What is a **modulus**?

It's a quantity that determines the property of a material or the relationship between two properties

MODULUS OF ELASTICITY

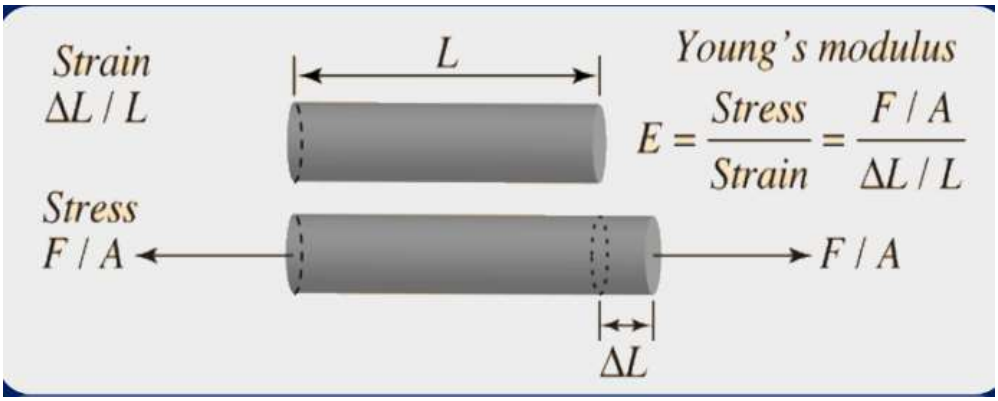
Often known as many things like (young's modulus, tensile modulus)

It's a measure of the **stiffness** or **rigidity** of a material, it represents the ratio n between the stress and the strain of an object within an elastic range

$$E = \frac{\sigma}{\varepsilon}$$

Where:

- E = Young's modulus (modulus of elasticity)
- σ = Stress (force applied per unit area)
- ε = Strain (relative deformation or change in length)



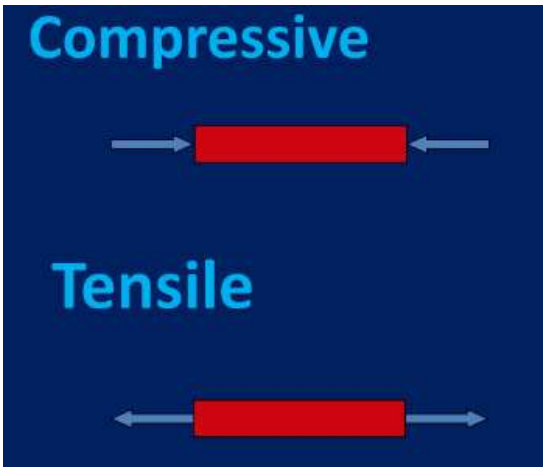
STRESS (σ)

It's the internal resistance of an object to being deformed, it is measured in terms of the applied load

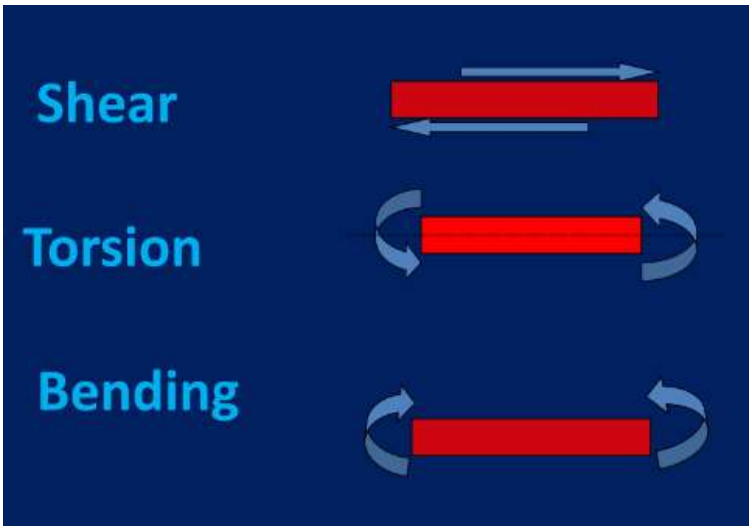
$$i.e.\ \sigma = F/A\ (N/m^2)$$

TYPES OF STRESS

Axial (force applied in 1 axis)



