

Please print:

Last name: Answer key

First name: \_\_\_\_\_

**Chem 2062 Exam 4**

**Spring 2006**

**Andy Aspaas, Instructor**

**Friday, April 28, 2006**

**Instructions:**

You have 55 minutes to complete this exam.

There are 5 questions on this exam, worth a total of 100 points.

No model kits or calculators may be used.

I, \_\_\_\_\_ have read and understand the directions given above, and pledge that I will follow all regulations with regard to Academic Dishonesty as outlined by this college when taking this exam.

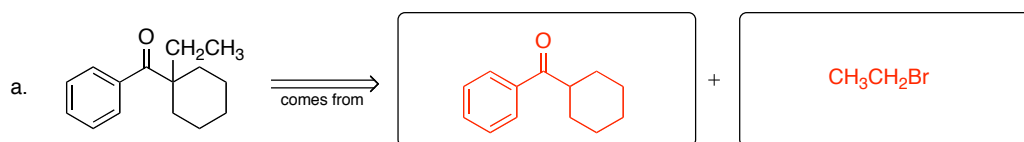
Signature \_\_\_\_\_ Date and Time \_\_\_\_\_

## 1. Perform retrosynthetic analyses on the following carbonyl compounds.

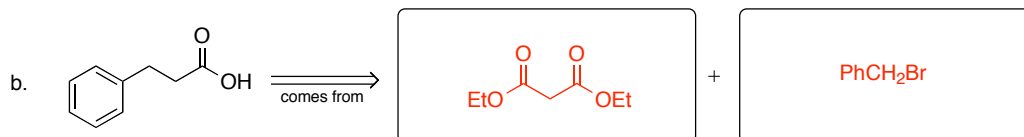
First, decide which type of reaction can be used to form each of the compounds and **write the reaction's name** after "reaction type" below. Here's a list of possible reactions: *enolate alkylation*, *aldol condensation with or without dehydration*, *Claisen condensation*, *Michael reaction*, or *malonic ester synthesis*. Hint: what type of compound are you forming? Dicarbonyl? Substituted? Unsaturated? Each of the above reactions forms a characteristic product.

Then, for each of the compounds, **draw a squiggly line** through the carbon-carbon bond that is formed. For many of these, there is more than one possible choice of bonds to construct, so be sure to choose one that will provide a feasible reaction.

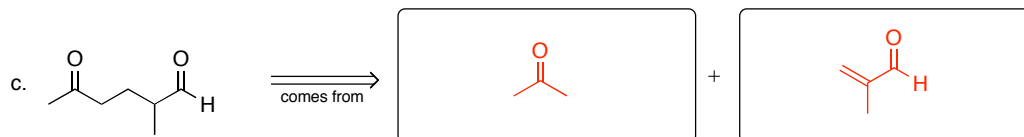
Finally **draw the reactants** necessary to produce the given compounds.



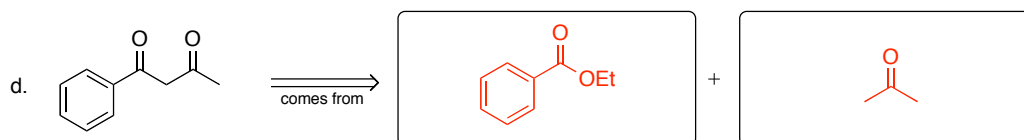
reaction type: enolate alkylation



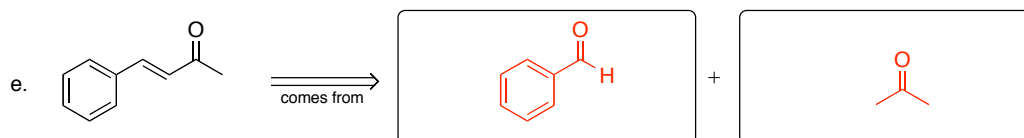
reaction type: malonic ester synthesis



reaction type: Michael reaction

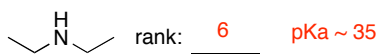
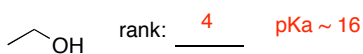
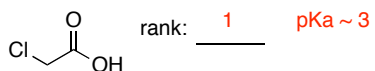
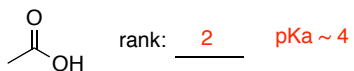


reaction type: Claisen condensation

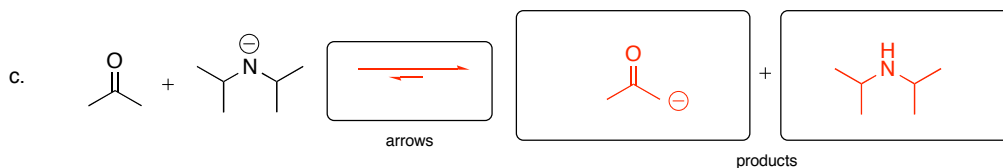
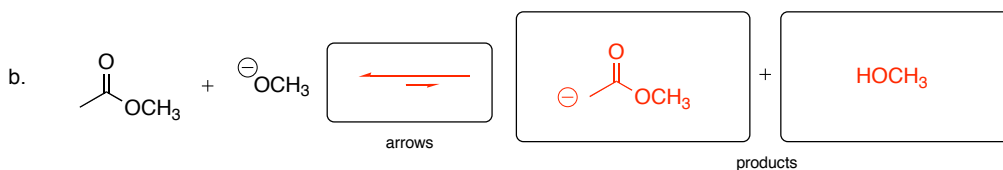
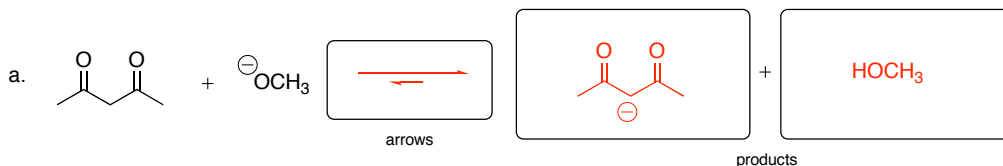


