

# Viscosity

**Viscous force** : The force which opposes the relative motion between different layers of liquid or gases is called viscous force.

**Viscosity** : Viscosity is the property of a liquid by virtue of which it opposes the relative motion between its different layers.

1. Viscosity is the property of liquids and gases both.
2. The viscosity of a liquid is due to cohesive force between its molecules.
3. The viscosity of a gas is due to diffusion of its molecules from one layer to other layer.
4. Viscosity of gases is much less than that of liquids. There is no viscosity in solids.
5. Viscosity of an ideal fluid is zero.
6. With rise in temperature, viscosity of liquids decreases and that for gases increases.
7. Viscosity of a fluid is measured by its coefficient of viscosity. Its SI unit is decapoise (kg/ms) or pascal second. It is generally denoted by  $\eta$ .

**1. Terminal Velocity** : When a body falls in a viscous medium, its velocity first increases and finally becomes constant. This constant velocity is called Terminal velocity.

In this situation, the weight of the body is equal to the sum of viscous force and force of buoyancy i.e. the net force on the body is zero.

Terminal velocity of a spherical body falling in a viscous medium is proportional to the square of radius of the body.

**2. Streamline Flow** : If a fluid is flowing in such a way that velocity of all the fluid particles reaching a particular point is same at all time, then the flow of fluid is said to be streamline flow. Thus in streamline flow, each particle follows the same path as followed by a previous particle passing through that point.

**Critical Velocity** : The maximum velocity up to which fluid motion is streamline is called critical velocity. Clearly, if the velocity of flow is below critical velocity, flow is streamline and if the velocity is above the critical velocity, flow is turbulent.

If the velocity of flow is less than critical velocity, the rate of flow of fluid depends basically on viscosity of fluid. If the velocity of flow is more than critical velocity,

the rate of flow depends on the density of fluid and not on viscosity. Due to this reason, on eruption of the volcano the lava coming out of it flows very swiftly although it is very dense having large viscosity.

**3. Bernoulli's theorem :** According to Bernoulli's theorem, in case of streamline flow of incompressible and non viscous fluid (ideal fluid) through a tube, total energy (sum of pressure energy, potential energy and kinetic energy) per unit volume of fluid is same at all points.

Venturimeter, a device used to measure rate of flow of fluid, works on Bernoulli's theorem.

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