

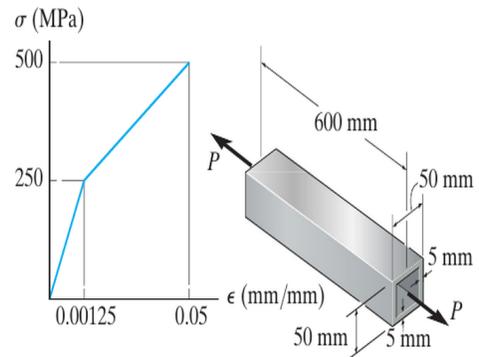
ENG104: Mechanics of Materials

ENG104, HW # 2, Due Tuesday, 22Apr2025 by midnight, on canvas

1. A tension test was performed on a specimen having an original diameter of 12.5 mm and a gage length of 50 mm. The data are listed in the table. Plot the stress–strain diagram, and determine approximately the modulus of elasticity, the ultimate stress, and the fracture stress. Use a scale of 20 mm = 50 MPa and 20 mm = 0.05 mm/mm. Redraw the linear-elastic region, using the same stress scale but a strain scale of 20 mm = 0.001 mm/mm.

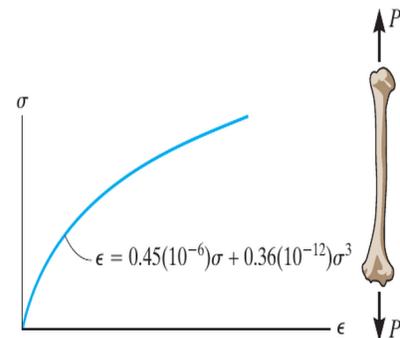
Load (kN)	Elongation (mm)
0	0
11.1	0.0175
31.9	0.0600
37.8	0.1020
40.9	0.1650
43.6	0.2490
53.4	1.0160
62.3	3.0480
64.5	6.3500
62.3	8.8900
58.8	11.9380

2. Determine the elongation of the square hollow bar when it is subjected to the axial force $P = 100$ kN. If this force is increased to $P = 360$ kN and released, find the permanent elongation of the bar. The bar is made of a metal alloy having a stress–strain diagram which can be approximated as shown.

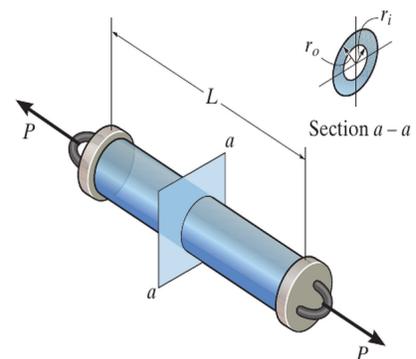


SOLUTION

3. The stress–strain diagram for a bone is shown and can be described by the equation $\epsilon = 0.45(10^{-6})\sigma + 0.36(10^{-12})\sigma^3$, where σ is in kPa. Determine the modulus of toughness and the amount of elongation of a 200-mm-long region just before it fractures if failure occurs at $\epsilon = 0.12$ mm/mm.



4. The pipe with two rigid caps attached to its ends is subjected to an axial force P . If the pipe is made from a material having a modulus of elasticity E and Poisson's ratio ν , determine the change in volume of the material.



SOLUTION