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Fluid Force Formulas

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List of 14 Fluid Force Formulas

Fluid Force ⎘

Applications of Fluid Force ⎘

1) Distance between Plates given Dynamic Viscosity of Fluid ⎘

fx $y = \mu \cdot \dfrac{u}{\tau}$

ex $0.02\text{m} = 0.0796\text{Pa*s} \cdot \dfrac{14.7\text{m/s}}{58.506\text{Pa}}$

2) Dynamic Viscosity of Fluids ⎘

fx $\mu_d = \dfrac{\tau \cdot y}{u}$

ex $0.796\text{P} = \dfrac{58.506\text{Pa} \cdot 0.02\text{m}}{14.7\text{m/s}}$

3) Dynamic Viscosity of Gases ⎘

fx $\mu = \dfrac{a \cdot T^{\frac{1}{2}}}{1 + \frac{b}{T}}$

ex $0.0796\text{Pa*s} = \dfrac{0.008 \cdot (293\text{K})^{\frac{1}{2}}}{1 + \frac{211.053}{293\text{K}}}$

4) Dynamic Viscosity of Liquids ⏏

fx $\mu = A \cdot e^{\frac{B}{T}}$

Open Calculator ⏏

ex $0.0796 \text{Pa*s} = 0.04785 \cdot e^{\frac{149.12}{293K}}$

5) Friction Factor given Frictional Velocity ⏏

fx $f = 8 \cdot \left(\dfrac{V_f}{v_m} \right)^2$

Open Calculator ⏏

ex $0.024996 = 8 \cdot \left(\dfrac{0.9972 \text{m/s}}{17.84 \text{m/s}} \right)^2$

6) Shear Stress using Dynamic Viscosity of Fluid ⏏

fx $\tau = \mu \cdot \dfrac{u}{y}$

Open Calculator ⏏

ex $58.506 \text{Pa} = 0.0796 \text{Pa*s} \cdot \dfrac{14.7 \text{m/s}}{0.02 \text{m}}$

7) Torque given Thickness of Oil ⏏

fx $T_d = \dfrac{\pi \cdot \mu \cdot \omega \cdot \left(r_o^4 - r_i^4 \right)}{2 \cdot h \cdot \sin(\theta)}$

Open Calculator ⏏

ex $19.50552 \text{N*m} = \dfrac{\pi \cdot 0.0796 \text{Pa*s} \cdot 2 \text{rad/s} \cdot \left((7 \text{m})^4 - (4 \text{m})^4 \right)}{2 \cdot 55 \text{m} \cdot \sin(30°)}$

8) Total Hydrostatic Force ⬀

Open Calculator ⬀

fx $F_h = \gamma \cdot h_c \cdot A_s$

ex $844.2878N = 7357.5N/m^3 \cdot 0.32m \cdot 0.3586m^2$

9) Total Surface Area of Object Submerged in Liquid ⬀

Open Calculator ⬀

fx $A_s = \dfrac{F_h}{\gamma \cdot h_c}$

ex $0.3586m^2 = \dfrac{844.288N}{7357.5N/m^3 \cdot 0.32m}$

Dynamic Force Equations ⬀

10) Body Force ⬀

Open Calculator ⬀

fx $F_b = \dfrac{F_m}{V_m}$

ex $9.81N/m^3 = \dfrac{9.3195N}{0.95m^3}$

11) Force in Direction of Jet Striking Stationary Vertical Plate ⬀

Open Calculator ⬀

fx $F = \rho \cdot A_c \cdot v_j^2$

ex $64225.28N = 980kg/m^3 \cdot 0.025m^2 \cdot (51.2m/s)^2$

12) Inertial Force per Unit Area 🔗

fx $F_i = v^2 \cdot \rho$

Open Calculator 🔗

ex $141120 \text{N/m}^2 = (12 \text{m/s})^2 \cdot 980 \text{kg/m}^3$

13) Stokes Force 🔗

fx $F_d = 6 \cdot \pi \cdot R \cdot \mu \cdot v_f$

Open Calculator 🔗

ex $53.04001 \text{N} = 6 \cdot \pi \cdot 1.01 \text{m} \cdot 0.0796 \text{Pa*s} \cdot 35 \text{m/s}$

