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Quality and Characteristics of Sewage Formulas

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List of 33 Quality and Characteristics of Sewage Formulas

Quality and Characteristics of Sewage

1) Time given Organic Matter Present at Start of BOD

$$fx \quad t = - \left(\frac{1}{K_D} \right) \cdot \log_{10} \left(\frac{L_t}{L_s} \right)$$

Open Calculator 

$$ex \quad 9.912351d = - \left(\frac{1}{0.23d^{-1}} \right) \cdot \log_{10} \left(\frac{0.21mg/L}{40mg/L} \right)$$

2) Total Amount of Organic Matter Oxidised

$$fx \quad l = L_s \cdot (1 - 10^{-K_D \cdot t})$$

Open Calculator 

$$ex \quad 39.65954mg/L = 40mg/L \cdot (1 - 10^{-0.23d^{-1} \cdot 9d})$$

Biodegradable Oxygen Demand BOD


3) BOD given Dilution Factor

$$fx \quad BOD = DO \cdot \left(\frac{3}{4} \right)$$

Open Calculator 

$$ex \quad 9.375mg/L = 12.5mg/L \cdot \left(\frac{3}{4} \right)$$



4) BOD in Sewage 

$$fx \text{ BOD} = \text{DO} \cdot \left(\frac{V}{V_u} \right)$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \ 20.83333\text{mg/L} = 12.5\text{mg/L} \cdot \left(\frac{3.5\text{m}^3}{2.1\text{m}^3} \right)$$

5) BOD of Industry given Population Equivalent 

$$fx \ Q = 0.08 \cdot P$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \ 120\text{mg/L} = 0.08 \cdot 1.5$$

Deoxygenation Constant 6) Deoxygenation Constant 

$$fx \ K_D = \frac{K}{2.3}$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$ex \ 0.304348\text{d}^{-1} = \frac{0.7\text{d}^{-1}}{2.3}$$

7) De-oxygenation Constant 

$$fx \ K_D = 0.434 \cdot K$$

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

$$ex \ 0.3038\text{d}^{-1} = 0.434 \cdot 0.7\text{d}^{-1}$$



8) Deoxygenation Constant at 20 degree Celsius 

$$\text{fx } K_{D(20)} = \frac{K_{D(T)}}{1.047^{T-20}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 0.237442\text{d}^{-1} = \frac{0.15\text{d}^{-1}}{1.047^{10\text{K}-20}}$$

9) Deoxygenation Constant at given Temperature 

$$\text{fx } K_{D(T)} = K_{D(20)} \cdot (1.047)^{T-20}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)


$$\text{ex } 0.126346\text{d}^{-1} = 0.20\text{d}^{-1} \cdot (1.047)^{10\text{K}-20}$$

10) Deoxygenation Constant given Organic Matter Present at Start of BOD 

$$\text{fx } K_D = -\left(\frac{1}{t}\right) \cdot \log_{10}\left(\frac{L_t}{L_s}\right)$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 0.253316\text{d}^{-1} = -\left(\frac{1}{9\text{d}}\right) \cdot \log_{10}\left(\frac{0.21\text{mg/L}}{40\text{mg/L}}\right)$$

11) Deoxygenation Constant given Total Amount of Organic Matter Oxidised 

$$\text{fx } K_D = -\left(\frac{1}{t}\right) \cdot \log_{10}\left(1 - \left(\frac{Y_t}{L_s}\right)\right)$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$\text{ex } 0.044216\text{d}^{-1} = -\left(\frac{1}{9\text{d}}\right) \cdot \log_{10}\left(1 - \left(\frac{24\text{mg/L}}{40\text{mg/L}}\right)\right)$$



DO Consumed

12) DO Consumed by Diluted Sample given BOD in Sewage

$$\text{fx } \text{DO} = \left(\text{BOD} \cdot \frac{V_u}{V} \right)$$

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9_img.jpg\)](#)

$$\text{ex } 12\text{mg/L} = \left(20\text{mg/L} \cdot \frac{2.1\text{m}^3}{3.5\text{m}^3} \right)$$

Organic Matter

13) Organic Matter Present at Start of BOD

$$\text{fx } L = \frac{L_t}{10^{-K_D \cdot t}}$$

[Open Calculator !\[\]\(6bb0e4f14c4133b37d2887cb37e67ddd_img.jpg\)](#)

$$\text{ex } 24.67285\text{mg/L} = \frac{0.21\text{mg/L}}{10^{-0.23\text{d}^{-1} \cdot 9\text{d}}}$$

