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Theory of Type 1 Settling Formulas

Calculators! Examples! Conversions!

List of 45 Theory of Type 1 Settling Formulas

Theory of Type 1 Settling

Coefficient of Drag

1) Coefficient of Drag for Transition Settling

Open Calculator

fx $$C_D = \left(\frac{24}{R_e}\right) + \left(\frac{3}{(R_e)^{0.5}}\right) + 0.34$$

ex $$0.387226 = \left(\frac{24}{5000}\right) + \left(\frac{3}{(5000)^{0.5}}\right) + 0.34$$

2) Coefficient of Drag for Transition Settling given Reynold Number

Open Calculator

fx $$C_{dt} = \left(\frac{18.5}{(R_e)^{0.6}}\right)$$

ex $$0.111632 = \left(\frac{18.5}{(5000)^{0.6}}\right)$$

3) Coefficient of Drag given Drag Force Offered by Fluid

Open Calculator

fx $$C_{df} = \frac{F_d}{A \cdot \rho_{water} \cdot \frac{(v)^2}{2}}$$

ex $$0.38 = \frac{76.95\text{N}}{50\text{m}^2 \cdot 1000\text{kg/m}^3 \cdot \frac{(0.09\text{m/s})^2}{2}}$$

4) Coefficient of Drag given Reynold Number

Open Calculator

fx $$C_{dr} = \frac{24}{R_e}$$

ex $$0.0048 = \frac{24}{5000}$$

5) Coefficient of Drag given Settling Velocity of Spherical Particle

Open Calculator

fx $$C_{ds} = \frac{\left(\frac{4}{3}\right) \cdot (\gamma_s - \gamma_w) \cdot D}{\rho_{water} \cdot (v_s)^2}$$

ex $$1.125926 = \frac{\left(\frac{4}{3}\right) \cdot (10\text{kN/m}^3 - 9810\text{N/m}^3) \cdot 10.0\text{m}}{1000\text{kg/m}^3 \cdot (1.5\text{m/s})^2}$$

Density of Water

6) Density of Water given Kinematic Viscosity of Water

Open Calculator

fx $$\rho_{water} = \left(\frac{\mu_{viscosity}}{\nu} \right)$$

ex $$1000\text{kg/m}^3 = \left(\frac{10.2\text{P}}{10.20\text{St}} \right)$$

Diameter of Particle

7) Diameter of Particle given Reynold Number

Open Calculator

fx $$D_p = \frac{R_p \cdot \nu}{v_s}$$

ex $$0.0136\text{m} = \frac{20 \cdot 10.20\text{St}}{1.5\text{m/s}}$$

8) Diameter of Particle given Settling Velocity for Modified Hazen's Equation

Open Calculator

fx $$D_p = \left(\frac{V_{sm}}{60.6 \cdot (G - 1) \cdot \left(\frac{(3 \cdot T) + 70}{100} \right)} \right)$$

ex $$0.009986\text{m} = \left(\frac{0.0118\text{m/s}}{60.6 \cdot (1.006 - 1) \cdot \left(\frac{(3 \cdot 85\text{K}) + 70}{100} \right)} \right)$$

9) Diameter of Particle given Settling Velocity for Organic Matter

Open Calculator

fx $$D_p = \left(\frac{v_{s(o)}}{0.12 \cdot ((3 \cdot T) + 70)} \right)$$

ex $$0.01\text{m} = \left(\frac{0.39\text{m/s}}{0.12 \cdot ((3 \cdot 85\text{K}) + 70)} \right)$$

10) Diameter of Particle given Settling Velocity for Turbulent Settling

Open Calculator

fx $$D_p = \left(\frac{V_{st}}{1.8 \cdot \sqrt{g \cdot (G - 1)}} \right)^2$$

ex $$0.009978\text{m} = \left(\frac{0.0436\text{m/s}}{1.8 \cdot \sqrt{9.8\text{m/s}^2 \cdot (1.006 - 1)}} \right)^2$$

11) Diameter of Particle given Settling Velocity of Spherical Particle

Open Calculator

fx $$D_p = \sqrt{\frac{V_{sp}}{\left(\frac{g}{18}\right) \cdot (G - 1) \cdot \left(\frac{1}{\nu}\right)}}$$

ex $$0.009996\text{m} = \sqrt{\frac{0.00032\text{m/s}}{\left(\frac{9.8\text{m/s}^2}{18}\right) \cdot (1.006 - 1) \cdot \left(\frac{1}{10.20\text{St}}\right)}}$$

