TOPIC WISE MULTIPLE CHOICE QUESTIONS

6.1 VISCOUS DRAG AND STOKE'S LAW

(1) An object moving through a fluid experience a retarding force known as
(a) external force **(b)** terminal force
(c) drag force **(d)** gravitational force

(2) When the temperature increases, the viscosity of the gases: GRW-2019 (G-II)
(a) decreases **(b)** remains constant
(c) increases **(d)** none of these

(3) The fluid is said to be incompressible, if its density is LHR-2018 (G-I)
(a) zero **(b)** very high
(c) very small **(d)** constant

(4) The word Fluid means SGD-2016 (G-II)
(a) to rise **(b)** to fall
(c) to flow **(d)** to oppose

(5) Which material has maximum viscosity: (RWP 2015)
(a) glycerin **(b)** plasma
(c) methanol **(d)** water

(6) Viscosity of air at 30°C is: MTN-2019 (G-II)
(a) 6.29 Nsm^{-2} **(b)** 0.019 Nsm^{-2}
(c) 1.00 Nsm^{-2} **(d)** 0.510 Nsm^{-2}

(7) η is denoted for
(a) coefficient of viscosity **(b)** coefficient of kinetic friction
(c) coefficient of static friction **(d)** coefficient of volume expansion

(8) Stoke's law is applicable on
(a) spherical surfaces **(b)** rectangular surfaces
(c) surfaces of all shapes **(d)** none

(9) Drag force is expressed by
(a) $3\pi\eta rv$ **(b)** $6\pi\eta rv$
(c) $\frac{2}{9\eta}\rho rv$ **(d)** $6\eta\rho rv$

(10) Substances which cannot flow easily have
(a) large viscosity **(b)** zero viscosity
(c) small viscosity **(d)** none of these

(11) Which of the following has the highest viscosity?
(a) air **(b)** water
(c) methanol **(d)** glycerin

(12) With increases in temperature, the viscosity of the liquid
(a) increases **(b)** decreases
(c) may increase or decrease **(d)** no change

(13) As the speed of the object increases the drag force
(a) increases **(b)** decreases
(c) remain same **(d)** none of these

(14) With increase in temperature viscosity of gases
(a) increases **(b)** decreases
(c) may increase or decrease **(d)** no change

(15) Liquid and gases have
(a) zero viscosity **(b)** non zero viscosity
(c) maximum viscosity **(d)** both a and b

(16) The frictional effect between different layers of flowing fluids is described in terms of
(a) viscosity of fluid **(b)** velocity of fluid
(c) pressure of fluid **(d)** acceleration of fluid

(17) The unit of co-efficient of viscosity is
(a) kgm^{-1} **(b)** $kg^{-1}ms^{-1}$
(c) $Nm^{-2}s$ **(d)** $Nm^{-2}s^{-2}$

(18) The dimension of co-efficient of viscosity is
(a) $[MLT^{-1}]$ **(b)** $[M^{-1}T]$
(c) $[ML^{-1}T^{-1}]$ **(d)** $[MT^{-1}]$

6.2 TERMINAL VELOCITY

(19) The maximum constant velocity of an object moving through the fluid is called
(a) escape velocity **(b)** drag velocity
(c) terminal velocity **(d)** fluid velocity

(20) Terminal velocity v_t is related with the radius r of a spherical object as: **LHR-2019 (G-I)**
(a) $v_t \propto r^2$ **(b)** $v_t \propto r$
(c) $v_t \propto \frac{1}{r}$ **(d)** $v_t \propto \frac{1}{r^2}$

(21) If the radius of droplet becomes half, then its terminal velocity will be **LHR-2018 (G-II)**
(a) double **(b)** half
(c) one fourth **(d)** four times

(22) Terminal velocity of a particle in the fluid depends on: **RWP-2019 (G-I)**
(a) Nature of fluid **(b)** Acceleration of particle
(c) Force on particle **(d)** angular velocity of particle

(23) A fog droplet falls vertically through air with an acceleration: **FSD-2017**
(a) equal to 'g' **(b)** less than 'g'
(c) zero **(d)** greater than 'g'

(24) A paratrooper moves downward with: **FSD-2017**
(a) zero acceleration **(b)** constant acceleration
(c) positive acceleration **(d)** negative acceleration

