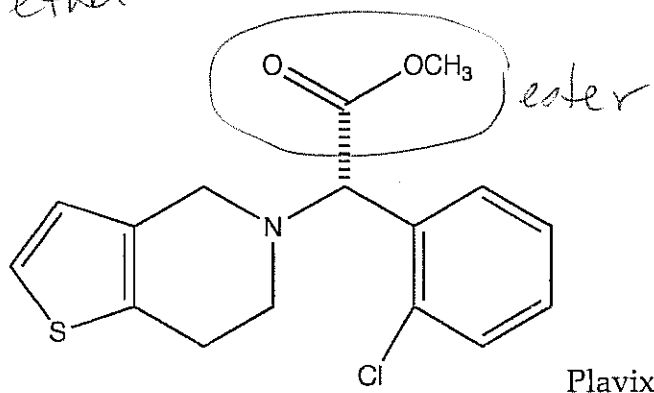
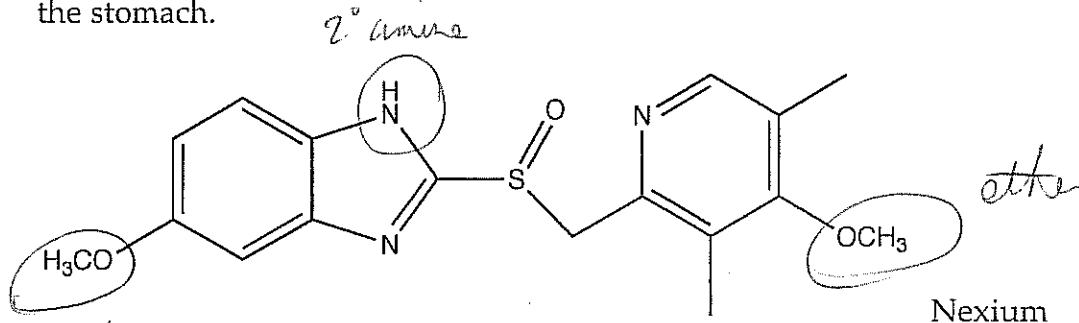


Final: all chapters

Answer all questions. Closed book, open notes, handouts, exercises, homeworks; no collaboration. You may use models if you wish. Please turn in all appropriate exercises and homeworks with the exam. 120 minutes. There are seven extra credit points built-in.

Quick hits:

1. Plavix is an anti-clotting drug and Nexium is a drug that reduces acid production in the stomach.



(8 points) Three out of the following four functional groups exist on one or both of these molecules. For the three that exist, circle one example on either molecule.

carboxylic acid

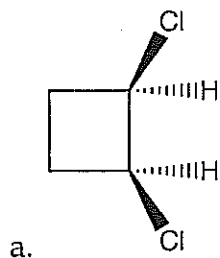
ether

ester

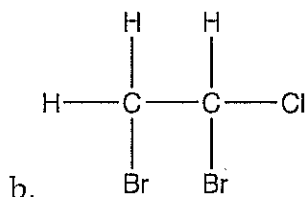
secondary amine

none

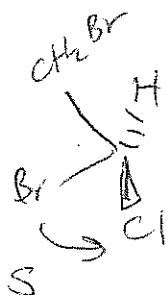
2. (2 points each) Give the proper IUPAC name for the following structures. Indicate (E,Z), (R,S) or cis-trans where needed; do not include those designations where not needed.



