

Important Water Content of Soil and Related Formulas PDF



Formulas Examples with Units

List of 27 Important Water Content of Soil and Related Formulas

1) Bulk Unit Weight of Soil given Dry Unit Weight of Soil in Water Content Formula ↻

Formula

$$\gamma = \gamma_d \cdot (1 + w_s)$$

Example with Units

$$7.245 \text{ kg/m}^3 = 4.5 \text{ kN/m}^3 \cdot (1 + 0.61)$$

Evaluate Formula ↻

2) Dry Unit Weight of Soil given Water Content Formula ↻

Formula

$$\gamma_d = \frac{\gamma}{1 + w_s}$$

Example with Units

$$3.1056 \text{ kN/m}^3 = \frac{5 \text{ kg/m}^3}{1 + 0.61}$$

Evaluate Formula ↻

3) Dry Unit Weight of Soil given Water Content in Total Volume Formula ↻

Formula

$$\rho_d = \frac{W_t}{V \cdot (1 + w_s)}$$

Example with Units

$$3.1649 \text{ kg/m}^3 = \frac{80 \text{ kg}}{15.7 \text{ m}^3 \cdot (1 + 0.61)}$$

Evaluate Formula ↻

4) Total Volume of Soil given Water Content given Total Volume Formula ↻

Formula

$$V = \frac{W_t}{\gamma_d \cdot (1 + w_s)}$$

Example with Units

$$11.0421 \text{ m}^3 = \frac{80 \text{ kg}}{4.5 \text{ kN/m}^3 \cdot (1 + 0.61)}$$

Evaluate Formula ↻

5) Total Weight of Soil given Water Content given Total Volume Formula ↻

Formula

$$W_t = \gamma_d \cdot V \cdot (1 + w_s)$$

Example with Units

$$113.7465 \text{ kg} = 4.5 \text{ kN/m}^3 \cdot 15.7 \text{ m}^3 \cdot (1 + 0.61)$$

Evaluate Formula ↻

6) Total Weight of Soil given Water Content in Total Weight of Soil Formula ↻

Formula

$$W_t = W_s \cdot (1 + w_s)$$

Example with Units

$$113.827 \text{ kg} = 70.7 \text{ N} \cdot (1 + 0.61)$$

Evaluate Formula ↻



7) Water Content given Dry Unit Weight of Soil in Water Content Formula ↻

Formula

$$w_s = \left(\frac{\gamma}{\gamma_d} \right) - 1$$

Example with Units

$$0.1111 = \left(\frac{5 \text{ kg/m}^3}{4.5 \text{ kN/m}^3} \right) - 1$$

Evaluate Formula ↻

8) Water Content given Total Volume Formula ↻

Formula

$$w_s = \left(\frac{W_t}{V \cdot \gamma_d} \right) - 1$$

Example with Units

$$0.1323 = \left(\frac{80 \text{ kg}}{15.7 \text{ m}^3 \cdot 4.5 \text{ kN/m}^3} \right) - 1$$

Evaluate Formula ↻

9) Water Content given Total Weight of Soil Formula ↻

Formula

$$w_s = \frac{W}{W_s} - 1$$

Example with Units

$$0.6973 = \frac{120 \text{ N}}{70.7 \text{ N}} - 1$$

Evaluate Formula ↻

10) Water Content of Soil from Pycnometer Formula ↻

Formula

$$w_s = \left(\left(\left(\frac{w_2 - w_1}{w_3 - w_4} \right) \cdot \left(\frac{G - 1}{G} \right) \right) - 1 \right)$$

Example with Units

$$0.1981 = \left(\left(\left(\frac{800 \text{ g} - 125 \text{ g}}{1000 \text{ g} - 650 \text{ g}} \right) \cdot \left(\frac{2.64 - 1}{2.64} \right) \right) - 1 \right)$$

Evaluate Formula ↻

11) Water Content of Soil given Saturated Unit Weight Formula ↻

Formula

$$w_s = \left(\left(\gamma_{\text{saturated}} \cdot \frac{1 + e}{G_s \cdot \gamma_{\text{water}}} \right) - 1 \right)$$

Example with Units

$$0.1001 = \left(\left(22.0 \text{ kN/m}^3 \cdot \frac{1 + 0.3}{2.65 \cdot 9.81 \text{ kN/m}^3} \right) - 1 \right)$$

