Strain

Actually strain is a physical property, when material undergoes deformation within elastic limit, under static loading, for e.g. in 1D strain, the factor ΔL/L is uniformly distributed along the length for each smaller length.

Strain is defined as extension per unit length.

Strain = extension / original length

$$\varepsilon = \frac{e}{lo}$$

Where,

ε = strain,

l_o = the original length

e = extension = (l-l_o), and

l = stretched length

Strain has no units because it is a ratio of lengths.

- We can use the above definitions of stress and strain for forces causing tension or compression.
- If we **apply** tensile force **we have** tensile stress **and** tensile strain
- **If we apply** compressive force **we have** compressive stress **and** compressive strain.

1. A cord has original length of 100 cm is pulled by a force. The change in length of the cord is 2 mm. Determine the strain!

Known:

Original length (l0) = 100 cm = 1 m

The change in length (Δl) = 2 mm = 0.002 m

Wanted: The strain

Solution:

$$Strain = \frac{the change in length(\Delta l)}{Original length(l_0)}$$

$$Strain = \frac{0.002m}{1m}$$

$$Strain = 0.002$$

Moment of Force

The turning effect of a force is known as the moment. It is the product of the force multiplied by the perpendicular distance from the line of action of the force to the pivot or point where the object will turn.

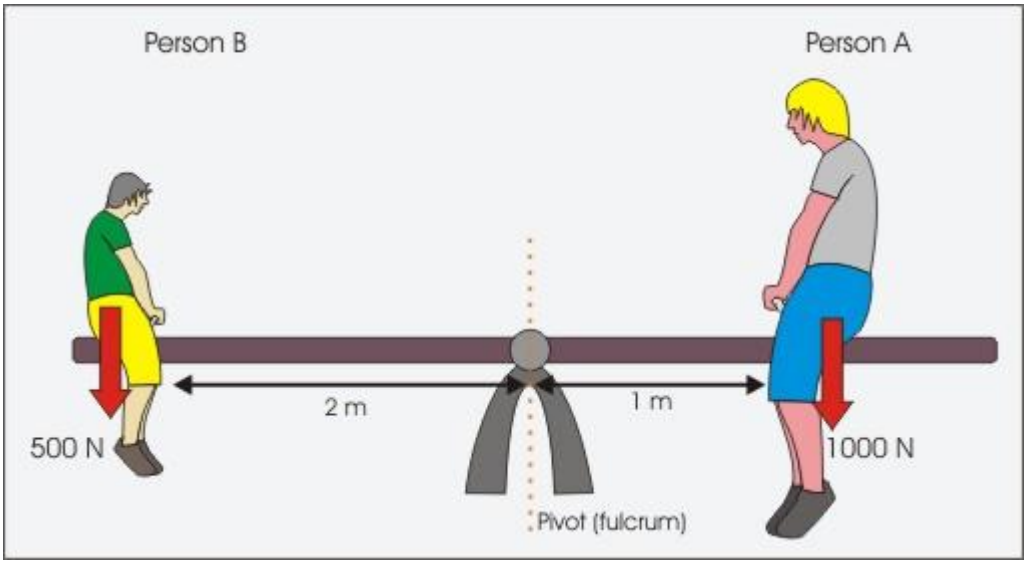
Moment of a force (Newton meters) = Force (Newtons) X Perpendicular distance from the force to the pivot (meters)

When undoing a nut fastened to a screw by hand one realizes that the amount of force required is a lot greater than when undoing the same nut using a spanner. The spanner increases the distance between the fulcrum and the line of action of the force, thus for the same force a greater moment is obtained.

Principle of moment

The principle of moments states that when in equilibrium the total sum of the anti-clockwise moment is equal to the total sum of the clockwise moment.

When a system is stable or balance it is said to be in equilibrium as all the forces acting on the system cancel each other out.



Moments Acting On A Seesaw

Both people exert a downward force on the seesaw due to their weights.

Person A's weight is trying to turn the seesaw anticlockwise whilst person B's weight is trying to turn the seesaw clockwise.

Person A's Moment = Force x perpendicular distance from fulcrum

1000 x 1 = 1000 Nm

Person B's Moment = Force x perpendicular distance from fulcrum

500 x 2 = 1000 Nm

Persons A's moment = Persons B's Moment
Anticlockwise moment = Clockwise moment

Momentum

Momentum is defined as the product of mass and velocity.

$$\underset{(kgm/s)}{\text{Momentum}} = \underset{(kg)}{\text{mass}} \times \underset{(m/s)}{\text{velocity}}$$

The unit for momentum is kilogram meters per second (kgm/s) and it is a vector quantity as it has both size and direction. The direction is given by the velocity (velocity = speed in a particular direction).

Momentum has the symbol "p" and can be written mathematically as:

$p = m \times v$

Equlibirium

A state of balance between opposing forces or actions that is either static (as in a body acted on by forces whose resultant is zero) or dynamic (as in a reversible chemical reaction when the rates of reaction in both directions are equal)