12) Diameter of Particle given Settling Velocity within Transition Zone

Open Calculator

fx $$D_p = \left(\frac{(V_{s'})^{\frac{1}{0.714}}}{g \cdot (G - 1)} / \left(13.88 \cdot (\nu)^{0.6}\right)\right)^{\frac{1}{1.6}}$$

ex $$0.01938\text{m} = \left(\frac{(0.0005\text{m/s})^{\frac{1}{0.714}}}{9.8\text{m/s}^2 \cdot (1.006 - 1)} / \left(13.88 \cdot (10.20\text{St})^{0.6}\right)\right)^{\frac{1}{1.6}}$$

Drag Force

13) Area of Particle given Drag Force Offered by Fluid

Open Calculator

fx $$a_p = \frac{F_{dp}}{C_D \cdot \rho_{water} \cdot \frac{(v)^2}{2}}$$

ex $$0.493827\text{m}^2 = \frac{0.760\text{N}}{0.38 \cdot 1000\text{kg/m}^3 \cdot \frac{(0.09\text{m/s})^2}{2}}$$

14) Drag Force Offered by Fluid

Open Calculator

fx $$F_d = \left(C_D \cdot A \cdot \rho_{water} \cdot \frac{(v)^2}{2}\right)$$

ex $$76.95\text{N} = \left(0.38 \cdot 50\text{m}^2 \cdot 1000\text{kg/m}^3 \cdot \frac{(0.09\text{m/s})^2}{2}\right)$$

15) Velocity of Fall given Drag Force Offered by Fluid

Open Calculator

fx $$v = \sqrt{2 \cdot \left(\frac{F_d}{C_D \cdot A \cdot \rho_{water}}\right)}$$

ex $$0.09\text{m/s} = \sqrt{2 \cdot \left(\frac{76.95\text{N}}{0.38 \cdot 50\text{m}^2 \cdot 1000\text{kg/m}^3}\right)}$$

Effective Weight of Particle

16) Buoyancy given Effective Weight of Particle

Open Calculator

fx $$f_b = w_p - W_p$$

ex $$1.999991\text{N} = 2.00009\text{N} - 0.099\text{g}$$

17) Effective Weight of Particle

Open Calculator

fx $$W_p = \left(\left(\frac{4}{3}\right) \cdot \pi \cdot (r_p)^3\right) \cdot (\gamma_s - \gamma_w)$$

ex $$0.099484\text{g} = \left(\left(\frac{4}{3}\right) \cdot \pi \cdot (0.005\text{m})^3\right) \cdot (10\text{kN/m}^3 - 9810\text{N/m}^3)$$

18) Effective Weight of Particle given Buoyancy

Open Calculator

fx $$W_p = w_p - f_b$$

ex $$0.09\text{g} = 2.00009\text{N} - 2.0\text{N}$$

19) Radius of Particle given Effective Weight of Particle

Open Calculator

fx $$r_p = \left(\frac{W_p}{\left(\frac{4}{3}\right) \cdot \pi} \cdot (\gamma_s - \gamma_w)\right)^{\frac{1}{3}}$$

ex $$0.164981\text{m} = \left(\frac{0.099\text{g}}{\left(\frac{4}{3}\right) \cdot \pi} \cdot (10\text{kN/m}^3 - 9810\text{N/m}^3)\right)^{\frac{1}{3}}$$

20) Total Weight given Effective Weight of Particle

Open Calculator

fx $$w_p = W_p + f_b$$

ex $$2.000099\text{N} = 0.099\text{g} + 2.0\text{N}$$

21) Unit weight of Particle given Effective Weight of Particle

Open Calculator

fx $$\gamma_s = \left(\frac{W_p}{\left(\frac{4}{3}\right) \cdot \pi \cdot (r)^3} \right) + \gamma_w$$

ex $$9.81\text{kN/m}^3 = \left(\frac{0.099\text{g}}{\left(\frac{4}{3}\right) \cdot \pi \cdot (2.00\text{m})^3} \right) + 9810\text{N/m}^3$$