(25) The ratio of the velocities of water in a pipe lying horizontally at two ends is 1:4. The ratio of diameters of pipe at these two ends is: **FSD-2016 (G-I)**
(a) 1:2 **(b)** 2:1
(c) 1:4 **(d)** 4:1

(26) When body acquires terminal velocity, then its acceleration 'a' becomes: MTN-2016 (G-II)
(a) a = 0 **(b)** a = g
(c) a > g (d) a < g

(27) If the radius of the droplet becomes half, then its terminal velocity in fluid will be DGK-2018 (G-II)
(a) half **(b)** double
(c) one fourth (d) one third

(28) Two fog droplets have radius 2:3 their terminal velocities are in ratio of
(a) 4:6 **(b)** 4:9
(c) 2:3 **(d)** 4:3

(29) The terminal velocity of spherical object is given by
(a) $v_t = \frac{6\rho^2 gvr^2}{9\eta}$ **(b)** $v_t = \frac{2\rho^2 gr^2}{9\eta}$
(c) $v_t = \frac{2\rho gr^2}{9\eta}$ **(d)** $v_t = \frac{2\rho^2 g^2 r^2}{9\eta}$

(30) The net force acting on a body falling through the fluid is given by
(a) net force = drag force - weight **(b)** net force = drag force + weight
(c) net force = drag force / weight **(d)** net force = weight- drag force

(31) The unit of terminal velocity is
(a) ms^{-1} **(b)** ms
(c) Ns^{-1} **(d)** ms^{-2}

(32) A fog droplet falls vertically through air with terminal velocity, then an acceleration is
(a) equal to g **(b)** greater than g
(c) less than g **(d)** equal to zero

(33) If the radius of droplet is doubled then terminal velocity would be
(a) half **(b)** doubled
(c) quadrupled **(d)** one fourth

6.3 FLUID FLOW

(34) The unsteady flow of the fluid is called
(a) steady flow **(b)** streamline flow
(c) turbulent flow **(d)** none of these

(35) The formula one cars have a
(a) steady flow designed **(b)** streamlined designed
(c) Turbulent designed **(d)** Unsteady flow designed

(36) The incompressible and non-viscous fluid is called
(a) viscous fluid **(b)** non ideal fluid
(c) fluid **(d)** ideal fluid

(37) The dolphins have
(a) Streamlined bodies **(b)** turbulent bodies
(c) Unsteady bodies **(d)** none of these

(38) A fluid is said to be ideal when it appears
(a) non-viscous **(b)** incompressible
(c) to move with uniform speed **(d)** all of these

6.4 EQUATION OF CONTINUITY

(39) Equation of continuity is given by the relation

(a) $A_1P_2 = A_2P_1$ **(b)** $A_1v_1 = A_2v_2$

(c) $A_2D_2 = A_1D_1$ **(d)** $P_1v_1 = P_2v_2$

(40) Equation of continuity gives the conservation of the: LHR-2019 (G-II)

(a) mass **(b)** energy

(c) speed **(d)** volume

(41) Equation of continuity gives conservation of: FSD 2019 (G-I)

(a) energy **(b)** power

(c) mass **(d)** density

(42) Product of area of cross section, velocity and time gives: FSD 2019 (G-I)

(a) volume **(b)** density

(c) mass **(d)** weight

(43) The law of conservation of mass gives: RWP-2016 (G-I)

(a) Bernoulli's equation **(b)** Venturi relation

(c) Torricelli's theorem **(d)** Equation of continuity

(44) The S.I Unit of Flow Rate of a Fluid is: BWP-2019 (G-II)

(a) m^2s^{-1} **(b)** ms^{-1}

(c) m^3s^{-1} **(d)** m^3s^{-2}

(45) The rate of flow of liquid through pipes

(a) A/v **(b)** v/A

(c) Av **(d)** 1/Av

(46) The product of cross-sectional area of pipe and fluid speed is equal to

(a) pressure **(b)** volume

(c) flow rate **(d)** work done

(47) If area of cross-section is decreased, then fluid pressure

(a) increases **(b)** decreases

(c) remain same **(d)** may increase or decrease

(48) SI unit of flow rate is

(a) ms^{-2} **(b)** m^3s^{-2}

(c) m^3s^{-1} **(d)** m^2s^{-1}

(49) The law of conservation of mass gives us

(a) Bernoulli's equation **(b)** equation of continuity

(c) Van-der wall's equation **(d)** Einstein's equation

(50) The radius at two ends of a pipe is in the ratio of 2:3, then the speed of fluid at the two ends is in the ratio of

