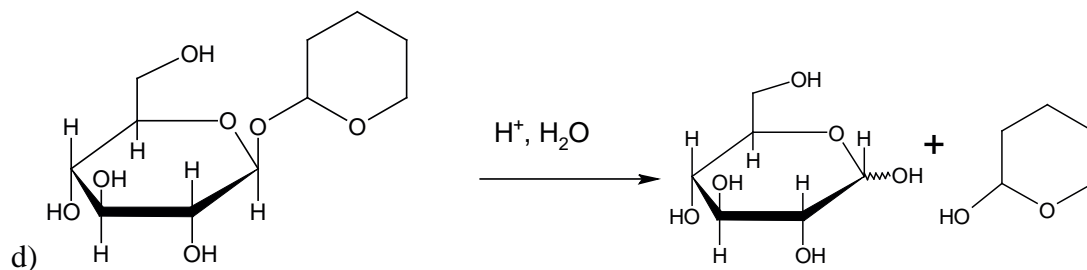
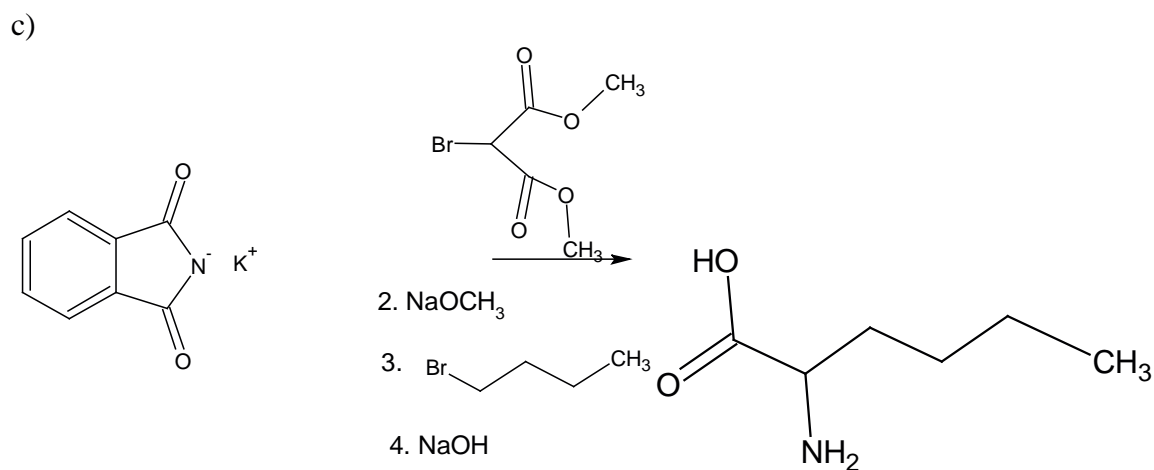
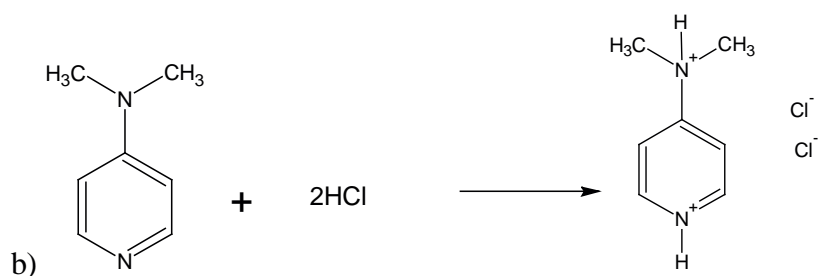
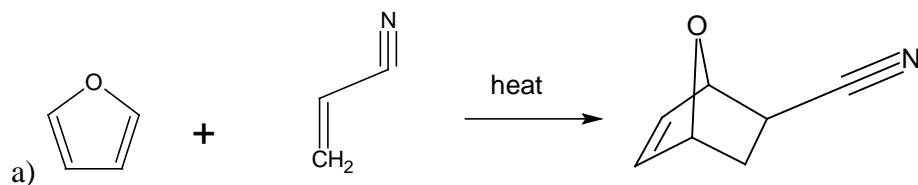
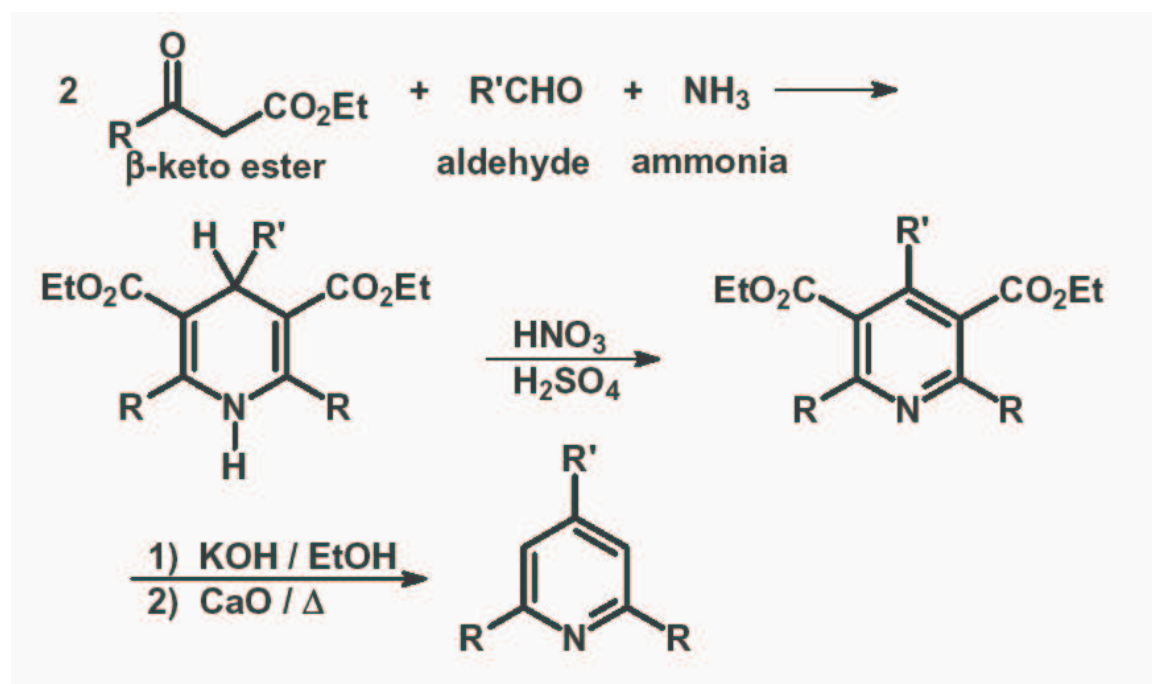
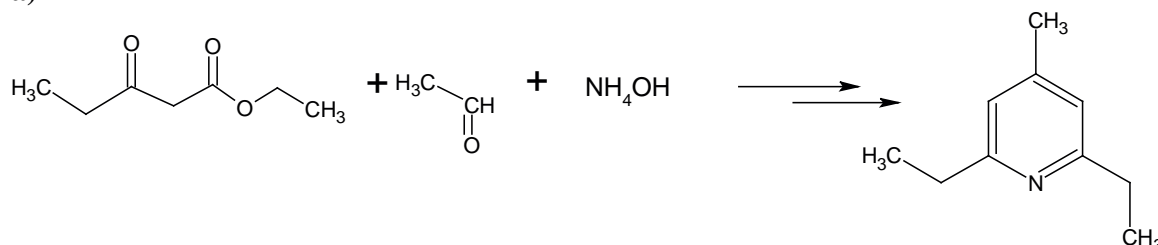


