

Part III exam reflection

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Preparation

I spent two weeks preparing for the part III exam. Basically I followed the suggestions by former students and Prof.Jeff Gore. I think there are three important aspects of preparation: reading, solving problems and practice exams.

Reading: I read the following materials in detail: 1) Biological physics, Chapter 3-8; 2) Physical Biology, Chapter 8,9,10,12,15; 3) 8.592 lecture notes on polymers. I also read other chapters, but not in full details. I read the materials based on my personal category of topics, such as diffusion, fluid dynamics, E&M, rate equations, DNA, stat mech, etc. My given question is Problem 5.8 in Biological Physics. Because of this I spent more time on topics including polymer physics, DNA and fluid dynamics (as it turned out, the random questions in the exam were almost irrelevant to my preparation). Also, I would suggest not to read the wordy texts in Physical Biology, but only focus on figures and equations. The first two or three chapters in each book are also enjoyable to read and a good refreshment of the biology (not very helpful for the exam though).

Solving problems: I solved some of the sample questions from past years and the end-of-chapter questions in both books. My basic goals are: 1) remember some constants needed for estimation; 2) practice dimensional analysis; 3) practice stat mech calculations; 4) establish confidence.

Practice exam: I did three practice exams with different groups of people (many thanks!). I would strongly recommend practice as many times as possible. It helped a lot, in the sense that: 1) perfect the presentation of the first question, have an expectation of what people may ask; 2) learn how to handle difficult questions.

What happened during the exam

First half an hour: prepared question on the intrinsic viscosity of polymers in solution. A few questions on the derivation and related concepts: why intrinsic viscosity is defined like this, how will the scaling of polymer radius change in different solvents.

Random questions: (the ones I remember)

Mehran: if I put a random coil of polymers between you and me, would it be possible to see through it (answer is no, because the dimension of the fractal is two).

Alexander: if there are two DNA in bacteria, what is the ground-state configuration. Suppose one of them is more rigid than the other, what would be difference between the two (only ask for qualitative answers). DNA melting model, treating the dsDNA as a zipper, derive the probability of being at different states in closed form.

Jeremy: derive the Flory exponent 3/5. why would DNA prefer to be in double strands.

Overall the professors were very nice and gave me hints when I got stuck in attacking the questions. I made a few silly mistakes that could have been avoided during the last half an hour, as I was both nervous and tired. More practice with doing derivations on a blackboard would help ease the nervousness in such an intensive oral exam.

Good luck!