Grade Distribution

withheld*

3 Total

*I'm not showing a grade distribution because, with only three people officially in the class, it might violate your privacy; the fourth person in the class has not yet taken the exam (illness) and the fifth person, who is taking the exams but as an auditor, failed to get his exam to me by the deadline (actually by two hours after the deadline).

**COMMENTS:** Although the average on this exam and on Exam I were relatively high, nobody managed to get a grade above 90% on either of them. I find this surprising ... and disappointing. I commented, on an earlier note, that your performance on Exam I provided evidence that some of you might just as well not have learned any orbital symmetry, given the number of symmetry-forbidden and stepwise processes that you wrote. The very first lesson in this course was to recognize that simply pushing curved arrows is not enough - not every reaction can be concerted. Cases in point, from earlier in the course, were: (1) the different con/dis stereochemistry when butadienes and hexatrienes were cyclized; (2) the different con/dis stereochemistry when such processes were performed with thermal vs. photochemical activation; (3) the vast difference between [2 + 2] and [4+ 2] cycloadditions; and so on. I'm sorry to say that some of this behavior spilled over onto this exam as well.

The other thing that saddens me is how little interaction I've had with the class. Yes, we meet twice a week in Bu 511 (well, most of us meet there - some of us are a bit neglectful of our responsibility and arrive late or not at all) but aside from one of the auditors there were practically no questions in class and, for certain, almost none outside of class either. Perhaps you hated the course - perhaps you were counting the days until it ended - but regardless of your personal views you should have arranged to get the very most out of it. Orbital symmetry is one of the major ideas of organic chemistry - you cannot succeed in any area related to organic if you don't appreciate its importance. For support of this statement, I need only point to the brilliant scientists (the best in the world) who devoted their talent and energy to establishing the theoretical and experimental limits of symmetry control. One of the reasons for my giving you 12 days on the take-home exams was to encourage you to think deeply about these questions and to seek my help, but with just a couple of rare instances people did not come to my office for guidance.

Question IA is an example of what I referred to, above. Compounds 1 and 3 are homobasketenes, but nobody seemed to recognize that you had seen essentially identical behavior for basketene, itself (Handout VI, p 8-9) - as evidence, I'll note that two of you showed retro [2+2] processes rather than the much more favorable retro Diels-Alder that both substrates can perform. IB was handled in a rather unsophisticated way; that is, people did recognize that loss of stereochemistry would occur via a long-lived zwitterion intermediate, but I saw practically no discussion of the relative magnitude of $k_{\text{rotation}}$ and
Your work on IC was nothing short of disgraceful! Simple azo compounds 5 and 6 came directly from the notes (Handout VI, p. 1-2) but nobody showed the two boat conformations that are available plus a discussion of which one is reactive. And compounds 7 and 8 were analogous to the cyclopropane-containing azo compounds of Handout VI, p. 3-4. Nobody saw fit to draw the two possible boat conformations and to comment on the spectacular behavior of 8 in which 100% of the reaction comes from the less stable conformation and produces the less stable product. If ever there were a nice example of Curtin-Hammet behavior, this was it. And yet, nobody invoked participation of the small ring σ electrons in the cleavage of the two C-N bonds.

**Question IIA** is a classic: here’s a potentially very exothermic reaction (A \(\rightarrow\) B) that does not occur because it violates orbital symmetry. I think that that's dramatic and fascinating! (The possibility of a 1,2 H-shift in cationic and anionic systems was addressed in Handout VII, p. 6.) In IIB, most of you identified this as a \([1\sigma,7\sigma]\) allowed reaction, but didn't appreciate what antara would mean with a substrate like 1d; also, your drawings were not at all convincing. **IIC1** asked about the thermodynamics of this reaction (as contrasted with the Roth case) but everyone, instead, talked about rates. **IID** was probably the most difficult question on the exam (because of its difficult drawings), and most of you did well until I asked about the invariance of the product ratio as a function of temperature; this is precisely what was described and discussed in Handout VIII, p. 15a-15d.

**Question IIIA** was answered correctly by everyone, but only up to a point. The question specifically asked you to show how 1 gives the two enantiomers of 3 (chair TS) and the two enantiomers of 4 (boat); all of you showed the formation of just one. For IIB, better drawings would have helped your cause. Did you make models of 7 and 8 and then try to sketch them?

**Question IVA1** caused trouble for those who tried to force a fluxional answer onto a compound whose rearrangement is slow on the NMR time scale and can, therefore, be described as static. That’s why it was necessary to do a different experiment using labeled substrate 1d\(_2\). Full credit for IVB was obtained by just one person; the others showed various \([2+2]\) steps in their sequences. The good news is that IVC was handled well by everyone.

LAST CHANCE   LAST CHANCE   LAST CHANCE   LAST CHANCE   LAST CHANCE   LAST CHANCE

Nobody has claimed the reprints of the articles used for the questions on Exam I nor has anybody claimed them for Exam II. I would think that you’d be curious to see how these orbital symmetry concepts are portrayed in the literature, some of which is very very current. One of my main goals of this course was to get you to the point where you’d read articles that you once might have shied away from because they involved orbital symmetry ideas; these reprints are examples of such articles.