Important Laminar Flow around a Sphere Stokes' Law Formulas PDF

Formulas
Examples
with Units

List of 18
Important Laminar Flow around a Sphere Stokes' Law Formulas

1) Coefficient of Drag given density Formula

Evaluate Formula

Formula

$$C_D = \frac{24 \cdot F_D \cdot \mu}{\rho \cdot V_{mean} \cdot D_S}$$

Example with Units

$$0.0027 = \frac{24 \cdot 1.1\,\text{kN} \cdot 10.2\,\text{P}}{1000\,\text{kg/m}^3 \cdot 10.1\,\text{m/s} \cdot 10\,\text{m}}$$

2) Coefficient of Drag given Drag Force Formula

Evaluate Formula

Formula

$$C_D = \frac{F_D}{A \cdot V_{mean} \cdot V_{mean} \cdot \rho \cdot 0.5}$$

Example with Units

$$0.0108 = \frac{1.1\,\text{kN}}{2\,\text{m}^2 \cdot 10.1\,\text{m/s} \cdot 10.1\,\text{m/s} \cdot 1000\,\text{kg/m}^3 \cdot 0.5}$$

3) Coefficient of Drag given Reynolds Number Formula

Evaluate Formula

Formula

$$C_D = \frac{24}{Re}$$

Example

$$0.01 = \frac{24}{2400}$$

4) Density of Fluid given Drag Force Formula

Evaluate Formula

Formula

$$\rho = \frac{F_D}{A \cdot V_{mean} \cdot V_{mean} \cdot C_D \cdot 0.5}$$

Example with Units

$$1078.3257\,\text{kg/m}^3 = \frac{1.1\,\text{kN}}{2\,\text{m}^2 \cdot 10.1\,\text{m/s} \cdot 10.1\,\text{m/s} \cdot 0.01 \cdot 0.5}$$

5) Diameter of Sphere for given Fall Velocity Formula

Evaluate Formula

Formula

$$D_S = \sqrt{\frac{V_{mean} \cdot 18 \cdot \mu}{\gamma_f}}$$

Example with Units

$$0.0137\,\text{m} = \sqrt{\frac{10.1\,\text{m/s} \cdot 18 \cdot 10.2\,\text{P}}{9.81\,\text{kN/m}^3}}$$

6) Diameter of Sphere given Coefficient of Drag Formula

Evaluate Formula

Formula

$$D_S = \frac{24 \cdot \mu}{\rho \cdot V_{mean} \cdot C_D}$$

Example with Units

$$0.2424\,\text{m} = \frac{24 \cdot 10.2\,\text{P}}{1000\,\text{kg/m}^3 \cdot 10.1\,\text{m/s} \cdot 0.01}$$

7) Diameter of Sphere given Resistance Force on Spherical Surface Formula

Evaluate Formula

Formula

$$D_S = \frac{F_{resistance}}{3 \cdot \pi \cdot \mu \cdot V_{mean}}$$

Example with Units

$$9.9903\,\text{m} = \frac{0.97\,\text{kN}}{3 \cdot 3.1416 \cdot 10.2\,\text{P} \cdot 10.1\,\text{m/s}}$$

8) Drag Force given Coefficient of Drag Formula

Evaluate Formula

Formula

$$F_D = C_D \cdot A \cdot V_{mean} \cdot V_{mean} \cdot \rho \cdot 0.5$$

Example with Units

$$1.0201\,\text{kN} = 0.01 \cdot 2\,\text{m}^2 \cdot 10.1\,\text{m/s} \cdot 10.1\,\text{m/s} \cdot 1000\,\text{kg/m}^3 \cdot 0.5$$

9) Dynamic Viscosity of fluid given Resistance Force on Spherical Surface Formula

Evaluate Formula

Formula

$$\mu = \frac{F_{resistance}}{3 \cdot \pi \cdot D_S \cdot V_{mean}}$$

Example with Units

$$10.1901\,\text{P} = \frac{0.97\,\text{kN}}{3 \cdot 3.1416 \cdot 10\,\text{m} \cdot 10.1\,\text{m/s}}$$

10) Dynamic Viscosity of fluid given Terminal Fall Velocity Formula

Evaluate Formula

Formula

$$\mu = \left(\frac{D_S^{\,2}}{18 \cdot V_{terminal}} \right) \cdot \left(\gamma_f - S \right)$$

Example with Units

$$10.2721\,\text{P} = \left(\frac{10\,\text{m}^{\,2}}{18 \cdot 49\,\text{m/s}} \right) \cdot \left(9.81\,\text{kN/m}^3 - 0.75\,\text{kN/m}^3 \right)$$

