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Froude Scaling and Scale Factor Formulas

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List of 21 Froude Scaling and Scale Factor Formulas

Froude Scaling and Scale Factor

Froude Scaling

1) Froude Scaling

Open Calculator

fx $$F_n = \sqrt{\frac{F_i}{F_g}}$$

ex $$0.6 = \sqrt{\frac{3.636\text{kN}}{10.1\text{kN}}}$$

2) Froude Scaling given Velocity and Length

Open Calculator

fx $$F_n = \frac{V_f}{\sqrt{[g] \cdot L_f}}$$

ex $$0.594263 = \frac{20\text{m/s}}{\sqrt{[g] \cdot 115.5\text{m}}}$$

3) Gravity Forces for Froude Scaling

Open Calculator

fx $$F_g = \frac{F_i}{F_n^2}$$

ex $$10.1\text{kN} = \frac{3.636\text{kN}}{(0.6)^2}$$

4) Inertia or Pressure Forces given Froude Scaling

Open Calculator

fx $$F_i = \left(F_n^2\right) \cdot F_g$$

ex $$3.636\text{kN} = \left((0.6)^2\right) \cdot 10.1\text{kN}$$

5) Length for Froude Scaling

Open Calculator

fx $$L_f = \frac{\left(\frac{V_f}{F_n}\right)^2}{[g]}$$

ex $$113.3018\text{m} = \frac{\left(\frac{20\text{m/s}}{0.6}\right)^2}{[g]}$$

6) Velocity for Froude Scaling

Open Calculator

fx $$V_f = F_n \cdot \sqrt{[g] \cdot L_f}$$

ex $$20.19308\text{m/s} = 0.6 \cdot \sqrt{[g] \cdot 115.5\text{m}}$$

Scale Factor

7) Scale Factor for Acceleration

Open Calculator

fx $$\alpha A = \frac{\alpha V^2}{\alpha L}$$

ex $$0.999698 = \frac{(4.242)^2}{18}$$

8) Scale Factor for Acceleration given Scale Factor for Time and Velocity

Open Calculator

fx $$\alpha A = \frac{\alpha V}{\alpha T}$$

ex $$0.999764 = \frac{4.242}{4.243}$$

9) Scale Factor for Density of Fluid given Scale Factor for Inertia Forces

Open Calculator

fx $$\alpha \rho = \frac{\alpha F}{\alpha V^2 \cdot \alpha L^2}$$

ex $$1.0004 = \frac{5832.571}{(4.242)^2 \cdot (18)^2}$$

10) Scale Factor for Inertia Forces

Open Calculator

fx $$\alpha F = \alpha \rho \cdot \alpha V^2 \cdot \alpha L^2$$

ex $$5829.656 = 0.9999 \cdot (4.242)^2 \cdot (18)^2$$

11) Scale Factor for Kinematic Viscosity given Scale Factor for Time and Length

Open Calculator

fx $$\alpha \nu = \frac{\alpha L^2}{\alpha_{TR}}$$

ex $$1 = \frac{(18)^2}{324.0001}$$

12) Scale Factor for Length given Scale Factor for Acceleration

Open Calculator

fx $$\alpha L = \frac{\alpha V^2}{\alpha A}$$

ex $$17.98737 = \frac{(4.242)^2}{1.0004}$$

13) Scale Factor for Length given Scale Factor for Inertia Forces

Open Calculator

fx $$\alpha L = \sqrt{\frac{\alpha F}{\alpha \rho \cdot \alpha V^2}}$$

ex $$18.0045 = \sqrt{\frac{5832.571}{0.9999 \cdot (4.242)^2}}$$

14) Scale Factor for Length given Scale Factor for Time

Open Calculator

fx $$\alpha L = \alpha T^2$$

ex $$18.00305 = (4.243)^2$$

15) Scale Factor for Length given Scale Factor for Time and Kinematic Viscosity

Open Calculator

fx $$\alpha L = \sqrt{\alpha_{TR} \cdot \alpha \nu}$$

ex $$17.991 = \sqrt{324.0001 \cdot 0.999}$$

16) Scale Factor for Time

Open Calculator

fx $$\alpha T = \sqrt{\alpha L}$$

ex $$4.242641 = \sqrt{18}$$

17) Scale Factor for Time given Scale Factor for Acceleration

Open Calculator

fx $$\alpha T = \left(\frac{\alpha V}{\alpha A}\right)$$

ex $$4.240304 = \left(\frac{4.242}{1.0004}\right)$$

18) Scale Factor for Time given Scale Factor for Length and Kinematic Viscosity

Open Calculator

fx $$\alpha_{TR} = \frac{\alpha L^2}{\alpha \nu}$$

ex $$324.3243 = \frac{(18)^2}{0.999}$$

19) Scale Factor for Velocity given Scale Factor for Acceleration

Open Calculator

fx $$\alpha V = \sqrt{\alpha A \cdot \alpha L}$$

ex $$4.243489 = \sqrt{1.0004 \cdot 18}$$

20) Scale Factor for Velocity given Scale Factor for Inertia Forces

Open Calculator

fx $$\alpha V = \sqrt{\frac{\alpha F}{\alpha \rho \cdot \alpha L^2}}$$

ex $$4.243061 = \sqrt{\frac{5832.571}{0.9999 \cdot (18)^2}}$$

21) Scale Factor for Velocity given Scale Factor for Time

Open Calculator

fx $$\alpha V = \frac{\alpha L}{\alpha T}$$

ex $$4.242281 = \frac{18}{4.243}$$

Variables Used

- F_g Forces Due to Gravity *(Kilonewton)*
- F_i Inertia Forces *(Kilonewton)*
- F_n Froude Scaling
- L_f Length for Froude Scaling *(Meter)*
- V_f Velocity of Fluid *(Meter per Second)*
- α_{TR} Scale Factor for the Time of Reynolds Scaling
- αA Scale Factor for the Acceleration
- αF Scale Factor for Inertia Forces
- αL Scale Factor for Length
- αT Scale Factor for the Time
- αV Scale Factor for Velocity
- $\alpha \nu$ Scale Factor for Fluid Viscosity
- $\alpha \rho$ Scale Factor for Density of Fluid

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion

Check other formula lists

- **Froude Scaling and Scale Factor Formulas**
- **Relation between Forces on the Prototype and Forces on the Model Formulas**

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