Chapter = 06

Fluid Dynamics

Fluid: Any substance that can flow from one place to other place is called fluid. e.g water, honey. Fluid is combination of liquid and gases.

Fluid statics: The branch of Physics which deals with the study of fluid at the state of rest is called Electrostatics. Fluid statics is based upon Newton's first and third law.

Fluid dynamics: The branch of Physics which deals with study of fluids in motion is called Fluid dynamics.

A fluid is studied on the basis of (1) Law of conservation of mass (Eq. of continuity) (2) Law of conservation of energy (Bernoulli eq).

What is Viscous drag and Stokes law

What is Viscosity? Write formula and unit. Frictional force effect b/w different layers of flowing fluid is called viscosity. Its SI unit is $kgm^{-1}s^{-1}$ and its dimension is $[ML^{-1}T^{-1}]$. Co-efficient of viscosity is denoted by symbol η from stokes law **F=6πηrv.**

The fluids which can flow easily have small co-efficient of viscosity. For example air, water etc

The fluids which cannot flow easily have large co-efficient of viscosity. For example honey, tar etc.

What is the Effect of temperature on viscosity of liquid and gases?

Viscosity of gases increase with increase in temperature (due to random motion)

Viscosity of liquids decreases with increase of temperature.

What is Drag force? Upon which factors it depends?

An object moving through a fluid experiences a retarding force is called drag force. F=6πηrv

For example, when we switch our hand out of the window of a fast moving car, we feel a force opposite to our motion.

Factors upon which drag force depends: (1) speed of sphere (2) radius of sphere (3) viscosity of sphere.

State Stokes law. "Drag force acting on a sphere is equal to 6π time the product of co-efficient of viscosity, radius and fluid speed" $F = 6\pi\eta rv$. Stokes law is valid only for spherical bodies moving slowly. At high speed it is not valid.

What is Terminal velocity? Derive its relation. OR Prove that terminal velocity is directly proportional to the square of radius.

Terminal velocity: When the magnitude of drag force becomes equal to the weight of droplet, then it will start moving downward with constant and maximum velocity, this velocity is called terminal velocity. $V_t = \frac{2\rho g r^2}{9\eta}$.

Derivation: consider a droplet falling vertically downward under the influence of gravity and drag force. The drag force increases as the velocity of droplet increases. The net force on the droplet is

$$\text{Net force} = \text{weight} - \text{drag force}$$

$$ma = mg - 6\pi\eta rv$$

as the droplet moves with constant velocity so acceleration is zero so above eq becomes

$$m(0) = mg - 6\pi\eta r v_t$$

$$mg = 6\pi\eta r v_t$$

$$v_t = \frac{mg}{6\pi\eta r} \text{ --------------------------(1)}$$

now we have to find the value of m, as Density= mass/ volume

mass= Density x volume= ϱ* 4/3 πr^3 , putting in eq (1)

$$v_t = \frac{\rho * \frac{4}{3}\pi r^3 g}{6\pi\eta r} = \frac{\rho * 4\pi r^3 g}{18\pi\eta r}$$

$$v_t = \frac{2\rho g r^2}{9\eta}$$

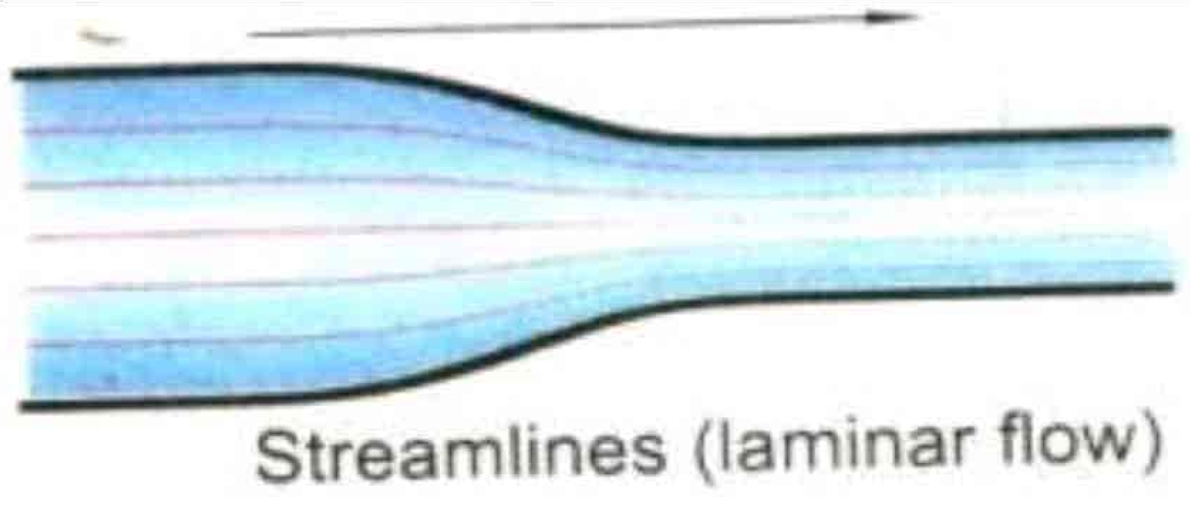
$$\frac{2\rho g}{9\eta} = \text{Constant}$$

$$v_t = Constant\ r^2$$

$$v_t \propto r^2,$$

This shows that terminal velocity is proportional to square of radius of droplet.

Difference b/w laminar and turbulent flow.

