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Fluid in Motion Formulas

Calculators!

Examples!

Conversions!

List of 17 Fluid in Motion Formulas

Fluid in Motion

Flow Rate

1) Rate of Flow

Open Calculator

fx $$q_{flow} = A_{cs} \cdot v_{avg}$$

ex $$99.45\text{m}^3/\text{s} = 1.3\text{m}^2 \cdot 76.5\text{m/s}$$

2) Rate of Flow given Head loss in Laminar Flow

Open Calculator

fx $$q_{flow} = h_f \cdot \gamma \cdot \pi \cdot \frac{d_{pipe}^4}{128 \cdot \mu \cdot L_{pipe}}$$

ex $$23.83758\text{m}^3/\text{s} = 1.2\text{m} \cdot 112\text{N/m}^3 \cdot \pi \cdot \frac{(1.01\text{m})^4}{128 \cdot 1.44\text{N} \cdot 0.10\text{m}}$$

3) Rate of Flow given Hydraulic Transmission Power

Open Calculator

fx $$q_{flow} = \frac{P}{y \cdot (H_{ent} - h_f)}$$

ex $$72.11538\text{m}^3/\text{s} = \frac{900\text{W}}{31.2\text{N/m}^3 \cdot (1.6\text{m} - 1.2\text{m})}$$

4) Volumetric Flow Rate at Vena Contracta

Open Calculator

fx $$V = C_d \cdot A_{vena} \cdot \sqrt{2 \cdot g \cdot H_w}$$

ex $$2.850908 m^3/s = 0.66 \cdot 0.611 m^2 \cdot \sqrt{2 \cdot 9.8 m/s^2 \cdot 2.55 m}$$

5) Volumetric Flow Rate of Circular Orifice

Open Calculator

fx $$V = 0.62 \cdot a \cdot \sqrt{2 \cdot g \cdot H_w}$$

ex $$39.44867 m^3/s = 0.62 \cdot 9 m^2 \cdot \sqrt{2 \cdot 9.8 m/s^2 \cdot 2.55 m}$$

6) Volumetric Flow Rate of Rectangular Notch

Open Calculator

fx $$V = 0.62 \cdot b \cdot H \cdot \frac{2}{3} \cdot \sqrt{2 \cdot g \cdot H_w}$$

ex $$12.85734 m^3/s = 0.62 \cdot 2.2 m \cdot 2 m \cdot \frac{2}{3} \cdot \sqrt{2 \cdot 9.8 m/s^2 \cdot 2.55 m}$$

7) Volumetric Flow Rate of Triangular Right Angled Notch

Open Calculator

fx $$V = 2.635 \cdot H^{\frac{5}{2}}$$

ex $$14.90581 m^3/s = 2.635 \cdot (2 m)^{\frac{5}{2}}$$

8) Volumetric Flow Rate of Venacontracta given Contraction and Velocity

Open Calculator

fx $$V = C_c \cdot C_v \cdot A_{vena} \cdot \sqrt{2 \cdot g \cdot H_w}$$

ex $$59.6099\text{m}^3/\text{s} = 15 \cdot 0.92 \cdot 0.611\text{m}^2 \cdot \sqrt{2 \cdot 9.8\text{m}/\text{s}^2 \cdot 2.55\text{m}}$$

Hydrodynamics Basics

9) Metacentric Height given Time Period of Rolling

Open Calculator

fx $$H_{metacentric} = \frac{(k_G \cdot \pi)^2}{\left(\left(\frac{T}{2}\right)^2\right) \cdot g}$$

ex $$0.730928\text{m} = \frac{(4.43\text{m} \cdot \pi)^2}{\left(\left(\frac{10.4\text{s}}{2}\right)^2\right) \cdot 9.8\text{m}/\text{s}^2}$$

10) Moment of Momentum Equation

Open Calculator

fx $$\tau = \rho_1 \cdot Q \cdot (v_1 \cdot R_1 - v_2 \cdot R_2)$$

ex $$-252.904\text{N*m} = 4\text{kg}/\text{m}^3 \cdot 1.01\text{m}^3/\text{s} \cdot (20\text{m}/\text{s} \cdot 1.67\text{m} - 12\text{m}/\text{s} \cdot 8\text{m})$$

11) Poiseuille's Formula

Open Calculator

fx $$v_o = \Delta p \cdot \frac{\pi}{8} \cdot \frac{r_{pipe}^4}{\mu_{viscosity} \cdot L}$$

ex $$10.47345\text{m}^3/\text{s} = 3.36\text{Pa} \cdot \frac{\pi}{8} \cdot \frac{(2.22\text{m})^4}{1.02\text{Pa*s} \cdot 3\text{m}}$$