11) Projected Area given Drag Force Formula

Evaluate Formula

Formula

$$A = \frac{F_D}{C_D \cdot V_{mean} \cdot V_{mean} \cdot \rho \cdot 0.5}$$

Example with Units

$$2.1567\,\text{m}^2 = \frac{1.1\,\text{kN}}{0.01 \cdot 10.1\,\text{m/s} \cdot 10.1\,\text{m/s} \cdot 1000\,\text{kg/m}^3 \cdot 0.5}$$

12) Resistance Force on Spherical Surface Formula

Evaluate Formula

Formula

$$F_{resistance} = 3 \cdot \pi \cdot \mu \cdot V_{mean} \cdot D_S$$

Example with Units

$$0.9709\,\text{kN} = 3 \cdot 3.1416 \cdot 10.2\,\text{P} \cdot 10.1\,\text{m/s} \cdot 10\,\text{m}$$

13) Resistance Force on Spherical Surface given Specific Weights Formula

Evaluate Formula

Formula

$$F_{resistance} = \left(\frac{\pi}{6}\right) \cdot \left(D_S^{\,3}\right) \cdot \left(\gamma_f\right)$$

Example with Units

$$5.1365\,\text{kN} = \left(\frac{3.1416}{6}\right) \cdot \left(10\,\text{m}^{\,3}\right) \cdot \left(9.81\,\text{kN/m}^3\right)$$

14) Reynolds Number given Coefficient of Drag Formula

Evaluate Formula

Formula

$$Re = \frac{24}{C_D}$$

Example

$$2400 = \frac{24}{0.01}$$

15) Terminal Fall Velocity Formula

Evaluate Formula

Formula

$$V_{terminal} = \left(\frac{D_S^{\,2}}{18 \cdot \mu}\right) \cdot \left(\gamma_f - S\right)$$

Example with Units

$$49.3464\,\text{m/s} = \left(\frac{10\,\text{m}^{\,2}}{18 \cdot 10.2\,\text{P}}\right) \cdot \left(9.81\,\text{kN/m}^3 - 0.75\,\text{kN/m}^3\right)$$

16) Velocity of Sphere given Coefficient of Drag Formula

Evaluate Formula

Formula

$$V_{mean} = \frac{24 \cdot \mu}{\rho \cdot C_D \cdot D_S}$$

Example with Units

$$0.2448\,\text{m/s} = \frac{24 \cdot 10.2\,\text{P}}{1000\,\text{kg/m}^3 \cdot 0.01 \cdot 10\,\text{m}}$$

17) Velocity of Sphere given Drag Force Formula

Evaluate Formula

Formula

$$V_{mean} = \sqrt{\frac{F_D}{A \cdot C_D \cdot \rho \cdot 0.5}}$$

Example with Units

$$10.4881\,\text{m/s} = \sqrt{\frac{1.1\,\text{kN}}{2\,\text{m}^2 \cdot 0.01 \cdot 1000\,\text{kg/m}^3 \cdot 0.5}}$$

18) Velocity of Sphere given Resistance Force on Spherical Surface Formula

Evaluate Formula

Formula

$$V_{mean} = \frac{F_{resistance}}{3 \cdot \pi \cdot \mu \cdot D_S}$$

Example with Units

$$10.0902\,\text{m/s} = \frac{0.97\,\text{kN}}{3 \cdot 3.1416 \cdot 10.2\,\text{P} \cdot 10\,\text{m}}$$

Variables used in list of Laminar Flow around a Sphere Stokes' Law Formulas above

- **A** Cross Sectional Area of Pipe *(Square Meter)*
- C_D Coefficient of Drag
- D_S Diameter of Sphere *(Meter)*
- F_D Drag Force *(Kilonewton)*
- $F_{resistance}$ Resistance Force *(Kilonewton)*
- **Re** Reynolds Number
- **S** Specific Weight of Liquid in Piezometer *(Kilonewton per Cubic Meter)*
- V_{mean} Mean Velocity *(Meter per Second)*
- $V_{terminal}$ Terminal Velocity *(Meter per Second)*
- γ_f Specific Weight of Liquid *(Kilonewton per Cubic Meter)*
- **μ** Dynamic Viscosity *(Poise)*
- **ρ** Density of Fluid *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used in list of Laminar Flow around a Sphere Stokes' Law Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **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: **Area** in Square Meter (m²) *Area Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Force** in Kilonewton (kN) *Force Unit Conversion*
- Measurement: **Dynamic Viscosity** in Poise (P) *Dynamic Viscosity Unit Conversion*
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³) *Density Unit Conversion*
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³) *Specific Weight Unit Conversion*

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