14) Organic Matter Present at Start of BOD given Total Amount of Organic Matter Oxidised

$$\text{fx } L = \frac{Y_t}{1 - 10^{-K_D \cdot t}}$$

[Open Calculator !\[\]\(799877f5c2f906134441300079881630_img.jpg\)](#)

$$\text{ex } 24.20603\text{mg/L} = \frac{24\text{mg/L}}{1 - 10^{-0.23\text{d}^{-1} \cdot 9\text{d}}}$$



Oxygen Equivalent

15) Constant of Integration given Oxygen Equivalent

$$\text{fx } c = \log(L_t, e) + (K \cdot t)$$

[Open Calculator !\[\]\(950a62bbddad88d64435fd35607dfc42_img.jpg\)](#)

$$\text{ex } 6.181914 = \log(0.21\text{mg/L}, e) + (0.7\text{d}^{-1} \cdot 9\text{d})$$

16) Oxygen Equivalent given Organic Matter Present at Start of BOD

$$\text{fx } L_t = L_s \cdot 10^{-K_D \cdot t}$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

$$\text{ex } 0.340455\text{mg/L} = 40\text{mg/L} \cdot 10^{-0.23\text{d}^{-1} \cdot 9\text{d}}$$

PH of Sewage

17) pH value of Sewage

$$\text{fx } \text{pH} = -\log_{10}(\text{H}^+)$$

[Open Calculator !\[\]\(aab88c0d099e5d18d6533a97b13ec28d_img.jpg\)](#)

$$\text{ex } -4.39794 = -\log_{10}(25\text{mol/L})$$

Population Equivalent

18) Population Equivalent

$$\text{fx } P = \frac{Q}{0.08}$$

[Open Calculator !\[\]\(f9f168a9979beed8b01f8750d577d508_img.jpg\)](#)

$$\text{ex } 1.4625 = \frac{117\text{mg/L}}{0.08}$$



19) Population Equivalent given standard BOD of Industrial Sewage

$$fx \quad P = \frac{Q}{D}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 1.5 = \frac{117\text{mg/L}}{78\text{mg/L}}$$

Rate Constant

20) Rate Constant given Deoxygenation Constant

$$fx \quad K = 2.3 \cdot K_D$$

[Open Calculator !\[\]\(3cb60d42b10e53f9522bb0b392c1c4cd_img.jpg\)](#)

$$ex \quad 0.529\text{d}^{-1} = 2.3 \cdot 0.23\text{d}^{-1}$$

21) Rate Constant given De-oxygenation Constant

$$fx \quad K = \frac{K_D}{0.434}$$

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

$$ex \quad 0.529954\text{d}^{-1} = \frac{0.23\text{d}^{-1}}{0.434}$$

22) Rate Constant given Oxygen Equivalent

$$fx \quad K_h = \frac{c - \log(L_t, e)}{t}$$

[Open Calculator !\[\]\(683dba75afe26e28cd4de5730b776760_img.jpg\)](#)

$$ex \quad 9E^{-6}\text{Hz} = \frac{6.9 - \log(0.21\text{mg/L}, e)}{9\text{d}}$$



Relative Stability

23) Period of Incubation given Relative Stability

$$\text{fx } t = \frac{\ln\left(1 - \left(\frac{\%S}{100}\right)\right)}{\ln(0.794)}$$

[Open Calculator !\[\]\(96cc62f861fdd6e50510c0224a756dff_img.jpg\)](#)

$$\text{ex } 16.95926\text{d} = \frac{\ln\left(1 - \left(\frac{98}{100}\right)\right)}{\ln(0.794)}$$

24) Period of Incubation given Relative Stability at 37 degree Celsius

$$\text{fx } t = \frac{\ln\left(1 - \left(\frac{\%S}{100}\right)\right)}{\ln(0.630)}$$

[Open Calculator !\[\]\(f95dab70c751fda7d824b8b03650f7aa_img.jpg\)](#)

$$\text{ex } 8.466932\text{d} = \frac{\ln\left(1 - \left(\frac{98}{100}\right)\right)}{\ln(0.630)}$$

25) Relative Stability

$$\text{fx } \%S = 100 \cdot \left(1 - (0.794)^t\right)$$

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c_img.jpg\)](#)

$$\text{ex } 87.45749 = 100 \cdot \left(1 - (0.794)^{9\text{d}}\right)$$



26) Relative Stability at 37 Degree Celsius

$$\text{fx } \%S = 100 \cdot (1 - (0.63)^t)$$

[Open Calculator !\[\]\(c3d993ca47bfe2a953c700506ce31fa0_img.jpg\)](#)

$$\text{ex } 98.43662 = 100 \cdot (1 - (0.63)^{9d})$$

Standard BOD

27) Standard BOD of Domestic Sewage given Standard BOD of Industrial Sewage

$$\text{fx } D = \frac{Q}{P}$$

[Open Calculator !\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#)

