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Distribution Ratio and Length of Column Formulas

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List of 15 Distribution Ratio and Length of Column Formulas

Distribution Ratio and Length of Column

1) Change in Retention Time given Half of Average Width of Peaks

$$\text{fx } \Delta t_{r_H} = \frac{R \cdot w_{1/2av}}{0.589}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 112.0543s = \frac{11 \cdot 6s}{0.589}$$

2) Change in Retention Time given Resolution and Average Width of Peak

$$\text{fx } \Delta t_{r_RandW} = (R \cdot w_{av})$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 44s = (11 \cdot 4s)$$

3) Change in Retention Volume given Resolution and Average Width of Peak

$$\text{fx } \Delta V_{r_RandW} = (R \cdot w_{av})$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 733333.3mL = (11 \cdot 4s)$$



4) Column Length given Number of Theoretical Plates

$$fx \quad L_c = (N \cdot H)$$

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

$$ex \quad 120m = (10 \cdot 12m)$$

5) Column Length given Number of Theoretical Plates and Standard Deviation

$$fx \quad L_c = \sigma \cdot (\sqrt{N})$$

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

$$ex \quad 129.1158m = 40.83 \cdot (\sqrt{10})$$

6) Column Length given Number of Theoretical Plates and Width of Peak

$$fx \quad L_{cl} = \left(\frac{W_{NandL}}{4} \right) \cdot (\sqrt{N})$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 9.882118m = \left(\frac{12.5}{4} \right) \cdot (\sqrt{10})$$

7) Column Length given Standard Deviation and Plate Height

$$fx \quad L_c = \frac{(\sigma)^2}{H}$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 138.9241m = \frac{(40.83)^2}{12m}$$



8) Distribution Ratio 

$$fx \quad D_{\text{actual}} = \left(\frac{C_o}{C_{\text{aq}}} \right)$$

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


$$ex \quad 1.25 = \left(\frac{50\text{mol/L}}{40\text{mol/L}} \right)$$

9) Distribution Ratio of Solute A given Separation Factor 

$$fx \quad D_{\text{RA}} = (\beta \cdot D_{\text{B}})$$

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

$$ex \quad 182 = (7 \cdot 26)$$

10) Distribution Ratio of Solute B given Separation Factor 

$$fx \quad D_{\text{RB}} = \left(\frac{D_{\text{A}}}{\beta} \right)$$

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

$$ex \quad 7.428571 = \left(\frac{52}{7} \right)$$

11) Plate Height given Standard Deviation and Length of Column 

$$fx \quad H_{\text{SD}} = \frac{(\sigma)^2}{L}$$

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

$$ex \quad 168.3928\text{m} = \frac{(40.83)^2}{9.9\text{m}}$$



12) Separation Factor of two solutes A and B

$$fx \quad \beta_{sp} = \left(\frac{D_A}{D_B} \right)$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 2 = \left(\frac{52}{26} \right)$$

13) Standard Deviation given Length of Column and Number of Theoretical Plates

$$fx \quad \sigma_{L \text{ and } N} = \frac{L}{\sqrt{N}}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$ex \quad 3.130655 = \frac{9.9m}{\sqrt{10}}$$

14) Standard Deviation given Plate Height and Length of Column

$$fx \quad \sigma_{H \text{ and } L} = \sqrt{H \cdot L}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 10.89954 = \sqrt{12m \cdot 9.9m}$$

15) Width of Peak given Number of Theoretical Plates and Length of Column

$$fx \quad W_{N \text{ and } L} = \frac{4 \cdot L}{\sqrt{N}}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$ex \quad 12.52262 = \frac{4 \cdot 9.9m}{\sqrt{10}}$$



Variables Used





- C_{aq} Concentration in Aqueous Phase (Mole per Liter)
- C_o Concentration in Organic Phase (Mole per Liter)
- D_A Distribution Ratio of Solute A
- D_{actual} Actual Distribution Ratio
- D_B Distribution Ratio of Solute B
- D_{RA} Distribution Ratio A
- D_{RB} Distribution Ratio B
- H Plate Height (Meter)
- H_{SD} Plate Height given SD (Meter)
- L Length of Column (Meter)
- L_c Chromatographic Column Length (Meter)
- L_{cl} Chromatographic Column Length given NP and WP (Meter)
- N Number of Theoretical Plates
- R Resolution
- $w_{1/2av}$ Half of Average Width of Peaks (Second)
- w_{av} Average Width of Peaks (Second)
- w_{NandL} Width of Peak N and L
- β Separation Factor
- β_{sp} Separation Factor A and B
- Δt_{r_H} Change in Retention Time given H (Second)
- $\Delta t_{r_{RandW}}$ Change in Retention Time given R and W (Second)



- ΔV_{r_RandW} Change in retention volume given Rand W (Milliliter)
- σ Standard Deviation
- σ_{HandL} Standard Deviation given H and L
- σ_{LandN} Standard Deviation given L and N



Constants, Functions, Measurements used

- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Time** in Second (s)
Time Unit Conversion 
- **Measurement:** **Volume** in Milliliter (mL)
Volume Unit Conversion 
- **Measurement:** **Molar Concentration** in Mole per Liter (mol/L)
Molar Concentration Unit Conversion 



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