Important Elasticity Formulas PDF

Formulas
Examples
with Units

List of 13
Important Elasticity Formulas

1) Modulus of Elasticity Formulas

1.1) Young's Modulus Formula

Evaluate Formula

Formula

$$E = \frac{\sigma}{\varepsilon}$$

Example with Units

$$3000\,\text{N/m} = \frac{1200\,\text{Pa}}{0.4}$$

1.2) Young's Modulus of Elasticity Formula

Evaluate Formula

Formula

$$E = \frac{F \cdot d}{A_{elast} \cdot l}$$

Example with Units

$$160\,\text{N/m} = \frac{66000\,\text{N} \cdot 2\,\text{m}}{55\,\text{m}^2 \cdot 15\,\text{m}}$$

2) Strain Formulas

2.1) Change in Volume of Body given Volumetric Strain Formula

Evaluate Formula

Formula

$$\Delta V = \varepsilon_v \cdot V_0$$

Example with Units

$$50\,\text{m}^3 = 2.5 \cdot 20\,\text{m}^3$$

2.2) Displacement of Upper Surface Formula

Evaluate Formula

Formula

$$l = \tan(Q) \cdot d$$

Example with Units

$$15.0093\,\text{m} = \tan(82.41°) \cdot 2\,\text{m}$$

2.3) Original Volume of Body given Volumetric Strain Formula

Evaluate Formula

Formula

$$V_0 = \frac{\Delta V}{\varepsilon_v}$$

Example with Units

$$20\,\text{m}^3 = \frac{50\,\text{m}^3}{2.5}$$

2.4) Perpendicular Distance between Two Surfaces given Shear Angle Formula

Evaluate Formula

Formula

$$d = \frac{l}{\tan(Q)}$$

Example with Units

$$1.9988\,\text{m} = \frac{15\,\text{m}}{\tan(82.41°)}$$

2.5) Strain Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{\Delta L}{L}$$

Example with Units

$$0.4 = \frac{2.2\,\text{m}}{5.5\,\text{m}}$$

2.6) Volume Strain Formula

Evaluate Formula

Formula

$$\varepsilon_v = \frac{\Delta V}{V_0}$$

Example with Units

$$2.5 = \frac{50\,\text{m}^3}{20\,\text{m}^3}$$

3) Stress Formulas

3.1) Area of Body given Stress Formula

Evaluate Formula

Formula

$$A_{elast} = \frac{F}{\sigma}$$

Example with Units

$$55\,\text{m}^2 = \frac{66000\,\text{N}}{1200\,\text{Pa}}$$

3.2) Change in Length given Longitudinal Stress Formula

Evaluate Formula

Formula

$$\Delta L = \varepsilon_l \cdot L_0$$

Example with Units

$$2.2\,\text{m} = 0.01 \cdot 220\,\text{m}$$

3.3) Normal Stress or Longitudinal Stress Formula

Evaluate Formula

Formula

$$\sigma = \frac{F}{A_{elast}}$$

Example with Units

$$1200\,\text{Pa} = \frac{66000\,\text{N}}{55\,\text{m}^2}$$

3.4) Original Length given Longitudinal Stress Formula

Evaluate Formula

Formula

$$L_0 = \frac{\Delta L}{\varepsilon_l}$$

Example with Units

$$220\,\text{m} = \frac{2.2\,\text{m}}{0.01}$$

3.5) Stress Formula

Evaluate Formula

Formula

$$\sigma = \frac{F}{A_{elast}}$$

Example with Units

$$1200\,\text{Pa} = \frac{66000\,\text{N}}{55\,\text{m}^2}$$

Variables used in list of Elasticity Formulas above

- ΔV Change in Volume *(Cubic Meter)*
- A_{elast} Area *(Square Meter)*
- **d** Perpendicular Distance *(Meter)*
- **E** Young's Modulus *(Newton per Meter)*
- **F** Force *(Newton)*
- F_s Shear Force *(Newton)*
- **l** Displacement of Upper Surface *(Meter)*
- **L** Length *(Meter)*
- L_0 Initial Length *(Meter)*
- **Q** Angle of Shear *(Degree)*
- V_0 Original Volume *(Cubic Meter)*
- ΔL Change in Length *(Meter)*
- ε Strain
- ε_l Longitudinal Strain
- ε_v Volumetric Strain
- σ Stress *(Pascal)*

Constants, Functions, Measurements used in list of Elasticity Formulas above

- Functions: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Stiffness Constant** in Newton per Meter (N/m)
  Stiffness Constant Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

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