Laminar flow	Turbulent flow
The regular, steady and smooth flow of fluid is called laminar flow.	The irregular and unsteady flow of fluid is called turbulent flow.
Laminar flow usually occurs at slow speed	Turbulent flow usually occurs at very high speed
	

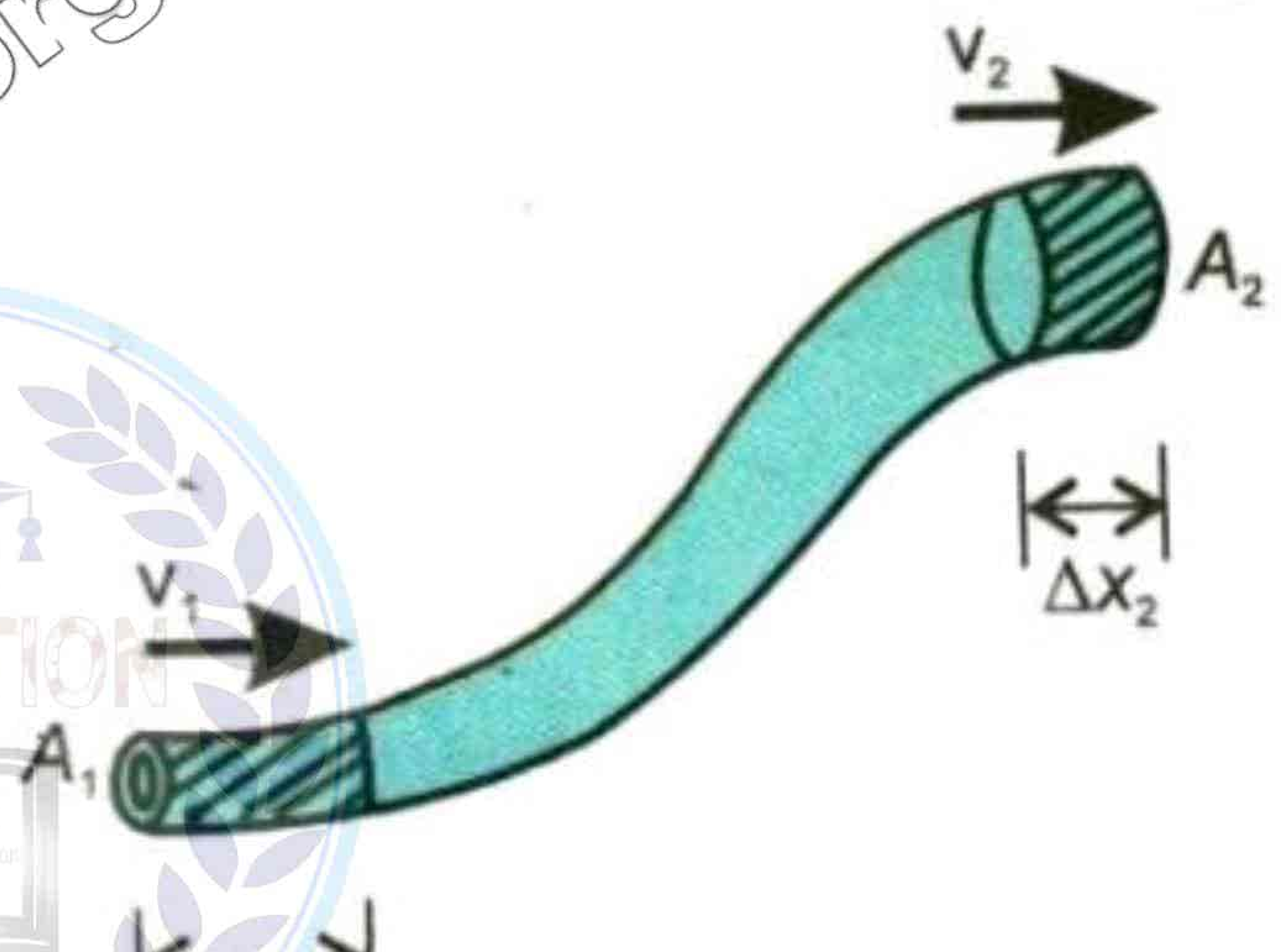
Steady flow condition: For steady flow, different streamline can never intersect each other, this is called steady flow condition.
Ideal fluid: A fluid which is non-viscous (no viscosity), incompressible (density is constant) and steady is called ideal fluid.

State and Explain Equation of continuity.

Statement: "For an ideal, the product of cross sectional area of pipe and fluid speed at any point along the pipe remains constant, this constant equals the volume flow per second of fluid or simply flow rate." $A_1v_1 = A_2v_2$

Derivation: Consider a fluid flowing through a pipe of non-uniform size. The particles in the fluid move along the streamline in steady state flow as shown in fig. In the small time Δt, the fluid at the lower end of the tube moves a distance Δx_1, with velocity v_1. If A1 is the area of cross section of this end,

Volume of fluid in lower side= $A_1\Delta x_1$



As density of fluid $= \rho = \dfrac{\Delta m_1}{\text{Volume}} \Rightarrow \Delta m_1 = \rho V$

$\Delta m_1 = \rho_1 A_1 \Delta x_1$

As $S = vt \Rightarrow \Delta x_1 = v_1 \Delta t$

$\Delta m_1 = \rho_1 A_1 v_1 \Delta t$ -------------(1)

similarly the fluid at the upper cross section of pipe

$\Delta m_2 = \rho_2 A_2 v_2 \Delta t$ -------------(2)

As $\Delta m_1 = \Delta m_2$

$\rho_1 A_1 v_1 \Delta t = \rho_2 A_2 v_2 \Delta t$

$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$ As density is same so $\rho_1 = \rho_2 = \rho$

$\rho A_1 v_1 = \rho A_2 v_2$

$A_1 v_1 = A_2 v_2 \Rightarrow Av = \text{constant}$..this is called volume flow rate whose unit is m^3/sec.

This is required Equation of continuity. This is according to law of conservation of mass.

State and Explain Bernoulli equation

Statement: For an incompressible, non-viscous fluid, sum of pressure, kinetic energy per unit volume and potential energy per unit volume remains constant. $P + \frac{1}{2}\rho v^2 + \rho gh = \text{Constant}$. This is according to law of conservation of energy.

Explanation: let us consider the flow of incompressible and steady fluid through the pipe in time t.

