

## Materials

STRESS is the force per unit area that causes an object to change shape and/or size. The units are  $\frac{\text{N}}{\text{m}^2} \equiv \text{Pascal(Pa)}$ .

$$\text{STRESS} \equiv \frac{\text{Compressing or Stretching or Shearing Force}}{\text{Area}}$$

STRAIN is the relative change in size and/or shape. NO UNITS.

$$\text{STRAIN} \equiv \frac{\Delta L}{L_{\text{original}}} \quad \text{or} \quad \frac{\Delta V}{V_{\text{original}}} \quad \text{etc.}$$

For an ELASTIC Material

STRESS  $\propto$  STRAIN or STRESS = (MODULUS)(STRAIN)

1D Deformation	Shear Deformation	Volume Deformation
$\frac{F_{\text{stretch}}}{A} = Y \frac{\Delta L}{L_0}$	$\frac{F_{\text{shear}}}{A} = S \frac{\Delta x}{h}$	$\frac{F_{\text{compress}}}{A} = -B \frac{\Delta V}{V_0}$
or		or
$\frac{F_{\text{compress}}}{A} = Y \frac{\Delta L}{L_0}$		$\Delta P = -B \frac{\Delta V}{V_0}$
$Y$ is Young's	$S$ is shear	$B$ is bulk

The minus in volume deformation means only that a pressure increase always gives a volume decrease.