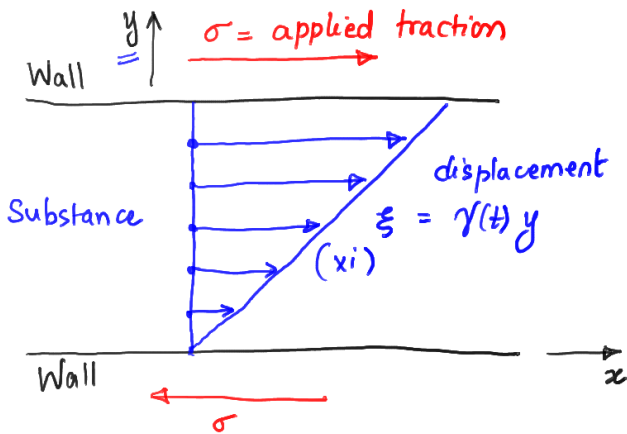


## DEFINITION OF A FLUID.

Definition: A fluid is a continuum substance which cannot withstand shear stress without continually deforming.

The Newtonian sketch.



$\sigma$  = applied traction = shear stress  
(Greek sigma) = force/area

$\xi$  = displacement  
=  $\gamma(t) y$

$$\text{shear} = \frac{\partial \xi}{\partial y} = \gamma(t).$$

For a solid, as  $t \rightarrow \infty$ ,  $\gamma(t)$  approaches a constant limit.

For a fluid, as  $t \rightarrow \infty$ ,  $\underline{\gamma(t)}$  continues to increase (proportional to  $t$ ).

$$\text{i.e. } \gamma(t) = \dot{\gamma}(t) t$$

A Newtonian fluid

↑  
rate of shear

A Newtonian fluid is one where,

$$\sigma = \mu \dot{\gamma}$$

$\dot{\gamma}$  — shear rate  
 $\mu$  — coefficient of dynamic viscosity.  
 $\sigma$  — shear stress