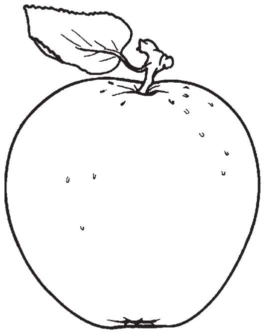
DEFINING TERMS

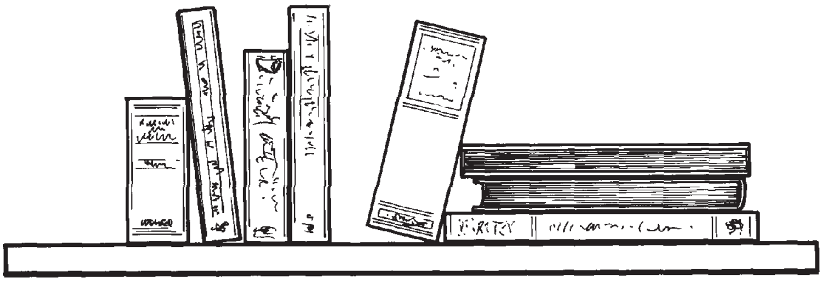
Force. When you push against something, you exert a force against it. The unit of force is the Newton ('N' for short). As a guide, a mass of 102 gram (about the weight of a large apple) exerts a downwards force of 1N



It is important to remember, however, that a Newton is **not** a unit of weight. Weight is determined by gravitational force and a similar mass of material will weigh less at high altitude than at sea level because the force ('pull') of gravity gets weaker the higher you go. The Newton is an absolute unit of force and is defined as that force needed to cause an acceleration of 1 m/sec^2 in a mass of 1 kg.

(Since the gravitational force on a mass of 1 kg causes an acceleration of 9.81 m/sec^2, it follows that the gravitational force on a mass of 1 kg is 9.81 Newtons - hence the figure for downward force exerted a mass of 102g.

Load. This is a term engineers often use. It is an example of a force. The load (or 'loading') on a bookshelf is the weight of the books which exert a downward force. The total loading on the bookshelf is the weight of the books plus the weight of the shelf.



Compression. If we say something is in compression, we mean that it is being 'squashed' or squeezed together. A material that has high *compressive* strength is very good at resisting forces acting inwards. Concrete is an example.

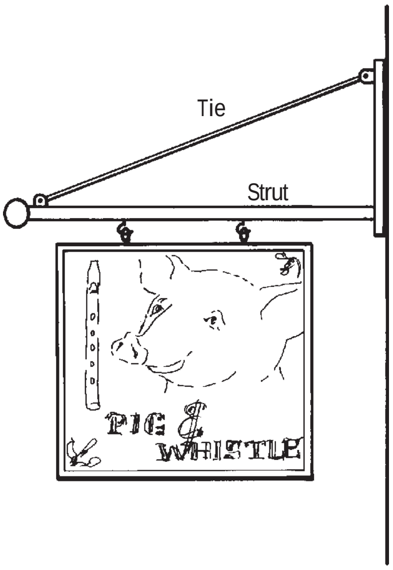
Compressive force

Tension. If we say something is in tension, we mean that it is being pulled apart. A material that has high *tensile* strength is very good at resisting forces acting outwards. Steel is a good example.

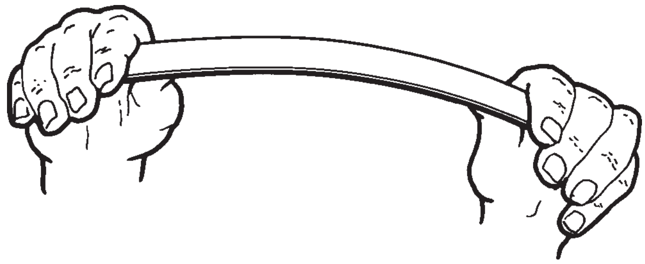
Tensile force

Strut. This term describes any part of a structure in compression when a force is acting on it.

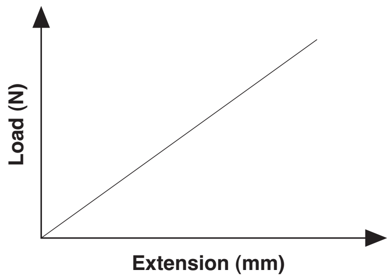
Tie. This term describes any part of a structure in tension when a force is acting on it.



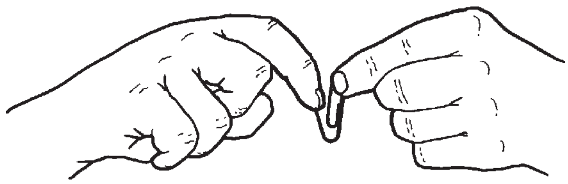
Elastic behaviour. When a material is stretched (or compressed) but returns to its original size when the load is removed, it undergoes *elastic behaviour.* Elastic bands are good examples. Most materials behave like these to some extent, but it is not always so obvious. (You cannot see a steel ruler stretching when you pull on the ends, but you can see the effect of it stretching and springing back if you bend it.)



When a material behaves elastically, it obeys Hooke's Law which states that extension is proportional to load. If load and extension are plotted on a graph, the result is a straight line.



Plastic behaviour. When a material is stretched (or compressed) but does not return to its original size when the load is removed, it undergoes plastic behaviour. A simple experiment with a paper clip will show the difference between elastic and plastic behaviour. Up to a certain point, a paper clip will spring back into shape when you bend the end outwards and let go.



If you bend it too far, it springs back slightly but stays permanently bent. When this happens, it has been bent beyond its *elastic limit* . This shows on the graph as a curved line. In structures, it is important that materials operate well within their elastic limit.