

**PHYSICS**

**CLASS 9**

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**DEFORMATION**

Elasticity is the property of solid materials to return to their original shape and size after the forces deforming them have been removed. Recall Hooke's law — first stated formally by [Robert Hooke](http://en.wikipedia.org/wiki/Robert_Hooke) in *The True Theory of Elasticity or Springiness* (1676)…

*ut tensio, sic vis*

which can be translated literally into…

As extension, so force.

or translated formally into…

Extension is directly proportional to force.

Most likely we'd replace the word "extension" with the symbol (Δ**x**), "force" with the symbol (**F**), and "is directly proportional to" with an equals sign (=) and a constant of proportionality (*k*), then, to show that the springy object was trying to return to its original state, we'd add a negative sign (−). In other words, we'd write the equation…

**F** = − *k* Δ**x**

This is Hooke's law for a spring — a simple object that's essentially one-dimensional. Hooke's law can be generalized to…

Stress is proportional to strain.

where strain refers to a change in some spatial dimension (length, angle, or volume) compared to its original value and stress refers to the cause of the change (a force applied to a surface).

The coefficient that relates a particular type of stress to the strain that results is called an elastic modulus (plural, moduli). Elastic moduli are properties of materials, not objects. There are three basic types of stress and three associated moduli.

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| **modulus (symbols)** | **stress(symbol)** | **strain(symbol)** | **configurationchange** |
| young's(*E* or *Y*) | normal toopposite faces (σ) | lengthε = Δℓ/ℓ0 | longer and thinneror shorter and fatter |
| shear(*G* or *S*) | tangential toopposite faces (τ) | tangentγ = Δ*x*/*y* | rectangles becomeparallelograms |
| bulk(*K* or *B*) | normal to all faces,pressure (*P*) | volumeθ = Δ*V*/*V*0 | volume changesbut shape does not |

Limit of proportionality is the limit at which the stress strain curve starts behaving in a non-linear way....The Elastic limit does not equal this limit and can usually take a little more stress...It's usually graphed parallel to the Proportional line but with a starting point of 0.01 strain (jus depends on the material). Wherever this line intersects the graph, this point will be the elastic limit

