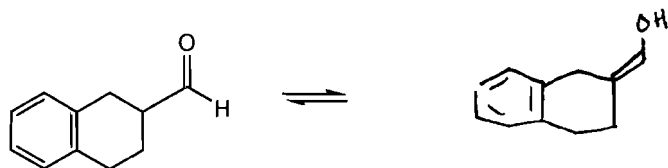


1. (3 pts) Draw the Enol form of the aldehyde below.

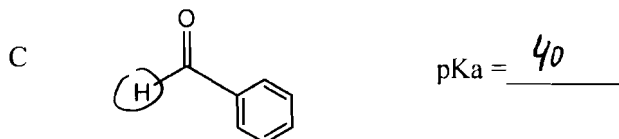
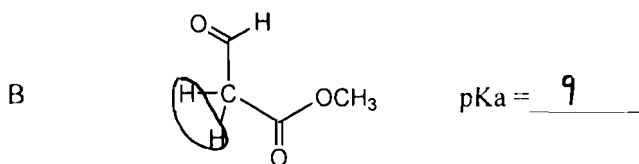
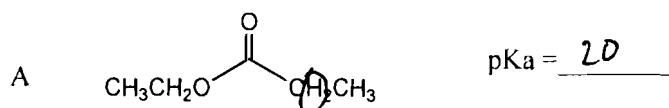


Enol

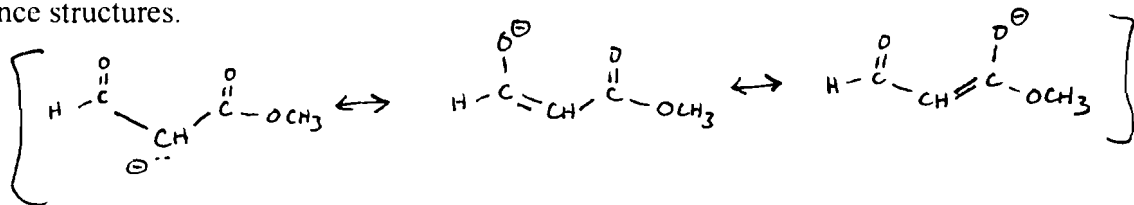
2a. (3 pts) Match the pKa values listed below with the most acidic hydrogen(s) in A, B and C. Possible pKa values: pKa = 9 pKa = 20, pKa = 40

b. (3 pts) For each compound (A,B, and C) **circle the hydrogen(s)** that are most acidic.

c. (2 pts) Which compound(s) (A-C) would be completely deprotonated by NaOH? (Note: the pKa of water is 15.7) B (pKa < 15.7)



d. (4 pts) For the **most acidic** compound above, draw its deprotonated form (conjugate base). Be sure to show all pertinent resonance structures.



3. (10 pts) **Circle** what is **true** about oxidation/reduction

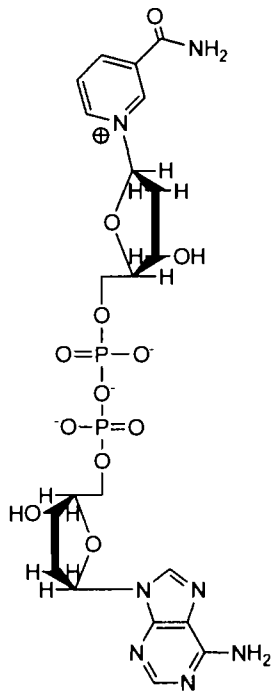
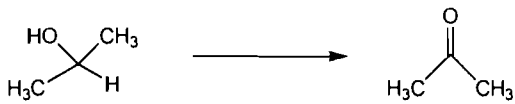
- a) An aldehyde is more oxidized than an alcohol
- b) A ketone is more reduced than a carboxylic acid
- c) A ketone is a better fuel (has more potential energy) than an alcohol
- d) Reduced forms of carbon are considered 'Fuels' (high potential energy)
- e) Humans are 'reducers' as opposed to 'oxidizers'
- f) Sodium Borohydride (NaBH<sub>4</sub>) is considered a 'reducing agent' (it reduces compounds it reacts with)
- g) During photosynthesis, plants reduce carbon dioxide.
- h) Coal is considered an oxidized form of Carbon.

