

**Questions for Class 5 (May 9)**  
**Chemical Analysis Techniques**  
**Chemical Engineering 733**

Reading Assignment: Pages 77-153 in Lee Smith green book. This is long, but try to see what you can learn.

1. Please summarize the types of data used to formulate proposed coal molecules (review of Class 4).
2. For NMR, PyMS, Extraction, and FTIR techniques, discuss the following:
  - a. Relative cost of the instrumentation
  - b. General types of information available (species considered, range of MW, % of coal observed, etc.)
  - c. Limitations/cautions about the data obtained
  - d. Rough idea of how the experiments are performed
3. What is the "mobile phase", and what evidence is there for this mobile phase in any of the four techniques from question 1?
4. Please stare at the Py-FIMS data in Figure 4.28 and describe the differences between coals. Don't forget to look at the scales on the y-axes.
5. Please compare the yields of extracts and depolymerization products in Table 4.37 with the spectra obtained on the different fractions in Figs. 4.45-47. What is learned about the structure as a function of coal type from these data, and what fraction of the coal does it represent?
6. Please compare the types of data from the NMR analyses with the types of data obtained from the FTIR analyses. For similar types of data, please compare the numbers obtained from the two techniques. Which do you believe, and why?
7. Please summarize the techniques for looking at the chemical structure of coal, including (a) if it destructive or non-destructive, and (b) what are the best features of each technique.