18. A structural steel rod has a radius of 10 mm and length of 1.0 m. A 100 kN force stretches it along its length. Young's modulus of structural steel is 2×10^{11} Nm^{-2}. The percentage strain is about

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(a) 0.16%
(b) 0.32%
(c) 0.08%
(d) 0.24%

18. **(a)** Given: $F = 100 \, kN = 10^5 \, N$

$Y = 2 \times 10^{11} \, Nm^{-2}$

$\ell_0 = 1.0 \, m$

radius $r = 10 \, mm = 10^{-2} \, m$

From formula, $Y = \dfrac{\text{Stress}}{\text{Strain}}$

$\Rightarrow \quad \text{Strain} = \dfrac{\text{Stress}}{Y} = \dfrac{F}{AY}$

$= \dfrac{10^5}{\pi r^2 Y} = \dfrac{10^5}{3.14 \times 10^{-4} \times 2 \times 10^{11}} = \dfrac{1}{628}$

Therefore % strain $= \dfrac{1}{628} \times 100 = 0.16\%$