Review Questions for the Chem 2315 Final Exam

These questions do not have to be turned in, and will not be graded. They are intended to help you review the material we have covered in the lab so far, and they reflect the kinds of things that you should know in order to do well on the exam. 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 be happy to discuss any questions that you have about them. 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.

The final exam is written in a short answer format. You will be able to use your lab notebook, which may contain any additional *handwritten* information that you would like to have available to you. You will also need a calculator.

<u>Safety</u>

- How many exits does the lab have in case of an emergency?
- Explain when you should use each of the following safety equipment: fire blanket, emergency shower, eye wash, fire extinguisher.
- What are the four routes of entry that you need to guard against chemicals getting into your body? What measures can you take to protect each one?
- What should you do if a fire starts in a small beaker? What if it spreads to solvent spilled in the fume hood? What if it occupies one whole end of the lab? What if the fire alarm goes off during lab?
- Why is it important to keep your work area clean?
- What are the 5 waste containers, and what goes into each?
- How should you decide whether a substance should go into the organic or inorganic waste?

Calculations

- How many mg are in 2.1 g? 0.21 g? 0.021 g? 0.00021 g?
- How much would 1 ml of 1-octene weigh? 1 ml of methyl iodide?
- What is the molecular weight of aspirin? How many mmols are in 500 mg of aspirin?
- What is the molecular weight of ibuprofen? What is the mass of 50 mmols of ibuprofen?

- How many mmols are in 5 ml of 2.5 M HCl? How many ml of 4 M NaOH would be needed to have 1.4 mmols of NaOH?
- What mass of NaI would be present in 2 ml of a 15% solution of NaI in acetone if the solution had a density of 1.2 g/ml?
- How much methyl iodide could we have used in order to have 3 equivalents in the Williamson ether synthesis?
- Calculate the theoretical yield of bromocyclohexane if 1.25 ml of cyclohexene had been used.
- How many mg of 1-octanol would be needed to have an 82% yield?
- How much cinnamaldehyde could be recovered from 50 kg of cinnamon if a 2.5% recovery were achieved?
- What is the difference between a % recovery and a % yield? When is each used?

Techniques

- How are solids usually measured? What about liquids?
- What are four things that can decrease the accuracy of the mass you obtain from a balance?
- What effect will refluxing a reaction have on the rate at which the reaction occurs?
- If you wanted to reflux a reaction at about 70°C, what solvents could you chose? What if you needed if over 100°C?
- If two liquids are present in a reaction, which one will control the reflux temperature?
- Why was the hydroboration-oxidation cooled in the first step but heated in the second?
- What is the difference between washing and extracting?
- If you extract a reaction mixture with dichloromethane, is the product on the top or the bottom?
- If you wash an ether solution with 1% aqueous HCl, is the product on the top or the bottom?
- Why can phenol be washed from an organic solution with 1% aqueous NaOH but not with distilled water?
- What is the purpose of washing with saturated sodium bicarbonate solution? Why does it fizz when added?

- Why is it important to dry an organic solution after an extraction or washing?
- What drying agent did we use in the lab, and how does it remove water?
- What is the purpose of rotovapping a solution? What is removed and what is left behind?
- Under what conditions should you use a Hickman still as well as a reflux condenser?
- Why was steam distillation rather than ordinary distillation used in the isolation of cinnamaldehyde from cinnamon?
- In what two ways does a melting point indicate the purity of a compound?
- What three factors affect the melting point of a solid?
- Why are boiling points affected by the altitude at which they are taken?
- If you weren't given a set amount of time to run a reaction, how could you check to see if it was done?
- What is it called when you put a TLC plate in a beaker of solvent and run it? What is it called when you look at it under the UV light?
- What determines whether a compound absorbs UV light?
- How can TLC be used to check the purity of a product?
- What should you do if all of the spots on your TLC plate run to the top? What if they all stay at the bottom?
- What should you do if your spots streak up the TLC plate?
- How can TLC be used to determine if a specific compound is present in a mixture?
- Would you expect an alcohol or an ether to run higher on TLC?
- Why do some compounds elute faster than others on a chromatography column?
- Why is it important to start with a low polarity solvent when running a chromatography column?
- How does the mini column chromatography purify the product in the Williamson ether synthesis?

• How can you distinguish between alkyl halides, alcohols, alkenes, and ethers by IR spectroscopy?

Other Important Concepts

- What are the main steps in running a reaction?
- What techniques have we used to isolate the products we have obtained?
- What techniques have we used to purify the products that we have obtained?
- What techniques have we used to characterize the products that we have obtained?
- What is a synonym for ethanol? Dichloromethane?
- Which goes to the top, dichloromethane or water? Ether or water? Why?
- What solvent has a ketone functional group? Which has an ester? Which are alkanes? Which are alcohols? Which are alkyl halides?
- If a liquid has a high dielectric constant, is it polar or nonpolar?
- If a liquid is nonpolar and has a low density, will it mix with water, sink to the bottom, or float on top?
- If you need to remove a solvent using the rotovap, which one will come off easier, diethyl ether or hexanes?
- Which solvent will carry the spots faster down a chromatography column, 20% ethyl acetate in hexanes, or 20% methanol in ethyl acetate?
- Which solvents are immiscible with water? Which float on top, and which sink to the bottom?
- What is the intermediate in each of the following reactions? HBr addition to alkenes, hydroboration-oxidation of alkenes, $S_N 2$ and $S_N 1$ reactions, and the Williamson ether synthesis.
- Compare the expected reactivity of 3-bromopentane and 3-methyl-3-bromopentane in 15% NaI in acetone. What about 1% AgNO₃ in ethanol?
- What precipitate formed in the $S_N 2$ reaction? In the $S_N 1$ reaction?
- What was calcium chloride used for in the hydroboration-oxidation reaction? Why was it needed?

- What purpose does tetrabutylammonium bromide serve in a reaction? How does it work?
- What chemicals with recognizable odors have we encountered this semester?
- In what reactions was acid used as reagent? When was a base used?