(a) 3:2 **(b)** 2:3

(c) 9:4 **(d)** 4:9

6.5 BERNOULLI'S EQUATION

(51) The law of conservation of energy is basis on the **BWP-2019 (G-I)**
(a) equation of continuity (b) Bernoulli's equation
(c) Einstein's equation (d) Van-derwall's equation

(52) The unit of $\frac{1}{2}\rho v^2$ in Bernoulli's equation is same as that of:
MTN-2018 (G-II)LHR-2019 (G-I)
(a) energy (b) pressure
(c) work (d) power

(53) Pascal is the unit of: **GRW-2019 (G-I)**
(a) pressure (b) force
(c) tension (d) weight

(54) The dimensions of ρgh are same as that of **MTN-2018 (G-I)**
(a) work (b) energy
(c) pressure (d) mass

(55) Which of the following cannot be explained on the basis of Bernoulli's effect?
(a) lift of an aero plane (b) lift of rocket
(c) swing of cricket ball (d) working of carburetor

(56) Bernoulli's equation is applicable for
(a) swing of a cricket ball (b) lift of an aeroplane
(c) working of spray (d) all of these

(57) According to Bernoulli's principle, velocity and pressure are
(a) inversely proportional (b) directly proportional
(c) have no relation (d) none of these

(58) Bernoulli's equation is expressed as
(a) $P-\frac{1}{2}\rho v^2 =$ constant (b) $P+\frac{1}{2}\rho v^2+\rho gh=$ constant
(c) $P+\frac{1}{2}\rho v^2-\rho gh=$ constant (d) $P-\frac{1}{2}\rho v^2-\rho gh=$ constant

(59) The effect used in perfume bottles and paint sprays is based upon.
(a) Bernoulli's theorem (b) equation of continuity
(c) Einstein's mass energy equation (d) Archimedes principle

(60) The fundamental equation in fluid dynamics that relates pressure to fluid speed and height is
(a) Bernoulli's equation (b) equation of continuity
(c) Stokes law (d) mass energy equation

(61) The volume flow per second of a fluid is always
(a) zero (b) constant
(c) changing continuously (d) none of these

(62) In Bernoulli's equation the unit of expression 'ρgh' is same as that of
(a) force (b) work
(c) density (d) pressure

(63) In a pipe, water is flowing through the region in the pipe where streamlines are forced close together

(a) speed is low and pressure is low **(b)** speed is high and pressure is high
(c) speed is high and pressure is low **(d)** none of these

(64) If a pipe placed horizontally on ground, then Bernoulli's equation can be expressed as

(a) $P + \rho gh + \frac{1}{2}\rho v^2 = \text{constant}$ **(b)** $P + \frac{1}{2}\rho v^2 = \text{constant}$
(c) $P - \rho gh = \text{constant}$ **(d)** $P + \rho gh = \text{constant}$

6.6 APPLICATION OF BERNOULLI'S EQUATION

(65) Speed of efflux of a liquid from an orifice is equal to

(a) $\sqrt{2g}$ **(b)** $\sqrt{\frac{2g}{h}}$
(c) $\sqrt{2gh}$ **(d)** $\sqrt{\frac{h}{2g}}$

(66) As the speed of object moving through a fluid increases then the drag force experienced by it: GRW-2019 (G-I)

(a) increases **(b)** decreases
(c) remains constant **(d)** becomes zero

(67) Venturi meter is used to measure LHR-2016(G-I)LHR-2017 (G-I)

(a) fluid pressure **(b)** fluid density
(c) Fluid viscosity **(d)** fluid speed

(68) Pressure of fluid will be low where speed of fluid is SWL-2016 (G-I), FSD-2018

(a) low **(b)** high
(c) zero **(d)** constant

(69) 6.0 meter high tank is full of water. A hole appears at its middle. What is the speed of efflux? (RWP 2014)

