficiently large to avoid capillary effect.

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

List-1 (Measuring instrument)		**List-2 (Variable to be measured)**	
A.	Pitot-tube pressure	1.	Flow static
B.	Micro-manometer (indirect)	2.	Rate of flow
C.	Pipe bend meter pressure	3.	Differential
D.	Wall pressure tap pressure	4.	Flow stagnation

A. A-1; B-3; C-2; D-4 B. A-4; B-3; C-2; D-1

C. A-1; B-2; C-3; D-4 D. A-4; B-2; C-3; D-1

Ans. B

Sol. Option B is correct.

Measuring instrument		**Variable to be measured**
Pitot-tube	⇒	Flow stagnation pressure
Micro-manometer	⇒	Differential pressure
Pipe bend meter	⇒	Rate of flow (indirect)
Wall pressure tap	⇒	Flow static pressure

66. The pressure in meters of oil of specific gravity 0.9 equivalent to 90 m of water is

A. 90 m B. 100 m

C. 80 m D. 95 m

Ans. B

Sol. For equivalent pressure,

$S_1h_1 = S_2h_2$

$0.9 \times h = 90 \times 1$

$h = 100$ m

67. A flow whose stream line is represented by a curve, is called _____.

A. One-dimensional flow B. Three dimensional flow

C. Two-dimensional flow D. Four-dimensional flow

Ans. C

Sol. Fluid motion is said to be two-dimensional when the velocity at every point is parallel to a fixed plane, and is the same everywhere on a given normal to that plane. Thus, in Cartesian coordinates, if the fixed plane is the **XY** plane then we can express a general two-dimensional flow pattern in the form

$v = v_x (x, y, t)\, e_x + v_y (x, y, t)\, e_y$

68. Continuity equation for 2 – D incompressible and steady flow is_____.

A. $A_1V_1 = A_2V_2$ B. $A_1V_2 = A_2V_1$

C. Both A and B D. None

Ans. A

Sol. Continuity equation for 2 – D incompressible and steady flow means

inflow = outflow

i.e. $A_1V_1 = A_2V_2$

69. Venturimeter is used to measure flow of fluids in pipes when pipe is

A. horizontal
B. vertical, flow downwards
C. vertical, flow upwards
D. in any position

Ans. D

Sol. Venturimeter is flow measurement instruments which use a converging section of pipe to give an increase in the flow velocity and a corresponding pressure drop from which the flow rate can be deduced. They have been in common use for many years, especially in the water supply industry. It use in any position of pipe.

70. A lubricant oil viscosity 9.81 poise filled between two parallel plates 1 cm apart and the upper one is moving with a relative velocity of 2 m/sec and lower is fixed, what is the shear stress on the lower fixed plate?

A. 200 N/m^2
B. 196.2 N/m^2
C. 296.2 N/m^2
D. 400N/m^2

Ans. B

Sol. Since the gap between the plates is very small, a linear variation can be assumed.

Given,

viscosity = 9.81 poise= 0.981 N/m^2

h= 1cm =0.01m

$$\frac{du}{dy} = \frac{(u-0)}{h} = \frac{2}{0.01} = 200s^{-1}$$

τ = shear stress on the bottom plate

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

$= 9.81 \times 10^{-1} \times 200$

$= 196.2\ N/m^2$

71. Which one of the following is an example of Bingham plastic?

A. Air
B. Blood
C. Tooth paste
D. Printing ink

Ans. C

Sol. A Bingham plastic is a viscoplastic material that behaves as a rigid body at low stresses but flows as a viscous fluid at high stress.

Since some initial force is required to have the flow of tooth paste hence it is example of bingham plastic.

72. Bluff body is the body of such a shape that pressure drag as compared to friction drag is

A. same
B. more
C. less
D. zero

Ans. B

Sol. Bluff body is the body of such a shape that pressure drag as compared to friction drag is more. There occurs no overlapping with streamlines during flow of liquid.

