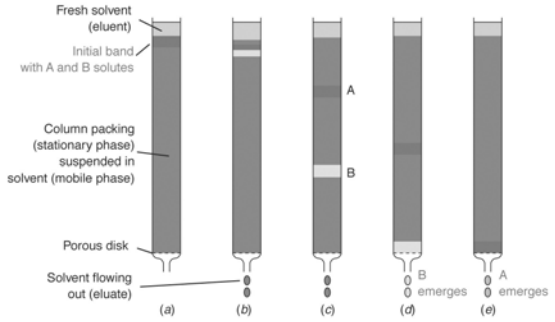
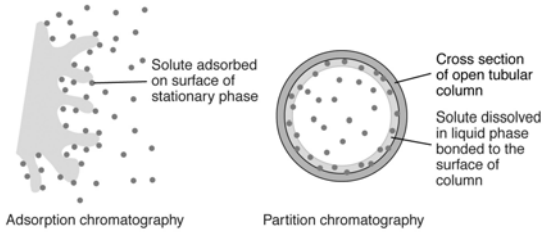
General Chromatography

A Review – Chapter 23 Harris

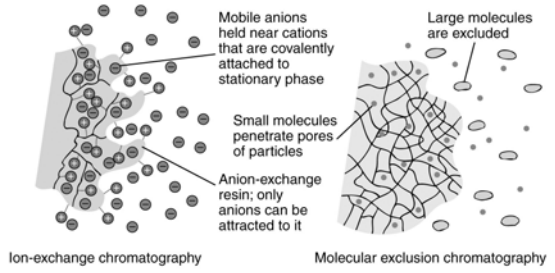
Basic Column Chromatography



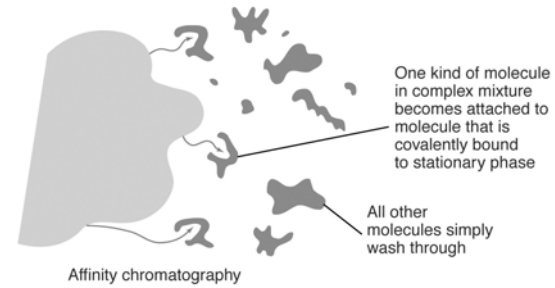
Types of Chromatography I.



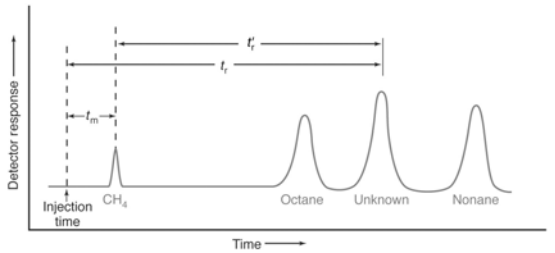
Types of Chromatography II.



Types of Chromatography III.



What can we say about the unknown substance?



What's this peak shape called?

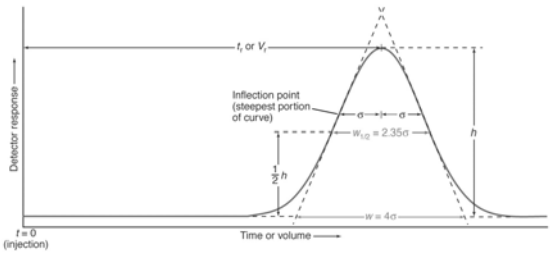
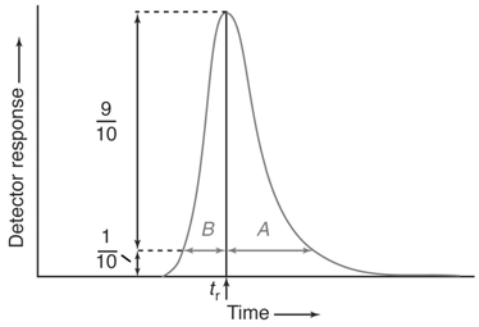


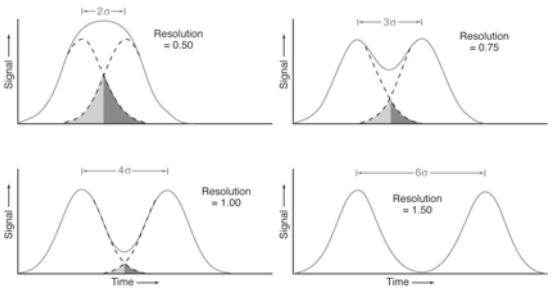
Table 23-2 Summary of chromatography equations