12) Power

Open Calculator

fx $$P = F \cdot \Delta v$$

ex $$625\text{W} = 2.5\text{N} \cdot 250\text{m/s}$$

13) Power Developed by Turbine

Open Calculator

fx $$P_{turbine} = \rho_l \cdot Q \cdot V_{w1} \cdot c_{t1}$$

ex $$113.12\text{W} = 4\text{kg/m}^3 \cdot 1.01\text{m}^3/\text{s} \cdot 2\text{m/s} \cdot 14\text{m/s}$$

14) Power Required to Overcome Frictional Resistance in Laminar Flow

Open Calculator

fx $$P = y \cdot q_{flow} \cdot h_f$$

ex $$898.56\text{W} = 31.2\text{N/m}^3 \cdot 24\text{m}^3/\text{s} \cdot 1.2\text{m}$$

15) Reynolds Number

Open Calculator

fx $$Re = \frac{\rho_l \cdot v_{fluid} \cdot d_{pipe}}{\mu_{viscosity}}$$

ex $$506.9804 = \frac{4\text{kg/m}^3 \cdot 128\text{m/s} \cdot 1.01\text{m}}{1.02\text{Pa*s}}$$

16) Reynolds Number given Frictional Factor of Laminar Flow

Open Calculator

fx $$Re = \frac{64}{f}$$

ex $$101.5873 = \frac{64}{0.63}$$

17) Reynolds Number given Length

Open Calculator

fx $$Re = \rho_l \cdot v \cdot \frac{L}{\nu}$$

ex $$567.3759 = 4\text{kg/m}^3 \cdot 60\text{m/s} \cdot \frac{3\text{m}}{12.69\text{kSt}}$$

Variables Used

- **a** Area of Orifice *(Square Meter)*
- A_{cs} Cross-Sectional Area *(Square Meter)*
- A_{vena} Area of Jet at Vena Contracta *(Square Meter)*
- **b** Thickness of Dam *(Meter)*
- C_c Coefficient of Contraction
- C_d Coefficient of Discharge
- c_{t1} Tangential Velocity at Inlet *(Meter per Second)*
- C_v Coefficient of Velocity
- d_{pipe} Pipe Diameter *(Meter)*
- **f** Friction Factor
- **F** Force *(Newton)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **H** Head of Water above Sill of Notch *(Meter)*
- H_{ent} Total Head at Entrance *(Meter)*
- h_f Head Loss *(Meter)*
- $H_{metacentric}$ Metacentric Height *(Meter)*
- H_w Head *(Meter)*
- k_G Radius of Gyration *(Meter)*
- **L** Length *(Meter)*
- L_{pipe} Length of Pipe *(Meter)*
- **P** Power *(Watt)*
- $P_{turbine}$ Power Developed by Turbine *(Watt)*

- **Q** Discharge *(Cubic Meter per Second)*
- **q_{flow}** Rate of Flow *(Cubic Meter per Second)*
- **R_1** Radius of Curvature at Section 1 *(Meter)*
- **R_2** Radius of Curvature at Section 2 *(Meter)*
- **r_{pipe}** Pipe Radius *(Meter)*
- **Re** Reynolds Number
- **T** Time Period of Rolling *(Second)*
- **v** Velocity *(Meter per Second)*
- **V** Volumetric Flow Rate *(Cubic Meter per Second)*
- **v_1** Velocity at Section 1-1 *(Meter per Second)*
- **v_2** Velocity at Section 2-2 *(Meter per Second)*
- **v_{avg}** Average Velocity *(Meter per Second)*
- **v_{fluid}** Fluid Velocity *(Meter per Second)*
- **v_o** Volumetric Flow Rate of Feed to Reactor *(Cubic Meter per Second)*
- **V_{w1}** Velocity of Whirl at Inlet *(Meter per Second)*
- **y** Specific Weight of Liquid *(Newton per Cubic Meter)*
- **γ** Specific Weight *(Newton per Cubic Meter)*
- **Δp** Pressure Changes *(Pascal)*
- **Δv** Change in Velocity *(Meter per Second)*
- **μ** Viscous Force *(Newton)*
- **$\mu_{viscosity}$** Dynamic Viscosity *(Pascal Second)*
- **ν** Kinematic Viscosity *(Kilostokes)*
- **ρ_l** Density of Liquid *(Kilogram per Cubic Meter)*
- **τ** Torque Exerted on Wheel *(Newton Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s^2)
  Acceleration Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Dynamic Viscosity** in Pascal Second (Pa*s)
  Dynamic Viscosity Unit Conversion
- Measurement: **Kinematic Viscosity** in Kilostokes (kSt)
  Kinematic Viscosity Unit Conversion

- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion
- Measurement: **Specific Weight** in Newton per Cubic Meter (N/m^3)
  Specific Weight 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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