Pressure on upper end of pipe $P_1=F_1/A_1$, the force on upper end= $F_1=P_1A_1$

The work done through $\Delta x_1 = W_1 = F_1\Delta x_1 = P_1A_1\Delta x_1$

similarly at lower end the work $= W_2 = -P_2A_2\Delta x_2$ (W_2 is taken as - ive as work is against the fluid force)

The net work done $= W = W_1 + W_2$

$$W = (P_1A_1\Delta x_1) + (-P_2A_2\Delta x_2) = P_1A_1\Delta x_1 - P_2A_2\Delta x_2$$

As According to Eq of continuity $A_1\Delta x_1 = A_2\Delta x_2 = V$

$$W = P_1V - P_2V$$

$$W = (P_1 - P_2)V \text{ ----------------- } (1)$$

As $V = m/\rho$ put in above $W = (P_1 - P_2)m/\rho \text{ --------- } (A)$

As part of this work is stored in form of potential and part in form of Kinetic energy so,

$$W = \Delta K.E + \Delta P.E \text{ ----------- } (2)$$

$$\Delta K.E = K.E_f - K.E_i = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \text{ ---------- } (B)$$

$$\Delta P.E = P.E_f - P.E_i = mgh_2 - mgh_1 \text{ ------------- } (C)$$

putting the value of (A), (B) and (C) in equation (2)

$$(P_1 - P_2)m/\rho = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_2 - mgh_1$$

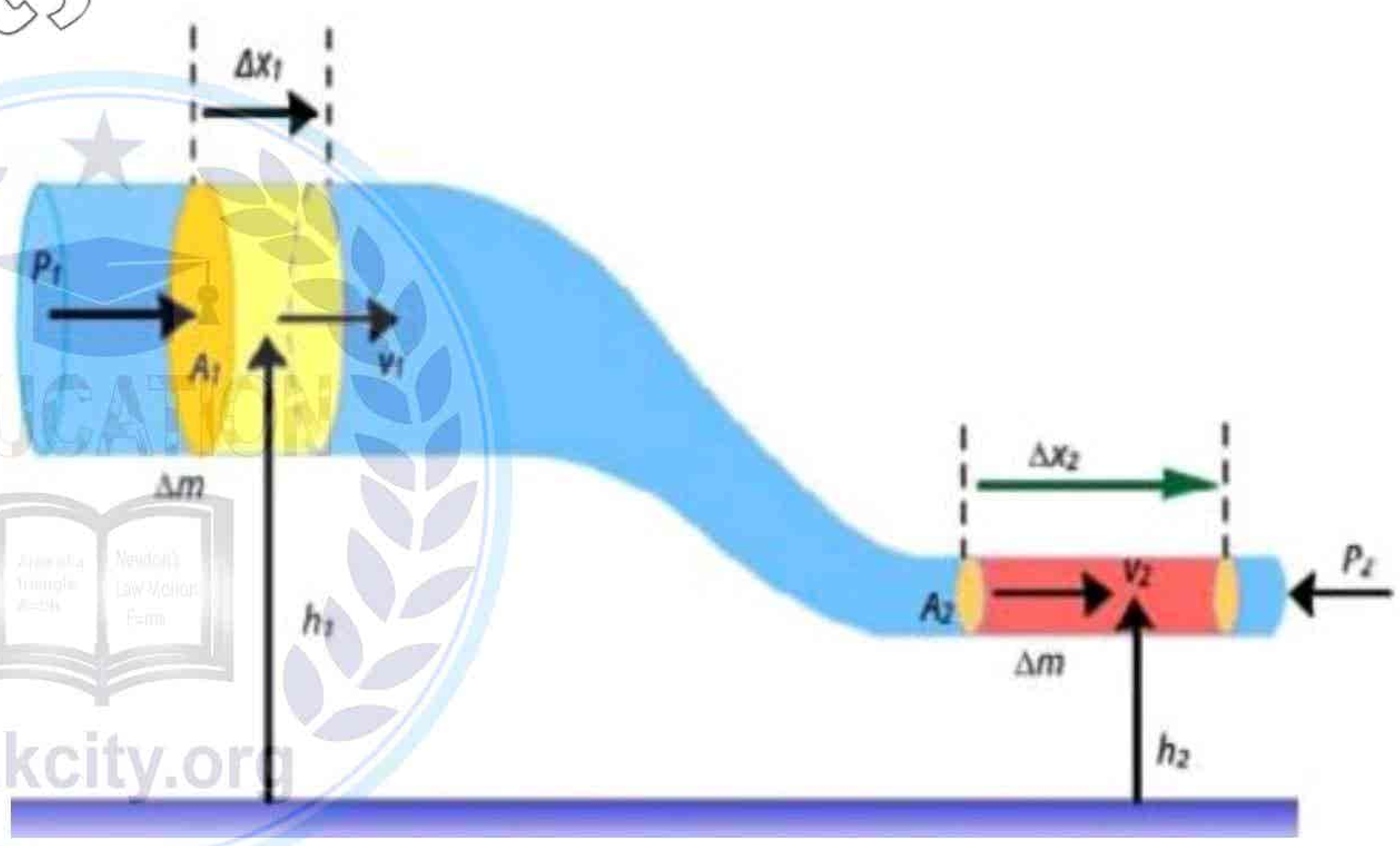
$$(P_1 - P_2)m/\rho = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_2 - mgh_1$$

$$(P_1 - P_2)m/\rho = m(\frac{1}{2}v_f^2 - \frac{1}{2}v_i^2 + gh_2 - gh_1)$$

$$(P_1 - P_2)1/\rho = (\frac{1}{2}v_f^2 - \frac{1}{2}v_i^2 + gh_2 - gh_1)$$

$$(P_1 - P_2) = (\frac{1}{2}\rho v_f^2 - \frac{1}{2}\rho v_i^2 + \rho gh_2 - \rho gh_1)$$

$$P_1 + \frac{1}{2}\rho v_i^2 + \rho gh_1 = P_2 + \frac{1}{2}\rho v_f^2 + \rho gh_2$$



$P + \frac{1}{2}\rho v^2 + \rho gh = \text{Constant}$, This is required Bernoulli equation