73. 1 bar is equals to

A. 10^5 Pa
B. 10^5 MPa
C. 10^5 KPa
D. None

Ans. A

Sol. 1 bar pressure is equal to the 10^5 Pa

74. The sum of pressure head and elevation head is known as _____.

A. dynamic head
B. piezometric head
C. direct head
D. potential head

Ans. B

Sol. Piezometric head is simply addition of pressure head at any point and datum head (elevation head).

$$\text{Piezometric head} = \text{Pressure head} + \text{Datum head}$$

$$\text{Pressure head} = \frac{P}{\rho g}$$

$$\text{Datum head} = Z$$

$$\text{Piezometric head} = \frac{P}{\rho g} + Z$$

75. Power transmitted through a pipe is maximum when where H = total head supplied H_L = Head loss due to friction

A. $H_L = \frac{H}{2}$
B. $H_L = \frac{H}{3}$
C. $H_L = \frac{H}{4}$
D. $H_L = H$

Ans. B

Sol. For maximum power transmission

$$H_L = \frac{H}{3}$$

76. In a pipeline 2520 m long, the velocity of propagation of pressure wave is 840 m/s. rapid closure of a downstream valve will entail, when the maximum time for the closure is

A. 3 sec
B. 4 sec
C. 2 sec
D. 6 sec

Ans. D

Sol. Time taken by pressure wave to travel from valve to the tank and tank to the valve
= 2L/C

Where, L is the length of the pipe

C velocity of propagation of pressure waves

$= \frac{2 \times 2520}{840}$ = 6 sec

77. In case of a two dimensional flow the components of velocity are given by u = ax; u = ay, the streamlines will consist of a series of

A. circular arcs
B. parabolic arcs
C. Straignt line passing through origin
D. straignt line not passing through origin

Ans. C

Sol. Given,

u = ax, v = ay

stream line equation

$\frac{dy}{dx} = \frac{v}{u} = \frac{ay}{ax} = \frac{y}{x}$

$\frac{dy}{y} = \frac{dx}{x} \Rightarrow \ln y = \ln x + \ln c$

$\ln y = \ln cx$

$y = cx$

Thus stream lines will be straight passing through origin

78. Stream function is given as $\psi = 2xy^2$, find the magnitude of velocity vector at (1,-1) is_____.

A. $\sqrt{10}$
B. $\sqrt{20}$
C. 5
D. 4

Ans. B

Sol. Given,

Stream function = $\psi = 2xy^2$

$v = \frac{\partial \psi}{\partial x} = 2y^2$, i.e. at (1, – 1), v = 2

$u = \frac{-\partial \psi}{\partial y} = -4xy$, i.e. at (1, – 1), u = 4

$v = \sqrt{u^2 + v^2}$

$= \sqrt{4^2 + 2^2}$

$= \sqrt{20}$

79. A fluid in which shear stress is a function of rate of deformation only, is called __.

A. Bingham plastic fluid
B. Pseudo plastic fluid
C. Dilatant fluid
D. Newtonian fluid

Ans. D

Sol. In Newtonian fluid, there is a linear relation between the magnitude of applied shear stress and the resulting rate of deformation. And shear stress is a function of deformation rate only and doesn't depends on temperature and time.

80. Which one of the following equation are considered gravity and pressure force only

A. Newton's equation of motion
B. Euler's equation of motion
C. Reynold's equation of motion
D. Navier – Stoke's equation of motion

Ans. B

Sol. When only pressure and gravity forces are considered then the equation is called Euler's equation of motion.

$M \times a = F_g + F_p$

81. The vacuum pressure of water is 5.2 m. The equivalent absolute pressure is

A. 4.9 m
B. 5.1 m
C. 5.3 m
D. 15.5 m

Ans. B

Sol. The vacuum pressure of water is 5.2 m= negative gauge pressure

Local atmospheric pressure of water= 10.3 m of water

Equivalent absolute pressure= -5.2+10.3=5.1 m of water

82. The magnitude of water hammer depends on

A. length of pipe
B. elastic properties of pipe material
C. rate of stoppage of flow
D. All options are correct

Ans. D

Sol. Water hammer is a pressure surge or wave caused when a fluid (usually a liquid but sometimes also a gas) in motion is forced to stop or change direction suddenly (momentum change).