Non Axial (forces applied in more than along a single direction)



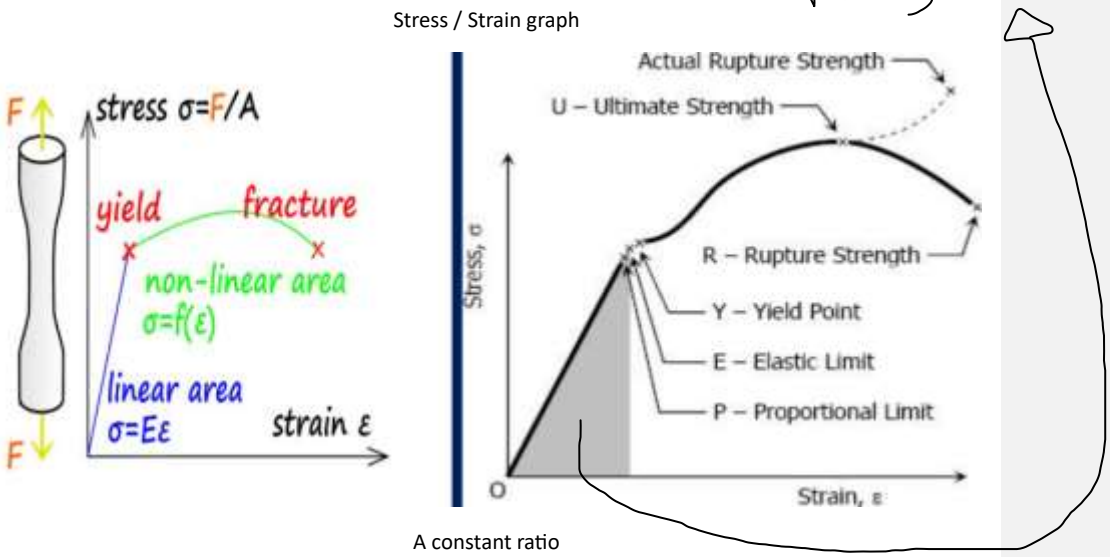
STRAIN (∈)

Is the extent of the stretching/compression produced by the material's respond to **stress**, and it's a dimensionless quantity

It's measured by the ratio of **the change in length ΔL** to the **original length L_0**

$$\epsilon = \Delta L / L_0$$

Stress / Strain graph



A constant ratio

Hooke's law says that in an elastic range, strain is proportional to stress

Hooks law is valid in the proportional level (O-P), as there are no values that change the linear-larity of the graph in this part

Yield point is a point will he metal will face an appreciable elongation without an increase in the load, this is the point where the metal becomes deformed beyond repair, here the material will turn from elastic to plastic

Elastic limit is the limit when broken, the body will face permanent deformation

Yield strength is the amount of stress a material can undergo before moving from elastic deformation, into plastic deformation

Tensile strength is the largest stress that a material can withstand before breaking, it is measured with **Pascals** or **Pa** which is unit of force over unit of area

Ultimate Tensile Strength (UTS) is the limit tensile stress at which the material **actually breaks**, because of the release of the stored elastic energy

Commented [SD1]: Deformaties get fixed over time

Commented [SD2]: Deformaties stay

Commented [SD3]: Deformation that will go back to normal overtime

Commented [SD4]: Deformation that won't go back to normal over time

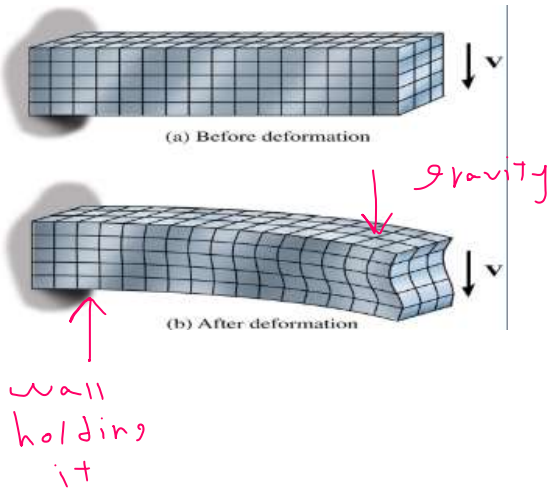
Rupture Strength is a point when the strain gets too high the material will just split, this can happen with the pressure not reaching its ultimate strength