14) Upthrust Force 🔗

fx $F_t = V_i \cdot [g] \cdot \rho$

Open Calculator 🔗

ex $11532.62 \text{N} = 1.2 \text{m}^3 \cdot [g] \cdot 980 \text{kg/m}^3$

Variables Used

- **A** Experimental Constant 'A'
- **a** Sutherland Experimental Constant 'a'
- **A_c** Cross Sectional Area of Jet *(Square Meter)*
- **A_s** Surface Area of The Object *(Square Meter)*
- **b** Sutherland Experimental Constant 'b'
- **B** Experimental Constant 'B'
- **f** Darcy's Friction Factor
- **F** Force Extracted by The Jet on Vertical Plate *(Newton)*
- **F_b** Body Force *(Newton per Cubic Meter)*
- **F_d** Stokes' Drag *(Newton)*
- **F_h** Hydrostatic Force *(Newton)*
- **F_i** Inertial Force Per Unit Area *(Newton per Square Meter)*
- **F_m** Force Acting on Mass *(Newton)*
- **F_t** Upthrust Force *(Newton)*
- **h** Thickness of Oil *(Meter)*
- **h_c** Vertical Distance From Centroid *(Meter)*
- **R** Radius of The Spherical Object *(Meter)*
- **r_i** Inner Radius of Disc *(Meter)*
- **r_o** Outer Radius of Disc *(Meter)*
- **T** Absolute Temperature of Fluid *(Kelvin)*
- **T_d** Torque Exerted on Disc *(Newton Meter)*
- **u** Velocity of Moving Plate *(Meter per Second)*

- **v** Speed of The Fluid *(Meter per Second)*
- $\mathbf{V_f}$ Friction Velocity *(Meter per Second)*
- $\mathbf{V_i}$ Volume Immersed *(Cubic Meter)*
- $\mathbf{V_m}$ Volume Occupied by Mass *(Cubic Meter)*
- **y** Distance Between Plates Carrying Fluid *(Meter)*
- **γ** Specific Weight of The Fluid *(Newton per Cubic Meter)*
- **θ** Tilt Angle *(Degree)*
- **μ** Dynamic Viscosity Fluid *(Pascal Second)*
- $\mathbf{\mu_d}$ Dynamic Viscosity of Fluid *(Poise)*
- $\mathbf{v_f}$ Velocity of Fluid *(Meter per Second)*
- $\mathbf{v_j}$ Velocity of Liquid Jet *(Meter per Second)*
- $\mathbf{v_m}$ Mean Velocity *(Meter per Second)*
- **ρ** Mass Density of Fluid *(Kilogram per Cubic Meter)*
- **ω** Angular Velocity *(Radian per Second)*
- **τ** Shear Stress on Lower Surface *(Pascal)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Constant: **e**, 2.71828182845904523536028747135266249
  Napier's constant
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion ↗
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion ↗
- Measurement: **Volume** in Cubic Meter (m³)
  Volume Unit Conversion ↗
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion ↗
- Measurement: **Pressure** in Newton per Square Meter (N/m²)
  Pressure Unit Conversion ↗
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion ↗
- Measurement: **Force** in Newton (N)
  Force Unit Conversion ↗
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion ↗

- Measurement: **Dynamic Viscosity** in Pascal Second (Pa*s), Poise (P)
  Dynamic Viscosity Unit Conversion

- Measurement: **Angular Velocity** in Radian per Second (rad/s)
  Angular Velocity Unit Conversion

- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion

- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

- Measurement: **Specific Weight** in Newton per Cubic Meter (N/m³)
  Specific Weight Unit Conversion

- Measurement: **Pressure Gradient** in Newton per Cubic Meter (N/m³)
  Pressure Gradient Unit Conversion

- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

Check other formula lists

- **Fluid Force Formulas** ⎆
- **Fluid in Motion Formulas** ⎆
- **Hydrostatic Fluid Formulas** ⎆
- **Liquid Jet Formulas** ⎆
- **Pipes Formulas** ⎆
- **Pressure Relations Formulas** ⎆
- **Specific Weight Formulas** ⎆

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