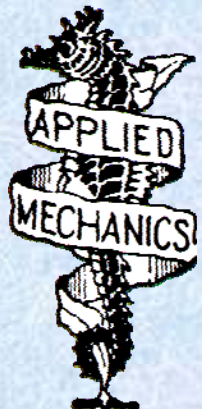


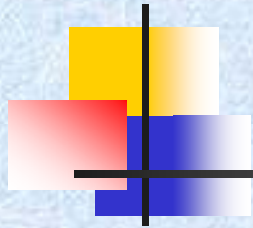
# Introduction of the LAMINAR FLOW AND TURBULENT FLOW

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## What is Fluid ? What is Flow ?

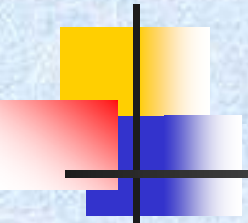
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- ◆ Let us first define what a **fluid** ? and What is **flow** ?
- ◆ **Fluid** is a liquid, gas, and air.
- ◆ **Flow** is the continuous movement of a fluid from one place to another.

# What is Laminar Flow ?

# What is Turbulent Flow ?

- ◆ Two types of flows, namely *laminar* flows and *turbulent* flows.
- ◆ Laminar flow is a '*simple*' flow, while Turbulent flow is a '*complicated*' flow.
- ◆ Define the terms *laminar* and *turbulent* in a more precise fashion.
- ◆ *In a laminar flow*, all the molecules in the fluid move *in the same direction and at the same speed*.
- ◆ *In a turbulent flow*, however, the molecules in the fluid move *in different directions and at different speeds*.



# What is Laminar Flow ?

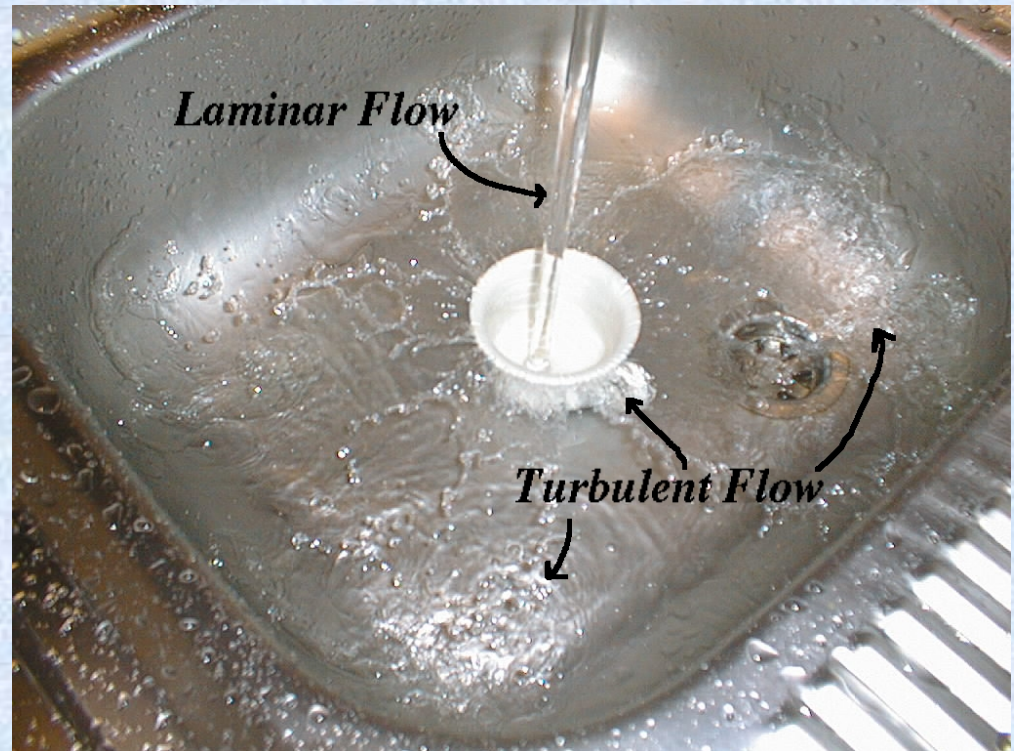
# What is Turbulent Flow ?

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- ◆ Basically there exist two types of flows, namely *laminar* flows and *turbulent* flows.
- ◆ Roughly speaking we can say that a laminar flow is a 'simple' flow while a turbulent flow is a 'complicated' flow.
- ◆ Now we are able to define the terms *laminar* and *turbulent* in a more precise fashion. In a laminar flow, all the molecules in the fluid move in the same direction and at the same speed.
- ◆ In a turbulent flow, however, the molecules in fluid move in different directions and at different speeds.

# What is Laminar Flow ?

# What is Turbulent Flow ?



# What is Laminar Flow ?

# What is Turbulent Flow ?

We will explain the meaning of 'simple' and 'complicated' using the following, simple experiment.

