

## Practice Midterm

### Instructions:

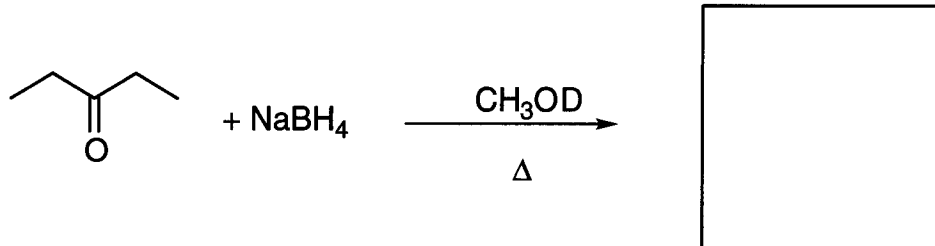
This is a midterm that you can take voluntarily. It does not have any impact on your grade in the class and is meant to serve as a diagnostic exam. You should be able to complete the exam in 60 minutes, and only using a pen (or pencil), a non-graphing calculator and a ruler. If you decide to take the exam, please turn it in until Wednesday morning May 12, 2004 at 8 am. The TAs and instructor will grade it and return it to you asap. The answer key will be posted after the deadline.

Name:

Teaching assistant:

Question 1		18	
Question 2		24	
Question 3		18	
Question 4		20	
Question 5		20	
Total		100	

1. A student carries out the following reaction in the lab



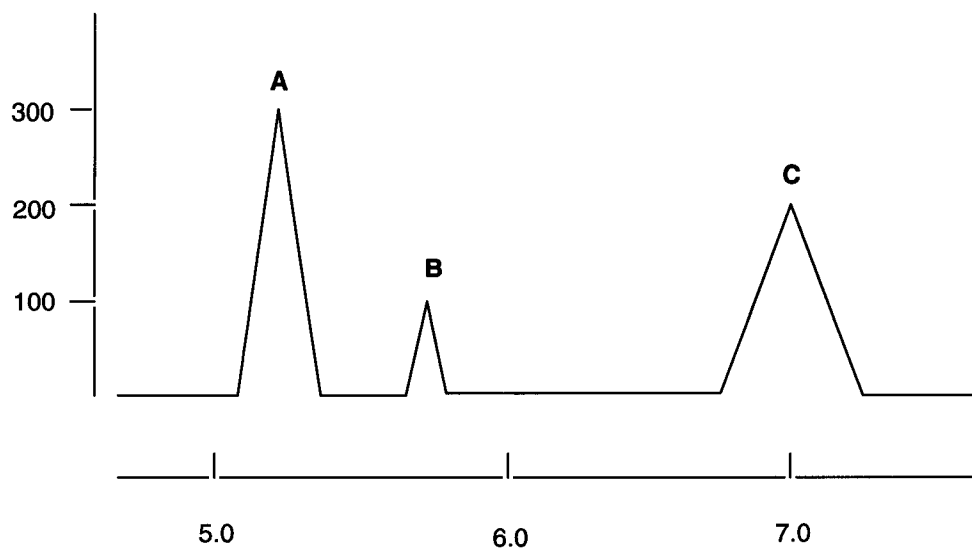
a. Place the product(s) of the reaction in the box.

b. Is the formed product chiral? If so, explain briefly.

c. Student A dissolves 0.5 mL of 3-pentanone ( $d=0.813$  g/mL) and 45 mg of sodium borohydride in 5 mL of  $\text{CH}_3\text{OD}$ . Do you see any problems with his setup of the reaction? Explain briefly and show pertinent equations.

d. Student B uses 0.40 mL of 3-pentanone and 400 mg of sodium borohydride. After the workup he isolates 0.30 g of the product. Determine the yield for his reaction. Show all work.

2. Student C has a mixture of hexane, heptane and hexanone. He acquires a GC spectrum at 80 °C, which is shown below.



a. Which peak belongs to which compound? Rationalize your choice.

b. Determine the relative composition of the compounds assuming that they have the same response factor. Show all work.

c. What would change if the GC was acquired using a temperature gradient from  $T=60\text{ }^{\circ}\text{C}$  to  $T=100\text{ }^{\circ}\text{C}$ ?

d. Why is dichloromethane often used as a solvent for GC?

e. How much sample is applied to the GC column? Explain briefly why.

