calculatoratoz.com

unitsconverters.com

Laminar Flow of Fluid in an Open Channel Formulas

Calculators! Examples! Conversions!

List of 23 Laminar Flow of Fluid in an Open Channel Formulas

Laminar Flow of Fluid in an Open Channel

1) Bed Shear Stress

fx $$\tau = \gamma_f \cdot s \cdot d_{section}$$

Open Calculator

ex $$490.5\text{Pa} = 9.81\text{kN/m}^3 \cdot 0.01 \cdot 5\text{m}$$

2) Bed Slope given Bed Shear Stress

fx $$s = \frac{\tau}{d_{section} \cdot \gamma_f}$$

Open Calculator

ex $$0.01 = \frac{490.5\text{Pa}}{5\text{m} \cdot 9.81\text{kN/m}^3}$$

3) Diameter of Section given Bed Shear Stress

fx $$d_{section} = \frac{\tau}{s \cdot \gamma_f}$$

Open Calculator

ex $$5\text{m} = \frac{490.5\text{Pa}}{0.01 \cdot 9.81\text{kN/m}^3}$$

4) Diameter of Section given Discharge per Unit Channel Width

Open Calculator

fx $d_{section} = \left(\frac{3 \cdot \mu \cdot \nu}{s \cdot \gamma_f}\right)^{\frac{1}{3}}$

ex $4.99694\text{m} = \left(\frac{3 \cdot 10.2\text{P} \cdot 4\text{m}^2/\text{s}}{0.01 \cdot 9.81\text{kN}/\text{m}^3}\right)^{\frac{1}{3}}$

5) Diameter of Section given Mean Velocity of Flow

Open Calculator

fx $d_{section} = \frac{\left(R^2 + \left(\mu \cdot V_{mean} \cdot \frac{S}{\gamma_f}\right)\right)}{R}$

ex $11.30461\text{m} = \frac{\left((1.01\text{m})^2 + \left(10.2\text{P} \cdot 10\text{m}/\text{s} \cdot \frac{10}{9.81\text{kN}/\text{m}^3}\right)\right)}{1.01\text{m}}$

6) Diameter of Section given Potential Head Drop

Open Calculator

fx $d_{section} = \sqrt{\frac{3 \cdot \mu \cdot V_{mean} \cdot L}{\gamma_f \cdot h_L}}$

ex $4.962437\text{m} = \sqrt{\frac{3 \cdot 10.2\text{P} \cdot 10\text{m}/\text{s} \cdot 15\text{m}}{9.81\text{kN}/\text{m}^3 \cdot 1.9\text{m}}}$

7) Diameter of Section given Slope of Channel

Open Calculator

$$d_{section} = \left(\frac{\tau}{s \cdot \gamma_f}\right) + R$$

ex $$6.01\text{m} = \left(\frac{490.5\text{Pa}}{0.01 \cdot 9.81\text{kN/m}^3}\right) + 1.01\text{m}$$

8) Discharge per unit channel width

Open Calculator

$$\nu = \frac{\gamma_f \cdot s \cdot d_{section}^3}{3 \cdot \mu}$$

ex $$4.007353\text{m}^2/\text{s} = \frac{9.81\text{kN/m}^3 \cdot 0.01 \cdot (5\text{m})^3}{3 \cdot 10.2\text{P}}$$

9) Dynamic Viscosity given Discharge per Unit Channel Width

Open Calculator

$$\mu = \frac{\gamma_f \cdot s \cdot d_{section}^3}{3 \cdot \nu}$$

ex $$10.21875\text{P} = \frac{9.81\text{kN/m}^3 \cdot 0.01 \cdot (5\text{m})^3}{3 \cdot 4\text{m}^2/\text{s}}$$

10) Dynamic Viscosity given Mean Velocity of Flow in Section

Open Calculator

$$\mu = \frac{\gamma_f \cdot dh|dx \cdot \left(d_{section} \cdot R - R^2\right)}{V_{mean}}$$

ex $$10.21146\text{P} = \frac{9.81\text{kN/m}^3 \cdot 0.2583 \cdot \left(5\text{m} \cdot 1.01\text{m} - (1.01\text{m})^2\right)}{10\text{m/s}}$$

11) Length of Pipe given Potential Head Drop

Open Calculator

$$L = \frac{h_L \cdot \gamma_f \cdot \left(d_{section}^2\right)}{3 \cdot \mu \cdot V_{mean}}$$

$$15.22794\text{m} = \frac{1.9\text{m} \cdot 9.81\text{kN/m}^3 \cdot \left((5\text{m})^2\right)}{3 \cdot 10.2\text{P} \cdot 10\text{m/s}}$$

12) Mean Velocity of Flow in Section

Open Calculator

$$V_{mean} = \frac{\gamma_f \cdot dh|dx \cdot \left(d_{section} \cdot R - R^2\right)}{\mu}$$

$$10.01123\text{m/s} = \frac{9.81\text{kN/m}^3 \cdot 0.2583 \cdot \left(5\text{m} \cdot 1.01\text{m} - (1.01\text{m})^2\right)}{10.2\text{P}}$$

13) Potential Head Drop

Open Calculator

$$h_L = \frac{3 \cdot \mu \cdot V_{mean} \cdot L}{\gamma_f \cdot d_{section}^2}$$

$$1.87156\text{m} = \frac{3 \cdot 10.2\text{P} \cdot 10\text{m/s} \cdot 15\text{m}}{9.81\text{kN/m}^3 \cdot (5\text{m})^2}$$

