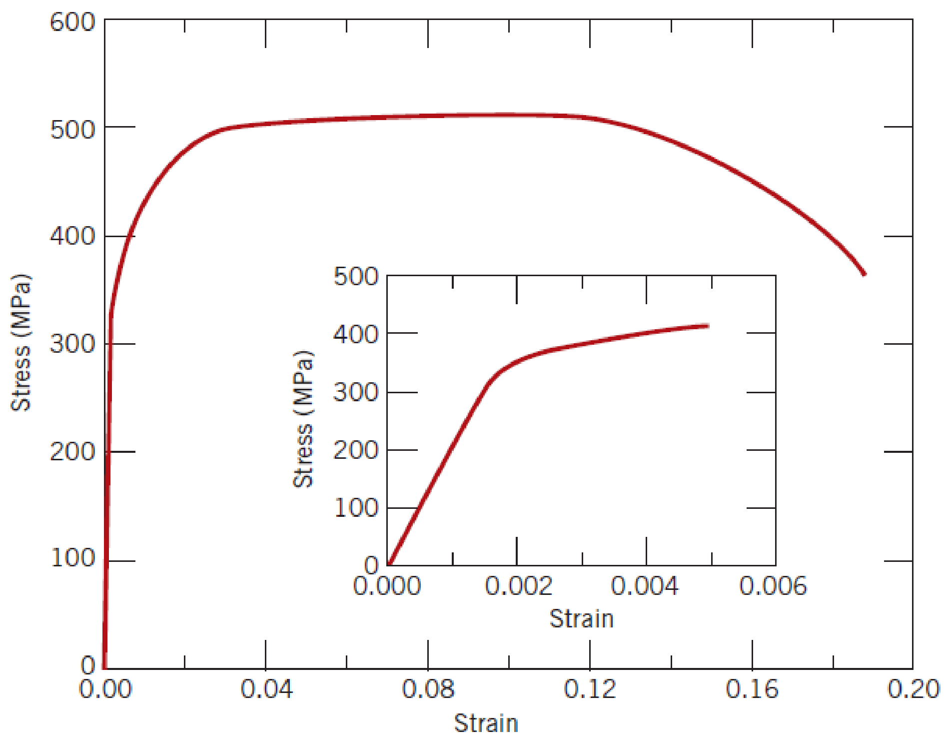
Question 1:

A steel alloy specimen having a rectangular cross section of dimensions 10 mm × 5 mm has the stress–strain behavior shown on the right. If this specimen is subjected to a tensile force of 20,000 N then:

(a) Determine the elastic and plastic strain values.

(b) If its original length is 350 mm, what will be its final length after the load in part (a) is applied and then released?



Question 2:

A cylindrical rod 120 mm long and having a diameter of 15.0 mm is to be deformed using a tensile load of 35,000 N. It must not experience either plastic deformation or a diameter reduction of more than 1.2×10^{-2} mm. Of the materials listed below, which are possible candidates? Justify your choice(s).

Material	Modulus of Elasticity (GPa)	Yield Strength (MPa)	Poisson’s Ratio
Aluminum Alloy	70	250	0.33
Titanium Alloy	105	850	0.36
Steel Alloy	205	550	0.27
Magnesium Alloy	45	170	0.35

Question 3:

For a brass alloy, the following engineering stresses produce the corresponding plastic engineering strains, prior to necking:

Engineering Stress (MPa)	Engineering Strain
235	0.194
250	0.296

On the basis of this information, compute the *engineering* stress necessary to produce an *engineering* strain of 0.25.

Question 4:

A single crystal of a metal that has the FCC crystal structure is oriented such that a tensile stress is applied parallel to the [100] direction. If the critical resolved shear stress for this material is 0.5 MPa, calculate the magnitude of applied stress necessary to cause slip to occur on the (111) plane in the $[1\bar{1}0]$ direction.

Question 5:

(a) A 10-mm-diameter Brinell hardness indenter produced an indentation 1.62 mm in diameter in a steel alloy when a load of 500 kg was used. Compute the HB of this material.
(b) What will be the diameter of an indentation to yield a hardness of 450 HB when a 500 kg load is used?