$$\text{ex } 78\text{mg/L} = \frac{117\text{mg/L}}{1.5}$$

28) Standard BOD of Industrial Sewage

$$\text{fx } Q = D \cdot P$$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

$$\text{ex } 117\text{mg/L} = 78\text{mg/L} \cdot 1.5$$



Threshold Odour Number

29) Threshold Odour Number

$$\text{fx } T_o = V_s + \frac{V_D}{V_s}$$

[Open Calculator !\[\]\(339a16584d5da0f0a3ca4e9ec17bf6a1_img.jpg\)](#)

$$\text{ex } 12.4 = 2.2\text{m}^3 + \frac{22.44\text{m}^3}{2.2\text{m}^3}$$

30) Volume of Distilled Water given Threshold Odour Number

$$\text{fx } V_D = (T_o - 1) \cdot V_s$$

[Open Calculator !\[\]\(6059a5aa8b4ca7bb793408023d6c6e42_img.jpg\)](#)

$$\text{ex } 22.44\text{m}^3 = (11.2 - 1) \cdot 2.2\text{m}^3$$

31) Volume of Sewage given Threshold Odour Number

$$\text{fx } V_s = \frac{V_D}{T_o - 1}$$

[Open Calculator !\[\]\(e3275251d0893157c3584e20c81dc3ba_img.jpg\)](#)

$$\text{ex } 2.2\text{m}^3 = \frac{22.44\text{m}^3}{11.2 - 1}$$



Volume of Sample

32) Volume of Diluted Sample given BOD in Sewage

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{fx } V = \text{BOD} \cdot \frac{V_u}{\text{DO}}$$

$$\text{ex } 3.36\text{m}^3 = 20\text{mg/L} \cdot \frac{2.1\text{m}^3}{12.5\text{mg/L}}$$

33) Volume of Undiluted Sample given BOD in Sewage

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{fx } V_u = \text{DO} \cdot \frac{V}{\text{BOD}}$$

$$\text{ex } 2.1875\text{m}^3 = 12.5\text{mg/L} \cdot \frac{3.5\text{m}^3}{20\text{mg/L}}$$



Variables Used








- **%S** Relative Stability
- **BOD** BOD (Milligram per Liter)
- **c** Integration Constant
- **D** BOD of Domestic Sewage (Milligram per Liter)
- **DO** DO Consumed (Milligram per Liter)
- **H⁺** Concentration of Hydrogen Ion (Mole per Liter)
- **K** Rate Constant in BOD (1 Per Day)
- **K_D** Deoxygenation Constant (1 Per Day)
- **K_{D(20)}** Deoxygenation Constant at Temperature 20 (1 Per Day)
- **K_{D(T)}** Deoxygenation Constant at Temperature T (1 Per Day)
- **K_h** Rate Constant (Hertz)
- **I** Organic Matter (Milligram per Liter)
- **L** Organic Matter at Start (Milligram per Liter)
- **L_s** Organic Matter at Start s (Milligram per Liter)
- **L_t** Oxygen Equivalent (Milligram per Liter)
- **P** Population Equivalent
- **pH** Negative Log of Hydronium Concentration
- **Q** BOD of Industrial Sewage (Milligram per Liter)
- **t** Time in Days (Day)
- **T** Temperature (Kelvin)
- **T_o** Threshold Odor Number
- **V** Volume of Diluted Sample (Cubic Meter)



- V_D Volume of Distilled Water (Cubic Meter)
- V_S Volume of Sewage (Cubic Meter)
- V_u Volume of Undiluted Sample (Cubic Meter)
- Y_t Organic Matter Oxidised (Milligram per Liter)























Constants, Functions, Measurements used

- **Constant:** **e**, 2.71828182845904523536028747135266249
Napier's constant
- **Function:** **ln**, $\ln(\text{Number})$
The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- **Function:** **log**, $\log(\text{Base}, \text{Number})$
Logarithmic function is an inverse function to exponentiation.
- **Function:** **log10**, $\log_{10}(\text{Number})$
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.
- **Measurement:** **Time** in Day (d)
Time Unit Conversion 
- **Measurement:** **Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement:** **Volume** in Cubic Meter (m^3)
Volume Unit Conversion 
- **Measurement:** **Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement:** **Molar Concentration** in Mole per Liter (mol/L)
Molar Concentration Unit Conversion 
- **Measurement:** **Density** in Milligram per Liter (mg/L)
Density Unit Conversion 
- **Measurement:** **First Order Reaction Rate Constant** in 1 Per Day (d^{-1})
First Order Reaction Rate Constant Unit Conversion 



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