83. In a static fluid _____.

A. resistance to shear stress is small
B. fluid pressure is small
C. linear deformation is small
D. only normal stresses can exist

Ans. D

Sol. static fluid means the fluid which is not moving or we can say that the fluid on which there is no tangential shear force is acting, it can be termed as static fluid.

84. An error of 2% in measuring head over a weir will produce _____ error in discharge

A. 1%
B. 2%
C. 5%
D. 3%

Ans. D

Sol. For a weir $= \frac{dQ}{Q} = \frac{3}{2} \times \frac{dH}{H}$

$\frac{dH}{H}$ = 2% (given)

$\frac{dQ}{Q} = \frac{3}{2} \times 2\% = 3\%$

85. The forebays, a storage reservoir sometimes used in hydraulic turbine are mainly suitable for

A. high head power plant only

B. medium head power plant only

C. high and medium head power plant

D. medium and low head power plant

Ans. D

Sol. The forebays are suitable for medium and low head power plant while surge tank is suitable for high and medium head power plant.

86. The top surface of a vertical rectangular gate, with 16 m width and 12 m height, and the upper surface of height coincides with the free water surface. The depth of the centre of pressure is

A. 9.6 m

B. 4 m

C. 8 m

D. 10 m

Ans. C

Sol. Given,

vertical rectangular gate, with 16 m width and 12 m height,

Gate is vertical then Centre of pressure for vertical rectangular gate

$h_{cp} = 2h/3 = 2(12)/3 = 8$

87. If the surface tension of water air interface is 0.073 N/m; The gauge pressure inside a rain drop of 1 mm diameter will be.

A. 0.146 N/m^2

B. 73 N/m^2

C. 146 N/m^2

D. 292 N/m^2

Ans. D

Sol. $P = \frac{4\sigma}{d}$

$P = \frac{4 \times 0.073}{1 \times 10^{-3}}$

$P = 0.292 \times 10^3$

$= 292\ N/m^2$

88. The buoyant force is the _____.

A. Lateral force acting on a submerged body

B. Apparent weight of the body.

C. Net upward hydrostatic force.

D. Hydrostatic force on a body due to fluid surrounding it.

Ans. C

Sol. Buoyant force is the net upward hydrostatic force on the body immersed in fluid.This net upward hydrostatic force is equal to the weight of the fluid displaced by the body and passes through the centre of gravity of the displaced fluid.

The word "Net upward " is what distinguishes buoyant force from the simple hydrostatic force because any body immersed will experience hydrostatic force on its surfaces in contact with fluid, but buoyancy is net upward hydrostatic force.

89. A body is immersed in a fluid having an angle θ with the liquid surface. The depth of centre of pressure on the body

A. lies $\frac{I_G \sin^2\theta}{Ah_G}$ distance below the centre of gravity

B. lies $\frac{I_G \sin^2\theta}{Ah_G}$ distance above the centre of gravity

C. lies $\frac{I_G \sin\theta}{Ah_G}$ distance below the centre of gravity

D. lies at the centre of gravity

Ans. A

Sol. We know that for an inclined plate, centre of pressure is given by,

$$h_{C.P.} = h_G + \frac{I_G \sin^2\theta}{Ah_G}$$

$$\Rightarrow h_{C.P.} - h_G = \frac{I_G \sin^2\theta}{Ah_G}$$

So, centre of pressure will at more depth from the free surface of water.

90. Unit of compressibility is

A. Pa B. N/m

C. Pa^{-1} D. N/m^3

Ans. C

Sol. Mathematically, compressibility is defined as the reciprocal of bulk modulus (k).

$$k = \frac{\text{Hydrostatic stress (Pa)}}{\text{Volumetric strain}} = Pa$$

$$\text{Compressibility} = \frac{1}{k} = Pa^{-1}$$

91. Density of water is maximum at

A. 0°C B. 0°K

C. 4°C D. 100°C

Ans. C

Sol. As temperature rises to over 4° C, the extra space needed by increased motion of water molecules starts being larger than the space gained due to structural changes and the molecules start to move away from each other due to which the Volume again increases and Density decreases. Thus, Density maximum is reached at 4°C.