4. One of the 3 (A,B,C) molecules below is NAD<sup>+</sup> (nicotinamide adenine dinucleotide) and another is NADH.

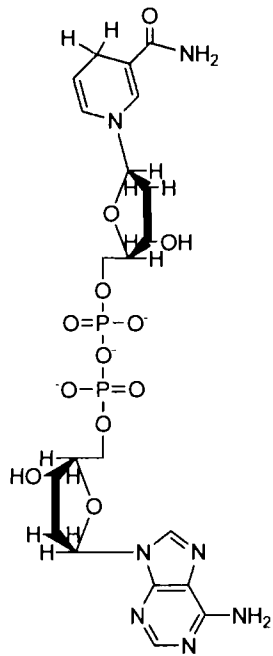
a. (2 pts) Which compound is NADH? (A, B or C) B

b. (2 pts) Which molecule could reduce an aldehyde to an alcohol? (A, B or C) B

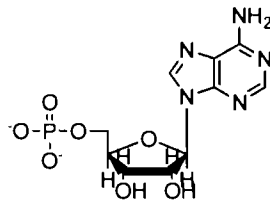
c. (2 pts) Which molecule could convert 2-propanol to acetone? (A, B or C) A



A

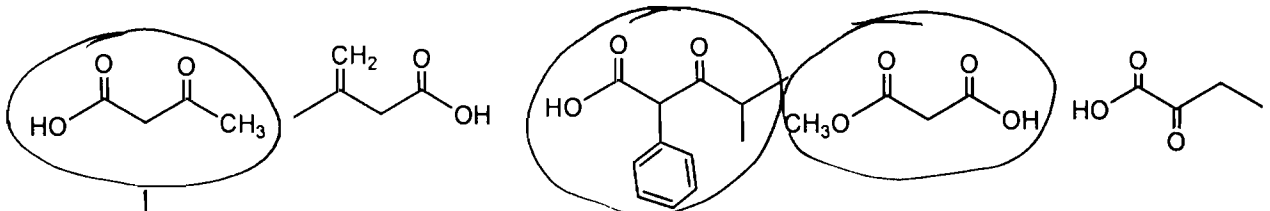


B

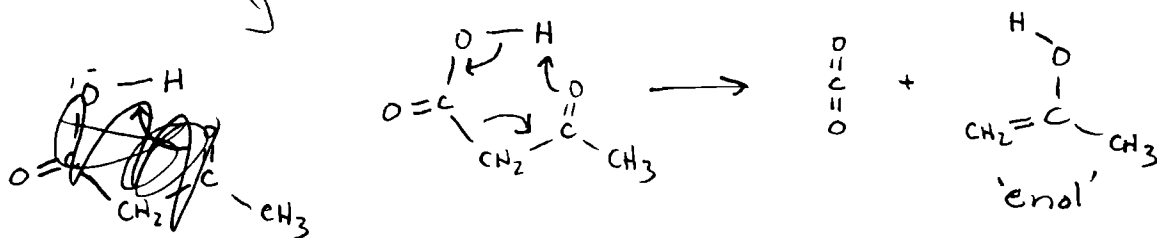


C

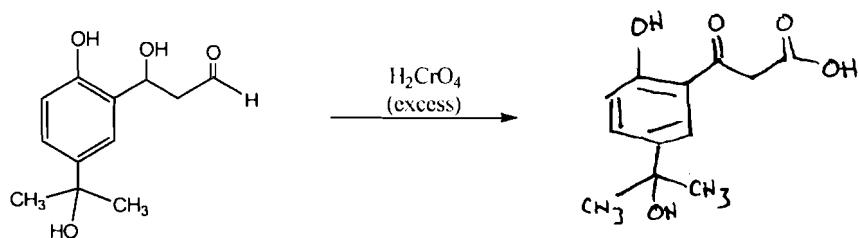
5. a. (4 pts) Circle the compound(s) below that would be expected to decarboxylate (lose CO<sub>2</sub>) when heated.



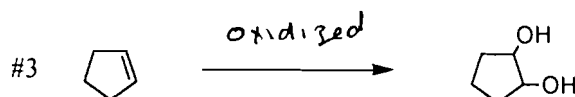
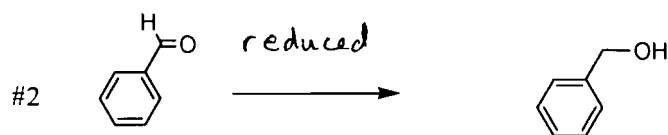
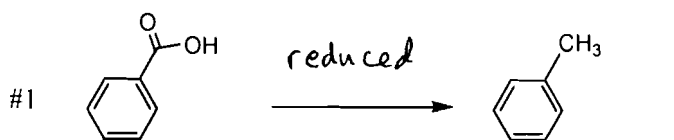
b. (5 pts) Depict the decarboxylation mechanism and **Enol** product formed for **one** of the compound you circled above.



