Chromatographic Figures of Merit

Agilent Technologies

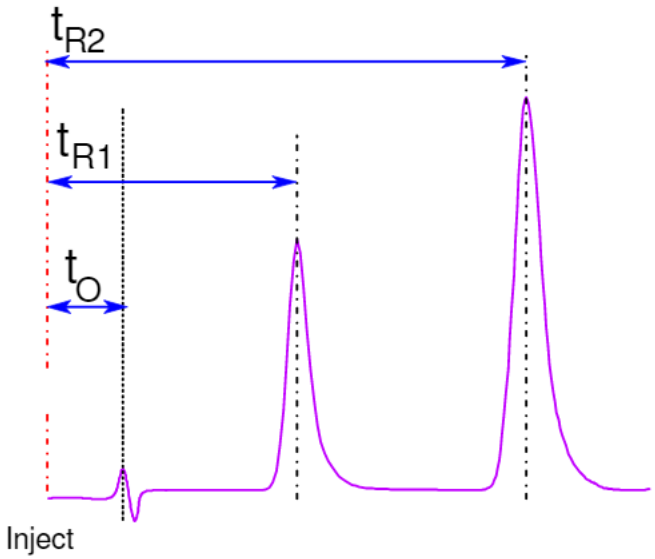
In This Section, We Will Discuss:

- The relevance and use of capacity factor
- The calculation of efficiency or plate number
- How to calculate the resolution between two chromatographic peaks
- Peak symmetry

NOTE: You will need a hard copy of the chromatogram and report from the last laboratory exercise.

Capacity Factor and Relative Retention

- **Capacity factor** is characteristic of a specific compound at a given mobile phase composition, temperature, and column type.
- **Capacity factor** is equal to the number of moles in the stationary phase divided by the number of moles n the mobile phase.