1. Give the principal organic product from each of the following reactions. Include stereochemistry when necessary. (5 points each)

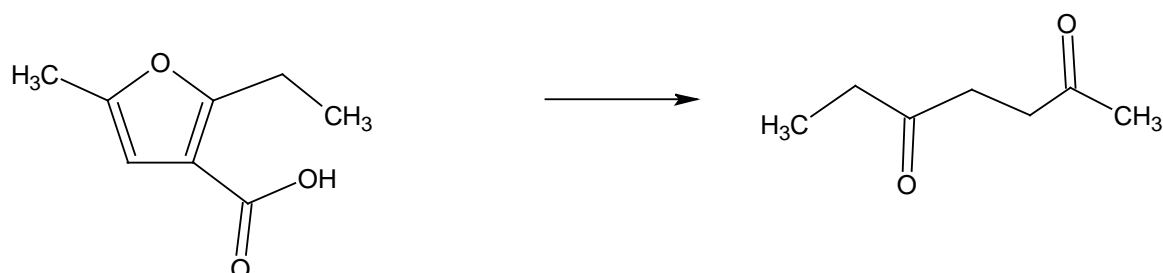


2. Indicate how you would carry out the following transformations. Be sure to include the necessary solvents and conditions. Probably more than one step may be necessary. (5 points each).