6. (6 pts each) Draw the expected organic products of the reactions shown below

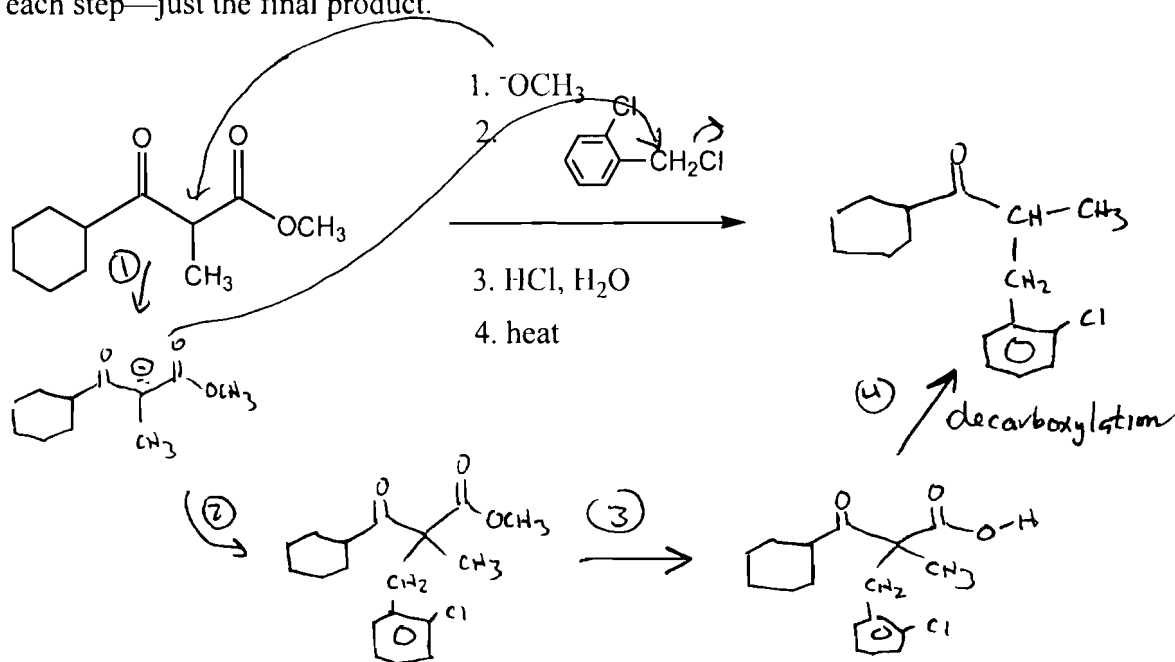


7 (6 pts) For each reaction, is the organic molecule being oxidized or reduced?

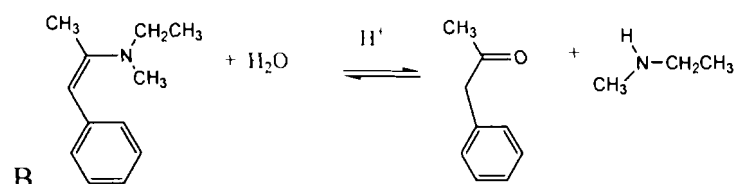
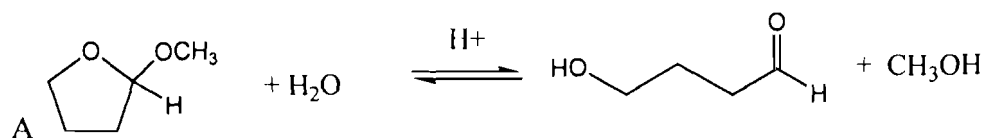


b. (4 pts) Which reaction(s) above (1-3) would release heat (would be an exothermic reaction)? #3

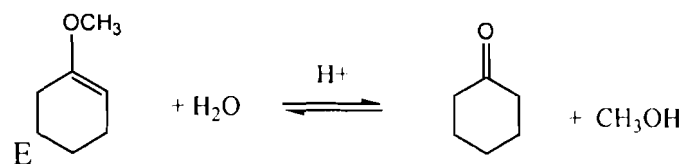
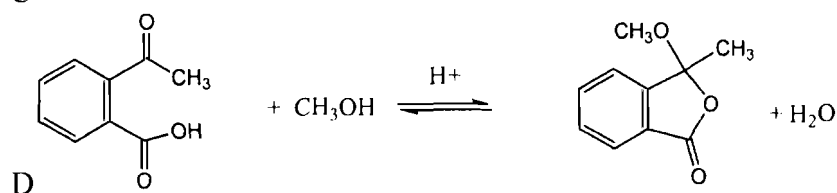
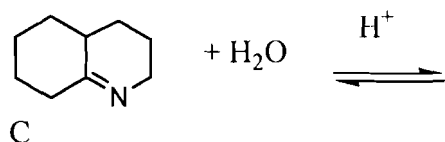
8. (6 pts) Fill in the **final product** of the synthesis shown below. You do not have to draw the structures, after each step—just the final product.