(a) $7.66 ms^{-1}$ **(b)** $5.66 ms^{-1}$
(c) $6.66 ms^{-1}$ **(d)** $8.66 ms^{-1}$

(70) A 10 meter high tank is full of water. A hole appears at its middle. The speed of efflux will be: BWP-2019 (G-II)

(a) $5\ ms^{-1}$ **(b)** $10\ ms^{-1}$
(c) $100\ ms^{-1}$ **(d)** $5.11\ ms^{-1}$

(71) A 20 metre high tank is full of water. A hole appears at its middle. The speed of efflux will be: BWP-2019 (G-I)

(a) $10\ ms^{-1}$ **(b)** $14\ ms^{-1}$
(c) $11.5\ ms^{-1}$ **(d)** $9.8\ ms^{-1}$

(72) Venturi relation is given as: **(MTN 2013)**

(a) $P = \frac{1}{2}\rho v^2$ **(b)** $P_1 - P_2 = \frac{1}{2}\rho v_2^2$

(c) $P_1 - P_2 = \frac{1}{2}\rho v_1^2$ **(d)** $v_2 = \sqrt{2g(h_1 - h_2)}$

(73) Dimension of flow rate is

(a) $[L^3T^{-1}]$ **(b)** $[LT^{-3}]$

(c) $[L^2T^{-1}]$ **(d)** $[L^{-1}T^{-1}]$

(74) Torricelli's expression is written as **MTN-2019 (G-II)**

(a) $v = \sqrt{2g(h_1 - h_2)}$ **(b)** $v = \sqrt{2g(h_1 + h_2)}$

(c) $v = \sqrt{2g(h_2 - h_1)}$ **(d)** $v = \sqrt{2\rho g(h_1 - h_2)}$

(75) A 2-meter-high tank is full of water. If a hole appears at it middle then the speed of efflux is

(a) 4.42m/s **(b)** 42.4m/s

(c) 5.42m/s **(d)** 424m/s

(76) A man standing near a fast-moving train

(a) fall towards the train **(b)** fall away from the train

(c) no effect **(d)** none of these

ANSWER KEYS

(Topic Wise Multiple Choice Questions)

1	c	16	a	31	a	46	c	61	b	76	a
2	c	17	c	32	d	47	a	62	d		
3	d	18	c	33	c	48	c	63	c		
4	c	19	c	34	c	49	b	64	b		
5	a	20	a	35	b	50	c	65	c		
6	b	21	d	36	d	51	b	66	a		
7	a	22	a	37	a	52	b	67	d		
8	a	23	a	38	d	53	a	68	b		
9	b	24	a	39	b	54	c	69	a		
10	a	25	b	40	a	55	b	70	b		
11	d	26	a	41	c	56	d	71	b		
12	b	27	c	42	a	57	a	72	b		
13	a	28	b	43	d	58	b	73	a		
14	b	29	c	44	c	59	a	74	a		
15	b	30	d	45	c	60	a	75	a		

SHORT QUESTIONS
(From Textbook Exercise)

6.1. Explain what do you understand by the term viscosity?

MTN 15(G-I), LHR-17 (G-II)

Ans: Definition:

"The frictional effect between different layers of a flowing fluid is described in terms of viscosity of fluid." Viscosity measures how much force is required to slide one layer of fluid over the other layer. e.g; glycerin, honey and thick tar has highest viscosity.

Unit: $kg\, m^{-1} s^{-1}$

6.2. 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 a liquid, depends?

Ans: Definition:

"When the body moves through a viscous medium, its motion is opposed by a force known as drag force." **OR**

An object moving through a fluid experience a retarding force known as drag force.

