

$$\frac{1}{\sqrt{2\pi}\sigma_c} \int_{b-2\sigma_s}^{b+2\sigma_s} e\left(\frac{-t_c^2}{2\sigma_c^2}\right) dt = \frac{1}{\sqrt{2\pi}} \int_{\frac{b-2\sigma_s}{\sigma_c}}^{\infty} e\left(\frac{-x^2}{2}\right) dx - \frac{1}{\sqrt{2\pi}} \int_{\frac{b+2\sigma_s}{\sigma_c}}^{\infty} e\left(\frac{-x^2}{2}\right) dx$$

The following calculation steps are required:*

1. $2\sigma_s = t_s / \sqrt{2 \ln 2}$

2. $\sigma_c = t_c / 2\sqrt{2 \ln 2}$

3. $x_1 = (b - 2\sigma_s) / \sigma_c$

4. $x_2 = (b + 2\sigma_s) / \sigma_c$

5. $Q(x_1) = \frac{1}{\sqrt{2\pi}} \int_{x_1}^{\infty} e\left(\frac{-x^2}{2}\right) dx$

6. $Q(x_2) = \frac{1}{\sqrt{2\pi}} \int_{x_2}^{\infty} e\left(\frac{-x^2}{2}\right) dx$

7. $I_0 = Q(x_1) - Q(x_2)$

8. $A_0 = I_0 A_c / A_s$

9. Percentage overlap = $A_0 \times 100$,

where:

A_s = Area of the sample peak of interest determined by electronic integration or by the formula $A_s = h_s t_s$.

A_c = Area of the contaminant peak, determined in the same manner as A_s .

b = Distance on the chromatographic chart that separates the maxima of the two peaks.

H_s = Peak height of the sample compound of interest, measured from the average value of the baseline to the maximum of the curve.

t_s = Width of sample peak of interest at 1/2 peak height.

t_c = Width of the contaminant peak at 1/2 of peak height.

σ_s = Standard deviation of the sample compound of interest elution curve.

σ_c = Standard deviation of the contaminant elution curve.

$Q(x_1)$ = Integral of the normal distribution function from x_1 to infinity.

$Q(x_2)$ = Integral of the normal distribution function from x_2 to infinity.

I_0 = Overlap integral.

A_0 = Area overlap fraction.

*In most instances, $Q(x_2)$ is very small and may be neglected.