9 (16 pts) Carefully draw the **mechanism** and product for **one** the reactions below(A-E). **It is your choice on which you do.** Note that some of the reactions do not have the product drawn in while others do.

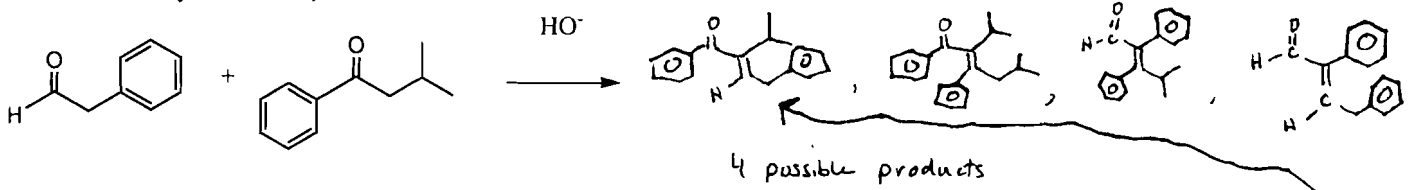


*see in-class #2 Key*

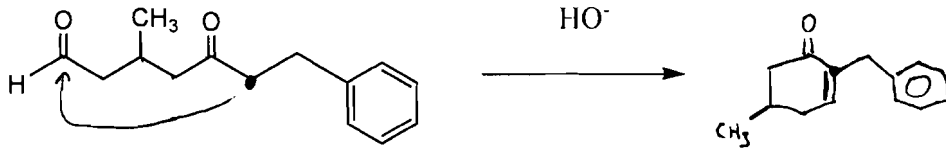


10 (14-18 pts each) Draw the **mechanism** and product for **one** of the reactions below (A, B or C). It is your choice on which you do. Note that they have slightly different point values depending on degree of hardness.

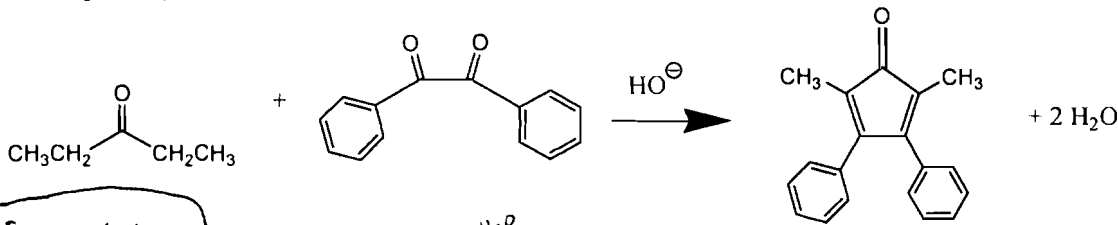
A. (14 pts) Aldol condensation-show mechanism for only **one** of the aldol condensation products (your choice to which one you show). Assume heat is added at the end of the reaction.



