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Uniform Flow in Channels Formulas

Calculators! Examples! Conversions!

List of 32 Uniform Flow in Channels Formulas

Uniform Flow in Channels

Average Velocity in Uniform Flow in Channels

1) Average Velocity in Channel

Open Calculator

fx $$V_{avg} = \sqrt{8 \cdot [g] \cdot R_H \cdot \frac{S}{f}}$$

ex $$0.316891\text{m/s} = \sqrt{8 \cdot [g] \cdot 1.6\text{m} \cdot \frac{0.0004}{0.5}}$$

2) Boundary Shear Stress

Open Calculator

fx $$\zeta_0 = \gamma_l \cdot R_H \cdot S$$

ex $$6.2784\text{Pa} = 9.81\text{kN/m}^3 \cdot 1.6\text{m} \cdot 0.0004$$

3) Friction Factor given Average Velocity in Channel

Open Calculator

fx $$f = \left(8 \cdot [g] \cdot R_H \cdot \frac{S}{V_{avg}^2}\right)$$

ex $$0.490332 = \left(8 \cdot [g] \cdot 1.6\text{m} \cdot \frac{0.0004}{(0.32\text{m/s})^2}\right)$$

4) Hydraulic Radius given Average Velocity in Channel

Open Calculator

fx $$R_H = \left(\frac{V_{avg}}{\sqrt{8 \cdot [g] \cdot \frac{S}{f}}} \right)^2$$

ex $$1.631546\text{m} = \left(\frac{0.32\text{m/s}}{\sqrt{8 \cdot [g] \cdot \frac{0.0004}{0.5}}} \right)^2$$

5) Hydraulic Radius given Boundary Shear Stress

Open Calculator

fx $$R_H = \frac{\zeta_0}{\gamma_l \cdot S}$$

ex $$1.605505\text{m} = \frac{6.3\text{Pa}}{9.81\text{kN/m}^3 \cdot 0.0004}$$

6) Slope of Channel Bed given Average Velocity in Channel

Open Calculator

fx $$S = \left(\frac{V_{avg}}{\sqrt{8 \cdot [g] \cdot \frac{R_H}{f}}} \right)^2$$

ex $$0.000408 = \left(\frac{0.32\text{m/s}}{\sqrt{8 \cdot [g] \cdot \frac{1.6\text{m}}{0.5}}} \right)^2$$

7) Slope of Channel Bottom given Boundary Shear Stress

Open Calculator

$$S = \frac{\zeta_0}{\gamma_l \cdot R_H}$$

$$0.000401 = \frac{6.3\text{Pa}}{9.81\text{kN/m}^3 \cdot 1.6\text{m}}$$

8) Specific Weight of Liquid given Boundary Shear Stress

Open Calculator

$$\gamma_l = \frac{\zeta_0}{R_H \cdot S}$$

$$9.84375\text{kN/m}^3 = \frac{6.3\text{Pa}}{1.6\text{m} \cdot 0.0004}$$

9) Strickler Formula for Average Height of Roughness Protrusions

Open Calculator

$$R_a = (21 \cdot n)^6$$

$$0.256096\text{mm} = (21 \cdot 0.012)^6$$

Chezy Constant in Uniform Flow

10) Average Velocity in Channel given Chezy Constant

Open Calculator

$$V_{avg} = C \cdot \sqrt{R_H \cdot S}$$

$$1.011929\text{m/s} = 40 \cdot \sqrt{1.6\text{m} \cdot 0.0004}$$

11) Chezy Constant given Average Velocity in Channel

Open Calculator

$$C = \frac{V_{avg}}{\sqrt{R_H \cdot S}}$$

$$12.64911 = \frac{0.32\text{m/s}}{\sqrt{1.6\text{m} \cdot 0.0004}}$$

12) Chezy Constant through Ganguillet-Kutter Formula

Open Calculator

$$C = \frac{23 + \left(\frac{0.00155}{S}\right) + \left(\frac{1}{n}\right)}{1 + \left(23 + \left(\frac{0.00155}{S}\right)\right) \cdot \left(\frac{n}{\sqrt{D_{Hydraulic}}}\right)}$$

$$92.90908 = \frac{23 + \left(\frac{0.00155}{0.0004}\right) + \left(\frac{1}{0.012}\right)}{1 + \left(23 + \left(\frac{0.00155}{0.0004}\right)\right) \cdot \left(\frac{0.012}{\sqrt{3\text{m}}}\right)}$$

