

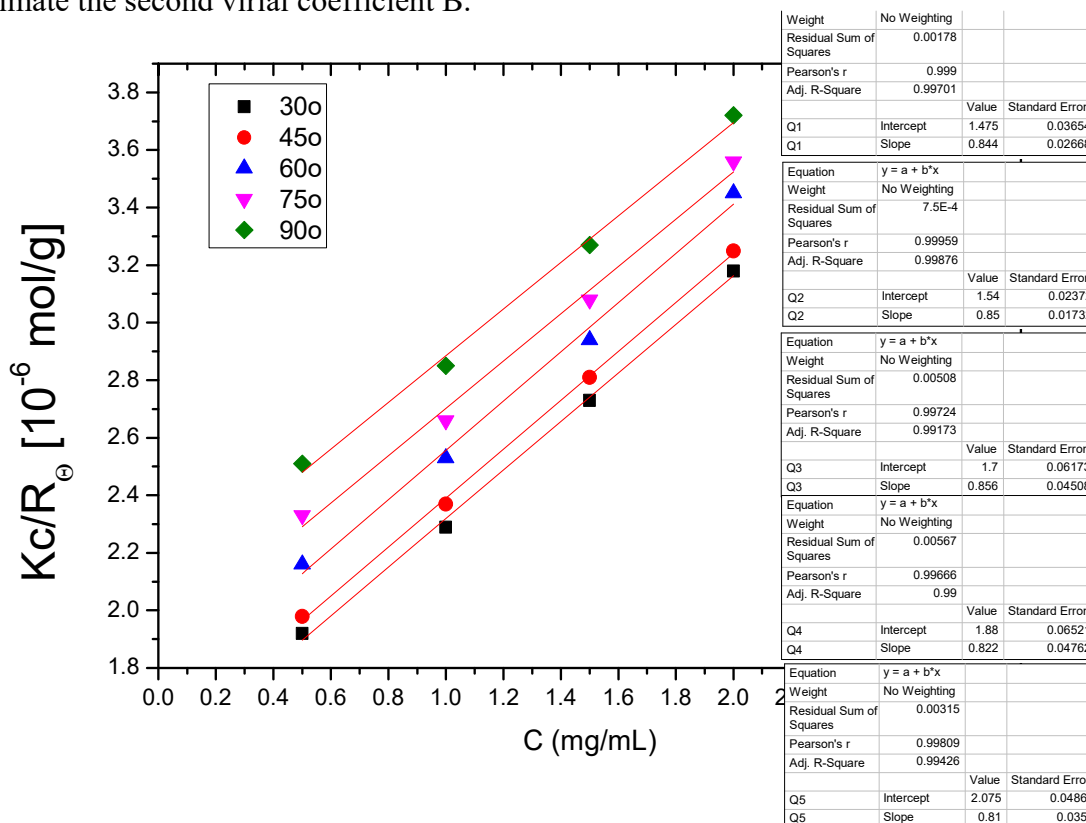
Home assignments for the Course of Polymer Physical Chemistry

First two sections of the course:

- Kc/R_θ for PS in benzene is given in the Table below in units [10^{-6} mol/g]. Please, estimate M_w , the second virial coefficient and R_g of the polymer in the solution. To calculate scattering wave vector q use the equation $q=4\pi n \sin(\theta/2)/\lambda$, with $n=1.5$ and laser $\lambda=532$ nm. (Note: you don't have to use all the data).

c (mg/ml)	$\theta = 30^\circ$	$\theta = 45^\circ$	$\theta = 60^\circ$	$\theta = 75^\circ$	$\theta = 90^\circ$
0.5	1.92	1.98	2.16	2.33	2.51
1.0	2.29	2.37	2.53	2.66	2.85
1.5	2.73	2.81	2.94	3.08	3.27
2.0	3.18	3.25	3.45	3.56	3.72

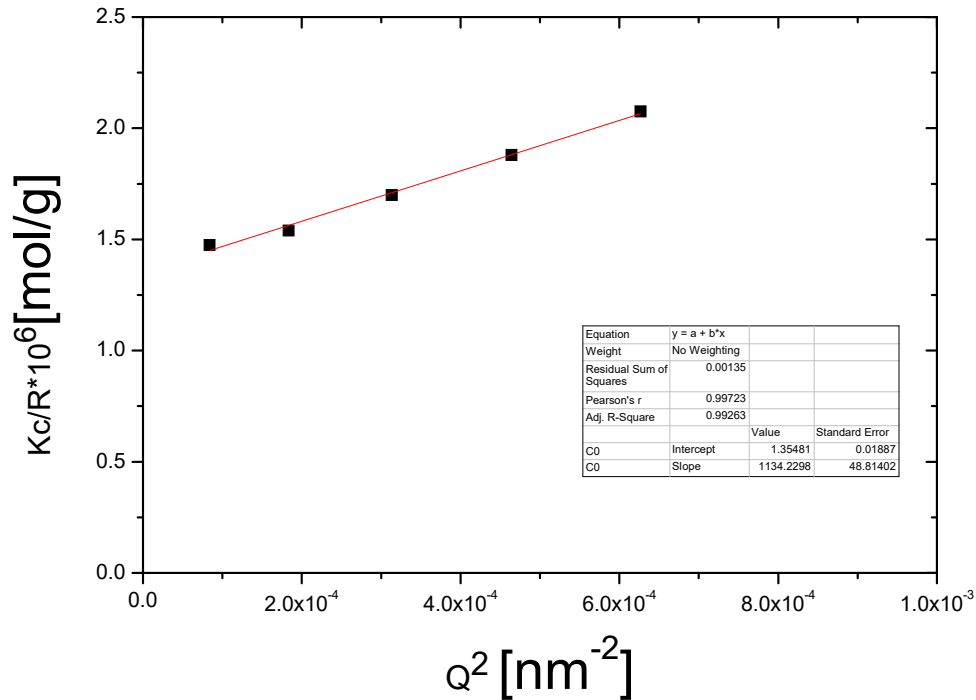
First you analyze data at different angles extrapolated to $c=0$. In that case you can directly estimate the second virial coefficient B .



It gives from the average slope $B \sim 4.2 \cdot 10^{-4}$ [$\text{mL} \cdot \text{mol/g}^2$].

Then you use the obtained value for intercepts at $c=0$ and plot vs q^2 . In this case intercept provides $1/M_w$, while the slope provides $R_g^2/3M_w$.

This provides value (see the plot below): $M_w \sim 7.4 \cdot 10^5$ g/mol; $R_g \sim 50$ nm.



- Calculate the fraction of triads (isotactic, syndiotactic and heterotactic) in the polymer assuming Zero-order Markov process for the case when (i) $p_m=0.2$; (ii) $p_r=0.2$.

Case (i): isotactic $p_m^2=0.04$; syndiotactic $(1-p_m)^2=0.64$; heterotactic $2p_m(1-p_m)=0.32$

Case (ii): $p_m=0.8$ and we calculate isotactic 0.64; syndiotactic 0.04; heterotactic 0.32

- If you want to get random copolymer with $\sim 1:1$ ratio of monomers in the chain, what should be the ratio of monomers concentration in the solution, if $r_1=0.1$ and $r_2=10$? Please, explain.

The task is to calculate the ratio f_1/f_2 . Using the equation on page 12 of the lecture, one can estimate $f_1/f_2=10:1$, or $f_1 \sim 0.91$ and $f_2 \sim 0.09$. One can also use the plot on the same page, and find where the corresponding curve crosses $F_1=0.5$.

Total 10 points