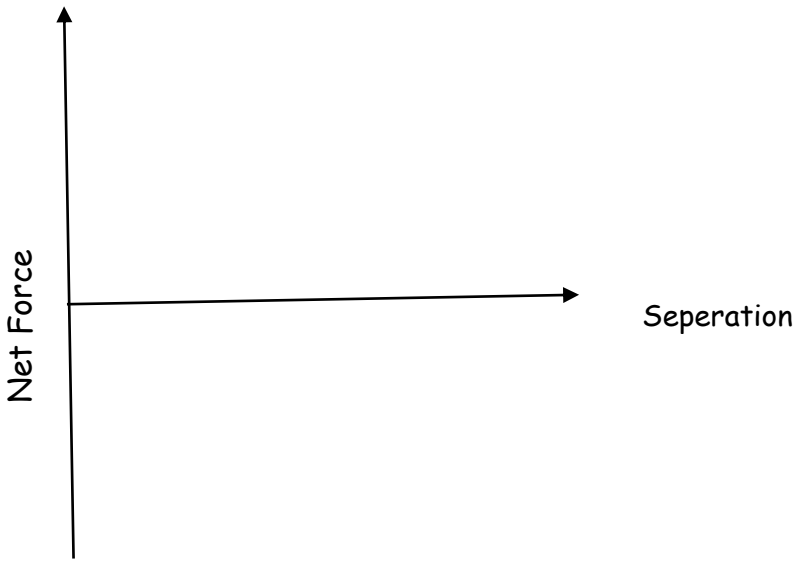
MECHANICAL PROPERTIES OF MATERIALS

1) Below in the figure, the net force vs. interatomic separation curves for the materials A and B at the same temperature are shown. Compare the given properties:

(a) Bonding Energies
(b) Modulus of elasticity



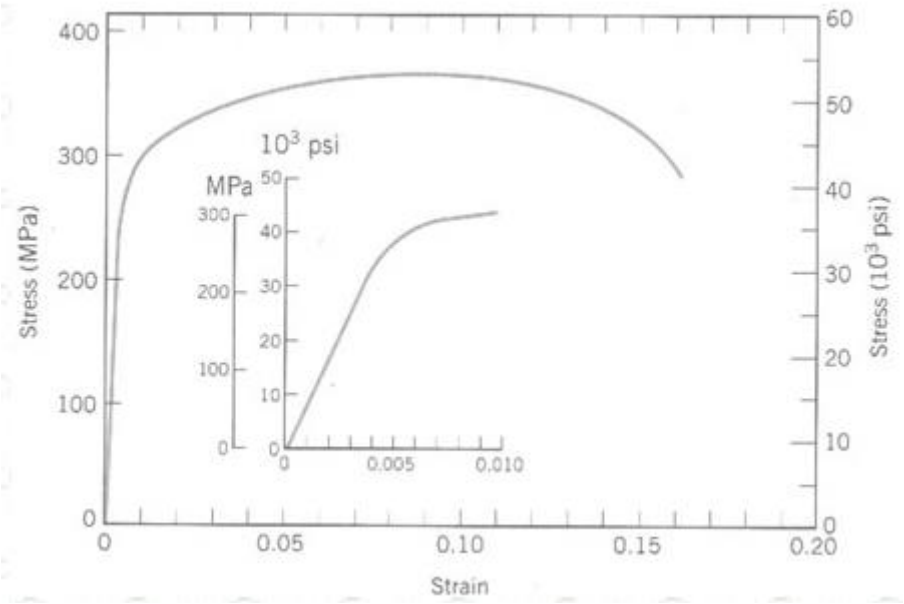
2) An aluminum-alloy bar 127 mm long and having a square cross-section 16.5 mm on an edge is pulled in tension with a load of 66.7 kN and experiences an elongation of 0.43 mm.

(a) Assuming that the deformation is entirely elastic, calculate the modulus of elasticity of aluminum
(b) What is the maximum length to which it may be stretched without causing plastic deformation if yielding starts at 300 MPa

3) Consider cylindrical specimen of an aluminum alloy 10 mm in diameter and 75 mm long which is pulled in tension.