14) Shear Stress given Slope of Channel

Open Calculator

$$\tau = \gamma_f \cdot s \cdot (d_{section} - R)$$

$$391.419\text{Pa} = 9.81\text{kN/m}^3 \cdot 0.01 \cdot (5\text{m} - 1.01\text{m})$$

15) Slope of Channel given Discharge per Unit Channel Width

Open Calculator

$$s = \frac{3 \cdot \mu \cdot \nu}{\gamma_f \cdot d_{section}^3}$$

$$0.009982 = \frac{3 \cdot 10.2\text{P} \cdot 4\text{m}^2/\text{s}}{9.81\text{kN/m}^3 \cdot (5\text{m})^3}$$

16) Slope of Channel given Mean Velocity of Flow

Open Calculator

$$S = \frac{\mu \cdot V_{mean}}{\left(d_{section} \cdot R - \frac{R^2}{2}\right) \cdot \gamma_f}$$

$$0.229024 = \frac{10.2\text{P} \cdot 10\text{m/s}}{\left(5\text{m} \cdot 1.01\text{m} - \frac{(1.01\text{m})^2}{2}\right) \cdot 9.81\text{kN/m}^3}$$

17) Slope of Channel given Shear Stress

Open Calculator

$$s = \frac{\tau}{\gamma_f \cdot (d_{section} - R)}$$

$$0.012531 = \frac{490.5\text{Pa}}{9.81\text{kN/m}^3 \cdot (5\text{m} - 1.01\text{m})}$$

Laminar Flow Through Porous Media

18) Coefficient of Permeability given Velocity

Open Calculator

fx $$k = \frac{V_{mean}}{H}$$

ex $$10\text{cm/s} = \frac{10\text{m/s}}{100}$$

19) Hydraulic Gradient given Velocity

Open Calculator

fx $$H = \frac{V_{mean}}{k}$$

ex $$100 = \frac{10\text{m/s}}{10\text{cm/s}}$$

20) Mean Velocity using Darcy's Law

Open Calculator

fx $$V_{mean} = k \cdot H$$

ex $$10\text{m/s} = 10\text{cm/s} \cdot 100$$

Lubrication Mechanics Slipper Bearing

21) Dynamic Viscosity given Pressure Gradient

Open Calculator

fx $$\mu = dp|dr \cdot \frac{h^3}{12 \cdot (0.5 \cdot V_{mean} \cdot h - Q)}$$

ex $$10.43536P = 17N/m^3 \cdot \frac{(1.81m)^3}{12 \cdot (0.5 \cdot 10m/s \cdot 1.81m - 1.000001m^3/s)}$$

22) Pressure Gradient

Open Calculator

fx $$dp|dr = \left(12 \cdot \frac{\mu}{h^3}\right) \cdot (0.5 \cdot V_{mean} \cdot h - Q)$$

ex $$16.61658N/m^3 = \left(12 \cdot \frac{10.2P}{(1.81m)^3}\right) \cdot (0.5 \cdot 10m/s \cdot 1.81m - 1.000001m^3/s)$$

23) Rate of Flow given Pressure Gradient

Open Calculator

fx $$Q = 0.5 \cdot V_{mean} \cdot h - \left(dp|dr \cdot \frac{h^3}{12 \cdot \mu}\right)$$

ex $$0.814249m^3/s = 0.5 \cdot 10m/s \cdot 1.81m - \left(17N/m^3 \cdot \frac{(1.81m)^3}{12 \cdot 10.2P}\right)$$

Variables Used

- $d_{section}$ Diameter of Section *(Meter)*
- **dh|dx** Piezometric Gradient
- **dp|dr** Pressure Gradient *(Newton per Cubic Meter)*
- **h** Height of Channel *(Meter)*
- **H** Hydraulic Gradient
- h_L Head Loss due to Friction *(Meter)*
- **k** Coefficient of Permeability *(Centimeter per Second)*
- **L** Length of Pipe *(Meter)*
- **Q** Discharge in Pipe *(Cubic Meter per Second)*
- **R** Horizontal Distance *(Meter)*
- **s** Slope of Bed
- **S** Slope of Surface of Constant Pressure
- V_{mean} Mean Velocity *(Meter per Second)*
- γ_f Specific Weight of Liquid *(Kilonewton per Cubic Meter)*
- **μ** Dynamic Viscosity *(Poise)*
- **ν** Kinematic Viscosity *(Square Meter per Second)*
- τ Shear Stress *(Pascal)*

Constants, Functions, Measurements used

- 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), Centimeter per Second (cm/s)
  Speed Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Dynamic Viscosity** in Poise (P)
  Dynamic Viscosity Unit Conversion
- Measurement: **Kinematic Viscosity** in Square Meter per Second (m^2/s)
  Kinematic Viscosity Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
  Specific Weight Unit Conversion
- Measurement: **Pressure Gradient** in Newton per Cubic Meter (N/m^3)
  Pressure Gradient Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

Check other formula lists

- Dash Pot Mechanism Formulas
- Laminar Flow around a Sphere Stokes' Law Formulas
- Laminar Flow between Parallel Flat Plates, one plate moving and other at rest, Couette Flow Formulas
- Laminar Flow between Parallel Plates, both Plates at Rest Formulas
- Laminar Flow of Fluid in an Open Channel Formulas
- Measurement of Viscosity Viscometers Formulas
- Steady Laminar Flow in Circular Pipes Formulas

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

9/30/2024 | 8:19:52 AM UTC *Please leave your feedback here...*