Evaluate Formula ↻

12) Water Content of Soil given Total Weight of Sample Formula ↻

Formula

$$w_s = \left(\left(\frac{W_t}{W_s} \right) - 1 \right)$$

Example with Units

$$0.1315 = \left(\left(\frac{80 \text{ kg}}{70.7 \text{ N}} \right) - 1 \right)$$

Evaluate Formula ↻



13) Water Content of Soil with respect to its Mass Formula

Formula

$$w_s = \left(\left(\frac{\sum f_i}{M_s} \right) - 1 \right)$$

Example with Units

$$0.1111 = \left(\left(\frac{4_g}{3.6_g} \right) - 1 \right)$$

Evaluate Formula 

14) Water Content with respect to Mass of Water Formula

Formula

$$w_s = \frac{M_w}{M_s}$$

Example with Units

$$0.2778 = \frac{0.001_{kg}}{3.6_g}$$

Evaluate Formula 

15) Water Content with respect to Practical Value of Water Content Formula

Formula

$$w_s = \frac{w'}{1 - w'}$$

Example

$$0.1765 = \frac{0.15}{1 - 0.15}$$

Evaluate Formula 

16) Weight of Solids given Water Content in Total Weight of Soil Formula

Formula

$$W_s = \frac{W_t}{1 + w_s}$$

Example with Units

$$49.6894_N = \frac{80_{kg}}{1 + 0.61}$$

Evaluate Formula 

17) Weight of Solids with respect to Water Content of Soil given Total Weight of Sample Formula

Formula

$$W_s = W_t \cdot \frac{100}{w_s + 100}$$

Example with Units

$$79.515_N = 80_{kg} \cdot \frac{100}{0.61 + 100}$$

Evaluate Formula 

18) Weight of Water given Practical Value of Water Content with respect to Total Weight Formula

Formula

$$W_{Water} = \frac{w' \cdot W_t}{100}$$

Example with Units

$$0.12_{kg} = \frac{0.15 \cdot 80_{kg}}{100}$$

Evaluate Formula 

19) Practical Value of Water Content Formulas

19.1) Mass of Solids given Practical Value of Water Content with respect to Mass of Solids Formula

Formula

$$M_s = M_w \cdot ((w) - 1)$$

Example with Units

$$0.79_g = 0.001_{kg} \cdot ((1.79) - 1)$$

Evaluate Formula 



19.2) Mass of Water given Practical Value of Water Content with respect to Total Mass Formula

Formula

$$M_w = \frac{w \cdot 100 \cdot \Sigma f_i}{100}$$

Example with Units

$$0.0072 \text{ kg} = \frac{1.79 \cdot 100 \cdot 4_g}{100}$$

Evaluate Formula 

19.3) Practical Value of Water Content with respect to Mass of Solids Formula

Formula

$$w = \frac{M_w}{M_w + M_s}$$

Example with Units

$$0.2174 = \frac{0.001 \text{ kg}}{0.001 \text{ kg} + 3.6_g}$$

Evaluate Formula 

19.4) Practical Value of Water Content with respect to Total Mass Formula

Formula

$$w = \frac{M_w}{W_t}$$

Example with Units

$$1.3\text{E-}5 = \frac{0.001 \text{ kg}}{80 \text{ kg}}$$

Evaluate Formula 

19.5) Practical Value of Water Content with respect to Total Weight Formula

Formula

$$w = \frac{W_{\text{Water}}}{W_t}$$

Example with Units

$$0.004 = \frac{0.32 \text{ kg}}{80 \text{ kg}}$$

Evaluate Formula 

19.6) Practical Value of Water Content with respect to Water Content Formula

Formula

$$w = \frac{w'}{1 + w'}$$

Example

$$0.1304 = \frac{0.15}{1 + 0.15}$$

Evaluate Formula 

19.7) Practical value of water content with respect to water content in percentage Formula

Formula

$$w = \frac{w'}{1 + w'}$$

Example

$$0.1304 = \frac{0.15}{1 + 0.15}$$

Evaluate Formula 

19.8) Total Mass given Practical Value of Water Content with respect to Total Mass Formula