According to Stoke's law, drag force is given by the relation:

$$F_d = 6\pi\eta rv$$

This relation shows that drag force depends upon the factor as:

- radius of sphere (r)
- velocity of sphere (v)
- co-efficient of viscosity of fluid (η)

6.3. Why fog droplets appear to be suspended in air?

SGD-15(G-I), FSD-15(G-I), LHR-15(G-II), DGK-16 (G-I)&(G-II), LHR-16 (G-II), SWL-17, BWP-17 (G-I), SGD-18 (G-I), MTN-19 (G-I)

Ans: We know that as the terminal velocity of a body is directly proportional to the square of radius of a body. i.e. $v_t \propto r^2$

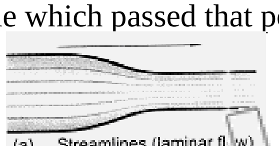
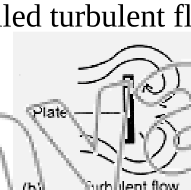
As, the size of the fog droplet is very small, therefore, their terminal velocity is very small and consequently, the fog droplet appears to be suspended in air.

6.4. Explain the difference between laminar flow and turbulent flow.

LHR-15(G-I), RWP-16 (G-I), FSD-17, LHR-17 (G-I), FSD-18, LHR-18 (G-II), DGK-18 (G-I), FSD-19 (G-I)

Ans:

LAMINAR FLOW	TURBULENT FLOW

• The flow is said to be stream line or laminar if every particle that passes a particular point, moves along exactly the same path, as following by the particle which passed that point earlier

(a) Streamlines (laminar flow)
• In this case each particle of fluid moves along a smooth path called streamlined or laminar.
• **For examples**
  ◦ Flow of water in wide and smooth river
  ◦ Flow of gentle breeze.
  ◦ Flow of wind around streamlined designed car.
  ◦ Flow of water around dolphins.
	• The irregular or unsteady flow of the fluid is called turbulent flow.
	
	
	(b) Turbulent flow
	• In turbulent flow, there is great disorder and a constantly changing flow pattern
	• **For examples**
	  ◦ Flow of water from the top of mountains.
	  ◦ Flow of water in the form of water fall.
	  ◦ Very strongly flowing wind
	  ◦ Water flow at sea shores.

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

MTN-15(G-I), RWP-15(G-I), GRW-15(G-I), MTN-16 (G-I), LHR-18 (G-II), LHR-19 (G-I), BWP-19 (G-I)

Ans: When the two row boats moving parallel in the same direction then the speed of water between the boats is greater than the speed of water on the other sides of the boats.

According to result of Bernoulli's equation: $P+\frac{1}{2}\rho v^2+\rho gh=\text{constant}$

"Where the speed of the fluid is high the pressure will be low,"
Therefore, the pressure between the boats is decreased and they are pulled towards each other.

6.9. Explain how the swing is produced in a fast-moving cricket ball.

SGD-16 (G-I), BWP-16 (G-I), MTN-16 (G-II), LHR-16 (G-I), BWP-17 (G-II), GRW-18, RWP-19 (G-I), LHR-19 (G-II)

Ans: One side of the cricket ball is rough and the other side is shining. When the ball is delivered, then the speed of air on the shining is greater than the speed of air on the rough side.

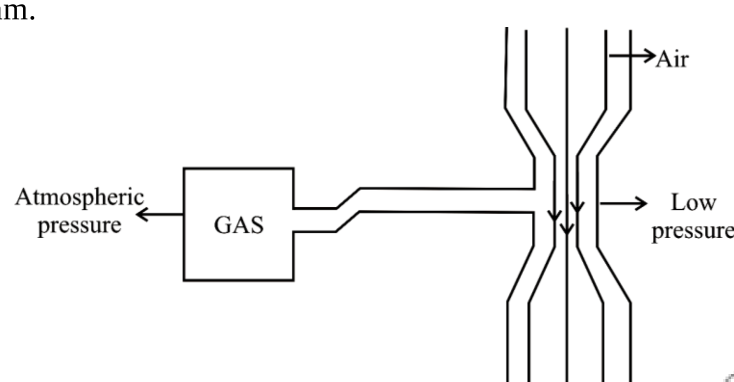
According to result of Bernoulli's equation: [$P+\frac{1}{2}\rho v^2+\rho gh=\text{constant}$.]

"Where the speed is high, pressure will be low."
Therefore, the pressure on shiny side decreases and the ball swings towards the shiny side.

6.10. Explain the working of carburetor of a motorcar by using Bernoulli's principle.

SWL-16, SWL-18, LHR-18 (G-I)

Ans: The carburetor of a car engine uses a Venturi duct to feed the correct mixture of air and fuel (petrol) to the cylinders. Air is drawn through the duct and along the pipe to the cylinders. A tiny inlet at the side of duct is fed with petrol, the air through the duct moves very fast, creating low pressure in the duct, which draws petrol vapours into the air stream.



