28.2. Three methods for improving resolution are: (1) Adjustment of k_a' and k_b' by employing a multi-component mobile phase and varying the ratio of the components to find an optimal mixture, (2) variation in the chemical composition of the solvent system in such a way as to make α larger, and (3) by employing a different packing in which α is greater.

28.5. In adsorption chromatography on an alumina packing it is generally best to increase the polarity of the mobile phase as the elution proceeds. Thus the ratio of acetone to hexane should be increased as elution proceeds.

28.13 In ion-exchange chromatography, ions are separated based on their exchange rate with the stationary phase. With size-exclusion chromatography, neutral molecules are separated based on the size of the molecule.

28.20 Because the peak widths are equal, we can assume that $R_s = \frac{T_r(b) - T_r(a)}{W}$, which allows us to use equation 26-26, which is

$$N = 16R_s^{\,2}\left(\frac{\alpha}{\alpha - 1}\right)^2\left(\frac{1 + k_B}{k_B}\right)^2$$

To find α, we need to find k_B and k_A, using the following equation

$$k = \frac{T_r - T_m}{T_m}$$

and converting the retention times to either all seconds or all minutes, giving the following values:

k(a)	k(b)	α
5	5.166667	1.033333

Rs	N
0.5	5476
0.75	12321
0.9	17742.24
1	21904
1.1	26503.84
1.25	34225
1.5	49284
1.75	67081
2	87616
2.5	136900

Second part: If one peak width was twice the other, then our resolution equation from above turns into:

$R_s = \frac{2(T_r(b) - T_r(a))}{2W(a) + W(a)} = \frac{2(T_r(b) - T_r(a))}{3W(a)}$, so our resolution will decrease. This also would decrease our values of N because of the relationship of $N \propto R_s^{\ 2}$ shown above.

28.22 a.) $k = \frac{T_r - T_m}{T_m} = \frac{29.1 - 1.05}{1.05} = 26.7$

b.) want k = 10

Polarity index(P_1') = $\varphi_{hex}P'_{hex} + \varphi_{chl}P'_{chl}$ = (0.5)(0.1) + (0.5)(4.1) = 2.1

We have a normal phase separation, so we want to use equation 28-3, so

$$\frac{k_2}{k_1} = 10^{(P_1' - P_2')/2}.$$

We want to solve for the Polarity index of our second solvent combination, P_2', giving

$$P_2' = 2\log\left(\frac{k_2}{k_1}\right) - P_1' = 2\log\left(\frac{10}{26.7}\right) - 2.1 = 2.953$$

P_2' = $\varphi_{hex}P'_{hex} + \varphi_{chl}P'_{chl}$ = (x)(0.1) + (1-x)(4.1)

Solving for x gives 0.287 = 29% Hexane, and 100 - 29 = 71% Chloroform.