a)

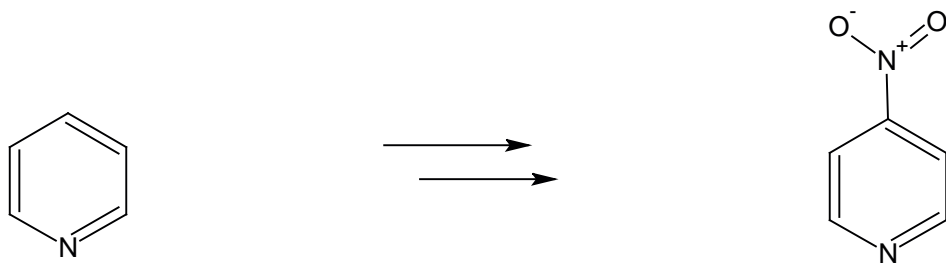


b)



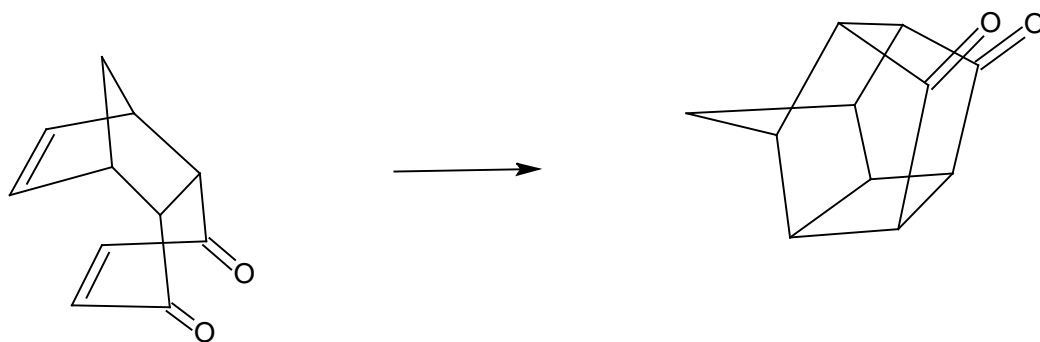
1. $\text{H}_2\text{O}/\text{H}^+$, 2. heat decarboxylation

c)



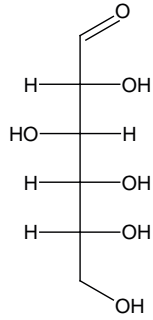
1. mCpBA (N-oxide), 2. AcONO₂ 3. PCl₃

d)

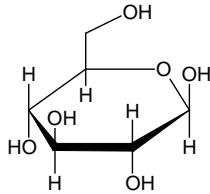


light, 2+2-cycloaddition

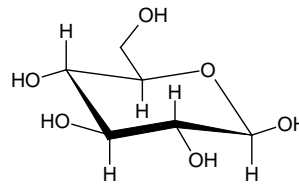
3. Characterize the following sugars (aldose, ketose, pentose, hexose.). Draw the Haworth formula and the most stable conformer according to the β -D-glucose example in the first row. (5 points each).



Aldohexose

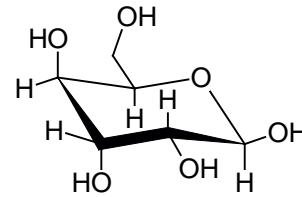
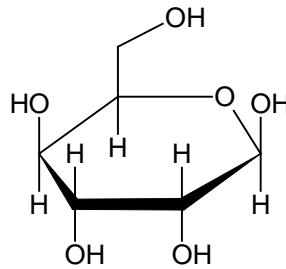
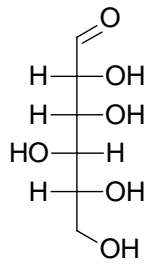