TOPIC WISE SHORT QUESTIONS

6.1 VISCOUS DRAG AND STOKE'S LAW

(1) What is Fluid Dynamics?

Ans: Fluid Dynamics

The branch of physics which deals with the study of fluid in motion is called Fluid Dynamics.

(2) Define co-efficient of viscosity. Write its units?

Ans: Co-efficient of viscosity

"The tangential force per unit area required to maintain relative velocity between its two layers is called co-efficient of viscosity and is denoted by η". Its units is $N\,s\,m^{-2}$ or $kgm^{-1}s^{-1}$.

(3) What is fluid? **DGK 2014**

Ans: Anything which can flow is called fluid. Thus liquid as well as gases can be treated as fluid.

Examples:

- Liquids
- Gases

(4) A meteor burns into ashes when enters into outer earth's atmosphere?

Ans: A meteor moving towards the earth's atmosphere is strongly opposed by the drag force of air. This drag force creates a lot of friction between the air particles and meteor resulting an intense amount of heat burning the meteor into ashes.

(5) State the Stoke's Law and write its mathematical form?

Ans: The drag force on a sphere of radius r moving slowly with speed v through a fluid of viscosity η is given by the Stoke's Law as under

$$F = 6\pi\eta rv$$

(6) What are the main principles of fluid Dynamics?

Ans: There are two main principles of fluid Dynamics

(i) Equation of continuity

(ii) Bernoulli's Equation

The law of conservation of mass gives us the equation of continuity.

The law of conservation of energy is the basis of Bernoulli's equation.

(7) What is meant by viscosity? Write down dimensional unit of coefficient of viscosity. MTN-2018 (G-I) FSD-2012

Ans: **Viscosity**

The internal frictional force between different layers of a flowing fluid is called viscosity of fluid, usually denoted by Greek letter 'η'.

The dimensional unit of co-efficient of viscosity kg m^{-1} s^{-1}.

(8) Define fluid friction and state Stoke's law. **DGK-2010**

Ans: **Fluid Friction**

An internal frictional force between different layers of a flowing fluid is called viscosity of fluid which is also known as fluid dynamics, usually denoted by Greek letter 'η'.

Stoke's law

It states that the drag force F on a spherical object of radius "r" moving slowly with speed "v" through a fluid of viscosity "η" is given by

$$F = 6\pi\eta rv$$

At high speed, the force is no longer proportional to speed

(9) What is Stoke's law and drag force? **MTN-2019 (G-I)**

Ans: **Stocks' law**

It states that the drag force F on a spherical object of radius "r" moving slowly with speed "v" through a fluid of viscosity "η" is given by

$$F = 6\pi\eta rv$$

At high speed, the force is no longer proportional to speed.

Drag Force

An object moving through a fluid experiences a retarding force called a drag force.

Drag force depends upon the following factors;

(1) Shape, size, velocity and orientation of motion of the body.

(2) It also depends upon the nature of fluid.

6.2 TERMINAL VELOCITY

(10) Why do clouds appear floating in air?

Ans: Clouds are made of very small droplets of water since the weight of these droplets is very small. Therefore, they possess very small terminal velocity. Hence, they appear to floating in air.

(11) Define terminal velocity. **GRW-2019 (G-II)**

Ans: Terminal velocity

When the weight of the falling body and drag force acting on the body become equal in magnitude, the velocity of the body becomes maximum then the body will fall with constant maximum velocity called terminal velocity. It is expressed

$$v_t = \frac{mg}{6\pi\eta r}$$

(12) A spherical body is dropped into two different fluid its terminal velocity is found to be different. Give the reason.

Ans: We know that $v_t = \frac{2gr^2\rho}{9\eta}$. In this case a spherical body of the same density and size is dropped into two fluids of different viscosities, It means ρ ,g and r are all constants, so

$$v_{t1} \propto \frac{1}{\eta_1} \Rightarrow v_{t2} \propto \frac{1}{\eta_2}$$

As the co-efficient of viscosities is different in two fluids, therefore the terminal velocity of the sphere will be different.

