Review Questions for the Chem 2325 Final

Preparing for the final exam:

The final exam for this course will be given during the last lab section of the semester. You will have 2 hours to take the exam. You will not need a scantron but you do need a <u>pen or pencil</u> and a <u>calculator</u>, as well as your <u>lab notebook</u>. The final exam is written in an essay and short answer format. It is designed to test how well you understand what we have done in the lab, and will require you to apply what you know to new situations!

As with the previous final, you may use your lab notebook on the exam. Anything that you have handwritten in it is ok to have, but you can't cut and paste printed things. You may take the IR's from your carbon copies that you turned in and put them in. If you missed any points on the labs, make sure to make corrections in your original lab notebook as needed before you use it on the exam.

The questions below are designed to help you review the concepts that we have covered during this semester. No questions will be asked specifically about the experiments that we did last semester, except as the concepts were involved in both semesters. These questions do not have to be turned in, and will not be graded. You may write out the answers in your lab book so that you will have access to them during the final if you wish.

I will not give out a key of correct answers, but I will help by clarifying any concepts you are having trouble with. You may also compare answers with your classmates to gain a greater understanding of these principles. You should also review the questions that go with each lab.

Calculations

- 1. Explain how to convert mass to volume, and volume to mass.
- 2. Explain how to calculate the mass of a reagent when given the mass of the limiting reagent and the equivalents of the other reagent.
- 3. List the steps for calculating a percent yield.
- 4. What is the difference between a percent yield and a percent recovery?

Running a Reaction

- 5. What are the basic steps in running a reaction?
- 6. Under what circumstances should you use more than 1.0 equivalent of a reagent? (3 answers)
- 7. Under what circumstances might you use less than 1.0 equivalent of a reagent?
- 8. Which reactions were heated at reflux this semester? Why was heat needed? How was the temperature of the reaction controlled?

- 9. Why couldn't ethanol be used as the solvent in the Grignard reaction? What would happen if acetone were used?
- 10. What drove the esterification reaction to completion? The aldol reaction?
- 11. What compound did we use as a phase transfer catalyst this semester? What was its purpose in the reaction?
- 12. What does it mean to run a reaction (or an IR) neat?
- 13. What was the stereochemistry of the Diels-Alder reaction? How many stereoisomers would result if 2-methyl-1,3-butadiene were used instead of 1,3-butadiene?
- 14. Review each of the mechanisms for the reactions we ran this semester, identifying the nucleophile and electrophile in each case.
- 15. List all of the ways in which the Horner-Emmons Wittig reaction was different from the standard Wittig that we studied in class.
- 16. How was the mechanism of the Friedel-Crafts acylation different when using ferrocene instead of a benzene ring?
- 17. Which reactions this semester were water sensitive? How would water affect each of these? What techniques did we use to exclude or remove water from them?
- 18. What products resulted when the Grignard reaction was quenched with mild aqueous acid? What products resulted when the Friedel-Crafts reaction was quenched with water?

Isolation of the Product

- 19. If you pull a product out of a mixture, is this washing or extracting? What if you remove impurities from a mixture?
- 20. What would happen if you added dichloromethane, then water, then ether to a sep funnel? What would happen if you shook them up and then allowed the layers to separate?
- 21. How can you tell whether a compound will be more soluble in the organic or in the aqueous phase of a washing or extraction?
- 22. Why are carboxylic acids soluble in basic solution but insoluble in acid solution?
- 23. Why is sodium bicarbonate so useful in organic chemistry? Why does it fizz when it reacts?
- 24. Which solvents can be easily removed without using vacuum at 60°C? Which solvents require vacuum?

Purification of the Product

- 25. What is the difference between isolating and purifying a product?
- 26. What is the most common method for purifying solids? For purifying liquids?
- 27. Describe the steps needed for recrystallization of a crude product. How are the impurities separated from the product?
- 28. If no crystals form while you are recrystallizing a solvent, what went wrong? How should you correct this problem?
- 29. What would happen if the solvent you were using for recrystallization wasn't heated to its boiling point?
- 30. What will happen if you cool a recrystallization too quickly?
- 31. What was the purpose of using column chromatography in the Friedel-Crafts reaction?
- 32. Should you start with a low polarity solvent or high polarity solvent when performing column chromatography?
- 33. Which is more polar, di- or monoacetylferrocene? Which should come out first from the column?

Characterization of a Product

- 34. What does it mean to characterize a product? What methods were used this semester to characterize products?
- 35. How could IR be used to determine whether the esterification product is contaminated with starting materials?
- 36. Which products were characterized by TLC this semester? Why were they all UV active?
- 37. How could taking a TLC during a reaction be useful?
- 38. If you were to spot a pure liquid compound (not a solution) onto a TLC plate, what would happen?
- 39. How can you take a TLC of a solid product?
- 40. How do you choose a solvent for TLC?
- 41. If you change from ethyl acetate to hexanes as the eluting solvent in TLC, how will this affect the movement of the spots?
- 42. Why is a reference spot useful in TLC? What information can you get without one?
- 43. What two ways does the melting point give an indication of the purity of the compound?
- 44. What are two means other than melting point to get an idea of the purity of a compound?

- 45. Which is affected by altitude, boiling point or melting point? Why?
- 46. What product did we make this semester that smelled like bananas?
- 47. What color are most pure organic compounds? What products did we obtain this semester that were not this color? Why did these deviate? Why are were some products not the expected color?

<u>Unknowns</u>

- 48. What functional groups could you have if a N is present in the molecule?
- 49. What functional groups should you consider if your IR shows a C=O band?
- 50. What IR bands indicate the presence of an alcohol? A carboxylic acid? An alkyne? An aldehyde? A nitrile? A ketone? An ester? An amide? An amine? An alkene?
- 51. What does a positive Tollen's test tell you? A positive hydroxamate test? A positive Baeyer test? A positive Ferrox test? A positive iodoform test? A positive iron hydroxide test? A positive phenylhydrazine test? A positive Jones test? A positive Lucas test?
- 52. What should you physically observe if each of the functional group tests are positive? What causes that observable change?
- 53. If the results of a functional group test is different from what the IR tells you, which should you trust?
- 54. What is the purpose of running a neutralization equivalent on an unknown acid? What do you need to know to calculate the molecular weight?
- 55. What materials go into the organic waste? Inorganic waste? Solid waste? Needle waste? Trash cans?