cis-1,2-dichlorocyclobutane
or *1R, 2S-dichlorocyclobutane*

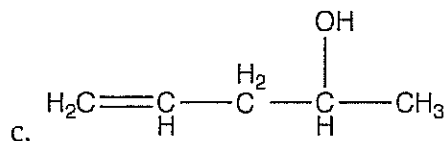


rewrite as



~~(S)-1-chloro-1,2-dibromoethane~~
~~(S)-1,2-dibromo-1-chloroethane~~

(S)-1,2-dibromo-1-chloroethane



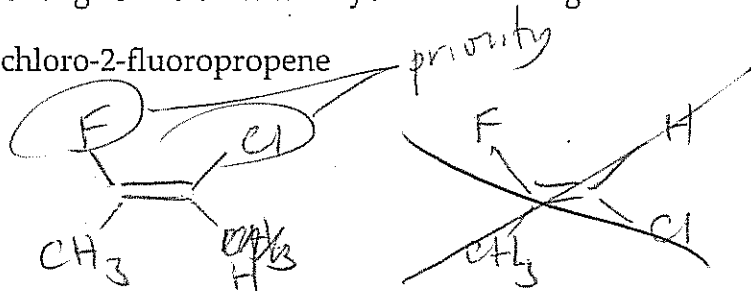
~~4-penten-2-ol~~
~~1-penten-4-ol~~

4-penten-2-ol

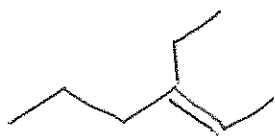
C takes precedence

3. (2 points each) Draw the structures from the IUPAC name given. Any representation is fine, so long as it is clear what you are drawing.

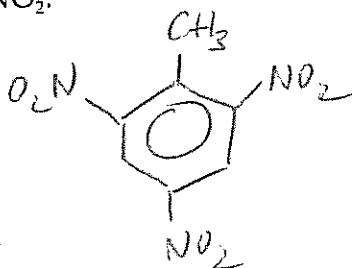
a. (Z)-1-chloro-2-fluoropropene



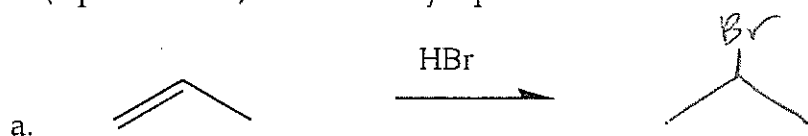
b. 3-ethyl-2-hexene

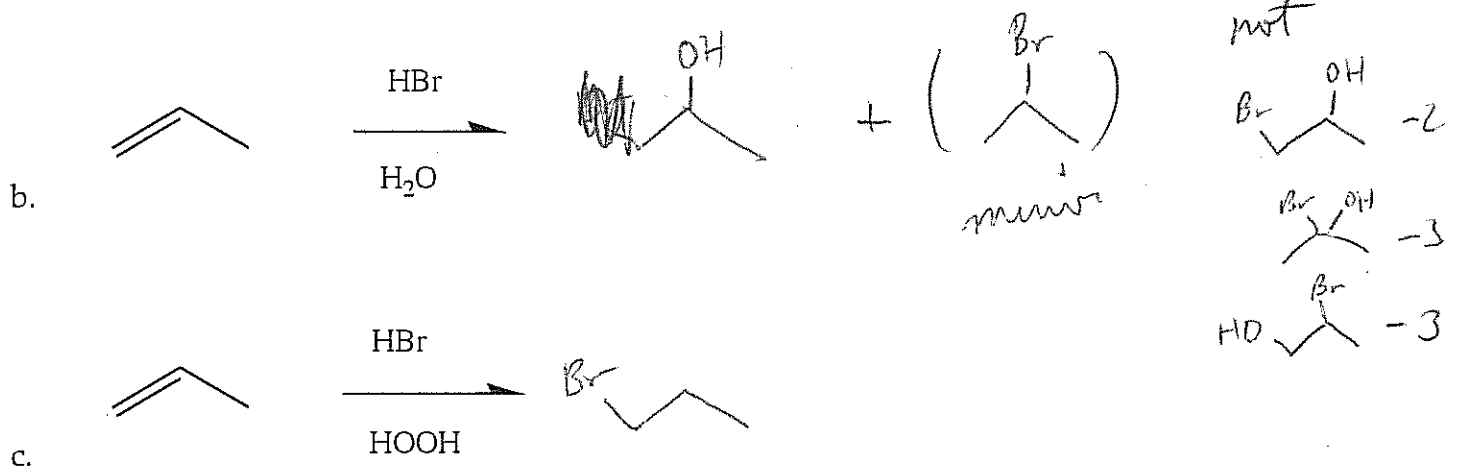


c. 2,4,6-trinitromethyl benzene (also known as 2,4,6-trinitrotoluene or TNT) Note: "nitro" is $-\text{NO}_2$.