Capacity Factor

$$k' = \frac{t_R - t_o}{t_o}$$

Relative Retention

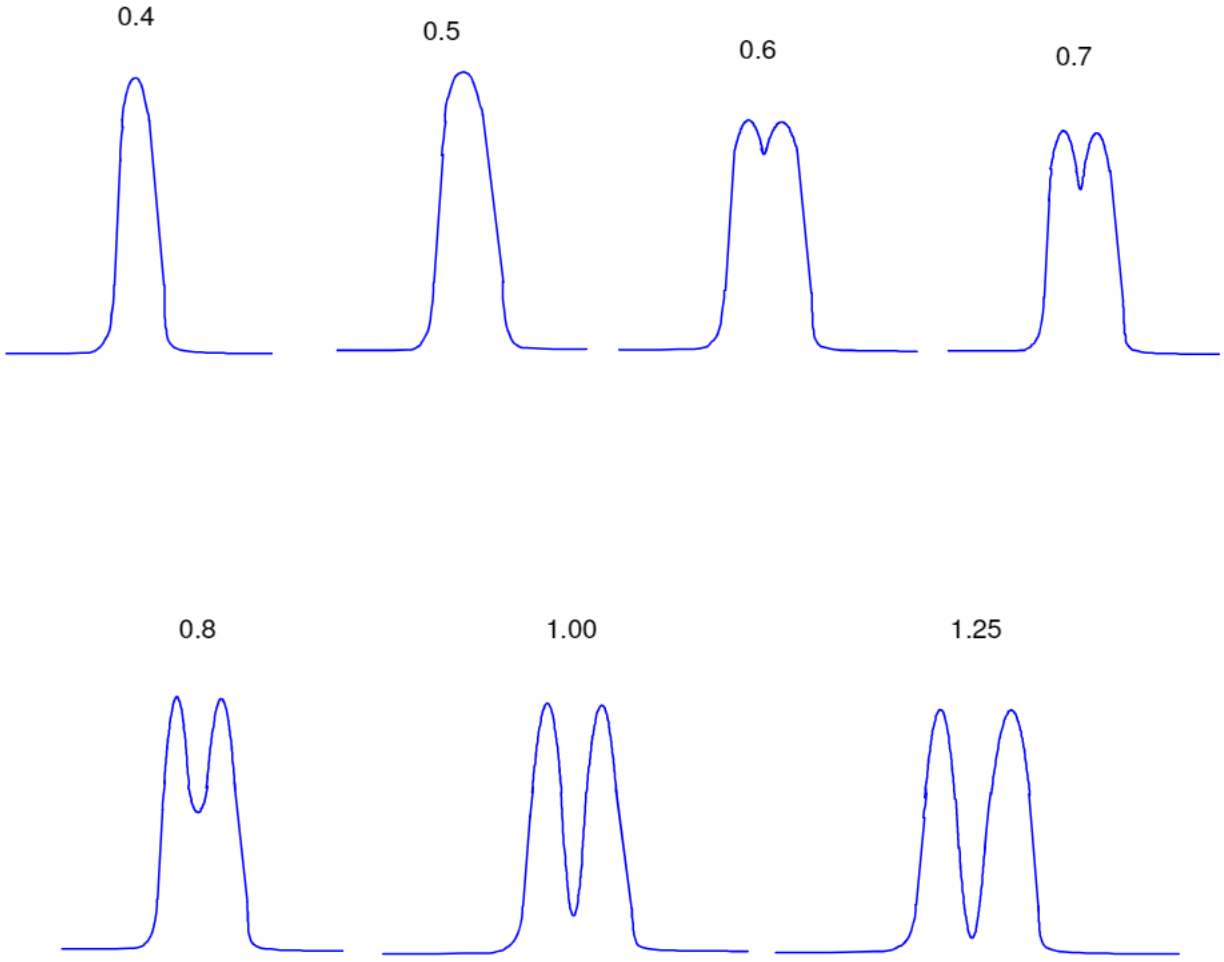
$$t'_R = t_R - t_o$$

Calculate Capacity Factor

Capacity Factor is independent of flow rate making day-to-day fluctuations less troublesome

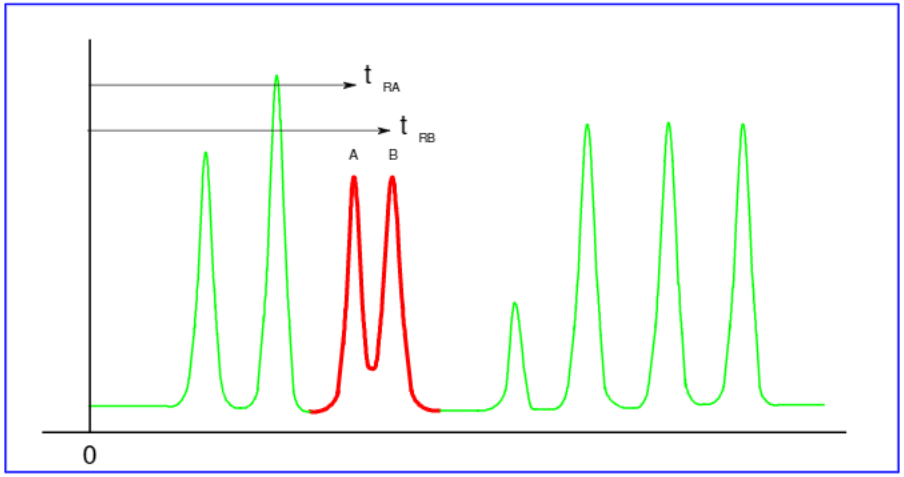
Calculate the capacity factor for the third major peak in your chromatogram.