Haworth

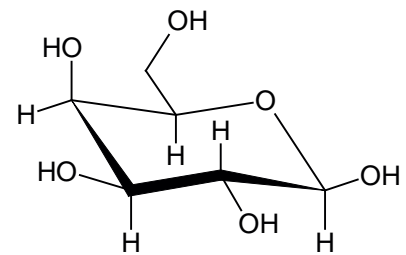
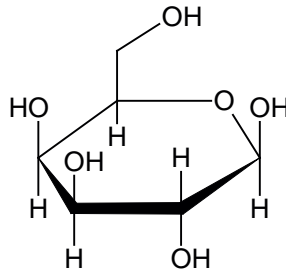
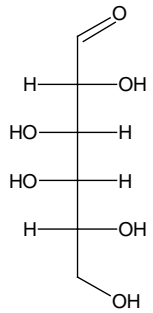


stereo

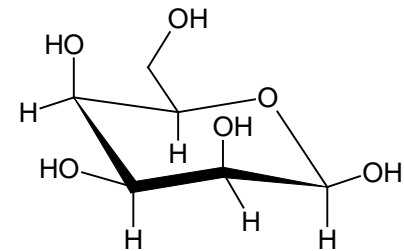
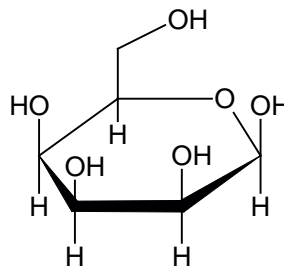
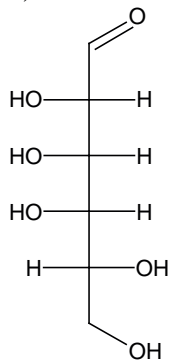
a)



b)



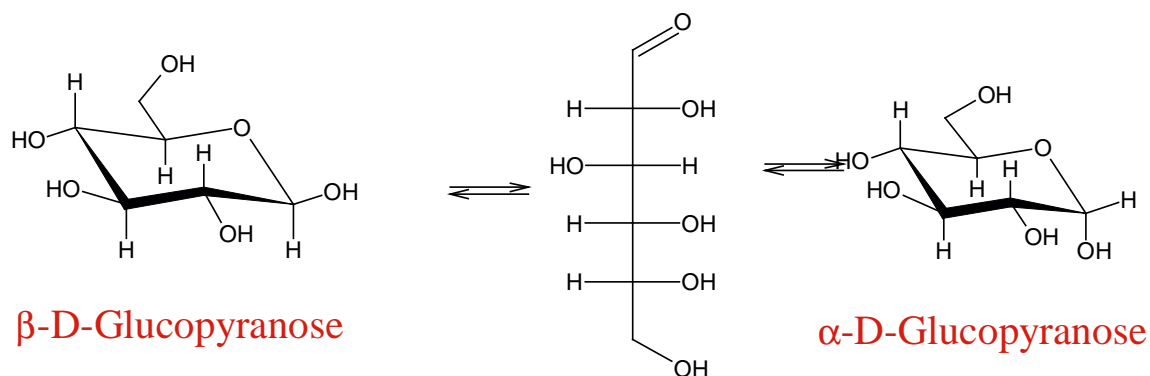
c)



4.) Explain the following observation(5 points):

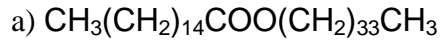
A compound (glucose) is dissolved in water, directly after dissolving the optical rotation is measured. After a couple of hours the optical rotation is measured again. The value has changed. How is this behavior called?

Mutarotation:

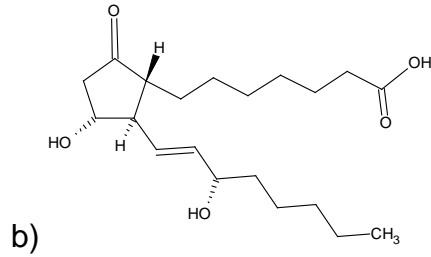


equilibrium between α -, open chain and β -D-Glucose. Each one of these three individual compounds has a different optical rotation, thus it changes over time.

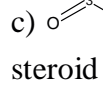
5.) Match the following lipids with the appropriate compound classification (wax, fatty acid, sesquiterpene, triterpene, carotenoid, phospholipid, monoterpene, prostaglandin, diterpene, triglyceride, steroid) (10 points).