13) Chezy Constant using Basin Formula

Open Calculator

$$C = \frac{157.6}{1.81 + \left(\frac{K}{\sqrt{D_{Hydraulic}}}\right)}$$

$$84.38028 = \frac{157.6}{1.81 + \left(\frac{0.10}{\sqrt{3\text{m}}}\right)}$$

14) Chezy Constant using Manning's Formula

Open Calculator

$$C = \left(\frac{1}{n}\right) \cdot D_{Hydraulic}^{\frac{1}{6}}$$

$$100.0781 = \left(\frac{1}{0.012}\right) \cdot (3\mathrm{m})^{\frac{1}{6}}$$

15) Hydraulic Radius given Average Velocity in Channel with Chezy Constant

Open Calculator

$$R_H = \frac{\left(\frac{V_{avg}}{C}\right)^2}{S}$$

$$0.16\mathrm{m} = \frac{\left(\frac{0.32\mathrm{m/s}}{40}\right)^2}{0.0004}$$

16) Slope of Channel Bed given Average Velocity in Channel with Chezy Constant

Open Calculator

$$S = \frac{\left(\frac{V_{avg}}{C}\right)^2}{R_H}$$

$$4E\hat{}\text{-}5 = \frac{\left(\frac{0.32\mathrm{m/s}}{40}\right)^2}{1.6\mathrm{m}}$$

Manning's Formula in Uniform Flow

17) Manning's Coefficient using Strickler Formula

Open Calculator

$$n = \frac{R_a^{\frac{1}{6}}}{21}$$

$$0.004762 = \frac{(0.001\text{mm})^{\frac{1}{6}}}{21}$$

18) Manning's Formula for Average Velocity

Open Calculator

$$V_{avg(U)} = \left(\frac{1}{n}\right) \cdot \left(R_H^{\frac{2}{3}}\right) \cdot \left(S^{\frac{1}{2}}\right)$$

$$2.279968\text{m/s} = \left(\frac{1}{0.012}\right) \cdot \left((1.6\text{m})^{\frac{2}{3}}\right) \cdot \left((0.0004)^{\frac{1}{2}}\right)$$

19) Manning's Formula for Coefficient of Roughness given Average Velocity

Open Calculator

$$n = \left(\frac{1}{V_{avg(U)}}\right) \cdot \left(S^{\frac{1}{2}}\right) \cdot \left(R_H^{\frac{2}{3}}\right)$$

$$0.034371 = \left(\frac{1}{0.796\text{m/s}}\right) \cdot \left((0.0004)^{\frac{1}{2}}\right) \cdot \left((1.6\text{m})^{\frac{2}{3}}\right)$$

20) Manning's Formula for Hydraulic Radius given Average Velocity

Open Calculator

fx $$R_H = \left(V_{avg(U)} \cdot \frac{n}{\sqrt{S}}\right)^{\frac{3}{2}}$$

ex $$0.330063\text{m} = \left(0.796\text{m/s} \cdot \frac{0.012}{\sqrt{0.0004}}\right)^{\frac{3}{2}}$$

21) Manning's Formula for Hydraulic Radius given Chezy's Constant

Open Calculator

fx $$R_H = \left(\frac{1}{S}\right) \cdot \left(\frac{V_{avg}}{C}\right)^2$$

ex $$0.16\text{m} = \left(\frac{1}{0.0004}\right) \cdot \left(\frac{0.32\text{m/s}}{40}\right)^2$$

22) Manning's Formula for Roughness Coefficient given Chezy's Constant

Open Calculator

fx $$n = \left(\frac{1}{C}\right) \cdot D_{Hydraulic}^{\frac{1}{6}}$$

ex $$0.030023 = \left(\frac{1}{40}\right) \cdot (3\text{m})^{\frac{1}{6}}$$

23) Manning's Formula for Slope of Channel Bed given Average Velocity

Open Calculator

$$S = \left(V_{avg(U)} \cdot \frac{n}{R_H^{\frac{2}{3}}}\right)^2$$

$$4.9E\hat{}\text{-}5 = \left(0.796\text{m/s} \cdot \frac{0.012}{(1.6\text{m})^{\frac{2}{3}}}\right)^2$$

Uniform Turbulent Flow

24) Average Height of Roughness Protrusions given Chezy Constant for Rough Channels

Open Calculator

$$z_0 = 12.2 \cdot \frac{R_H}{10^{\frac{C}{18}}}$$

$$0.117019\text{m} = 12.2 \cdot \frac{1.6\text{m}}{10^{\frac{40}{18}}}$$

25) Average Height of Roughness Protrusions given Mean Velocity of flow in Rough Channels

Open Calculator

fx $$R_a = \frac{R_H}{10^{\frac{\left(\frac{V_{avg(Tur)}}{V_{shear}}\right)-6.25}{5.75}}}$$

ex $$0.000887\text{mm} = \frac{1.6\text{m}}{10^{\frac{\left(\frac{380\text{m/s}}{9\text{m/s}}\right)-6.25}{5.75}}}$$