Resolution



For equal peak areas, R of 1.5 gives baseline separation

Calculate Resolution



R - resolution

t_{RB}- retention time of component B

t_{RA}- retention time of component A

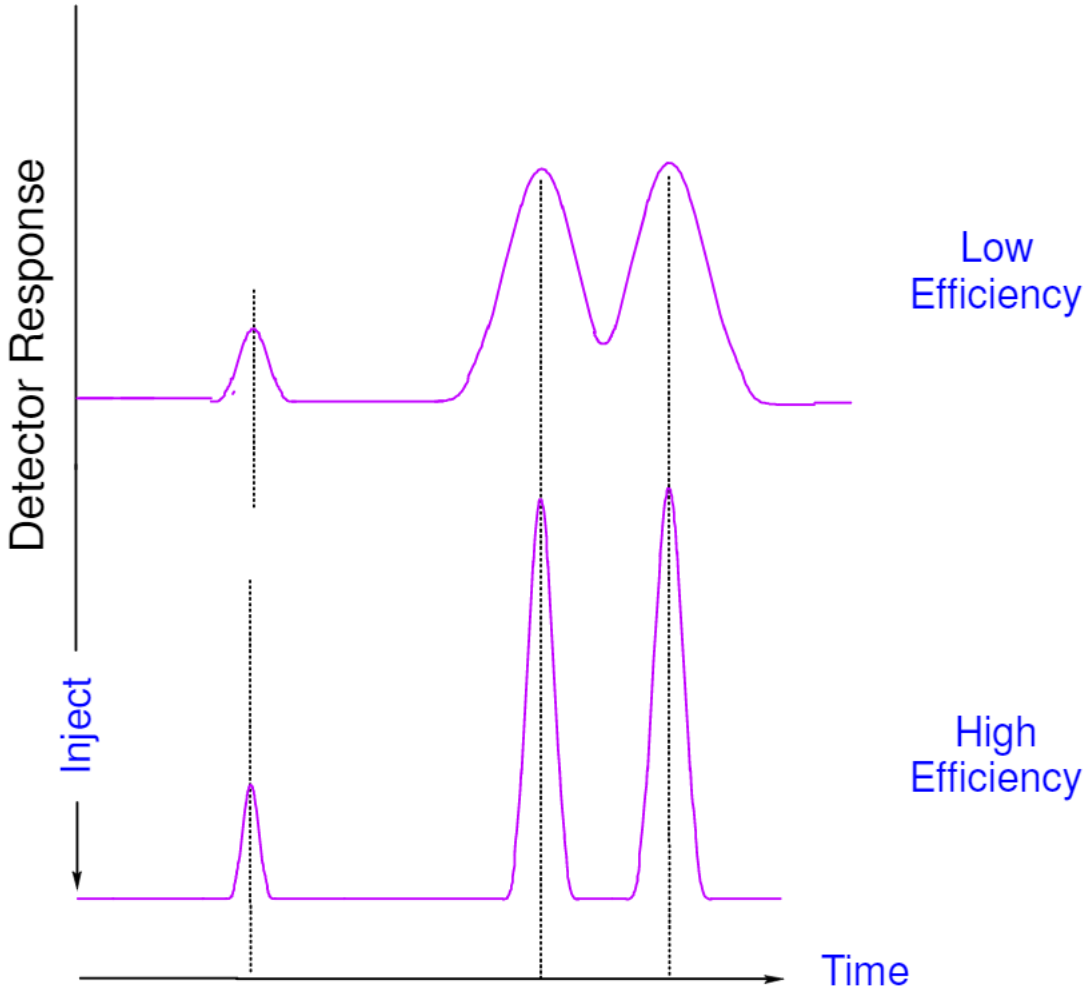
w - width at base of peak

$w_{1/2}$ - width at half-height

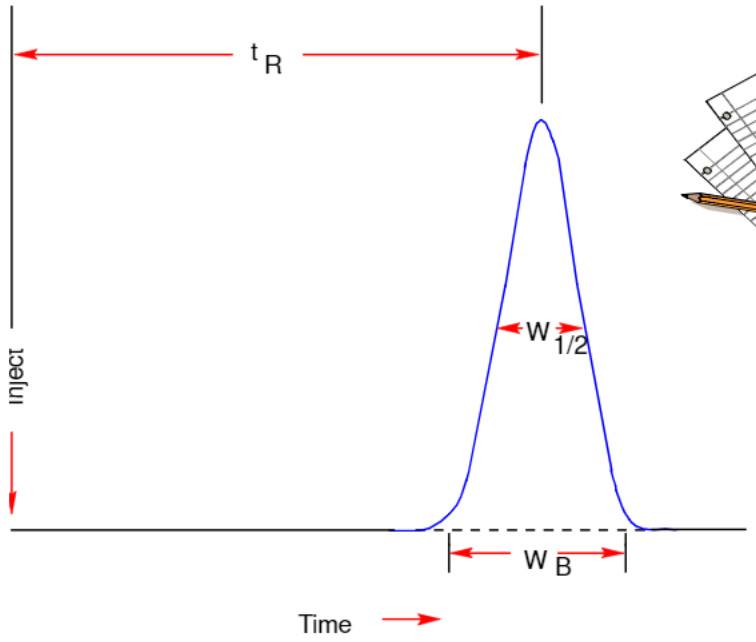
$$R=2\left(\frac{t_{RB}-t_{RA}}{W_A+W_B}\right) \qquad R=1.176\left(\frac{t_{RB}-t_{RA}}{W_{1/2A}+W_{1/2B}}\right)$$