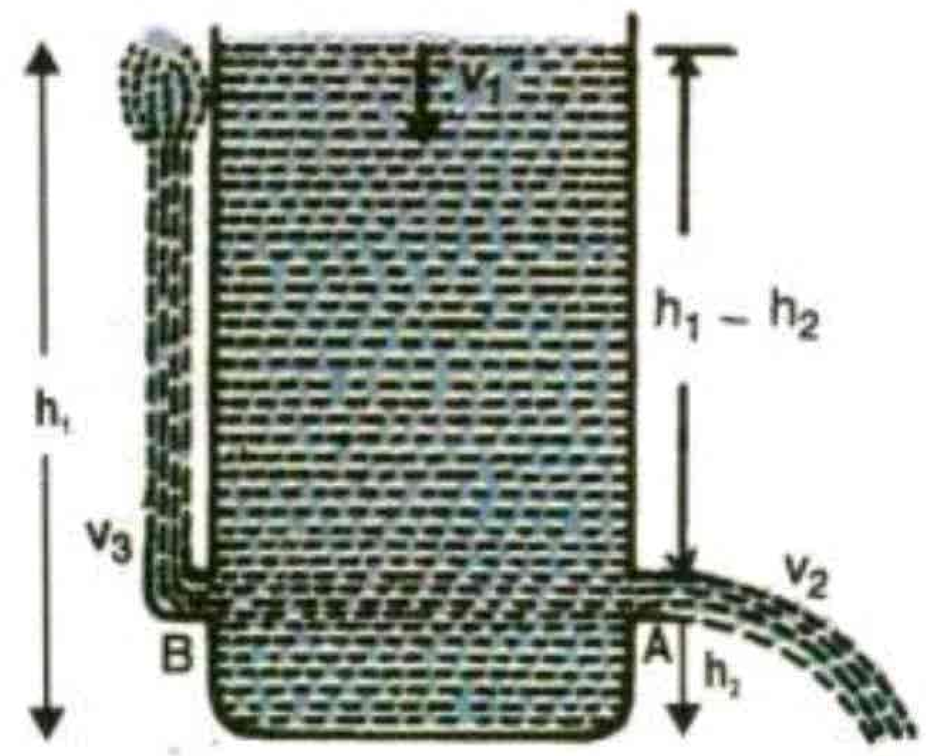
State and prove Torricelli theorem

Statement: "Speed of efflux is equal to the velocity gained by the fluid in falling through distance (h_1-h_2) under the action of gravity" $v = \sqrt{2g(h_1 - h_2)}$.

Proof: Let us consider a large tank of fluid has two orifices A and B on it as shown in fig. to the find the speed the speed with which the water flow from A, speed v_1 is so small approximate zero. Using Bernoulli equation

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$$P_1 = P_2 = P = \text{Atmospheric pressure}, v_1 = 0 \Rightarrow P + \frac{1}{2}\rho (0)_1^2 + \rho g h_1 = P + \frac{1}{2}\rho v_2^2 + \rho g h_2$$



$$\rho g h_1 = \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$$\frac{1}{2}\rho v_2^2 = \rho g h_2 - \rho g h_1 = \rho g(h_2 - h_1)$$

$$v_2^2 = 2g(h_2 - h_1)$$

$$v_2 = \sqrt{2g(h_2 - h_1)}, \text{ This is called Torricelli Theorem}$$

What is Relation b/w pressure and speed of fluid

Statement: "Where the speed is high, pressure will be low"

Let us consider water flows through a pipe as system , the water will flow faster at B , than does at A or C. let suppose speed=v_1=0.20 m/s, v_2= 2m/s, so we can compare pressure at A and B and having same P.E, so

$$P_1 - P_2 = \frac{1}{2}\rho(v_2^2 - v_1^2)$$

$$P_1 - P_2 = \frac{1}{2} * 1000 * (2^2 - (0.2)^2)$$

$$P_1 - P_2 = 1980\text{pa}, \text{This show that pressure is high where speed is low}$$

What is Dynamic lift in aero plane?

It is produced due to the effect, where the speed of fluid is high, its pressure will be low because when air moves faster at upper side of wing than lower side pressure is lower at the top of wind so the wing feels a net upward force.

How Perfume bottle works?

A stream of air passing over a tube dipped in a liquid will cause the liquid to rise in tube. This effect is used in perfume bottles and pain sprayers.

Why the chimney works best when it is tall?

Chimney works best when it is tall and exposed to air currents which reduces the pressure at the pressure at the top and force the flow of smoke.

Swing of fast moving cricket ball

The velocity of the air on one side of the ball increases due to spin and air speed in the same direction and so pressure decreases. This gives swing to the ball.

What is Venture meter? Give its principle

Definition: A device which measures the fluid speed is called venture meter

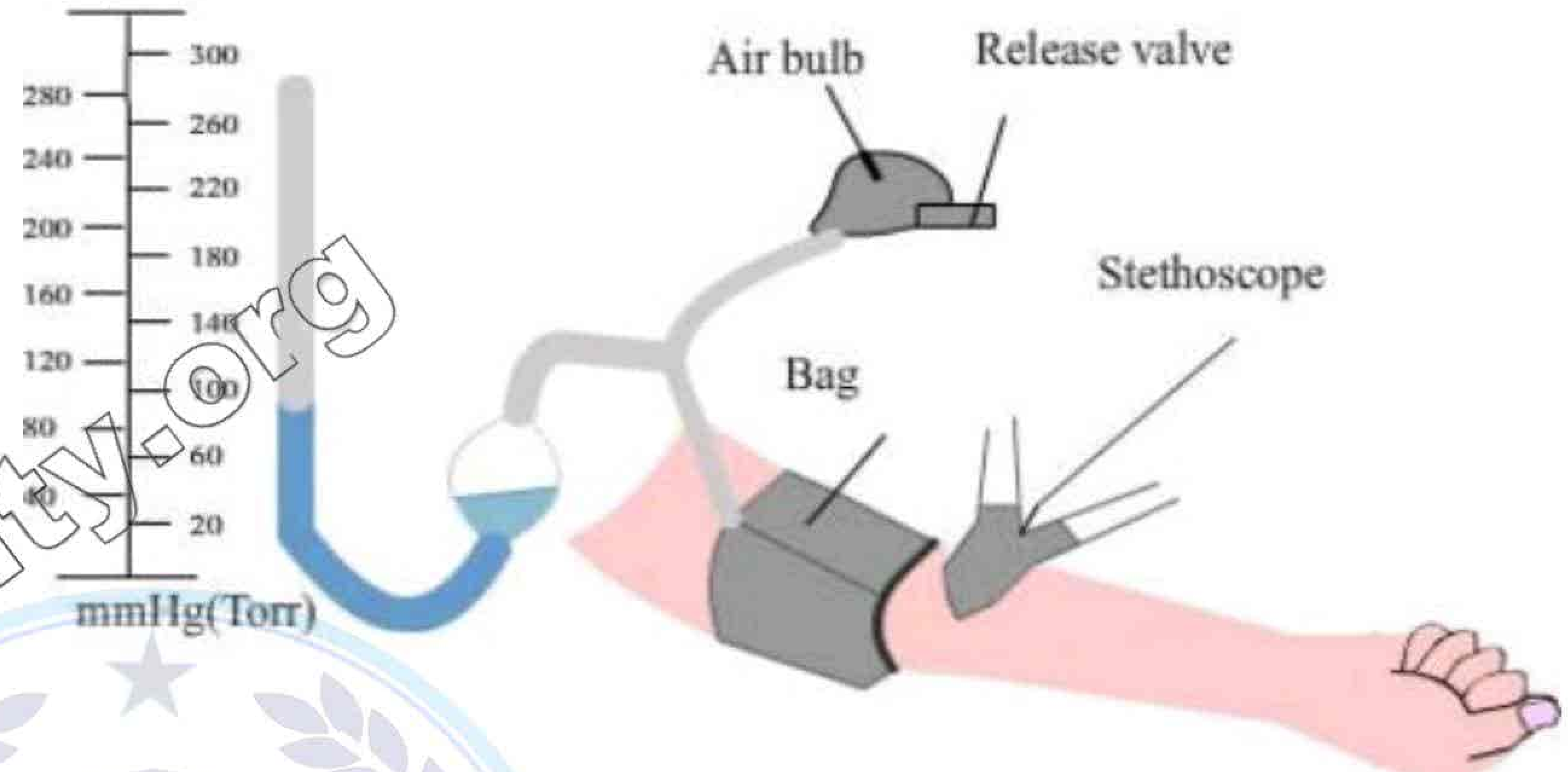
Its working principle is venture relation. $P_1 - P_2 = \frac{1}{2}\rho v^2$