26) Chezy Constant for Rough Channels

Open Calculator

fx $$C = 18 \cdot \log 10\left(12.2 \cdot \frac{R_H}{R_a}\right)$$

ex $$131.2286 = 18 \cdot \log 10\left(12.2 \cdot \frac{1.6\text{m}}{0.001\text{mm}}\right)$$

27) Hydraulic Radius given Chezy Constant for Rough Channels

Open Calculator

fx $$R_H = \frac{\left(10^{\frac{C}{18}}\right) \cdot R_a}{12.2}$$

ex $$1.4\text{E\^{}-5m} = \frac{\left(10^{\frac{40}{18}}\right) \cdot 0.001\text{mm}}{12.2}$$

28) Hydraulic Radius given Mean Velocity of flow in Rough Channels

Open Calculator

fx $$R_H = \left(10^{\frac{\left(\frac{V_{avg(Tur)}}{V_{shear}}\right)-6.25}{5.75}}\right) \cdot R_a$$

ex $$1.803178\text{m} = \left(10^{\frac{\left(\frac{380\text{m/s}}{9\text{m/s}}\right)-6.25}{5.75}}\right) \cdot 0.001\text{mm}$$

29) Hydraulic Radius given Mean Velocity of flow in Smooth Channels

Open Calculator

fx $$R_H = \left(10^{\frac{\left(\frac{V_{avg(Tur)}}{V_{shear}}\right)-3.25}{5.75}}\right) \cdot \left(\frac{\nu_{Tur}}{V_{shear}}\right)$$

ex $$1.931671\text{m} = \left(10^{\frac{\left(\frac{380\text{m/s}}{9\text{m/s}}\right)-3.25}{5.75}}\right) \cdot \left(\frac{0.029\text{St}}{9\text{m/s}}\right)$$

30) Kinematic Viscosity given Mean Velocity of flow in Smooth Channels

Open Calculator

fx $$\nu_{Tur} = \frac{R_H \cdot V_{shear}}{10^{\frac{\left(\frac{V_{avg(Tur)}}{V_{shear}}\right)-3.25}{5.75}}}$$

ex $$0.024021\text{St} = \frac{1.6\text{m} \cdot 9\text{m/s}}{10^{\frac{\left(\frac{380\text{m/s}}{9\text{m/s}}\right)-3.25}{5.75}}}$$

31) Mean Velocity of flow in Rough Channels

Open Calculator

fx

$$V_{avg(Tur)} = V_{shear} \cdot \left(6.25 + 5.75 \cdot \log 10 \left(\frac{R_H}{R_a} \right) \right)$$

ex

$$377.3132\text{m/s} = 9\text{m/s} \cdot \left(6.25 + 5.75 \cdot \log 10 \left(\frac{1.6\text{m}}{0.001\text{mm}} \right) \right)$$

32) Mean Velocity of flow in Smooth Channels

Open Calculator

fx

$$V_{avg(Tur)} = V_{shear} \cdot \left(3.25 + 5.75 \cdot \log 10 \left(R_H \cdot \frac{V_{shear}}{\nu_{Tur}} \right) \right)$$

ex

$$375.7662\text{m/s} = 9\text{m/s} \cdot \left(3.25 + 5.75 \cdot \log 10 \left(1.6\text{m} \cdot \frac{9\text{m/s}}{0.029\text{St}} \right) \right)$$

Variables Used

- **C** Chezy's Constant
- **$D_{Hydraulic}$** Hydraulic Depth *(Meter)*
- **f** Darcy Friction Factor
- **K** Bazin's Constant
- **n** Manning's Roughness Coefficient
- **R_a** Roughness Value *(Millimeter)*
- **R_H** Hydraulic Radius of Channel *(Meter)*
- **S** Bed Slope
- **V_{avg}** Average Velocity of Flow *(Meter per Second)*
- **$V_{avg(Tur)}$** Average Velocity of Turbulent flow *(Meter per Second)*
- **$V_{avg(U)}$** Average Velocity of Uniform Flow *(Meter per Second)*
- **V_{shear}** Shear Velocity *(Meter per Second)*
- **z_0** Roughness Height of Surface *(Meter)*
- **γ_l** Liquid Specific Weight *(Kilonewton per Cubic Meter)*
- **ζ_0** Shear Stress of Wall *(Pascal)*
- **v_{Tur}** Kinematic Viscosity of Turbulent Flow *(Stokes)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **log10**, log10(Number)
  The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.
- 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), Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Kinematic Viscosity** in Stokes (St)
  Kinematic Viscosity Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
  Specific Weight Unit Conversion

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- Impulse Momentum Equation and its Applications Formulas
- Liquids in Relative Equilibrium Formulas
- Most Efficient Section of Channel Formulas
- Non uniform Flow in Channels Formulas
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