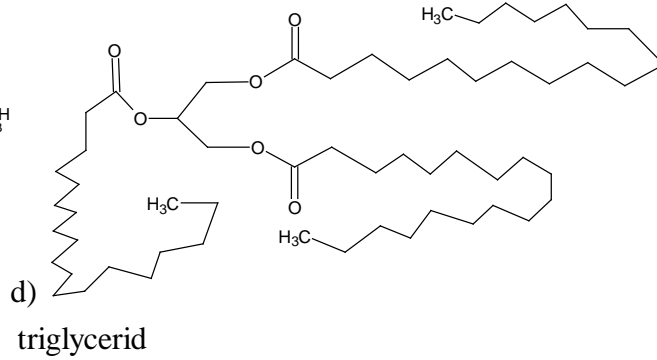
wax



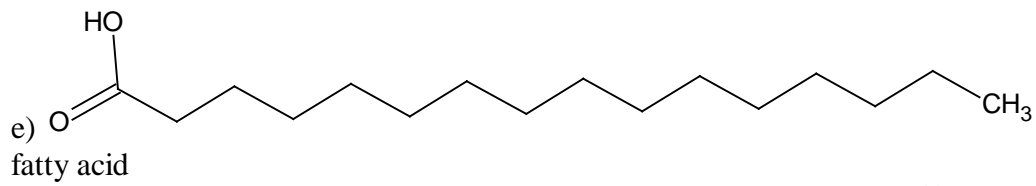
prostaglandin



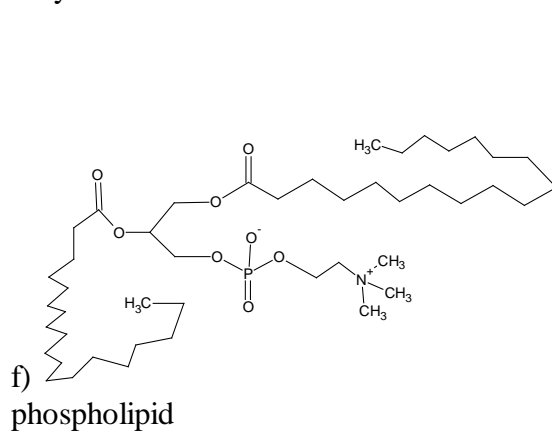
steroid



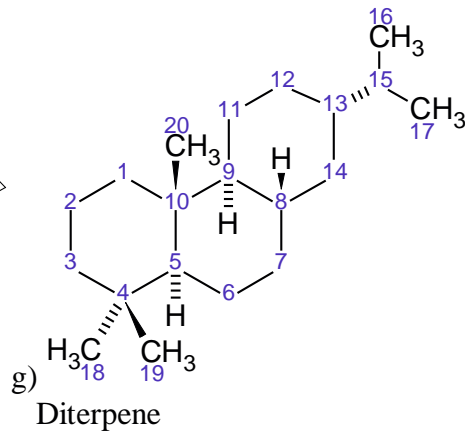
triglycerid



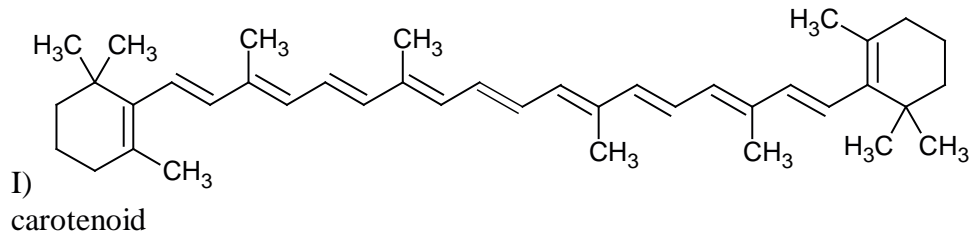
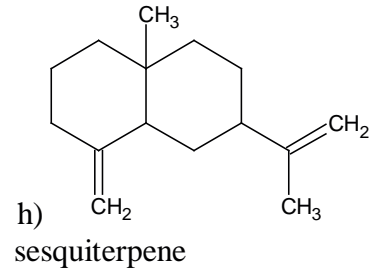
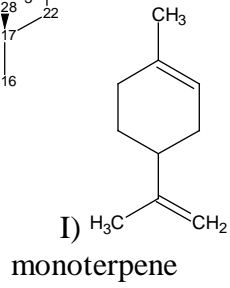
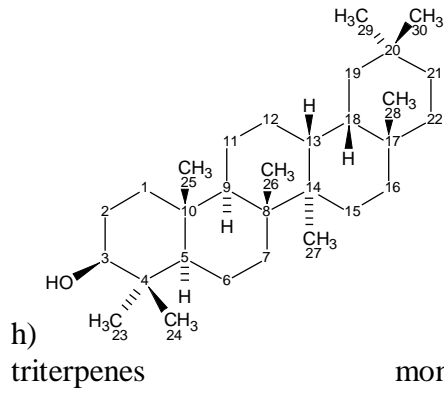
fatty acid