Briefly describe about Blood flow

- Blood is incompressible fluid. Density of blood is nearly equal to water.
- Viscosity of blood increase 3 to 5 times that of water.
- High concentration of red blood cells is 50%.
- The pressure exerted by circulation of blood on the walls of the blood vessels is called blood pressure
- High blood pressure is systolic and low blood pressure is diasystolic.
- Systolic Bp is 120 torr and diastolic pressure is 75-80 torr.
- Blood pressure is measured in torr or mm of Hg. 1 torr= 133.3 Nm^{-2}.
- Blood pressure is measured by an instrument which is called sphygmomanometer.

How blood pressure is measured?

- An inflatable bag is wound around the arm of a patient and external pressure on the arm is increased by inflating the bag. This effect is to squeeze the arm and compress the blood vessels inside.
- When the external pressure applied becomes larger than the systolic pressure, the vessel collapse and flow of blood stop.
- By opening the release valve on the bag gradually decrease the pressure.
- A stethoscope detects the instant at which the external pressure becomes equal to systolic pressure. At this point the blood flow through it produce a high flow speed in turbulent flow
- As the pressure drops, the external pressure eventually equals the diastolic pressure, from this point, the vessel no longer collapse during any portion of the flow cycle. The flow switches from turbulent to laminar and gurgle in stethoscope disappears, this is the signal to record diastolic pressure.



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Exercise Short Questions

Q.1 Explain what do you understand by the term viscosity?

Frictional effect b/w different layers of flowing fluid is called viscosity. Its SI unit is $kgm^{-1}s^{-1}$ and its dimension is $[ML^{-1}T^{-1}]$.

Q.2 What is meant by drag force? What are the factors upon which drag force acting upon a small sphere of radius r, moving down through liquid, depend?

"The retarding force experienced, when an object move through a fluid". According to Stoke's Law, the drag force, F is; $F = 6\pi\eta rv \Rightarrow$ F depends upon η = coefficient of viscosity, r = radius of the sphere v = speed of the sphere through the fluid.

Q.3 Why fog droplets appear to be suspended in air?

Due to drag force. As fog droplet falls, soon its weight becomes equal to the drag force. And net force becomes zero. So it appears to be suspended in air. Putting F=0 in equation to get the required equation

$F=weight-F_D$ ….> $mg=6\pi\eta rv$

Q.4 Explain the difference between laminar flow and turbulent flow. The regular, steady and smooth flow of fluid is called laminar flow. The irregular and unsteady flow of fluid is called turbulent flow.

In laminar flow each particle of fluid moves along smooth path, in turbulent flow pattern is not smooth.

Q.5 State Bernoulli's relation to a liquid in motion and describe some of its applications.

For an incompressible, non-viscous fluid, sum of pressure, kinetic energy per unit volume and potential energy per unit volume remains constant.

$P + \frac{1}{2}\rho v^2 + \rho gh = \text{Constant}$. Its applications are Torricelli theorem, Venture relation, blood flow etc

Q.6 A person is standing near a fast moving train. Is there any danger that he will fall towards it?

Yes, He will fall towards the train. As the relative speed of air is high, the pressure will be low. So the greater air pressure behind the person will push him towards low pressure.

Q.7 Identify the correct answer. What do you infer from Bernoulli's theorem?

Where the speed of the fluid is high the pressure will be low.

Q.8 Two row boats moving parallel in the same direction are pulled towards each other. Explain.

Relative speed of water and air between the boats is high, the pressure will be low, so both boats pulled towards each other.

Q.9 Explain, how the swing is produced in a fast moving cricket ball.

The velocity of the air on one side of the ball increases due to spin and air speed in the same direction and so pressure decreases. This gives swing to the ball.

Q.10 Explain the working of a carburetor of a motor car using Bernoulli's principle.

"An apparatus used to charge air with gas from petrol for producing light or power" is called carburetor. Air is drawn outward through small pipe with a piston. High velocity of air produces low pressure. So petrol-air mixture is drawn inside.

Q.11 For which position will the maximum blood pressure in the body have the smallest value. (a) Standing up right (b) Sitting (c) Lying horizontally (d) Standing onone's head?

(c) Lying horizontally, position will have smallest value of maximum blood pressure in the body have the smallest value. In this position all parts of the body are nearly in level with the heart

Q.12 In an orbiting space station, would the blood pressure in major arteries in the leg ever be greater than the blood pressure in major arteries in the neck?

No. Due to lack of force of gravity, (as we use to experience on the earth) The blood pressure in major arteries in the leg will be equal than in arteries in the neck, due to weightlessness.