(13) A tiny water droplet of radius 0.010 cm descends through air from a high building. Calculate its terminal velocity. Given that for air $=19\times10^{-6}\,kgm^{-1}s^{-1}$ and density of water = 1000 kgm^{-3}. **DGK-2012**

Ans: $r = 1.0 \times 10^{-4}\,m$, $\rho = 1000\,kg\,m^{-3}$, $\eta = 19 \times 10^{-6}\,kg\,m^{-1}\,s^{-1}$

As $$v_t = \frac{2gr^2\rho}{9\eta}$$

$$v_t = \frac{2\times9.8\,ms^{-2}\times\left(1\times10^{-4}\,m\right)^2\times1000\,kg\,m^{-3}}{9\times19\times10^{-6}\,kg\,m^{-1}\,s^{-1}}$$

$$v_t = 1.1\,m\,s^{-1}$$

6.3 FLUID FLOW

(14) What are the properties of an ideal fluid?

Ans: Properties

(i) The fluid is non-viscous i.e. there is no internal frictional force between adjacent layers of fluid.

(ii) The fluid is incompressible. i.e. its density is constant.

(iii) The fluid motion is steady

(15) What is meant when we say fluid is non-viscous and in compressible? **GRW-2018**

Ans:

- The fluid is non viscous i.e. there is no internal frictional force between adjacent layers of fluid.
- The fluid is incompressible i.e. its density is constant.

(16) A liquid was passed through a pipe and it was found that the rate of influx is equal to the rate of efflux, what information do you get about the liquid.

Ans: Where rate of influx = rate of efflux
Such a fluid is an ideal fluid. This fluid gives information that it has no viscosity and is incompressible.

(17) Describe what is an ideal fluid? Can an ideal fluid exist in nature? **DGK-2014**

Ans: A fluid which satisfies the following conditions is called an ideal fluid.
i. The fluid is non viscous i.e. there is no internal frictional force between adjacent layers of fluid.
ii. The fluid is incompressible i.e. its density is constant.
iii. The fluid motion is steady.
The ideal fluid does not exist in nature because all above conditions perfectly not full fill in any fluid.

6.4 EQUATION OF CONTINUITY

(18) Why the cross-sectional areas of the water decreases as it come out of the tap?

Ans: According to equation Av = constant, as the water falls, its speed increases and so its cross-sectional area decreases.

6.5 BERNOULLI'S EQUATION

(19) State Bernoulli's equation.

Ans: It states that the sum of pressure, Kinetic and Potential energies per unit volume in a steady flow of an incompressible fluid remains constant.
Mathematically:

$$P+\frac{1}{2}\rho v^2+\rho gh = \text{constant}$$

6.6 APPLICATIONS OF BERNOULLI'S EQUATION

(20) Why does the pipe of paper squeezes when air is blown through it.

Ans: As air blows through the pipe, the speed of air inside it increases so its pressure decreases as compared to the pressure outside the pipe. So the increased pressure on the outside squeezes the pipe of paper.

(21) What is Venturi's effect. **BWP-2019 (G-II), FSD-2019 (G-I)**

Ans: The effect of decrease in pressure with increase in speed of the fluid in a horizontal pipe is known as Venturi's effect

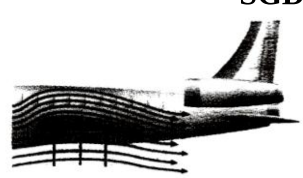
Mathematically, $P_1 - P_2 = \frac{1}{2}\rho v_2^2$

(22) What effect is used in chimney? **LHR-2019 (G-II)**

Ans: When air passes above the chimney, it reduces the pressure above the chimney. The smoke rises up in the chimney. The air and smoke together move away into the atmosphere.

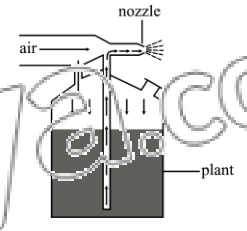
(23) Explain how the lift is produced in an aero plane? **SGD-2018**

Ans: **Lifting of an Aeroplane**



To lift an aeroplane same principle works i.e. where the speed is high, the pressure will be low. The wings are designed to deflect the air so that the stream lines are closer together above the wing than below it.
When streamlines are forced together, speed is high pressure is low, so air travels faster on upper side of the wing than on the lower. The pressure will be lower at the top of the wing and upward thrust acts on wings which helps to lift aeroplane in air.