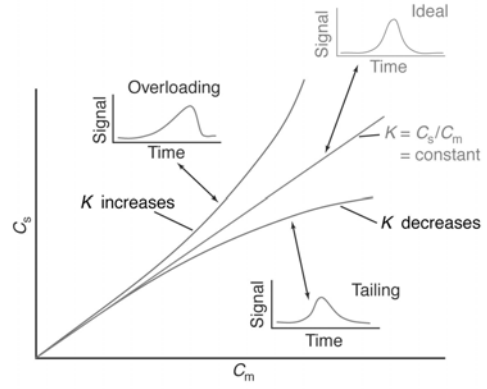
Quantity	Equation	Parameters
Partition coefficient	$K = C_s/C_m$	C_s = concentration of solute in stationary phase C_m = concentration of solute in mobile phase
Adjusted retention time	$t_r' = t_r - t_m$	t_r = retention time of solute of interest t_m = retention time of unretained solute
Retention volume	$V_r = t_r \cdot u_x$	u_x = volume flow rate = volume/unit time
Capacity factor	$k' = t_r'/t_m = KV_s/V_m$ $k' = \frac{t_s}{t_m}$	V_s = volume of stationary phase V_m = volume of mobile phase t_s = time solute spends in stationary phase t_m = time solute spends in mobile phase
Relative retention	$\alpha = \frac{t_{r2}'}{t_{r1}'} = \frac{k_2'}{k_1'} = \frac{K_2}{K_1}$	Subscripts 1 and 2 refer to two solutes
Number of plates	$N = \frac{16t_r^2}{w^2} = \frac{5.55t_r^2}{w_{1/2}^2}$	w = width at base $w_{1/2}$ = width at half-height
Plate height	$H = \frac{\sigma^2}{x} = \frac{L}{N}$	σ = standard deviation of band x = distance traveled by center of band L = length of column N = number of plates on column
Resolution	$\text{Resolution} = \frac{\Delta t_r}{w_{av}} = \frac{\Delta V_r}{w_{av}}$	Δt_r = difference in retention times ΔV_r = difference in retention volumes w_{av} = average width measured at baseline in same units as numerator (time or volume)
	$\text{Resolution} = \frac{\sqrt{N}}{4}\left(\frac{\alpha - 1}{\alpha}\right)\left(\frac{k_2'}{1 + k_{av}'}\right)$	N = number of plates α = relative retention k_2' = capacity factor for second peak k_{av}' = average capacity factor

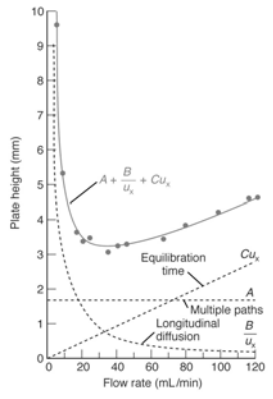
What's being measured here?



How do you calculate Resolution?

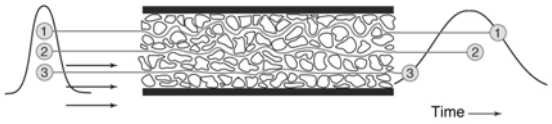




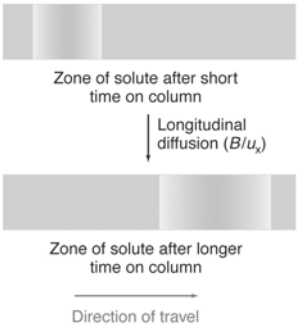


What is being determined in this plot?

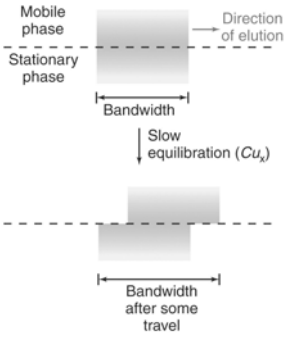
How is this related to Van Deemter?

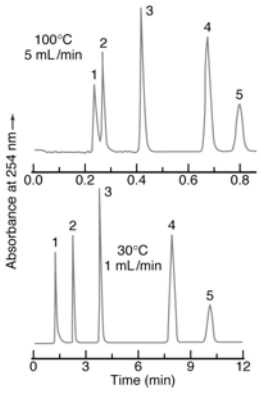


How is this related to Van Deemter?



How is this related to Van Deemter?





What does this show?

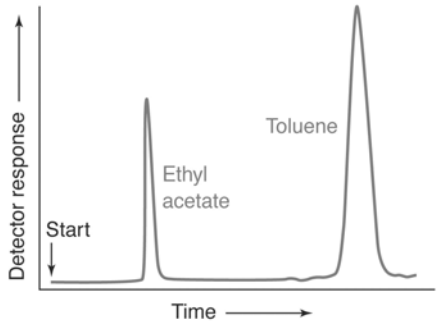
Table 23-3 Comparison of packed and wall-coated open tubular column performance[a]

Property	Packed	Open tubular
Column length, L	2.4 m	100 m
Linear gas velocity	8 cm/s	16 cm/s
Plate height for methyl oleate	0.73 mm	0.34 mm
Capacity factor, k', for methyl oleate	58.6	2.7
Theoretical plates, N	3 290	294 000
Resolution of methyl stearate and methyl oleate	1.5	10.6
Retention time of methyl oleate	29.8 min	38.5 min

a. Methyl stearate ($CH_3(CH_2)_{16}CO_2CH_3$) and methyl oleate (cis-$CH_3(CH_2)_7CH{=}CH(CH_2)_7CO_2CH_3$) were separated on columns with poly(diethylene glycol succinate) stationary phase at 180°C.

SOURCE: L. S. Ettre, *Introduction to Open Tubular Columns* (Norwalk, CT: Perkin-Elmer Corp., 1979),

What does this chromatogram tell you?



What would you say about the two columns?