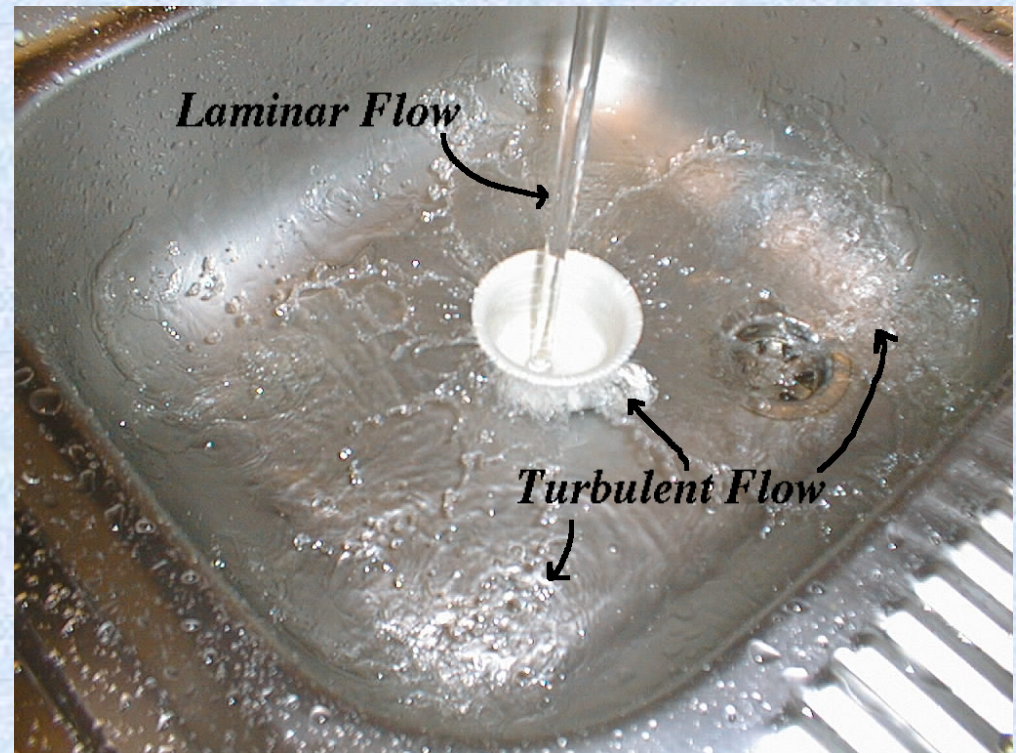
Go to your kitchen sink and open the faucet. The stream of water that emerges from your faucet is very smooth and very regular. The flow of water is smooth because all the water molecules move, at more or less the same speed, in the same direction. This is called a laminar flow.



# What is Laminar Flow ?

# What is Turbulent Flow ?

Now place a cup under the stream of water emerging from the faucet. Although the stream is still laminar, the flow pattern of the water in the sink has become very complicated. This is due to the fact that now the water molecules tend to move in different directions at different speeds. Such a flow is called turbulent.





# Where does Turbulent Flow occur ?

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Turbulent motions are very common in Nature. Turbulence occurs nearly everywhere:

in the oceans, in the atmosphere, in rivers, even in stars and galaxies.

In fact, it is easier to find a turbulent flow than a really laminar flow.



# Where does Turbulent Flow occur ?

Here are a few examples of turbulent flows:

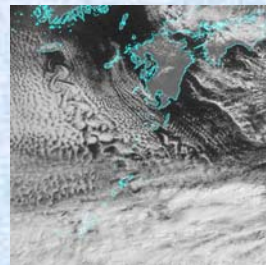
1. The wake of a ship or submarine is turbulent.
2. The swirls and eddies in a fast flowing river are turbulent.
3. The air currents in the atmosphere are turbulent.
4. Turbulence was observed when volcano erupts.
5. The outer layer of the Sun, i.e. the convection zone, is highly turbulent.



Wake of submarine



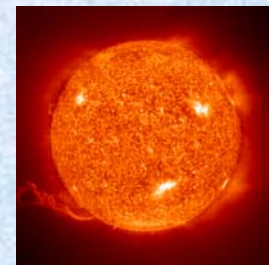
Rapids



Air currents  
In the atmosphere



Eruption



The sun



# Research in Turbulence

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He placed obstructions in water and observed the result.

Turbulence is a very complex physical phenomena and even today we do not fully understand how turbulence works.

Richard Feynman, a Nobel Prize-winning physicist, once said that turbulence is the most important unsolved problem of classical physics.

The first person that described and studied turbulence was probably Leonardo da Vinci (1452-1519). His sketches of turbulence can still be seen today.

Many problems related to turbulence have been studying in the world.