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

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

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

Open Calculator

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

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

3) Capacity Factor given Retention Volume and Unretained Volume

Open Calculator

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

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

4) Capacity Factor given Stationary Phase and Mobile Phase

Open Calculator

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

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

5) Capacity Factor of Solute 1 given Relative Retention

Open Calculator

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

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

6) Capacity Factor of Solute 2 given Relative Retention

Open Calculator

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

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

7) Height of Column given Number of Theoretical Plates

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

11) Number of Theoretical Plates given Resolution and Separation Factor

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

15) Separation Factor given Resolution and Number of Theoretical Plates

Open Calculator

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

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

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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