(24) How perfume bottles and paint spray work.



Ans: A stream of air passing over a tube dipped in a liquid will cause the liquid to rise in the tube as shown in fig. This is because of the fact that pressure of fast moving air becomes lesser than the air above the paint level. Hence paint rises through pipe due to difference of pressure.

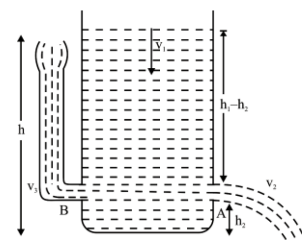
(25) State and explain Torricelli's Theorem?

Ans: The speed of efflux is equal to the velocity gained by the fluid in falling through the distance (h_1-h_2) under the action of gravity.

Explanation: Suppose a large tank of fluid has two orifices A and B on it.

Since orifices are so small, the efflux speed v_2 and v_3 will be much larger than v_1

Therefore $v_1 \approx 0$



Hence Bernoulli's equation can be written as

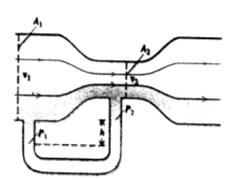
$$P_1 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$P_1 = P_2$ = Atmospheric Pressure

Hence, $v_2 = \sqrt{2g(h_1 - h_2)}$

(26) Define venturi effect. Also write its relation. **FSD-2019 (G-I)**

Ans: $\mathbf{P_1 - P_2 = \frac{1}{2}\rho v_2^2}$



This is called venturi relation and it is used in Venturi-meter, a device used to measure speed of liquid flow this effect is called venturi effect. We get above relation from Bernoulli's equation.

If one pipe has very small diameter than the other such that A_2 is small as compared to A_1, then equation of continuity is

$$A_1 v_1 = A_2 v_2$$

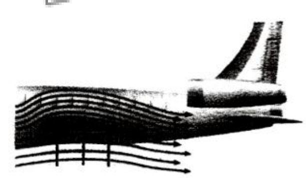
$$v_1 = \frac{A_2}{A_1} v_2$$

If $A_2 < A_1$ then $v_1 << v_2$, so we neglect v_1 for flow from large pipe as compared to v_2.

(27) Give two application of Bernoulli's equation.

BWP-2019 (G-II),DGK-2018 (G-II)

Ans: **Lifting of an Aeroplane**



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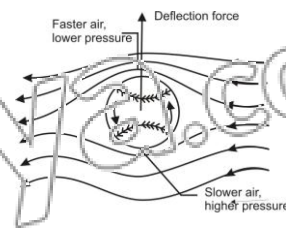
Swing of the Ball

LHR-2012, 2016 (G-I), GRW-2012, 2013, 2018
BWP-2016 (G-I), 2017 (G-II) , DGK-2018 (G-I)



When a tennis ball is hit by a racket, it spins as well as moves forward, the velocity of air on one side of the ball increases, due to spin and air speed in the same direction. Hence, the pressure decreases. This gives an extra curvature to the ball known as swing which deceives an opponent player.

(28) Write few lines on blood flow. **LHR-2012**

Ans: Blood vessels stretch like rubber hose. The volume of the blood is sufficient to keep the vessels inflated at all times. This make a tension in the walls of the blood vessels and consequently the pressure of blood inside is greater than the external atmospheric pressure.

The unit torr or mm of Hg is opted to measure the blood instead of SI unit of pressure because of its extensive use in medical equipments. The blood pressure varies from a high (systolic pressure) of 120 torr to a low (diastolic pressure) of about 75-80 torr where 1 torr = 133.3 Nm^{-2}

(29) State Torricelli's theorem. Write mathematical form.
MTN-2019 (G-II),GRW-2012, LHR-2012MTN-2019 (G-II)

Ans: Torricelli's Theorem

It states that "the speed of efflux is equal to the velocity gained by the fluid in falling through the distance (h_1-h_2) under the action of gravity".

Mathematical Formula:

$v_2 = \sqrt{2g(h_1 - h_2)}$