### 3. Lab techniques

a. Why is a reaction mixture generally refluxed?

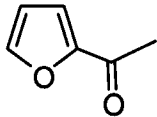
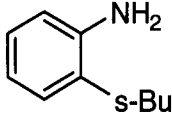
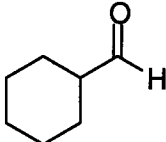
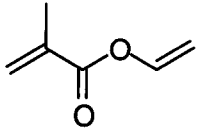
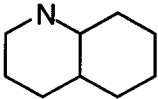

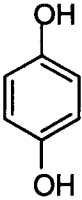
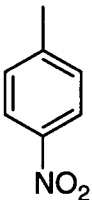
b. A student performs a recrystallization in the lab. The procedure asks him to get the solvent to a boil. Explain briefly why.

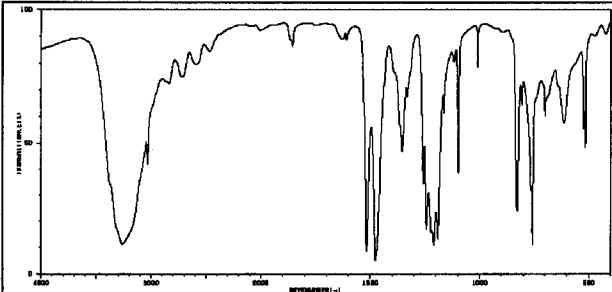
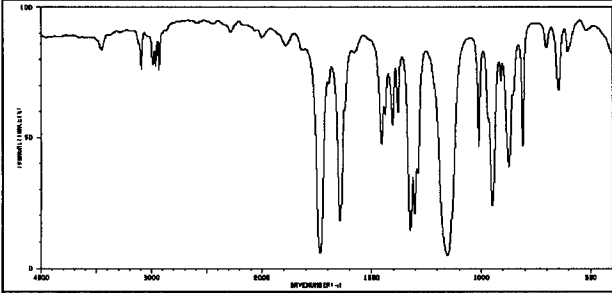
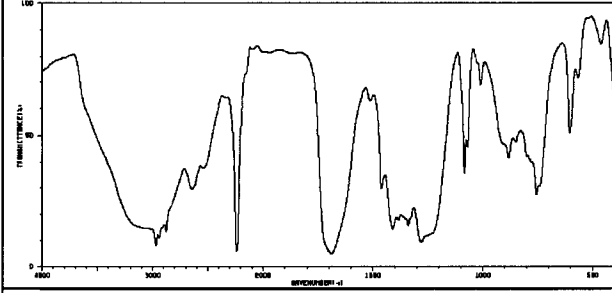
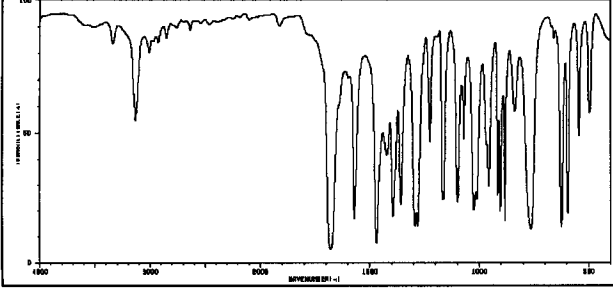
c. Which drying agent would you use if you dry an ethereal solution of acetophenone ( $\text{C}_6\text{H}_5\text{COCH}_3$ )?

d. What does "ECD" stand for? Where is it used?

e. Sketch a LUMO orbital for carbonyl function.

4. Assign the following IR spectra to one of the compounds listed in the table. Make sure to assign pertinent peaks.

5. Student X conducts the recrystallization of his crude product. In the literature he finds the solubility data for the compound in two solvents.

Temperature (°C)	Solvent A (g/10 mL)	Solvent B (mg/mL)
0	0.2	20
20	0.4	50
40	0.6	125
60	1	300
80	1.5	

a. Which solvent should she choose for the task? Rationalize your choice.

b. Assuming that she performs the recrystallization correctly, how much material (in g) would she recover if she starts with 6 g of the crude product? Show all work.

c. What can be said about the polarity of the compound if solvent A is a polar solvent and solvent B is a non-polar solvent?