22) Unit Weight of Water given Effective Weight of Particle

Open Calculator

fx $$\gamma_w = \gamma_s - \left(\frac{W_p}{\left(\frac{4}{3}\right) \cdot \pi \cdot (r)^3} \right)$$

ex $$10000\text{N/m}^3 = 10\text{kN/m}^3 - \left(\frac{0.099\text{g}}{\left(\frac{4}{3}\right) \cdot \pi \cdot (2.00\text{m})^3} \right)$$

Kinematic Viscosity

23) Dynamic Viscosity given Kinematic Viscosity of Water

Open Calculator

fx $$\mu_{viscosity} = \nu \cdot \rho_{water}$$

ex $$10.2\text{P} = 10.20\text{St} \cdot 1000\text{kg/m}^3$$

24) Kinematic Viscosity of Water given Dynamic Viscosity

Open Calculator

fx $$\nu = \frac{\mu_{viscosity}}{\rho_{water}}$$

ex $$10.2\text{St} = \frac{10.2\text{P}}{1000\text{kg/m}^3}$$

25) Kinematic Viscosity of Water given Reynold Number

Open Calculator

fx $$\nu = \frac{D_p \cdot V_{sr}}{R_p}$$

ex $$10.2\text{St} = \frac{0.01\text{m} \cdot 2.04\text{m/s}}{20}$$

Reynold Number

26) Reynold Number given Coefficient of Drag

Open Calculator

fx $$R_{cd} = \frac{24}{C_D}$$

ex $$63.15789 = \frac{24}{0.38}$$

27) Reynold Number given Coefficient of Drag for Transition Settling

Open Calculator

fx $$R_t = \left(\frac{18.5}{C_D}\right)^{\frac{1}{0.6}}$$

ex $$649.1029 = \left(\frac{18.5}{0.38}\right)^{\frac{1}{0.6}}$$

28) Reynold Number given Settling Velocity of Spherical Particle

Open Calculator

fx $$R_s = \frac{v_s \cdot D}{\nu}$$

ex $$14705.88 = \frac{1.5\text{m/s} \cdot 10.0\text{m}}{10.20\text{St}}$$

Settling Velocity of Particle

29) Settling Velocity for Inorganic Solids

Open Calculator

fx $$v_{s(in)} = (D_p \cdot ((3 \cdot T) + 70))$$

ex $$3.25\text{m/s} = (0.01\text{m} \cdot ((3 \cdot 85\text{K}) + 70))$$

30) Settling Velocity for Modified Hazen's Equation

fx Open Calculator

$$V_{sm} = \left(60.6 \cdot D_p \cdot (G-1) \cdot \left(\frac{(3 \cdot T)+70}{100}\right)\right)$$

ex

$$0.011817\text{m/s} = \left(60.6 \cdot 0.01\text{m} \cdot (1.006-1) \cdot \left(\frac{(3 \cdot 85\text{K})+70}{100}\right)\right)$$

31) Settling Velocity for Organic Matter

fx Open Calculator

$$v_{s(o)} = 0.12 \cdot D_p \cdot ((3 \cdot T)+70)$$

ex

$$0.39\text{m/s} = 0.12 \cdot 0.01\text{m} \cdot ((3 \cdot 85\text{K})+70)$$

32) Settling Velocity for Turbulent Settling

fx Open Calculator

$$V_{st} = \left(1.8 \cdot \sqrt{g \cdot (G-1) \cdot D_p}\right)$$

ex

$$0.043648\text{m/s} = \left(1.8 \cdot \sqrt{9.8\text{m/s}^2 \cdot (1.006-1) \cdot 0.01\text{m}}\right)$$

33) Settling Velocity given Specific Gravity of Particle

fx Open Calculator

$$V_{sg} = \sqrt{\frac{\left(\frac{4}{3}\right) \cdot g \cdot (G-1) \cdot D_p}{C_D}}$$

ex

$$0.045422\text{m/s} = \sqrt{\frac{\left(\frac{4}{3}\right) \cdot 9.8\text{m/s}^2 \cdot (1.006-1) \cdot 0.01\text{m}}{0.38}}$$

34) Settling Velocity of Spherical Particle

Open Calculator

fx $$V_{sp} = \left(\frac{g}{18}\right) \cdot (G-1) \cdot \left(\frac{(D_p)^2}{\nu}\right)$$

ex $$0.00032\text{m/s} = \left(\frac{9.8\text{m/s}^2}{18}\right) \cdot (1.006-1) \cdot \left(\frac{(0.01\text{m})^2}{10.20\text{St}}\right)$$

