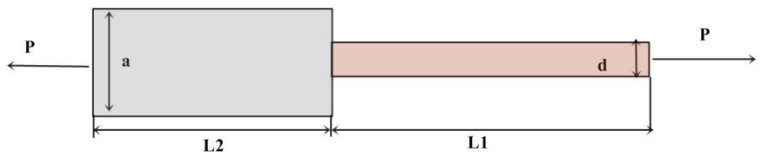
Answer on Question #50400, Physics, Mechanics | Kinematics | Dynamics

Task:

A solid circular steel rod 6mm in diameter and 500mm long is rigidly fastened to the end of a square brass bar 25mm on a side and 400mm long, the geometric axes of the bars lying along the same line. An axial tensile force of 5kN is applied at each of the extreme ends. Determine the total elongation of the assembly. For steel, E = 200GPa, and for brass, E = 90GPa. Express the answer in millimeters.

Answer:



$d = 6mm$

$a = 25mm$

$L_1 = 500mm, L_2 = 400mm, P = 5kN = 5000[N];$

$E_1(steel) = 200GPa = 200 \cdot 10^3 [N/mm^2]$

$E_2(brass) = 90GPa = 90 \cdot 10^3 [N/mm^2]$

$A_1(area\_of\_steel) = \frac{\pi d^2}{4} = 9\pi [mm^2]$

$A_2(area\_of\_brass) = a^2 = 625[mm^2]$

the total elongation :

$$\delta = \frac{PL_1}{E_1A_1} + \frac{PL_2}{E_2A_2} = P(\frac{L_1}{E_1A_1} + \frac{L_2}{E_2A_2}) = 5000(\frac{500}{2 \cdot 10^5 \cdot 9\pi} + \frac{400}{9 \cdot 10^4 \cdot 625}) \approx 0.478mm$$