(a) Determine the maximum load that can be applied without causing plastic deformation

(b) Determine its elongation when a load of 1346 kg is applied.



Tensile stress-strain behavior for an aluminum alloy

4) A cylindrical specimen of steel having a diameter of 15.2 mm and a length of 250 mm is deformed elastically in tension with a force of 48.9 kN. (E_{Steel}=207 GPa , G_{Steel}=830 GPa, v=0.27) Determine the following:

a) The amount by which this specimen will elongate in the direction of the applied stress.

b) The change in diameter of the specimen. Will the diameter increase or decrease?

5) Consider a cylindrical specimen of some hypothetical metal alloy that has a diameter of 10 mm. A tensile force of 1500 N produces an elastic reduction in diameter of 6.7×10^{-4} mm. Compute the modulus of elasticity for this alloy, given that Poisson's ratio is 0.35

6) (a) Cylindrical rod 380 mm long, having a diameter of 10 mm is to be subjected to a tensile load. If the rod is to experience neither plastic deformation nor an elongation of more than 0.9 mm when the applied load is 2500 kg, which of the four metals or alloys listed below are possible candidates?

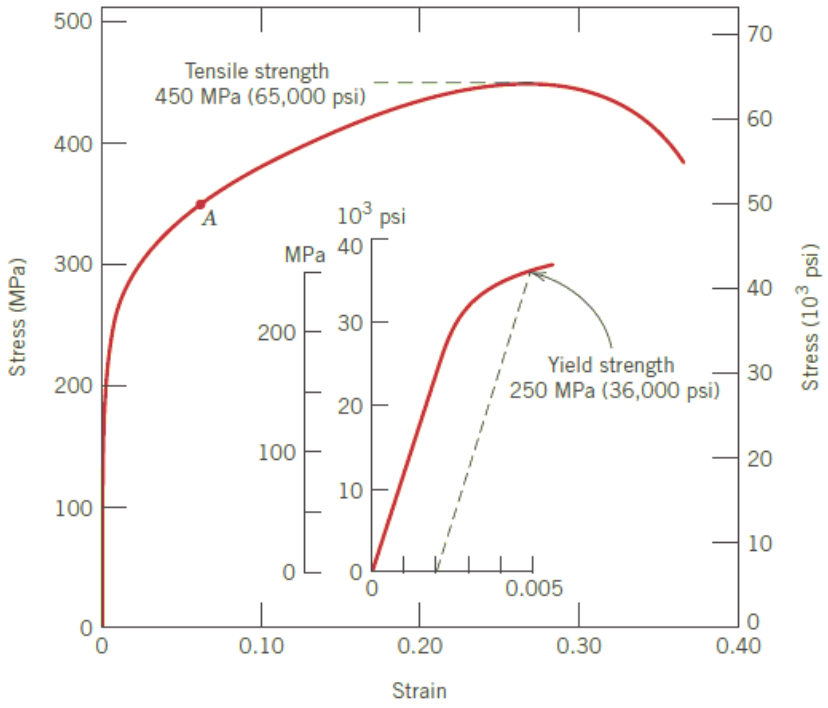
(b) If you were to select a material, listed below, for a spring application where high resilience is the primary requirement, which would be your choice?

Material	Modulus of Elasticity(GPa)	Yield Strength (MPa)
Al-Alloy	70	255
Brass Alloy	100	345
Copper	110	248
Steel	210	448

7) A cylindrical metal specimen having an original diameter of 12.8 mm and gauge length of 50.80 mm is pulled in tension until fracture occurs. The diameter at the point of fracture is 8.13 mm and fractured gauge length is 74.14 mm. Calculate the ductility.

8) If a brass specimen having a rectangular cross section of dimensions 12.7 mm x 6.4 mm and 120 mm long is pulled in tension with a force of 15 kN; the force is subsequently released.

(a) Compute the final length of the specimen at this time
(b) Compute the final specimen length when the load is increased to 32.5 kN and then release.



Tensile stress-strain behavior of brass specimen