Actual Rupture strength is a point when the stress and strain are too high that the material just splits

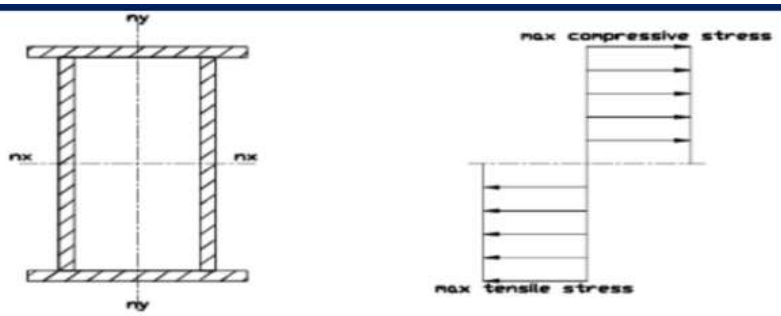
Ductile substances are Substances that elongate considerably and undergo plastic deformation before they break

SHEAR

It's a strain in a structure produced by pressure when its layers are latterly shifted towards each other



SHEAR BEAM



Simplified stress diagram for material response to bending shear within the elastic range of response (before yield onset)

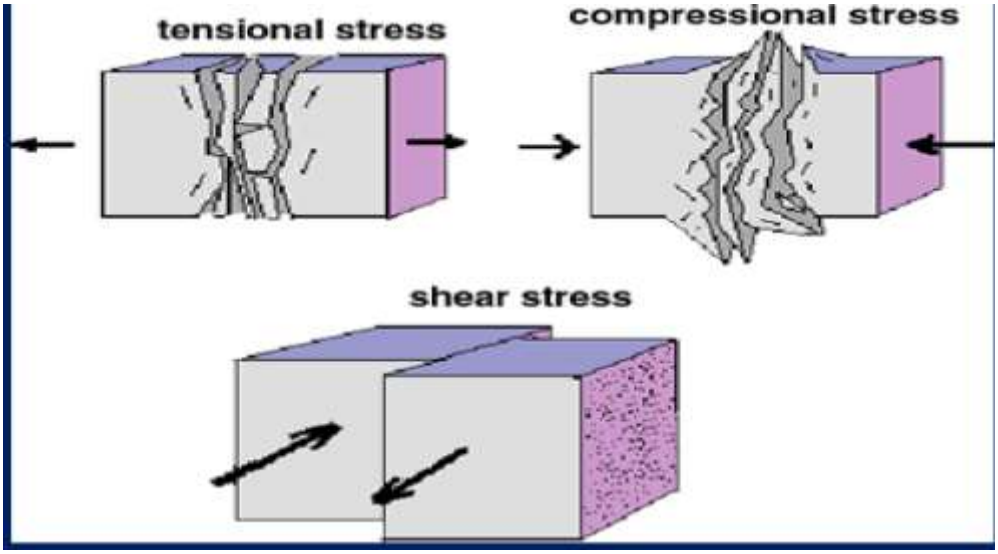
Shear Force (S.F)

Is the algebraic sum of vertical forces acting to the left or right of a section across the span of the beam, unit of N or kN

Sheer stress is a force tending to cause deformation of a material by slippage along a plan or planes parallel to the imposed stress

Bending moment is an algebraic sum of the moment (torque) of the forces to the left or right of the section and we use the Unit N.m or kN.m

Bending flexure characterizes the behaviour of a structure when loads/forces are applied perpendiculary to a longitundal axis of the element



Problems you might want to know

(b) Determine the shearing force necessary to punch a 1.50-cm-diameter hole in a steel plate 0.700 cm thick.

(b) In this case you are shearing a cylinder of diameter 1.5 cm and height 0.7 cm
Surface area of cylinder = $2x \pi x R x h$
$= 2 \times \pi \times 0.0075 \times 0.007 = 3.299 \times 10^{-4}\ m^2$
Force = stress x area
$= 4 \times 10^{8} \times 3.299 \times 10^{-4}$
$= 13.19 \times 10^{4}$
$= 131.9$ kN