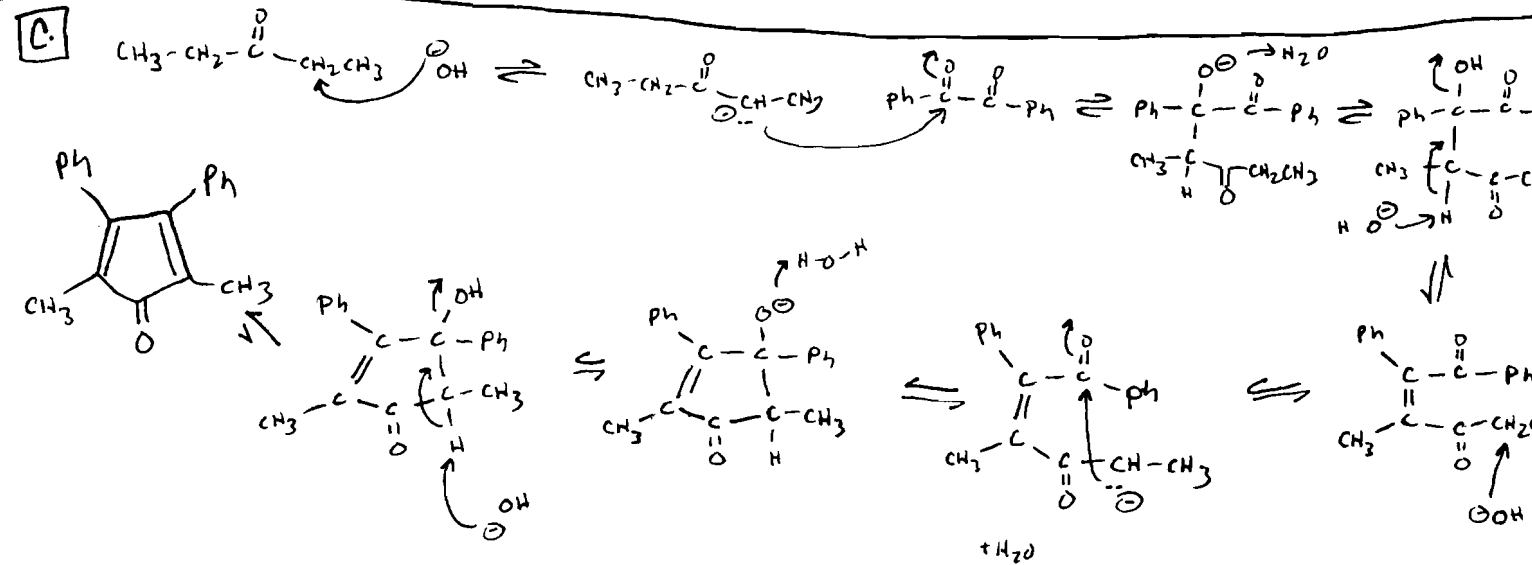
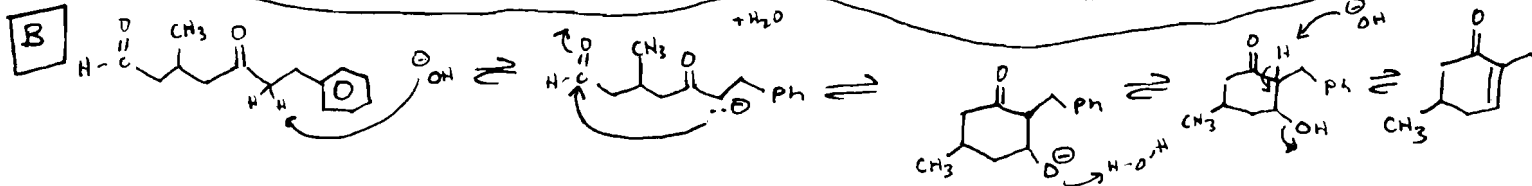
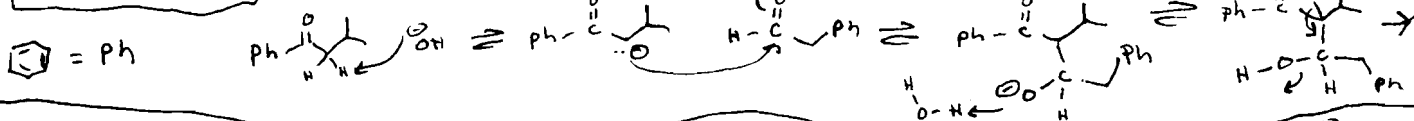
B (16pts) Intermolecular Aldol condensation. Assume heat is added at the end of the reaction



C (18 points) Aldol condensation



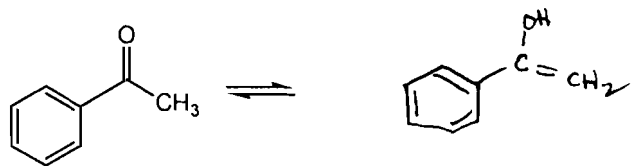
A For one of them



**Bonus question (+2)** If you were elected president, what would be your energy policy/program for the nation?

- ① Arizona Becomes a solar panel
- ② 1 Trillion to Fusion Research
- ③ mandatory 'Bike to work' programs
- ④ massive O-chem educational Research Program on Energy

1. (3 pts) Draw the Enol form of the ketone below.

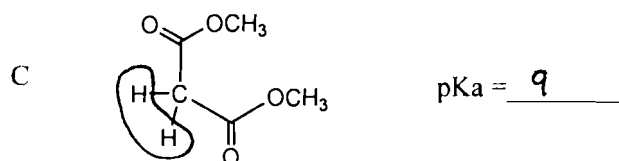
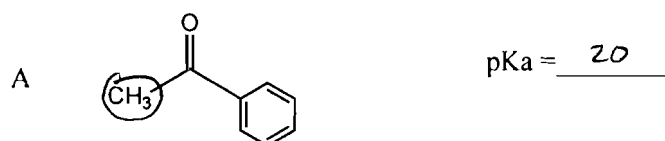


