Worksheet:

A section of magnesium alloy is being tested. It is subjected to a 12 kN compression force. The length is 50 mm. The cross section is 10 mm by 10 mm. The longitudinal strain is 0.0015. Poisson's ratio for the material is 0.35.

a) Find the average normal stress at the instant when the load is applied.

b) Find $\delta_{Longitudinal}$

c) Find the height and width of the cross section after compression.

Lateral Strain: $\varepsilon' = \dfrac{\delta_{Lateral}}{w_o}$

Longitudinal Strain: $\varepsilon = \dfrac{\delta_{Longitudinal}}{L_o}$

Poisson's ratio: $\upsilon = -\dfrac{\varepsilon'}{\varepsilon}$

a) $\sigma = P/A = \dfrac{12\ KN}{(10mm)(10mm)} = 0.12\ KN/mm^2 = \underline{\underline{120\ MPa}}$ ANS.

b) $\delta_{LONGITUDINAL} = -\epsilon L_o = -0.0015\,(50\ mm) = \underline{\underline{-0.075\ mm}}$ ANS [NEGATIVE BECAUSE OF COMPRESSION]

c) $\nu = -\dfrac{\epsilon'}{\epsilon}$

$0.35 = -\dfrac{\epsilon'}{(-0.0015)}$

$\epsilon' = 0.000525 = \dfrac{\delta_{LATERAL}}{w_o} = \dfrac{\delta_{LATERAL}}{10\ mm}$

$\delta_{LATERAL} = 0.00525mm$

NEW HEIGHT AND WIDTH $= 10mm + 0.00525\ mm = \underline{\underline{10.00525\ mm}}$ ANS