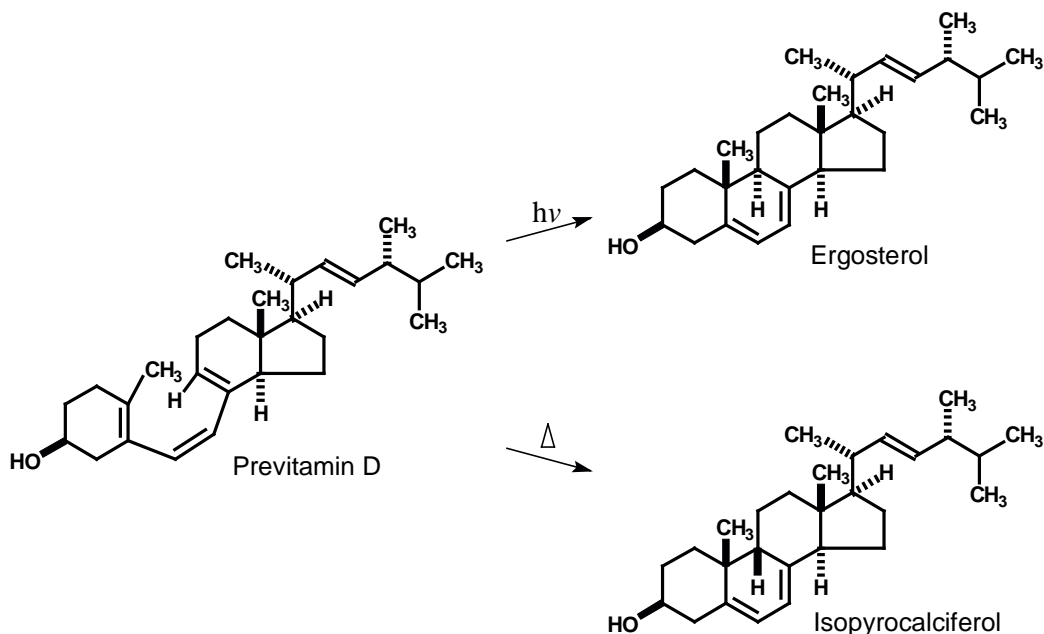
phospholipid



Diterpene



6.) Explain the following reactions (10 points)



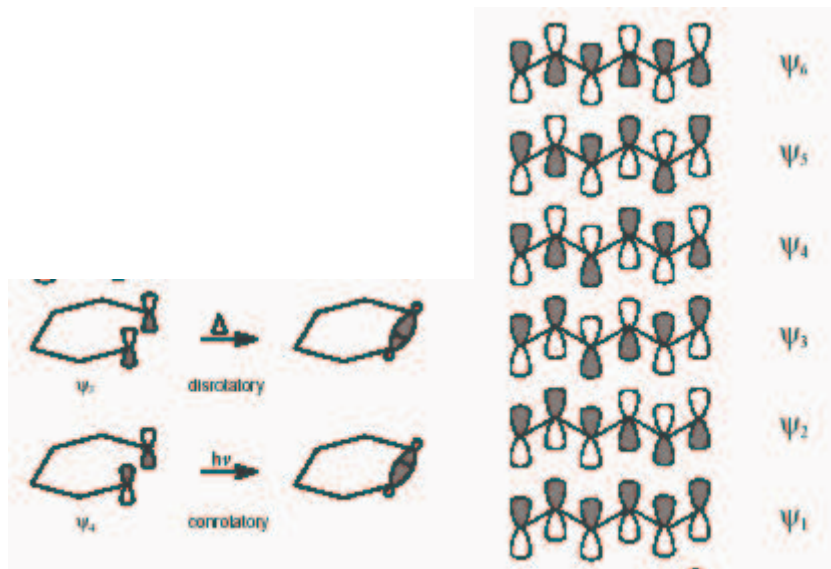
A substituted triene:



The photochemical process must have involved a situation in which the termini have rotated in the same direction--- a **conrotatory process**.