Enol

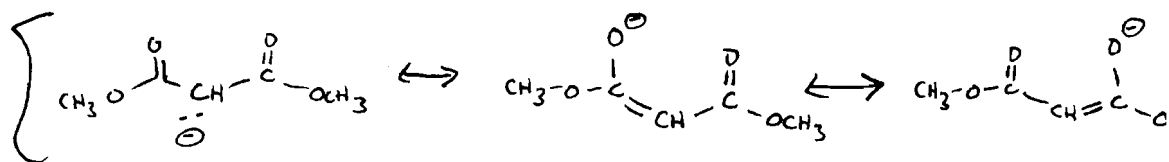
2a. (3 pts) Match the pKa values listed below with the most acidic hydrogen(s) in A, B and C. Possible pKa values: pKa = 9 pKa = 20, pKa = 40

b. (3 pts) For each compound (A,B, and C) **circle the hydrogen(s)** that are most acidic.

c. (2 pts) Which compound(s) (A-C) would be completely deprotonated by NaOH? (Note: the pKa of water is 15.7) \_\_\_\_\_



d. (4 pts) For the **most acidic** compound above, draw its deprotonated form (conjugate base). Be sure to show all pertinent resonance structures.



3. (10 pts) **Circle** what is **true** about oxidation/reduction

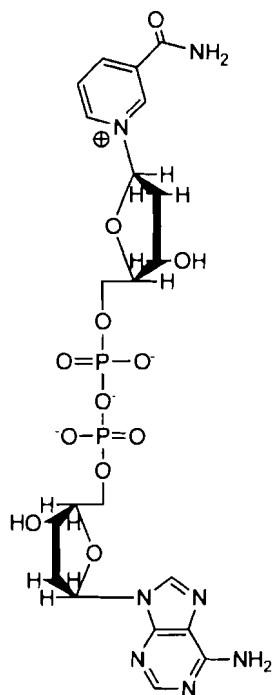
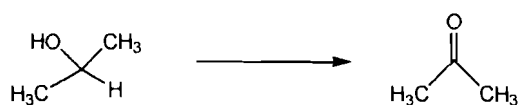
- a) An aldehyde is more reduced than an alcohol
- b) A ketone is more oxidized than a carboxylic acid
- c) A ketone is a better fuel (has more potential energy) than an alcohol
- d) Oxidized forms of carbon are considered 'Fuels' (high potential energy)
- e) Humans are 'Oxidizers' as opposed to 'Reducers'
- f) Sodium Borohydride (NaBH<sub>4</sub>) is considered a 'reducing agent' (it reduces compounds it reacts with)
- g) During photosynthesis, plants reduce carbon dioxide.
- h) Coal is considered an reduced form of Carbon.

4. One of the 3 (A,B,C) molecules below is NAD<sup>+</sup> (nicotinamide adenine dinucleotide) and another is NADH.

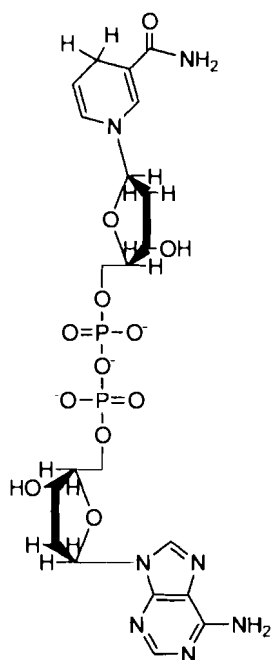
a. (2 pts) Which compound is NAD<sup>+</sup>? (A, B or C) A

b. (2 pts) Which molecule could reduce an aldehyde to an alcohol? (A, B or C) B

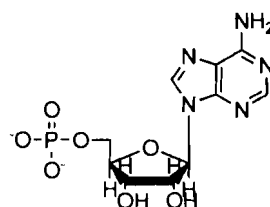
c. (2 pts) Which molecule could convert 2-propanol to acetone? (A, B or C) A