Calculate the resolution between the 2nd and 3rd chromatographic peaks.

Efficiency


Detector Response
Low
Efficiency
Inject
High
Efficiency
Time

Calculate Efficiency



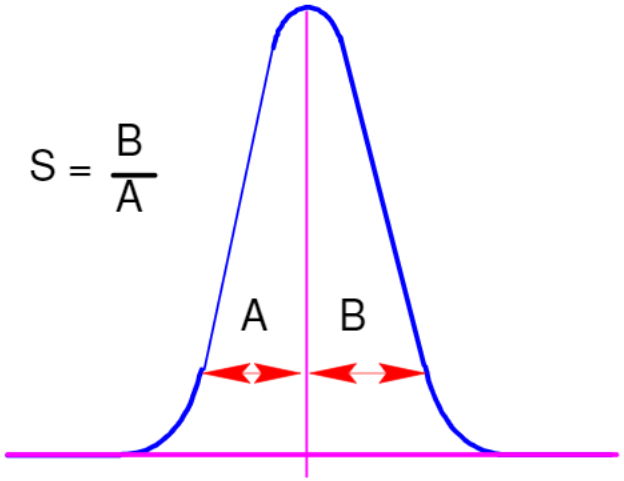
Calculate the efficiency of the fourth peak.

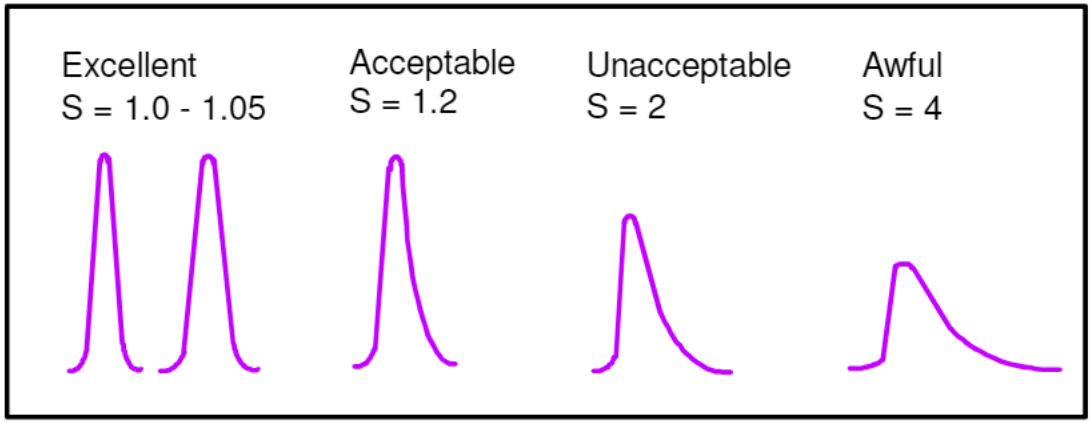
$$N = 16\left(\frac{t_R}{W_B}\right)^2 = 5.54\left(\frac{t_R}{W_{1/2}}\right)^2 = 2\,\Pi\left(\frac{hptr}{A}\right)^2$$

$$HETP = \frac{L}{N}$$

N: Efficiency
HETP: Height Equivalent to a Theoretical Plate
L: Column Length
hp: Peak Height
A: Peak Area

Peak Symmetry





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These calculations can be done automatically by your ChemStation:

- Select a System Suitability (Performance) report style
- Perform a Sequence Summary Report