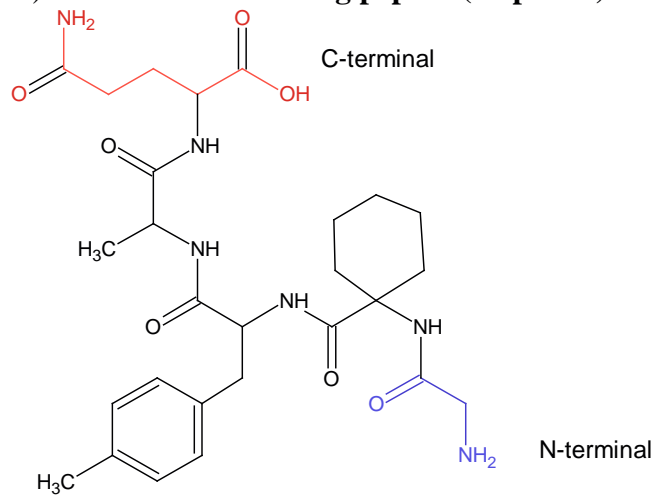


The thermal process must have involved rotation of the termini in opposite directions---a **disrotatory process**.



3rd MO is HOMO(for thermal reaction) with UV irradiation the LUMO (4th MO), gets HOMO*.

7.) Consider the following peptide (10 points):



Label

- N-terminal amino acid**
- C-terminal amino acid**
- Peptide bonds**
- Is it a tripeptide, tetrapeptide, pentapeptide, hexapeptide**
- Neutral, basic, or acidic**

SHOULD BE NEUTRAL AND A PENTAPEPTIDE:

PEPTIDE BONDS: C=O -NH—

8.) If you heat the three amino acids alanine(ala), glycine(gly), and phenylalanine(phe) you obtain a mixture of tripeptides.

- give the number of possible structures (1 point) : 27
- draw all possible structures (4 points), only 10
- explain a way, so that you can synthesize only phe-ala-gly (10 points).

A: 27 (3*3*3)

B:

A-A-A, A-A-G, A-A-P, A-G-A, G-A-A, A-P-A, P-A-A, A-G-G, G-A-G, G-G-A, A-P-P, P-A-P, P-P-A, G-G-G, G-P-G, G-G-P, P-G-G, A-G-P, A-P-G, G-A-P, G-P-A, P-A-G, P-G-A, P-P-P, P-P-G, G-G-P, G-P-P

C:

Boc-Gly + ClCH₂-Poly → Boc-Gly-CH₂-Poly

→(CF₃COOH) Gly-CH₂-Poly

→(Boc-Ala, DCC) Boc-Ala-Gly-CH₂-Poly

→(CF₃COOH) Ala-Gly-CH₂-Poly

→(Boc-Phe, DCC)

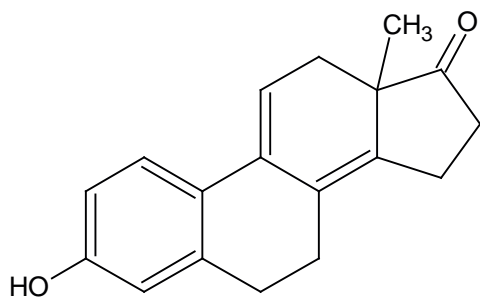
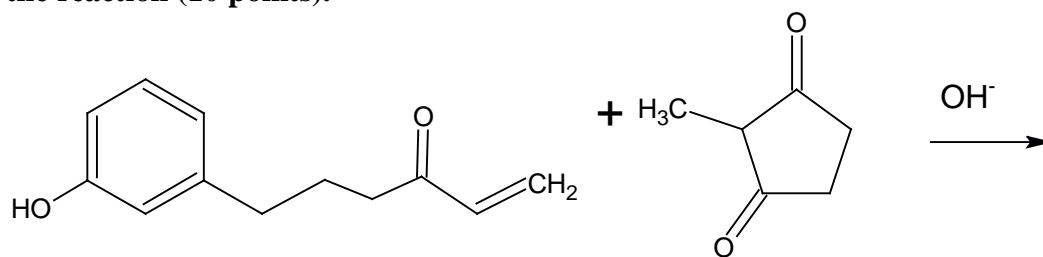
Boc-Phe-Ala-Gly-CH₂-Poly

