FLOW OF FLUIDS CH-07 VL-01

LEARNING OBJECTIVES:

- Understand how the upthrust force in a fluid can be calculated.
-Understand the terms laminar flow and turbulent flow.
-Understand the concept of viscosity.
-Understand the confuse the terms 'drag' and 'upthrust
-Know how viscosity is related to temperature.
-Use the equation for viscous drag.
-Use a falling ball method to determine the viscosity of a liquid.
- Understand the concept of surface tension.
-Use of different equation –

U= mg=$\sigma_f V_S g$	$\boldsymbol{F = 6\pi r\eta v}$	$\boldsymbol{F = \eta A\frac{dv}{dy}}$	$\boldsymbol{v_{term} = \frac{2r^2 g(\rho_s - \sigma_f}{9\eta}}$
$T = \frac{F}{L}$.	$T = \frac{w}{A}$.	$T_t = T_0(1 - \alpha t)$	$\boldsymbol{T = \frac{r\rho g(h + \frac{1}{2})}{2\cos\theta}}$ $\boldsymbol{T = \frac{r\rho gh}{2\cos\theta}}$

FLUID: A fluid is defined as any substance that can flow.
Normally this means any gas or liquid, but solids made up of tiny particles can sometimes behave as fluids; an example is the flow of sand through an hourglass.

UPTHRUST:
When an object is submerged in a fluid, it feels an upwards force caused by the fluid pressure − the upthrust. It turns out that the size of this force is equal to the weight of the fluid that has been displaced by the object. This is known as Archimedes' principle. If the object is completely submerged, the mass of fluid displaced is equal to the volume of the object multiplied by the **density of the fluid**.

So, UPTHRUST, **U= mg=$\sigma_f V_S g$**

Here, σ_f =

Que: WHY DOES A BRICK SINK?

Steady motion: If the **velocity all over** the fluid remains same, then it is steady motion.

Unsteady motion: If velocity all over the fluid does not remain same, then it called unsteady motion.

Streamline motion: If a different layer of a fluid travel **parallel to each** other then it is called streamline motion.

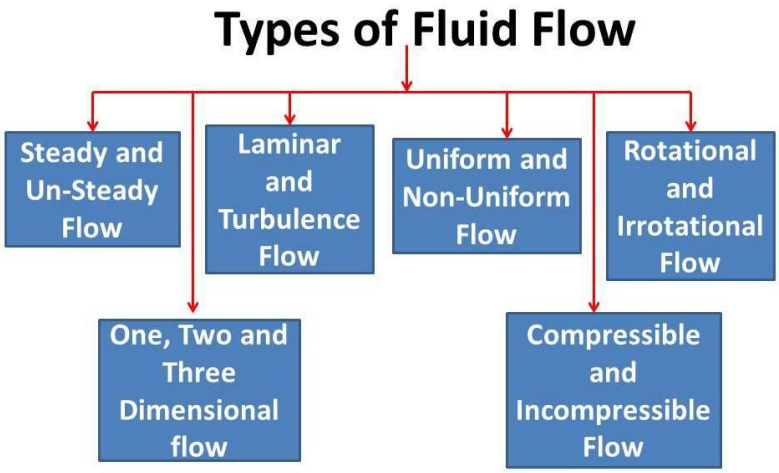
Blood flowing in our artery is also a streamline flow

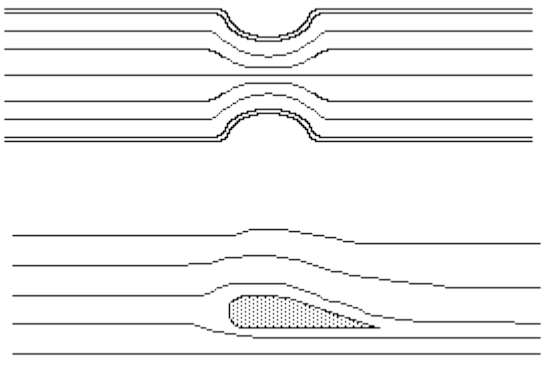
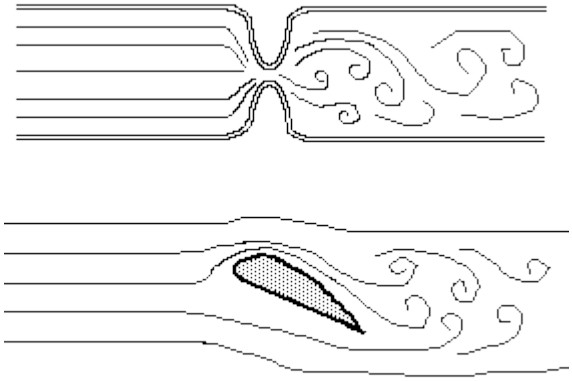
Turbulent motion: If different layers of a fluid **do not travel parallel to** each other, rather create turbulence and eddies then that motion is called turbulent motion.

Eddy is observed on river and surge or tidal bore of the sea. Turbulent flow increases the drag on a vehicle and so increases fuel consumption.

In general, laminar flow occurs at lower speeds, and will change to turbulent flow as the fluid velocity increases past a certain value. The velocity at which this changeover occurs will vary depending upon the fluid in question and the shape of the area through which it is flowing.

Newtonian fluid : If a liquid follows his formulae, as most common liquids do, it is known as a Newtonian fluid.



LAMINER FLOW Stream-line Motion	Turbulent Motion
	
If flow of fluid is such that at any point its velocity, pressure and density remain unchanged. then that flow is called stream-line flow	, if layers of flow are not parallel to each other, rather turbulence and eddies are formed, then that is called turbulent flow or chaotic flow.
In other words, if velocity flow of each particle in a fluid at a point remains unchanged, with time, then that flow is called streamline motion.	In turbulent flow particles of the flow neither follow the path nor velocity of the predecessor particles
no flow or motion can cross the boundaries of the flow-tubes	flow or motion can cross the boundaries of the flow-tubes
Path or motion of particles in streamline motion can either be straight or curvilinear. Tangent drawn at any point of the curvilinear gives the direction of flow.	Particles of the liquid mix continuously and magnitude and direction of the liquid at any place change randomly hence it can never be said to be calm, steady or unchanged.
Paths of flow of particles never intersect.	Layers of flow of the fluid are not parallel to each other, so intersects.
When velocity is large, lines of flow get crowded.	When velocity becomes very large, lines of flow form eddies.

Critical velocity:

The maximum velocity for which flow of fluid maintains streamline flow is called critical velocity.