reaction type: Aldol condensation, dehydration

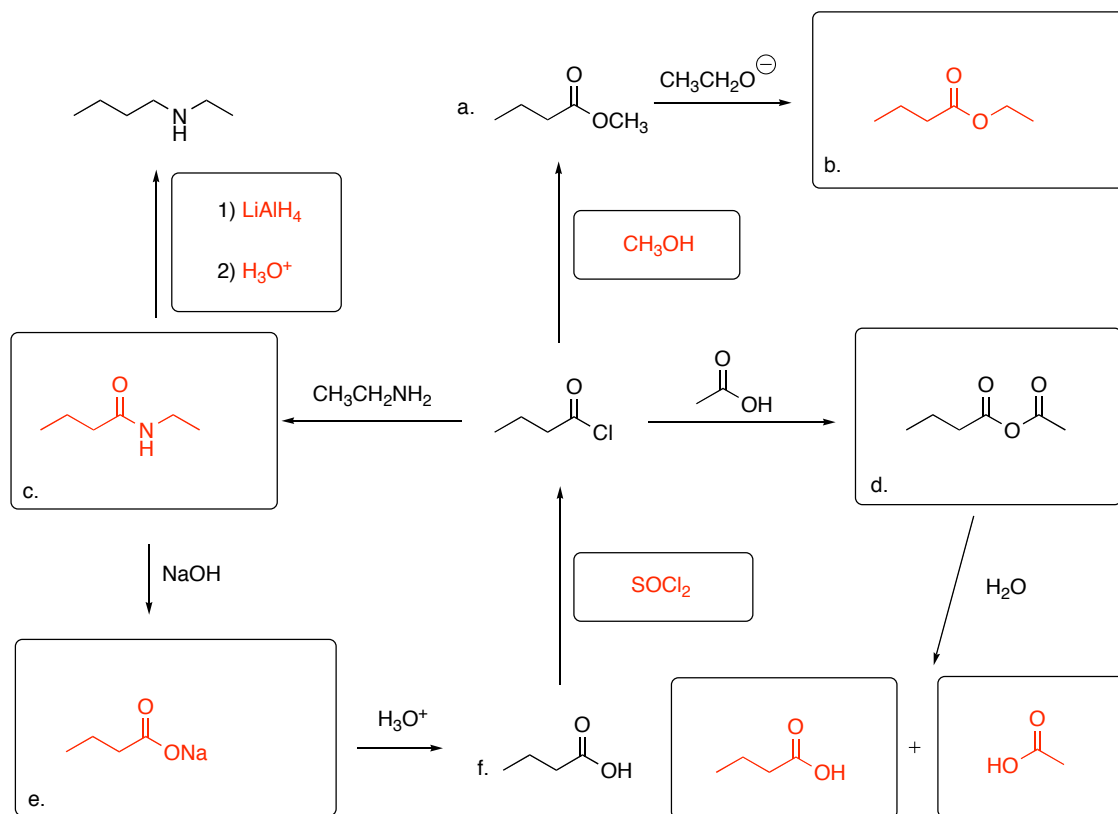
2. Rank these compounds in order of **decreasing** acidity, where 1 is the **most acidic** and 6 is the **least**. For consideration of partial credit, write any rationale you use for your rankings to the right of each compound. For possible **extra credit**, predict the pKa ( $\pm 2$ ) of the compounds.



3. Predict the most likely products of acid-base reactions between the following pairs of compounds, and use equilibrium arrows to show which direction the equilibrium predominately lies. Briefly explain your rationale underneath the appropriate compounds.



4. Below is an incomplete synthesis roadmap which inter-converts various carboxylic acid derivatives. Complete the roadmap by drawing the correct reagents or organic compounds in the boxes. Provide reasonable names (choose either IUPAC or common, but not a combination) for the lettered compounds at the bottom of the page.



Names:

- a.           methyl butanoate / methyl butyrate
- b.           ethyl butanoate / ethyl butyrate
- c.           N-ethylbutanamide / N-ethylbutyramide
- d.           ethanoic butanoic anhydride / acetic butyric anhydride
- e.           sodium butanoate / sodium butyrate
- f.           butanoic acid / butyric acid

5. Choose one of the reactions below, predict its products, and draw its mechanism. You **do not** need to explicitly show every proton transfer, and you **do not** need to show the mechanism for ester hydrolysis reactions.

**State the name** of the reaction(s) that occur.

For extra credit, do two mechanisms, and **clearly mark** which one you would like extra credit for. Use the back if you need to.