Formula

$$W_t = \frac{M_w}{w \cdot 100}$$

Example with Units

$$5.6\text{E-}6 \text{ kg} = \frac{0.001 \text{ kg}}{1.79 \cdot 100}$$

Evaluate Formula 



19.9) Total Weight of Soil Given Practical Value of Water Content with respect to Total Weight

Formula 

Evaluate Formula 

Formula

$$W_t = \frac{W_{\text{Water}} \cdot 100}{w'}$$

Example with Units

$$213.3333 \text{ kg} = \frac{0.32 \text{ kg} \cdot 100}{0.15}$$



Variables used in list of Water Content of Soil and Related Formulas above

- **e** Void Ratio
- **G** Specific Gravity of Soil Solids
- **G_s** Specific Gravity of Soil
- **M_s** Mass of Solids (*Gram*)
- **M_w** Mass of Water (*Kilogram*)
- **V** Total Volume of Soil (*Cubic Meter*)
- **w** Water Content of Soil
- **w'** Practical Water Content
- **W** Weight of Soil (*Newton*)
- **w₁** Weight of Empty Pycnometer (*Gram*)
- **w₂** Weight of Empty Pycnometer and Moist Soil (*Gram*)
- **w₃** Weight of Empty Pycnometer, Soil and Water (*Gram*)
- **w₄** Weight of Empty Pycnometer and Water (*Gram*)
- **w_s** Water Content of Soil from Pycnometer
- **W_s** Weight of Solids (*Newton*)
- **W_t** Total Weight of Soil (*Kilogram*)
- **W_{Water}** Weight of Water (*Kilogram*)
- **γ** Bulk unit Weight (*Kilogram per Cubic Meter*)
- **Y_d** Dry Unit Weight of Soil (*Kilonewton per Cubic Meter*)
- **Y_{saturated}** Saturated Unit Weight Of Soil (*Kilonewton per Cubic Meter*)
- **Y_{water}** Unit Weight of Water (*Kilonewton per Cubic Meter*)
- **ρ_d** Dry Density (*Kilogram per Cubic Meter*)
- **Σf_i** Total Mass of Sand (*Gram*)

Constants, Functions, Measurements used in list of Water Content of Soil and Related Formulas above

- **Measurement: Weight** in Kilogram (kg), Gram (g)
Weight Unit Conversion 
- **Measurement: Volume** in Cubic Meter (m³)
Volume Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Density** in Kilogram per Cubic Meter (kg/m³)
Density Unit Conversion 
- **Measurement: Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
Specific Weight Unit Conversion 



- **Important Bearing Capacity for Strip Footing for C- Φ Soils Formulas** 
- **Important Bearing Capacity of Cohesive Soil Formulas** 
- **Important Bearing Capacity of Non-cohesive Soil Formulas** 
- **Important Bearing Capacity of Soils Formulas** 
- **Important Bearing Capacity of Soils: Meyerhof's Analysis Formulas** 
- **Important Foundation Stability Analysis Formulas** 
- **Important Atterberg Limits Formulas** 
- **Important Bearing Capacity of Soil: Terzaghi's Analysis Formulas** 
- **Important Compaction of Soil Formulas** 
- **Important Earth Moving Formulas** 
- **Important Lateral Pressure for Cohesive and Non Cohesive Soil Formulas** 
- **Important Minimum Depth of Foundation by Rankine's Analysis Formulas** 
- **Important Pile Foundations Formulas** 
- **Important Scraper Production Formulas** 
- **Important Seepage Analysis Formulas** 
- **Important Slope Stability Analysis using Bishops Method Formulas** 
- **Important Slope Stability Analysis using Culman's Method Formulas** 
- **Important Soil Origin and Its Properties Formulas** 
- **Important Specific Gravity of Soil Formulas** 
- **Important Stability Analysis of Infinite Slopes in Prism Formulas** 
- **Important Vibration Control in Blasting Formulas** 
- **Important Void Ratio of Soil Sample Formulas** 
- **Important Water Content of Soil and Related Formulas** 

Try our Unique Visual Calculators

-  **Percentage decrease** 
-  **HCF of three numbers** 
-  **Multiply fraction** 

Please SHARE this PDF with someone who needs it!



[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

7/9/2024 | 4:45:15 AM UTC

