Important Number of Theoretical Plates and Capacity Factor Formulas PDF

Formulas
Examples
with Units

List of 15
Important Number of Theoretical Plates and Capacity Factor Formulas

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

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

$$k'_{compound} = \frac{t_r - t_m}{t_m}$$

Example with Units

$$1.7083 = \frac{13\,\text{s} - 4.8\,\text{s}}{4.8\,\text{s}}$$

3) Capacity Factor given Retention Volume and Unretained Volume Formula

Evaluate Formula

Formula

$$k'_{compound} = \frac{V_R - V_m}{V_m}$$

Example with Units

$$1.7317 = \frac{11.2\,\text{L} - 4.1\,\text{L}}{4.1\,\text{L}}$$

4) Capacity Factor given Stationary Phase and Mobile Phase Formula

Evaluate Formula

Formula

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

Example with Units

$$2.3333 = \frac{10\,\text{mol/L} \cdot 7\,\text{L}}{6\,\text{mol/L} \cdot 5\,\text{L}}$$

5) Capacity Factor of Solute 1 given Relative Retention Formula

Evaluate Formula

Formula

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

Example

$$0.3889 = \left(\frac{3.5}{9} \right)$$

6) Capacity Factor of Solute 2 given Relative Retention Formula

Evaluate Formula

Formula

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

Example

$$22.5 = \left(9 \cdot 2.5 \right)$$

7) Height of Column given Number of Theoretical Plates Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$1.8333 = \left(\frac{22\,\text{m}}{12\,\text{m}} \right)$$

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

Evaluate Formula

Formula

$$N_{LandSD} = \frac{\left(L \right)^2}{\left(\sigma \right)^2}$$

Example with Units

$$0.2903 = \frac{\left(22\,\text{m} \right)^2}{\left(40.83 \right)^2}$$

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

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example

$$53.7778 = \frac{\left(4 \cdot 11 \right)^2}{\left(7 - 1 \right)^2}$$

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

Evaluate Formula

Formula

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

Example with Units

$$26.0542 = \frac{5.55 \cdot \left(13\,\text{s} \right)^2}{\left(6\,\text{s} \right)^2}$$

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

Evaluate Formula

Formula

$$N_{RTandSD} = \frac{\left(t_r\right)^2}{\left(\sigma\right)^2}$$

Example with Units

$$0.1014 = \frac{\left(13\,s\right)^2}{\left(40.83\right)^2}$$

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

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example

$$14.914 = \left(\left(\frac{4 \cdot 11}{\sqrt{10}}\right) + 1\right)$$

Variables used in list of Number of Theoretical Plates and Capacity Factor Formulas above

- 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)*

Constants, Functions, Measurements used in list of Number of Theoretical Plates and Capacity Factor Formulas above

- Functions: **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: **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

- 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

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