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Number of Theoretical Plates and Capacity Factor Formulas

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List of 15 Number of Theoretical Plates and Capacity Factor Formulas

Number of Theoretical Plates and Capacity Factor ⤴

1) Capacity Factor given Partition Coefficient and Volume of Mobile and Stationary Phase ⤴

Open Calculator ⤴

fx $$k^{c'1} = K \cdot \left(\frac{V_s}{V_{\text{mobile phase}}} \right)$$

ex $$56 = 40 \cdot \left(\frac{7L}{5L} \right)$$

2) Capacity Factor given Retention Time and Mobile Phase Travel Time ⤴

Open Calculator ⤴

fx $$k^{'\text{compound}} = \frac{t_r - t_m}{t_m}$$

ex $$1.708333 = \frac{13s - 4.8s}{4.8s}$$

3) Capacity Factor given Retention Volume and Unretained Volume ⤴

Open Calculator ⤴

fx $$k^{'\text{compound}} = \frac{V_R - V_m}{V_m}$$

ex $$1.731707 = \frac{11.2L - 4.1L}{4.1L}$$

4) Capacity Factor given Stationary Phase and Mobile Phase

Open Calculator

$$fx \quad k' = \frac{C_s \cdot V_s}{C_m \cdot V_{\text{mobile phase}}}$$

$$ex \quad 2.333333 = \frac{10\text{mol/L} \cdot 7\text{L}}{6\text{mol/L} \cdot 5\text{L}}$$

5) Capacity Factor of Solute 1 given Relative Retention

Open Calculator

$$fx \quad k^{1'} = \left(\frac{k2'}{\alpha}\right)$$

$$ex \quad 0.388889 = \left(\frac{3.5}{9}\right)$$

6) Capacity Factor of Solute 2 given Relative Retention

Open Calculator

$$fx \quad k^{2'} = \left(\alpha \cdot k1'\right)$$

$$ex \quad 22.5 = (9 \cdot 2.5)$$

7) Height of Column given Number of Theoretical Plates

Open Calculator

$$fx \quad H_{TP} = \left(\frac{L}{N}\right)$$

$$ex \quad 2.2\text{m} = \left(\frac{22\text{m}}{10}\right)$$

8) Number of Theoretical Plates given Length and Height of Column ⎘

Open Calculator ⎘

$$fx \quad N_{LandH} = \left(\frac{L}{H} \right)$$

$$ex \quad 1.833333 = \left(\frac{22m}{12m} \right)$$

9) Number of Theoretical Plates given Length of Column and Standard Deviation ⎘

Open Calculator ⎘

$$fx \quad N_{LandSD} = \frac{(L)^2}{(\sigma)^2}$$

$$ex \quad 0.290326 = \frac{(22m)^2}{(40.83)^2}$$

10) Number of Theoretical Plates given Length of Column and Width of Peak ⎘

Open Calculator ⎘

$$fx \quad N_{LandW} = \frac{16 \cdot \left((L)^2 \right)}{(w)^2}$$

$$ex \quad 805.8273 = \frac{16 \cdot \left((22m)^2 \right)}{(3.1s)^2}$$

11) Number of Theoretical Plates given Resolution and Separation Factor 🔗

Open Calculator 🗗

$$fx \quad N_{RandSF} = \frac{(4 \cdot R)^2}{(\beta - 1)^2}$$

$$ex \quad 53.77778 = \frac{(4 \cdot 11)^2}{(7 - 1)^2}$$

12) Number of Theoretical Plates given Retention Time and Half Width of Peak 🔗

Open Calculator 🗗

$$fx \quad N_{RTandHP} = \frac{5.55 \cdot (t_r)^2}{\left(w_{1/2av}\right)^2}$$

$$ex \quad 26.05417 = \frac{5.55 \cdot (13s)^2}{(6s)^2}$$

13) Number of Theoretical Plates given Retention Time and Standard Deviation 🔗

Open Calculator 🗗

$$fx \quad N_{RTandSD} = \frac{(t_r)^2}{(\sigma)^2}$$

$$ex \quad 0.101374 = \frac{(13s)^2}{(40.83)^2}$$

14) Number of Theoretical Plates given Retention Time and Width of Peak 🔗

Open Calculator 🔗

$$fx \quad N_{RTandWP} = \frac{16 \cdot \left((t_r)^2 \right)}{(w)^2}$$

$$ex \quad 281.3736 = \frac{16 \cdot \left((13s)^2 \right)}{(3.1s)^2}$$

15) Separation Factor given Resolution and Number of Theoretical Plates 🔗

Open Calculator 🔗

$$fx \quad \beta_{TP} = \left(\left(\frac{4 \cdot R}{\sqrt{N}} \right) + 1 \right)$$

$$ex \quad 14.91402 = \left(\left(\frac{4 \cdot 11}{\sqrt{10}} \right) + 1 \right)$$

Variables Used

- C_m Concentration of Mobile Phase *(Mole per Liter)*

- C_s Concentration of Stationary Phase *(Mole per Liter)*

- H Plate Height *(Meter)*

- H_{TP} Plate Height given TP *(Meter)*

- K Partition Coefficient

- k' Capacity Factor

- $k^{1'}$ Capacity Factor of 1

- $k^{2'}$ Capacity Factor of 2

- $k^{c'1}$ Capacity Factor given partition Coeff

- $k'^{compound}$ Capacity Factor of the Compound

- $k1'$ Capacity Factor of Solute 1

- $k2'$ Capacity Factor of Solute 2

- L Length of Column *(Meter)*

- N Number of Theoretical Plates

- N_{LandH} Number of Theoretical Plates given L and H

- N_{LandSD} Number of Theoretical Plates given L and SD

- N_{LandW} Number of Theoretical Plates given L and W

- N_{RandSF} Number of Theoretical Plates given R and SF

- $N_{RTandHP}$ Number of Theoretical Plates given RT and HP

- $N_{RTandSD}$ Number of Theoretical Plates given RT and SD

- $N_{RTandWP}$ Number of Theoretical Plates given RT and WP
- R Resolution
- t_m Unretained Solute Travel Time *(Second)*
- t_r Retention Time *(Second)*
- V_m Unretained Mobile Phase Volume *(Liter)*
- $V_{mobile\ phase}$ Volume of Mobile Phase *(Liter)*
- V_R Retention Volume *(Liter)*
- V_s Volume of Stationary Phase *(Liter)*
- w Width of Peak *(Second)*
- $w_{1/2av}$ Half of Average Width of Peaks *(Second)*
- α Relative Retention
- β Separation Factor
- β_{TP} Separation Factor given TP
- σ Standard Deviation

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 Liter (L)
  Volume Unit Conversion ⬈
- Measurement: **Molar Concentration** in Mole per Liter (mol/L)
  Molar Concentration Unit Conversion ⬈

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