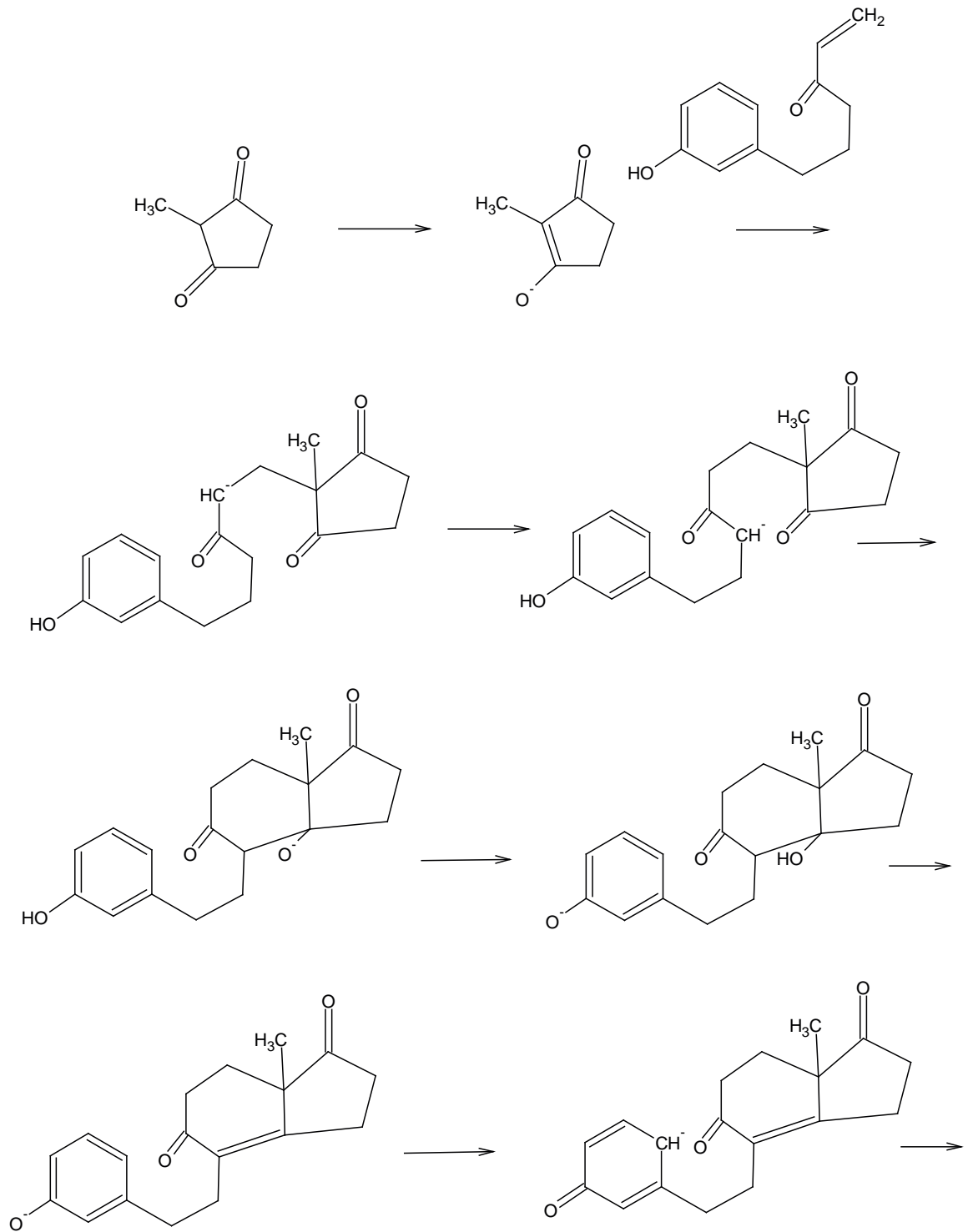
→(CF₃COOH) Phe-Ala-Gly-CH₂-Poly

→(HF)

Phe-Ala-Gly

9.) For the commercial synthesis of estrone, a steroid hormone, the following starting materials are used. Key reaction is a Robinson annulation. Propose a mechanism for the reaction (10 points).





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