

# MECHANICAL PROPERTIES

## Rheology

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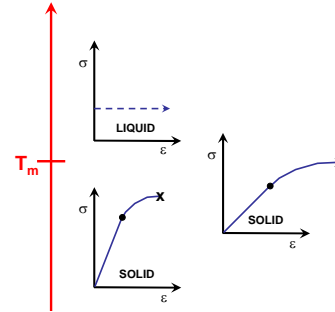
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## INTRODUCTION

Rheology = mechanical properties of liquids



## TERMINOLOGY

Viscosity and fluidity – and flow.

RHEOLOGY = measurement of flow

- (1) Viscosity = resistance to flow
- (2) Fluidity = tendency of liquid to flow = 1/(viscosity)

Modes of FLOW:

- (1) Laminar Flow = uniform force within fluid in motion

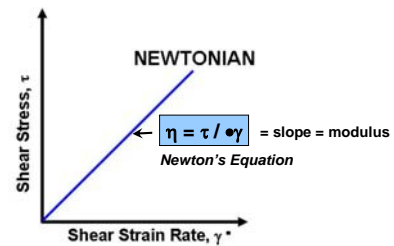


- (2) Turbulent Flow = widely varying force within moving fluid



## NEWTON'S EQUATION.

Graphical representation of mechanical properties of ideal liquid.



## VISCOSITY MEASUREMENT

Units, measurement approaches, and applications of concepts.

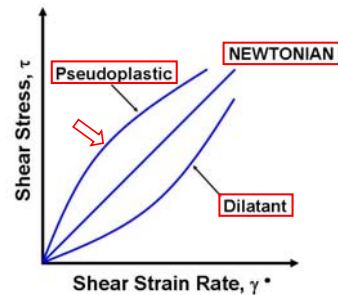
Simple measurement systems for viscosity:

- (1) Orifice rheometer: gravity flow of a fluid through an opening.
- (2) Falling ball or rising bubble: gravity flow of an object in the fluid.
- (3) Capillary rheometer: pressure flow of a fluid.
- (4) Parallel plate, cone-and-plate, or spindle: frictional drag of surface against a fluid.



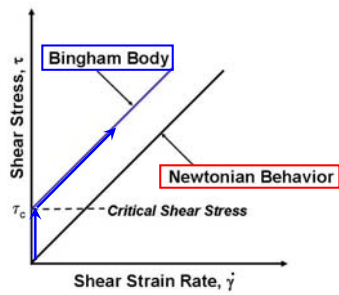
## VISCOSITY

Energy diagrams – shear stress versus shear strain rate.



## THIXOTROPY

Critical shear stress required to initiate flow.



## QUICK REVIEW

Review of mechanical properties of liquids.

- What is the reciprocal of viscosity?  
FLUIDITY
- What is NEWTON'S EQUATION?  
Viscosity = Shear Stress / Shear Strain Rate =  $\eta = \tau / \dot{\gamma}$
- Identify 3 viscosity behaviors.  
NEWTONIAN, PSEUDOPLASTIC, DILATANT
- What type of viscosity behavior includes a critical shear stress?  
BINGHAM BODY
- What are typical units used to express viscosity?  
POISES or CENTIPOISES



THANK YOU