A

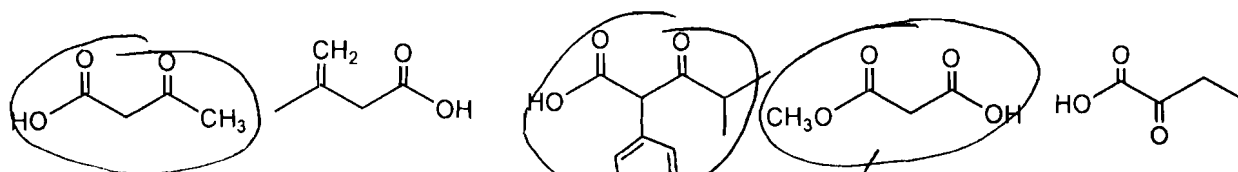


B

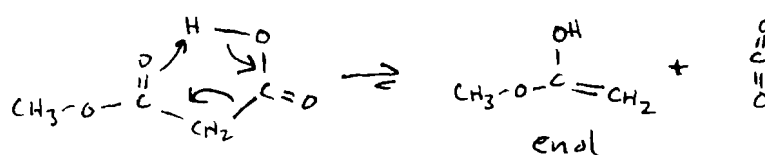


C

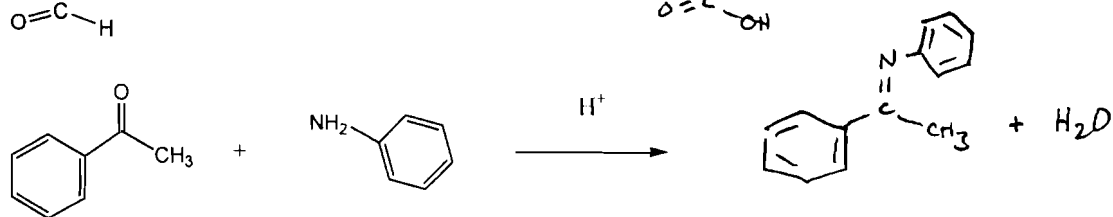
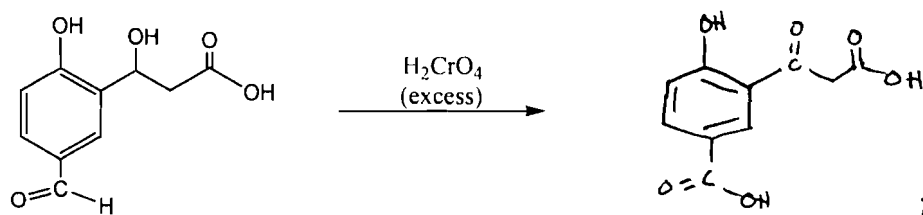
5. a. (4 pts) Circle the compound(s) below that would be expected to decarboxylate (lose CO<sub>2</sub>) when heated.



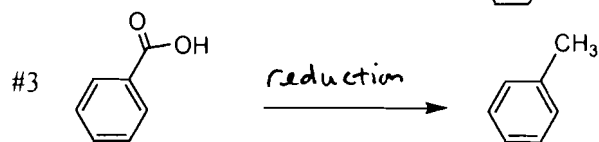
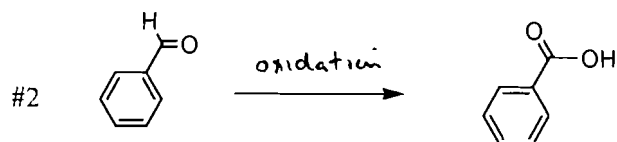
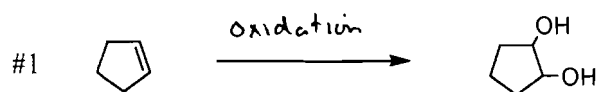
b. (5 pts) Depict the decarboxylation mechanism and **Enol** product formed for **one** of the compound you circled above.



6. (6 pts each) Draw the expected organic products of the reactions shown below

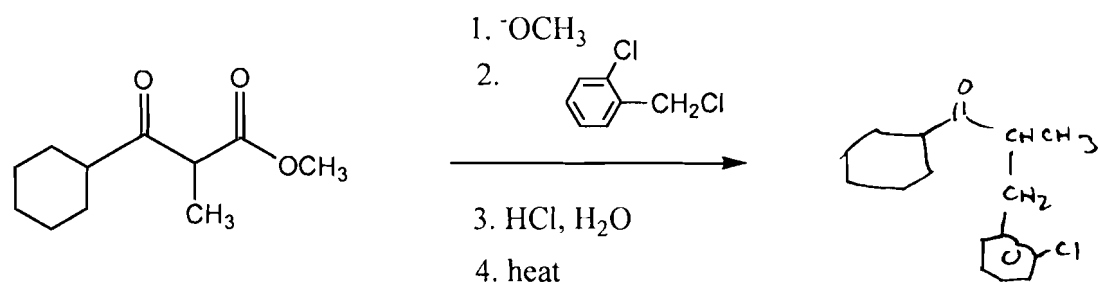


7 (6 pts) For each reaction, is the organic molecule being oxidized or reduced?