Numerical problems

6.1: Certain globular protein particle has a density of 1246 kgm-3. It falls through pure water $\left(\eta = 8.0\times10^{-4}\,Nm^{-2}s\right)$ with a terminal speed of 3.0 cm h-1. Find the radius of the particle.

Given Data : Density $= \rho = 1246\text{kgm}^{-3}, \eta = 8*10-4Nm^{-2}s, v_t = \frac{3*10^{-2}m}{3600\sec} = 8.33m/s, r = ?$

As we know that $v_t = \frac{2\rho gr^2}{9\eta} \Rightarrow r^2 = \frac{9\eta v_t}{2\rho g} \Rightarrow r = \sqrt{\frac{9\eta v_t}{2\rho g}} = \sqrt{\frac{9*8*10-4*8.33}{2*1246*9.8}} = 5*10^{-5}m.$

6.2: Water flows through a house, whose internal diameter is 1cm at a speed of 1ms-1. What should be the diameter of the nozzle if the water is to emerge at 21ms-1?

$$\text{Given Data}: d_1 = 1\text{cm} = 1*10^{-2}\text{m}, v_1 = 1\text{ms}^{-1}, v_2 = 21ms^{-1}, d_2 = ?$$

$$\text{sol}: \text{Using } A_1v_1 = A_2v_2 \Rightarrow (\pi r_1^2)v_1 = (\pi r_2^2)v_2 \Rightarrow (d_1/2)^2 v_1 = (d_2/2)^2 v_2 \;\; (d_1)^2 v_1 = (d_2)^2 v_2 \Rightarrow$$

$$(d_2)^2 = \frac{v_1}{v_2}(d_1)^2 \Rightarrow d_2 = \sqrt{\frac{v_1}{v_2}(d_1)^2} = \sqrt{\frac{1}{21}(1*10^{-2})^2} = 0.002m$$

6.3: The pipe near the lower end of a large water storage tank develops a small leak and a stream of water shoots from it. The top of water in the tank is 15m above the point of leak. (a) With what speed does the water rush from the hole? (b) If the hole has an area of 0.060 cm², how much water flows out in one second?

$$\text{Given Data}: h = 15\text{m}, A = 0.06\text{cm}^2, v = ?, \text{water flow out in one sec} = ?$$

$$\text{sol}: v = \sqrt{2gh} = \sqrt{2*9.8*15} = 17.1\text{ms}^{-1} = 17.1*100cms^{-1} = 1710cms^{-1}$$

$$\text{volume flow out in one sec} = Av = 0.06\text{cm}^2 * 1710cms^{-1} = 102\text{cm}^2$$

6.4: What is flowing smoothly through a closed pipe system. At one point the speed of water is 3.0 ms-1, while at another point 3.0m higher, the speed is 4.0 ms-1. If the pressure is 80 kPa at the lower point, what is pressure at the upper point?

$$\text{Given Data}: v_2 = 3\text{ms}^{-1}, v_1 = 4\text{ms}^{-1}, P_1 = 80*10^3\,pa, h_1 - h_2 = 3m, P_2 = ?$$

$$\text{sol}: \text{using Bernoulli eq}, P_1 + 1/2\rho v_1^2 + \rho gh_1 = P_2 + 1/2\rho v_2^2 + \rho gh_2$$

$$P_2 = P_1 + 1/2\rho(v_1^2 - v_2^2) + \rho g(h_1 - h_2) = 80*10^3 + 1/2(10^3)(1000*9.8*3) = 47*10^3\,pa = 47Kpa$$

6.5: An airplane wing is designed so that when the speed of the air across the top of the wing is 450 ms-1, the speed of air below the wing is 410ms-1. What is the pressure difference between the top and bottom of the wings? (Density of air = 1.29kgm-3)

$$\text{Given Data}: v_1 = 450\text{ ms}^{-1}, v_2 = 410\text{ ms}^{-1}, \rho = 1.29\text{kgm}^{-3}, P_2 - P_1 = ?$$

$$\text{sol}: \text{using } P_2 - P_1 = \frac{1}{2}\rho(v_1^2 - v_2^2) = \frac{1}{2}*1.29(450^2 - 410^2) = 22*10^3\,Pa = 22KPa$$

6.6: The radius of the aorta is about 1.0cm and the blood flowing through it has a speed of about 30 cms-1. Calculate the average speed of the blood in the capillaries using the fact that although each capillary has a diameter of about , there are literally millions of them so that their total cross section is about 2000 cm².

$$\text{Given Data}: r_1 = 1\text{cm}, A = \pi r_1^2 = 3.14*1 = 3.14\text{cm}^2, v_1 = 30\text{cm/s}, A_2 = 2000\text{cm}^2$$

$$\text{Sol}: \text{Using } A_1v_1 = A_2v_2 \Rightarrow v_2 = \frac{A_1}{A_2}v_1 = \frac{3.14}{2000}*30 = 4.7*10^{-2}\,cm/s = 4.7*10^{-4}\,m/s$$

6.7: How large must a heating duct be if air moving 3.0ms-1 along it can replenish the air in a room of 300 m³ volume every 15min? Assume the air's density remains constant.

$$\text{Given Data}: \text{speed} = v = 3\text{m/s}, \text{Volume} = V = 300\text{m}^3, t = 15\min = 15*60 = 900\sec, r = ?$$

$$\text{using}: Av = \text{volume/t} \Rightarrow \pi r^2 v = V/t \Rightarrow r^2 = V/\pi/\pi \Rightarrow r = \sqrt{V/\pi/\pi} = \sqrt{300/3.14*3*900} = 0.19m$$

6.8: An airplane design calls for a "lift" due to the net force of the moving air on the wing of about $1000Nm^{-2}$ of wing area. Assume that air flows past the wing of an aircraft with streamline flow. If the speed of flow past the lower surface is $160ms^{-1}$, what is the required speed over the upper surface to give a "lift" of $1000Nm^{-2}$? The density of air is 1.29 Kgm-3 and assume maximum thickness of wing to be one metre.

$$\text{Given Data}: P_1 - P_2 = 1000Nm^{-2}, v_1 = 160ms^{-1}, \rho = 1.29kgm^{-3}, v_2 = ?$$

$$\text{using } P_1 - P_2 = \frac{1}{2}\rho(v_2^2 - v_1^2) \Rightarrow v_2 = \sqrt{\frac{2(P_1 - P_2)}{\rho} + v_1^2} = \sqrt{\frac{2(1000)}{1.29} + (160)^2} = 165ms^{-1}$$