92. The value of critical velocity is governed by the

A. inertia force

B. viscous force

C. ratio of inertia force and viscous force

D. None of these

Ans. C

Sol. the value of critical velocity is governed by by ratio of inertia force and viscous force.
Ratio of inertia force and viscous force is also known as Re (Reynolds Number)

93. An object weighs 60 gm in air, 50 gm in water and 40 gm in oil. Then the specific gravity of the oil will be _____. (Assume, g = 10 m/s2)

A. 0.25 B. 1

C. 1.5 D. 2

Ans. D

Sol. We know,

Net weight of body = weight of body - buoyancy force

$0.05xg = 0.06xg - (\rho_w \times Vxg)$ .....(1)

$Vxg = 0.01xg/1000 = 0.00001xg$

$0.04xg = 0.06xg - (\rho_{oil} \times Vxg)$ .....(2)

$\rho_{oil} \times g = 2000$

Specific gravity of oil = 2000/1000 = 2

94. The velocity distribution in a turbulent boundary layer is given by $u/v = (y/\delta)^{1/7}$. The displacement thickness will be

A. δ/7 B. δ

C. 7δ/8 D. δ/8

Ans. D

Sol.

Given, velocity profile

$$\frac{u}{v} = \left(\frac{y}{\delta}\right)^{1/7}$$

From the definition of displacement thickness

$$\delta^* = \int_0^{\delta}\left(1 - \frac{u}{v}\right)dy = \int_0^{\delta} 1 - \left(\frac{y}{\delta}\right)^{\frac{1}{7}}$$

$$\delta^* = \left[y - \frac{1}{\delta^{\frac{1}{7}}}\ \frac{y^{\frac{1}{7}+1}}{\frac{1}{7}+1}\right] = \left[\delta - \frac{7}{8}\ \frac{\delta^{\frac{1}{7}+1}}{\delta^{\frac{1}{7}}}\right] = \delta - \frac{7\delta}{8}$$

$$\delta^* = \frac{\delta}{8}$$

95. In laminar flow through a round tube, the discharge varies _____.

A. linearly as the viscosity B. inversely as the pressure drop

C. as the cube of the diameter D. inversely as the viscosity

Ans. D

Sol. Discharge is proportional to velocity and velocity is decreases with increases with viscosity means velocity is inversely proportional to viscosity and also discharge.

96. The ratio of depth of bucket for Pelton Wheel to the diameter of jet is of the order of ___.

A. 1 B. 1.2

C. 1.5 D. 1.8

Ans. B

Sol. The ratio of depth of bucket for Pelton Wheel to the diameter of jet is of the order of 1.2

97. A fluid is flowing with an average velocity of 2m/s through a pipe of diameter 3cm.What is the maximum velocity of the fluid assuming laminar flow through the pipe?

A. 2 m/s B. 3 m/s

C. 4 m/s D. 6m/s

Ans. C

Sol. For a laminar flow flowing through a pipe,

$v_{max} = 2 \times v_{avg}$

Therefore, $v_{max} = 2 \times 2 = 4$ m/s

98. Barometer is used to measure:

A. Rain level B. Pressure in pipes and channels

C. Atmospheric pressure D. Very low pressure

Ans. C

Sol. A barometer is used to measure atmospheric pressure. Atmospheric pressure is a measure of the amount of force air exerts onto the earth as it is pushed down from the atmosphere. Another term for atmospheric pressure is barometric pressure.

99. The printer's ink is an example of

A. Newtonian Fluid B. Non- Newtonian fluid

C. Rheopectic fluids D. Elastic solid

Ans. C

Sol.

- Rheopectic fluids are an even rarer class of non-Newtonian fluids.
- Rheopectic fluids time-dependent increase in viscosity, they thicken or solidify when shaken or agitated. The longer they undergo a shearing force, the higher their viscosity becomes, as the microstructure of a rheopectic fluid builds under continuous shearing
- The printer's ink is an example of Rheopectic fluids.

100. 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

Ans. D

Sol. $P = \ell g h$

$P = 1000 \times 9.81 \times 1$

$P = 9810$ Pa

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