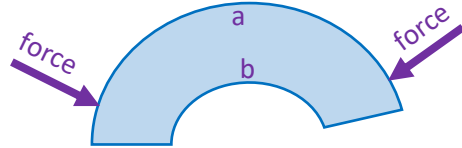




5.3.2 Forces and elasticity

When forces are applied to an object, they may cause the object to change shape. This is because the materials that the object is made from are being deformed. The materials in the object may remain permanently deformed, once the forces are removed, or they may spring back to their original shape.

Consider the following situations:

- A)  Two forces are compressing an object. We say that the material of the object is in compression.
- B)  Two forces are stretching an object. We say that the material of the object is in tension.
- C)  Two forces are being applied that are causing the object to bend. In the object there are regions which are in tension and regions which are in compression.

(1) What would tend to happen to the length of the object in situation A (above)?

(2) What would tend to happen to the length of the object in situation B (above)?

(3) In situation C (above), is the material at *a* in tension or compression?

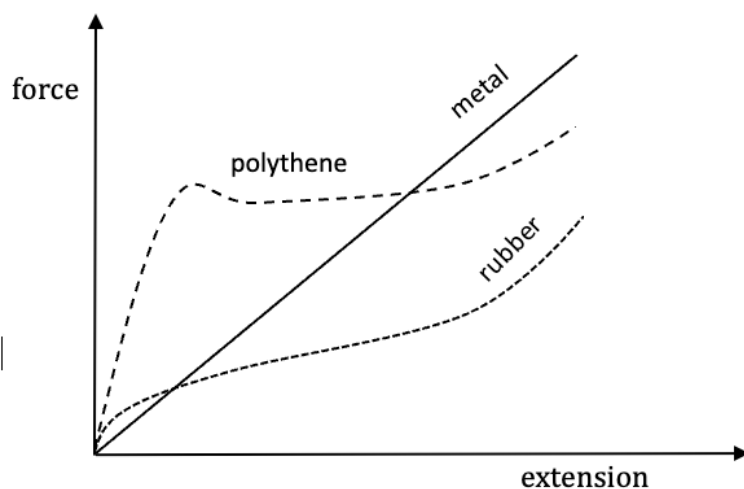
(4) In situation C (above), is the material at *b* in tension or compression?

(5)  Decide whether the following objects are in compression, tension, or both:

example	compression/tension/both
 the rope	
 the mattress	
 the bow	

We can test the behaviour of materials by applying compressive or tensile forces to a piece of the material and measuring how the length changes with the applied force.

The diagram below shows the behaviour of different materials subjected to different tensile forces. There is a wide range of behaviours.

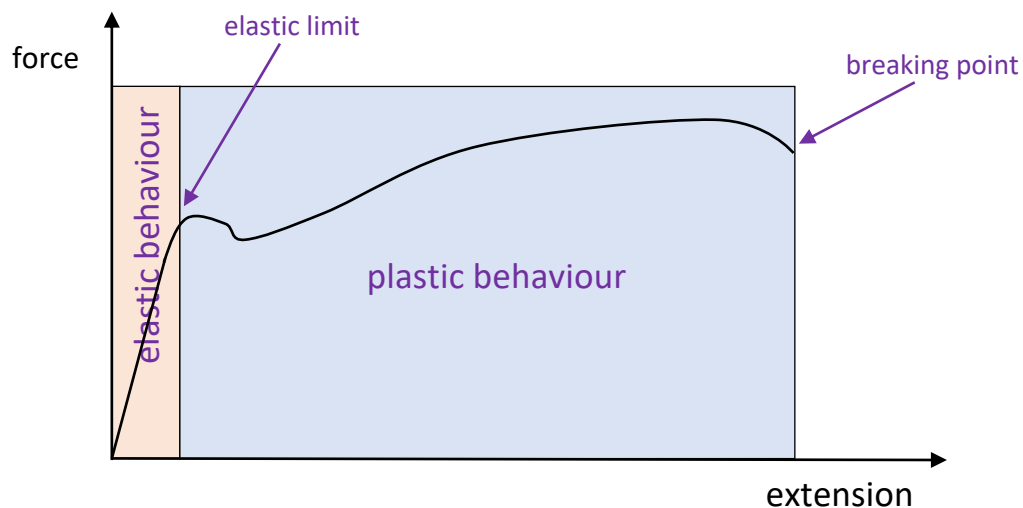


Note that the force axis will have different scales for these different materials. For example, generally much larger forces are required to stretch metals than rubber.

(6)  What is different between the behaviour of metal and rubber?

Both metal and rubber will return to their original length once the tensile force is removed, provided the force isn't too large. We call this 'elastic' behaviour.

Consider the graph (below), for a metal stretched with increasing force up to breaking point:



To start with the metal will stretch in a linear way. The extension is proportional to the applied force. Below the elastic limit, the metal is not permanently deformed, and will return to its original length once the force is removed.

(7) *What do you think happens to the metal for forces that extend the metal beyond the elastic limit? What do we call this type of behaviour?*

(8) *For a metal that has been stretched beyond its elastic limit, what will happen to the length of the metal once the force is removed?*

(8) *What is the name given to the ability of metals to permanently deform without breaking? (Hint: Think about the properties of metals from your chemistry.)*