6.9: What gauge pressure is required in the city mains for a stream from a fire hose connected to the mains to reach a vertical height of 15.0m?

$$\text{Given data}: \text{height } = h = 15m, g = 9.8\ ms^{-2}, \rho = 1000kgm^{-3}, P_1 - P_2 = ?$$

$$\text{using Bernoulli equation } P_1 - P_2 = \rho gh = 1000*9.8*15 = 147*10^3\ pa = 147KPa$$

Multiple choice questions

1) Viscosity of air at 30° is ----------x10-3 Nsm-2

0.019	0.295	0.510	0.564

2) Viscosity of acetone at 30° is ----------x10-3 Nsm-2

0.019	0.295	0.510	0.564

3) Viscosity of methanol at 30° is ----------x10-3 Nsm-2

0.019	0.295	**0.510**	0.564

4) Viscosity of benzene at 30° is ----------x10-3 Nsm-2

0.019	0.295	0.510	**0.564**

5) Viscosity of water at 30° is ----------x10-3 Nsm-2

0.801	1.000	1.6	6.29

6) Viscosity of ethanol at 30° is ----------x10-3 Nsm-2

0.801	**1.000**	1.6	6.29

7) Viscosity of plasma at 30° is ----------x10-3 Nsm-2

0.801	1.000	**1.6**	6.29

8) Viscosity of glycerin at 30° is----------x10-3 Nsm-2

0.801	1.000	1.6	**6.29**

9) Formula one racing car have a -----design

Streamlined	Circular	Elliptical	None

10) Dolphins have ------ bodies to assist their movement in water

Streamlined	Circular	Elliptical	None

11) As the water falls, its speed increases so its cross sectional area--- as by eq. of continuity

Zero	Increase	Remains same	**Decrease**

12) A stream of air passing over a tube dipped in a liquid will cause the liquid to rise in tube/capillary action is used in

Perfume bottles	Paint sprayer	**Both A&B**	None

13) A chimney works best when it is

Small	Large	**Tall**	None

14) A chimney works best when it is tall and exposed to air current, which can

Reduce the pressure at top	Force the upward flow of smoke	**Both A&B**	None

15) Carburetor of a car uses --- to feed the correct mix of air and petrol to the cylinders.

Small pipe	**Venture duct**	Gas	None

16) Drag force acts along --- to direction of motion of object

Same	**Opposite**	Both A&B	None

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Previous all Punjab Board Exams Solved MCQs

	Questions	Option A	Option B	Option C	Option D
1)	One torr is equal to	1.33 N/m^2	**133.3 N/m^2**	0.133 N/m^2	1333.3 N/m^2
2)	Stokes law hold good for bodies having shape	Circular	**Spherical**	Rectangular	Triangular
3)	The device used for liquid flow is called	Mano meter	Baro meter	Hydrometer	**Venture meter**
4)	The maximum force drag force on falling sphere is 9.8N then its weight will be?	1N	**9.8 N**	19.6 N	Zero
	Explanation: When a sphere is falling then its drag force is equal to weight so in this case weight is equal to 9.8N				
5)	Venture relation is given by P1-P2=?	**$\frac{1}{2}\rho v^2$**	$\frac{1}{2} v^2$	$\frac{1}{2}(v_2^2-v_1^2)$	$\frac{1}{2}\rho(v_2^2-v_1^2)$
6).	The term $\frac{1}{2}\rho v^2$ in Bernoulli equation has same unit as	Work	Volume	**Pressure**	Force
7)	Drag force depends upon	Density	Acceleration due to gravity	Linear acceleration	**Radius of sphere**
8)	Velocity of efflux is	$\sqrt{2gh}$	**$\sqrt{2g(h1-h2)}$**	St	Dt
9)	The study of properties of fluid in motion is called	Fluid	**Fluid dynamics**	Fluid statics	None of these
10)	Drag force increase as the speed of object	**Increase**	Decrease	Remains same	None of these
11)	Laminar flow occurs at	**low speed**	High speed	Very high speed	None
12)	Blood pressure is measured by	Barometer	Galvanometer	Stigmometer	**Sphygmo manmeter**
13)	The blood pressure in vessel is always	Less thenatm pressure	**Greater then atm pressure**	Equal to atm pressure	133.3 N/m^2
14)	Turbulent flow is	Unsteady and regular	Steady and regular	**Unsteady and irregular**	Steady and irregular
15)	Bernouli equation is based upon law of conservation of	Mass	Momentum	Pressure	**Energy**
16)	The property of fluid by which its own molecules are attracted is said to be	Surface tension	Adhesion	Cohesion	**Viscosity**
17)	Drag force on sphere of radius r moving with speed v	$6\pi\eta rv$	$6\pi\eta r^2 v$	$6\pi\eta r$	Ma
18)	A paratrooper moves downward with	**Zero acceleration**	Constatn acceleration	Positive acceleration	Negative acceleration
	As it moves with terminal velocity which is constant value so acceleration is zero				
19)	The density of blood is nearly equal to	Air	**Water**	Milk	Honey
20)	A fog droplet falls vertically through air with acceleration	Equal to g	**Zero**	Less than g	Greater than
21)	The dimension of co-efficient of viscosity are	$[MLT^{-2}]$	$[ML^2T^{-2}]$	**$[ML^{-1}T^{-1}]$**	$[ML^2T^{-1}]$
22)	The ratio of velocities of water in pipe lying horizontally at two ends is 1:4. The ratio of diameters of pipe at these ends	1:2	**2:1**	1:4	4:1
	As we know that Vt is proportional to square of radius/diameter so, diameter is sq.rt of velocities				
GHD	Venture meter is used to measure --- of fluid	Viscosity	Density	Pressure	**Speed**
	Law of conservation of mass gives us	Bernoulli equation	**Equation of continuity**	Torricelli theorem	None of these
	Bunsen burner works on the principle of	Venture effect	**Bernoulli effect**	Torricelli effect	None
26)	The maximum constant velocity of an object falling vertically downward is called	Final velocity	**Terminal velocity**	Initial velocity	None of these
27)	Ball pen function of the principle of	**Surface tension**	Viscosity	Gravitational force	All of these