35) Settling Velocity of Spherical Particle given Coefficient of Drag

Open Calculator

fx $$V_{sc} = \sqrt{\frac{\left(\frac{4}{3}\right) \cdot (\gamma_s - \gamma_w) \cdot D_p}{\rho_{water} \cdot C_D}}$$

ex $$0.08165\text{m/s} = \sqrt{\frac{\left(\frac{4}{3}\right) \cdot (10\text{kN/m}^3 - 9810\text{N/m}^3) \cdot 0.01\text{m}}{1000\text{kg/m}^3 \cdot 0.38}}$$

36) Settling Velocity of Spherical Particle given Reynold Number

Open Calculator

fx $$V_{sr} = \frac{R_p \cdot \nu}{D_p}$$

ex $$2.04\text{m/s} = \frac{20 \cdot 10.20\text{St}}{0.01\text{m}}$$

37) Settling Velocity with respect to Diameter of Particle

Open Calculator

$$V_{sd} = \left(\frac{g \cdot (G - 1) \cdot (D_p)^{1.6}}{13.88 \cdot (\nu)^{0.6}} \right)^{0.714}$$

$$0.002006\text{m/s} = \left(\frac{9.8\text{m/s}^2 \cdot (1.006 - 1) \cdot (0.01\text{m})^{1.6}}{13.88 \cdot (10.20\text{St})^{0.6}} \right)^{0.714}$$

Specific Gravity of Particle

38) Specific Gravity of Particle given Settling Velocity

Open Calculator

$$G = \frac{(v_s)^2}{\frac{\left(\frac{4}{3}\right) \cdot g \cdot D}{C_D}} + 1$$

$$1.006543 = \frac{(1.5\text{m/s})^2}{\frac{\left(\frac{4}{3}\right) \cdot 9.8\text{m/s}^2 \cdot 10.0\text{m}}{0.38}} + 1$$

39) Specific Gravity of Particle given Settling Velocity for Modified Hazen's Equation

Open Calculator

$$G = \left(\frac{v_s}{60.6 \cdot D \cdot \left(\frac{(3 \cdot T) + 70}{100} \right)} \right) + 1$$

$$1.000762 = \left(\frac{1.5 \text{m/s}}{60.6 \cdot 10.0 \text{m} \cdot \left(\frac{(3 \cdot 85 \text{K}) + 70}{100} \right)} \right) + 1$$

40) Specific Gravity of Particle given Settling Velocity of Spherical Particle

Open Calculator

$$G = \left(\frac{v_s}{\left(\frac{g}{18} \right) \cdot \left(\frac{(D)^2}{\nu} \right)} \right) + 1$$

$$1.000028 = \left(\frac{1.5 \text{m/s}}{\left(\frac{9.8 \text{m/s}^2}{18} \right) \cdot \left(\frac{(10.0 \text{m})^2}{10.20 \text{St}} \right)} \right) + 1$$

41) Specific Gravity of Particle given Settling Velocity within Transition Zone

Open Calculator

fx $$G = \left(\frac{(v_s)^{\frac{1}{0.714}}}{g \cdot (D)^{1.6}} / \left(13.88 \cdot (\nu)^{0.6} \right) \right) + 1$$

ex $$1.020317 = \left(\frac{(1.5\text{m/s})^{\frac{1}{0.714}}}{9.8\text{m/s}^2 \cdot (10.0\text{m})^{1.6}} / \left(13.88 \cdot (10.20\text{St})^{0.6} \right) \right) + 1$$

42) Specific Gravity of Particle when Settling Velocity for Turbulent Settling is Considered

Open Calculator

fx $$G_p = \left(\frac{v_s}{1.8 \cdot \sqrt{g \cdot (G-1) \cdot D}} \right)^2 + 1$$

ex $$2.181028 = \left(\frac{1.5\text{m/s}}{1.8 \cdot \sqrt{9.8\text{m/s}^2 \cdot (1.006 - 1) \cdot 10.0\text{m}}} \right)^2 + 1$$

Temperature

43) Temperature given Settling Velocity for Inorganic Solids

Open Calculator

fx $$T = \frac{\left(\frac{v_{s(in)}}{D_p} \right) - 70}{3}$$

ex $$85\text{K} = \frac{\left(\frac{3.25\text{m/s}}{0.01\text{m}} \right) - 70}{3}$$

