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Elastic Constants Formulas

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List of 20 Elastic Constants Formulas

Elastic Constants

Longitudinal and Lateral Strain

1) Lateral Strain using Poisson's Ratio

$$fx \quad \varepsilon_L = -(\nu \cdot \varepsilon_{\text{longitudinal}})$$

Open Calculator 

$$ex \quad -0.0186 = -(0.3 \cdot 0.062)$$

2) Longitudinal Strain using Poisson's Ratio

$$fx \quad \varepsilon_{\text{longitudinal}} = -\left(\frac{\varepsilon_L}{\nu}\right)$$

Open Calculator 

$$ex \quad 0.2 = -\left(\frac{-0.06}{0.3}\right)$$

3) Poisson's Ratio

$$fx \quad \nu = -\left(\frac{\varepsilon_L}{\varepsilon_{\text{longitudinal}}}\right)$$

Open Calculator 

$$ex \quad 0.3 = -\left(\frac{-0.06}{0.2}\right)$$



Volumetric Strain

4) Bulk Modulus given Direct Stress

$$fx \quad K = \frac{\sigma}{\epsilon_v}$$

[Open Calculator !\[\]\(a03a7eb2f4046e1d3c76772003e549ea_img.jpg\)](#)

$$ex \quad 180000MPa = \frac{18MPa}{0.0001}$$

5) Bulk Modulus using Young's Modulus

$$fx \quad K = \frac{E}{3 \cdot (1 - 2 \cdot \nu)}$$

[Open Calculator !\[\]\(5361750c22c4e047a52f4eac1ec2d4cc_img.jpg\)](#)

$$ex \quad 16666.67MPa = \frac{20000MPa}{3 \cdot (1 - 2 \cdot 0.3)}$$

6) Direct Stress for given Bulk Modulus and Volumetric Strain

$$fx \quad \sigma = K \cdot \epsilon_v$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$ex \quad 1.8MPa = 18000MPa \cdot 0.0001$$


7) Lateral Strain given Volumetric and Longitudinal Strain

$$fx \quad \epsilon_L = -\frac{\epsilon_{\text{longitudinal}} - \epsilon_v}{2}$$

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

$$ex \quad -0.09995 = -\frac{0.2 - 0.0001}{2}$$



8) Longitudinal Strain given Volumetric and Lateral Strain 

$$fx \quad \varepsilon_{\text{longitudinal}} = \varepsilon_v - (2 \cdot \varepsilon_L)$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 0.1201 = 0.0001 - (2 \cdot -0.06)$$

9) Longitudinal Strain given Volumetric Strain and Poisson's Ratio 

$$fx \quad \varepsilon_{\text{longitudinal}} = \frac{\varepsilon_v}{1 - 2 \cdot \nu}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)


$$ex \quad 0.00025 = \frac{0.0001}{1 - 2 \cdot 0.3}$$

10) Poisson's Ratio given Volumetric Strain and Longitudinal Strain 

$$fx \quad \nu = \frac{1}{2} \cdot \left(1 - \frac{\varepsilon_v}{\varepsilon_{\text{longitudinal}}} \right)$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 0.49975 = \frac{1}{2} \cdot \left(1 - \frac{0.0001}{0.2} \right)$$


11) Poisson's Ratio using Bulk Modulus and Young's Modulus 

$$fx \quad \nu = \frac{3 \cdot K - E}{6 \cdot K}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)


$$ex \quad 0.314815 = \frac{3 \cdot 18000\text{MPa} - 20000\text{MPa}}{6 \cdot 18000\text{MPa}}$$



12) Volumetric Strain given Bulk Modulus Open Calculator 

$$fx \quad \varepsilon_v = \frac{\sigma}{K}$$

$$ex \quad 0.001 = \frac{18MPa}{18000MPa}$$

13) Volumetric Strain given Change in Length Open Calculator 


$$fx \quad \varepsilon_v = \left(\frac{\Delta l}{l} \right) \cdot (1 - 2 \cdot \nu)$$

$$ex \quad 0.0004 = \left(\frac{0.0025m}{2.5m} \right) \cdot (1 - 2 \cdot 0.3)$$

14) Volumetric Strain given Change in Length, Breadth and Width Open Calculator 

$$fx \quad \varepsilon_v = \frac{\Delta l}{l} + \frac{\Delta b}{b} + \frac{\Delta d}{d}$$

$$ex \quad 0.020333 = \frac{0.0025m}{2.5m} + \frac{0.014m}{1.5m} + \frac{0.012m}{1.2m}$$

15) Volumetric Strain given Longitudinal and Lateral Strain Open Calculator 

$$fx \quad \varepsilon_v = \varepsilon_{\text{longitudinal}} + 2 \cdot \varepsilon_L$$

$$ex \quad 0.08 = 0.2 + 2 \cdot -0.06$$



16) Volumetric Strain of Cylindrical Rod

$$fx \quad \varepsilon_v = \varepsilon_{\text{longitudinal}} - 2 \cdot (\varepsilon_L)$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 0.32 = 0.2 - 2 \cdot (-0.06)$$

17) Volumetric Strain of Cylindrical Rod using Poisson's Ratio

$$fx \quad \varepsilon_v = \varepsilon_{\text{longitudinal}} \cdot (1 - 2 \cdot \nu)$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$ex \quad 0.08 = 0.2 \cdot (1 - 2 \cdot 0.3)$$

18) Volumetric Strain using Young's Modulus and Poisson's Ratio

$$fx \quad \varepsilon_v = \frac{3 \cdot \sigma_t \cdot (1 - 2 \cdot \nu)}{E}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$ex \quad 0.000996 = \frac{3 \cdot 16.6\text{MPa} \cdot (1 - 2 \cdot 0.3)}{20000\text{MPa}}$$

19) Young's Modulus using Bulk Modulus

$$fx \quad E = 3 \cdot K \cdot (1 - 2 \cdot \nu)$$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

$$ex \quad 21600\text{MPa} = 3 \cdot 18000\text{MPa} \cdot (1 - 2 \cdot 0.3)$$



20) Young's Modulus using Poisson's Ratio

[Open Calculator !\[\]\(feabb98897b440bc8695a03336a6e2df_img.jpg\)](#)

$$fx \quad E = \frac{3 \cdot \sigma_t \cdot (1 - 2 \cdot \nu)}{\epsilon_v}$$

$$ex \quad 199200MPa = \frac{3 \cdot 16.6MPa \cdot (1 - 2 \cdot 0.3)}{0.0001}$$





Variables Used

- **b** Breadth of Bar (Meter)
- **d** Depth of Bar (Meter)
- **E** Young's Modulus (Megapascal)
- **K** Bulk Modulus (Megapascal)
- **l** Length of Section (Meter)
- **Δb** Change in Breadth (Meter)
- **Δd** Change in Depth (Meter)
- **Δl** Change in Length (Meter)
- ϵ_L Lateral Strain
- ϵ_L Lateral Strain
- $\epsilon_{\text{longitudinal}}$ Longitudinal Strain
- $\epsilon_{\text{longitudinal}}$ Longitudinal Strain
- ϵ_v Volumetric Strain
- σ Direct Stress (Megapascal)
- σ_t Tensile Stress (Megapascal)
- ν Poisson's Ratio



Constants, Functions, Measurements used

- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Stress** in Megapascal (MPa)
Stress Unit Conversion 



Check other formula lists

- [Mohr's Circle of Stresses Formulas](#)
- [Beam Moments Formulas](#)
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