28).	If the radius of droplet becomes half then its terminal velocity will	Half	Double	**One fourth**	Four times
29)	η is denoted as co-efficient of	Friction	**Viscosity**	Gravitational customer	Linear expansion
30)	Swing is produced to	Increase the speed of ball	Decrease the speed of ball	**Deceive the player**	Apply the force on ball
31)	SI unit of rate of "flow rate"	m^2/sec	m^3sec	**m^3/sec**	m2sec
32)	The working of carburetor of car uses	Equation of continuity	Gravitation law	**Bernoulli equation**	Stokes theorem
33)	Which fluid has minimum viscosity?	Tar	**Water**	Acetone	Plasma
34)	An object having spherical shape of radius 'r' experiences a retarding force F from a fluid of coefficient of viscosity 'η' when moving through the fluid with speed 'v'. What is the ratio of retarding force to speed?	6πη r2	**6πη r** By stokes law divided both sides by v to get result	6πη/r2	6πη/r
35)	Which has max viscosity	Air	Water	Blood	**Glycerin**
36)	SI unit of pressure is	Nm^2	**Nm^{-2}**	N^2m	Js
37)	The mathematical relation is $V2 = \sqrt{2g(h2 - h1)}$	Equation of continuity	Bernoulli equation	**Torricelli theorem**	Venture relation
38)	For the horizontal pipe, the fluid inside it is flowing horizontally then Bernoulli's equation can be written as	$P + \rho v2 =$ constant	$P + 2\rho v^2 =$ constant	**$2P + \rho v^2 =$ constant**	$2P + 2\rho v2 =$ constant
$P + 1/2\rho v2 + \rho gh = constant$, put $h = 0$ and multiplying both sides by 2 to get said result					
39)	Stokes law holds for	Motion through free space	**Motion through viscous medium**	Bodies of all shape	All medium
40	Bernoulli theorem is applicable to	Solids	**Fluids**	Gases	None of these
41)	When a body is falling under the action of gravity with terminal velocity its acceleration is	Constant	**Zero**	Variable	9.8 m/s2
42)	Law of conservation of energy is the basis of	Stream line flow	Equation of continuity	**Bernoulli equation**	Venture relation
43)	Potential energy per unit volume is given by:	mgh	gh	Mgh/ρ	**ρgh**
44)	In Bernoulli's equation the term ½ ρv^2 is called	**K.E. per unit volume**	K.E. per unit area	K.E	K.E. per unit length
45)	SI unit of viscosity is	**$Kgm^{-1}s^{-1}$/ Nsm^{-2}**	Kgm/s	Js	$Kgm^{-1}s$
46)	When fluid is incompressible, the quantity is constant is:	Mass	Pressure	**Density**	Force
47)	Mass flow per second of the fluid is given by	**ρAv**	ρv	Av	Av/ρ
48)	If speed of efflux through a small hole in a large tank is 9.8 m/s. Find the height at the fluid above the hole	1 m	**4.9 m** Apply Torricelli theorem to get height	9.8 m	19.6 m
49)	Pressure will be low where speed of fluid is	Zero	**High**	Low	Medium
	The blood vessels collapse when	**External pressure applied becomes greater than the systolic pressure**	External pressure applied is equal to systolic pressure	External pressure applied is less than the systolic pressure	External pressure applied is zero

50)	The word “FLUID” means	to rise	To fall	**To flow**	To oppose
51)	When the drag force is equal to the weight of the droplet, the droplet will fall with:	High Speed	Certain acceleration	Low Speed	**Constant Speed**
52)	If cross sectional area of pipe decrease the speed of fluid must increase according to	**Venture relation**	Bernoulli equation	Vibration	Time period
53)	Flow speed of the fluid through a non-uniform pipe increases from 1 m/sec to 3 m/sec. If change in P.E. is zero, then pressure difference between two points will be: (density of the fluid $=1000 kg/m^3$)	$1000 N/m^2$	$8000 N/m^2$	$9000 N/m^2$	**$4000 N/m^2$** Apply venture relation to get the result
54)	Systolic pressure of normal healthy person	**120 Torr**	130 Torr	110 Torr	11 torr
55)	The terminal velocity of a droplet falling down under gravity is directly proportional to the square of	Its density	**Its radius**	Its viscosity	Its elasticity
56)	The product of cross-sectional area of the pipe and the fluid speed at any point along the pipe:	**Remains constant**	Exponentially increases	Is zero	Exponentially decreases
57)	What is the speed of an incompressible non-viscous liquid flowing out Where h = 5 m and $g = 10 m/s^2$.	A) 5 m/s	2 m/s	**10 m/s** Apply Torricelli theorem put h=5m	50 m/s
58)	When water falls from top,its cross sectional area decrease due to	Decrease of speed	**Increase of speed**	Air pressure	Gravity increase
59)	A 6m high tank is full of water. A hole appear at it middle. What is the speed of efflux?	**7.66 m/s**	5.66 m/s	6.66 m/s	8.66 m/s
$V=\sqrt{2g(h_1-h_2}$ putting values h_1-h_2=3m and g=9.8 to get the result $\sqrt{2*9.8*3}$=7.66					
60)	Which has minimum viscosity?	**Air**	Water	Glycerin	Acetone
61)	The instrument which detect the instant at which external pressure equal to systolic	manometer	Sphygmo manometer	Barometer	**Stethoscope**
62)	Stokes law is valid only for speed	**Slow**	High	Medium	All of these
63)	A small leak is developed in a large water storage tank. If the height of water above leakage is 10 m, then find the speed of efflux through the leak	**14 m/sec** Apply Torricelli theorem put h=10m	9.8 m/sec	10 m/sec	20 m/sec
64)	Let A=area of cross section, v=fluid speed, then Av is called	**Volume flow rate**	Energy flow rate	Mass flow rate	Pressure flow
65)	The dimension of potential energy per unit volume is equal to	**Pressure**	Work	speed	Density
66)	A pipe varies uniformly in diameter from 2 m to 4 m. An incompressible fluid enters the pipe with velocity 16m/sec. What is velocity of fluid when it leaves the pipe?	64 m/sec.	**8 m/sec.** Diameter varies double change the velocity half	32 m/sec.	4 m/sec.