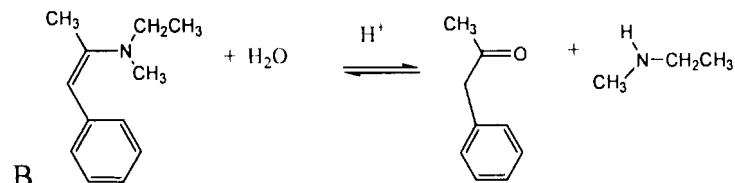
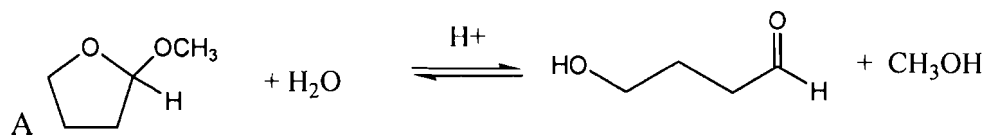


b. (4 pts) Which reaction(s) above (1-3) would release heat (would be an exothermic reaction)? 1 & 2

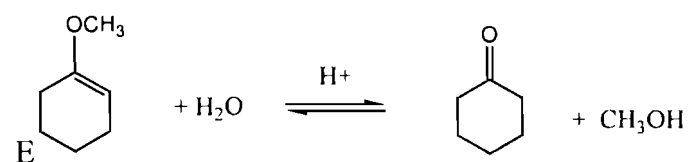
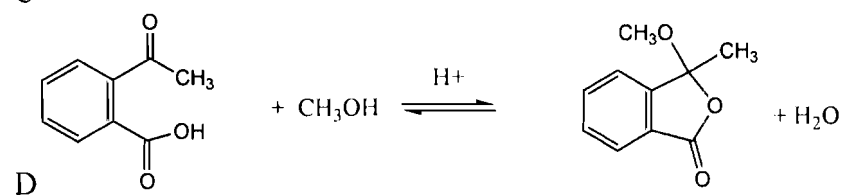
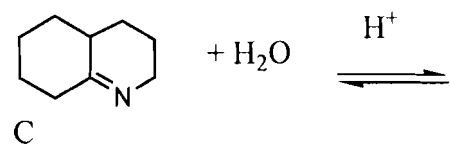
8. (6 pts) Fill in the **final product** of the synthesis shown below. You do not have to draw the structures, after each step—just the final product.



9 (16 pts) Carefully draw the **mechanism** and product for **one** the reactions below (A-E). It is your choice on which you do. Note that some of the reactions do not have the product drawn in while others do.

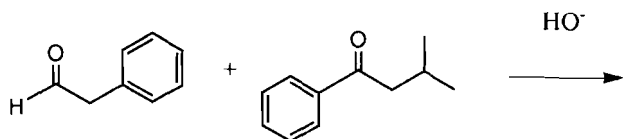


*please see in class #2 key*

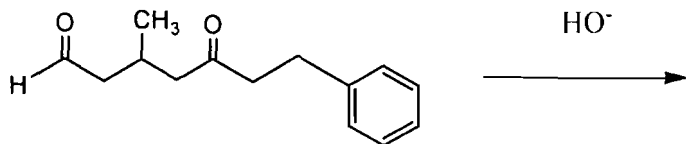


10 (14-18 pts each) Draw the **mechanism** and product for **one** the reactions below (A, B or C). **It is your choice on which you do.** Note that they have slightly different point values depending on degree of hardness.

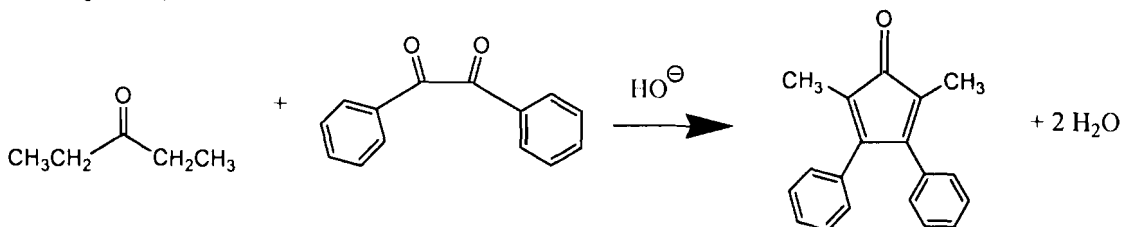
A. (14 pts) Aldol condensation-show mechanism for only **one** of the aldol condensation products (your choice to which one you show). Assume heat is added at the end of the reaction.



B (16pts) Intermolecular Aldol condensation. Assume heat is added at the end of the reaction



C (18 points) Aldol condensation



*Please see white copy (James T. Kirk version)*

**Bonus question (+2)** If you were elected president, what would be your energy policy/program for the nation?