44) Temperature given Settling Velocity for Modified Hazen's Equation

Open Calculator

$$T = \frac{\left(\left(\frac{V_{sm}}{60.6 \cdot D_p \cdot (G-1)}\right) \cdot 100\right) - 70}{3}$$

$$84.84415K = \frac{\left(\left(\frac{0.0118\text{m/s}}{60.6 \cdot 0.01\text{m} \cdot (1.006-1)}\right) \cdot 100\right) - 70}{3}$$

45) Temperature given Settling Velocity for Organic Matter

Open Calculator

$$T = \frac{\left(\frac{v_{s(o)}}{0.12 \cdot D_p}\right) - 70}{3}$$

$$85K = \frac{\left(\frac{0.39\text{m/s}}{0.12 \cdot 0.01\text{m}}\right) - 70}{3}$$

Variables Used

- **A** Area *(Square Meter)*
- **a_p** Area of Particle *(Square Meter)*
- **C_D** Coefficient of Drag
- **C_{df}** Coefficient of Drag given Drag Force
- **C_{dr}** Coefficient of Drag given Reynold Number
- **C_{ds}** Coefficient of Drag given Settling Velocity
- **C_{dt}** Coefficient of Drag for Transition Settling
- **D** Diameter *(Meter)*
- **D_p** Diameter of Particle *(Meter)*
- **f_b** Force due to Buoyancy *(Newton)*
- **F_d** Drag Force *(Newton)*
- **F_{dp}** Particle Drag Force *(Newton)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **G** Specific Gravity of Sediment
- **G_p** Specific Gravity of Particle
- **r** Radius *(Meter)*
- **R_{cd}** Reynold Number given Coefficient of Drag
- **R_e** Reynolds Number
- **r_p** Radius of Particle *(Meter)*
- **R_p** Reynolds Number of Particle
- **R_s** Reynold Number for Spherical Particle

- **R_t** Reynold Number for Transition Settling
- **T** Temperature *(Kelvin)*
- **v** Velocity of Fall *(Meter per Second)*
- **v_s** Settling Velocity *(Meter per Second)*
- **$V_{s'}$** Settling Velocity in Transition Zone *(Meter per Second)*
- **$v_{s(in)}$** Settling Velocity for Inorganic Solids *(Meter per Second)*
- **$v_{s(o)}$** Settling Velocity of Organic Solids *(Meter per Second)*
- **V_{sc}** Settling Velocity of Particle given Coeff of Drag *(Meter per Second)*
- **V_{sd}** Settling Velocity given Diameter of Particle *(Meter per Second)*
- **V_{sg}** Settling Velocity given Specific Gravity *(Meter per Second)*
- **V_{sm}** Settling Velocity for Modified Hazen's Equation *(Meter per Second)*
- **V_{sp}** Settling Velocity of Spherical Particle *(Meter per Second)*
- **V_{sr}** Settling Velocity of Particle given Reynold Number *(Meter per Second)*
- **V_{st}** Settling Velocity for Turbulent Settling *(Meter per Second)*
- **w_p** Total Weight of Particle *(Newton)*
- **W_p** Effective Weight of Particle *(Gram)*
- **γ_s** Unit Weight of Particle *(Kilonewton per Cubic Meter)*
- **γ_w** Unit Weight of Water *(Newton per Cubic Meter)*
- **$\mu_{viscosity}$** Dynamic Viscosity *(Poise)*
- **ν** Kinematic Viscosity *(Stokes)*
- **ρ_{water}** Water Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- 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: **Weight** in Gram (g)
  Weight Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area 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: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Dynamic Viscosity** in Poise (P)
  Dynamic Viscosity Unit Conversion
- Measurement: **Kinematic Viscosity** in Stokes (St)
  Kinematic Viscosity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion

- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3), Newton per Cubic Meter (N/m^3)
  Specific Weight Unit Conversion

Check other formula lists

- Design of Continuous Flow Type of Sedimentation Tank Formulas
- Efficiency of High Rate Filters Formulas
- Food to Microorganism Ratio or F to M Ratio Formulas
- Sludge Recycle and Rate of Returned Sludge Formulas
- Theory of Type 1 Settling Formulas

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