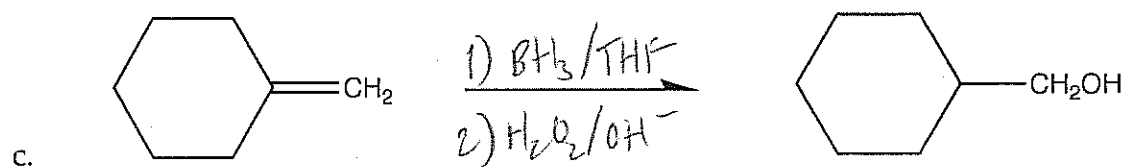
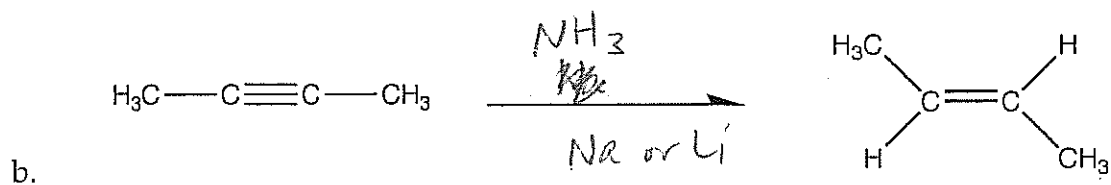
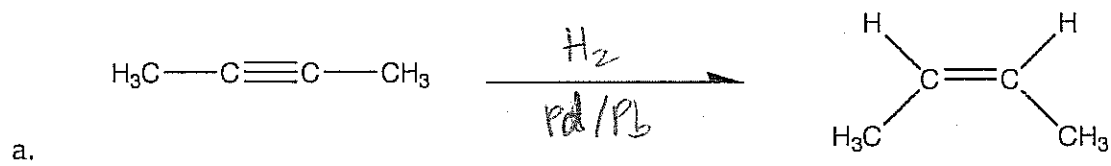


4. (3 points each) Give the major product of the reactions below.

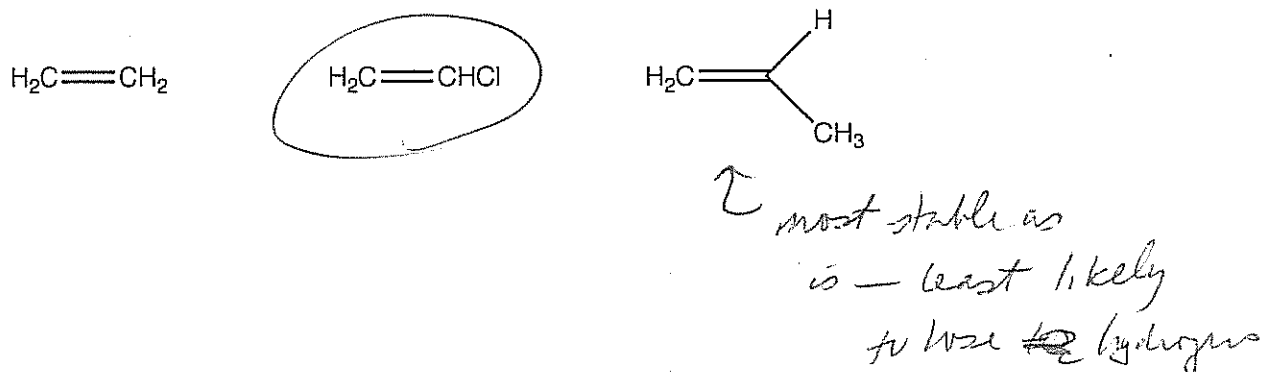




5. (3 points each) Give the reaction conditions that would result in the desired major product.

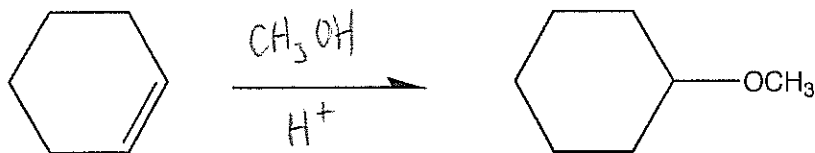


6. (4 points) Which of the following would have the most acidic hydrogens?

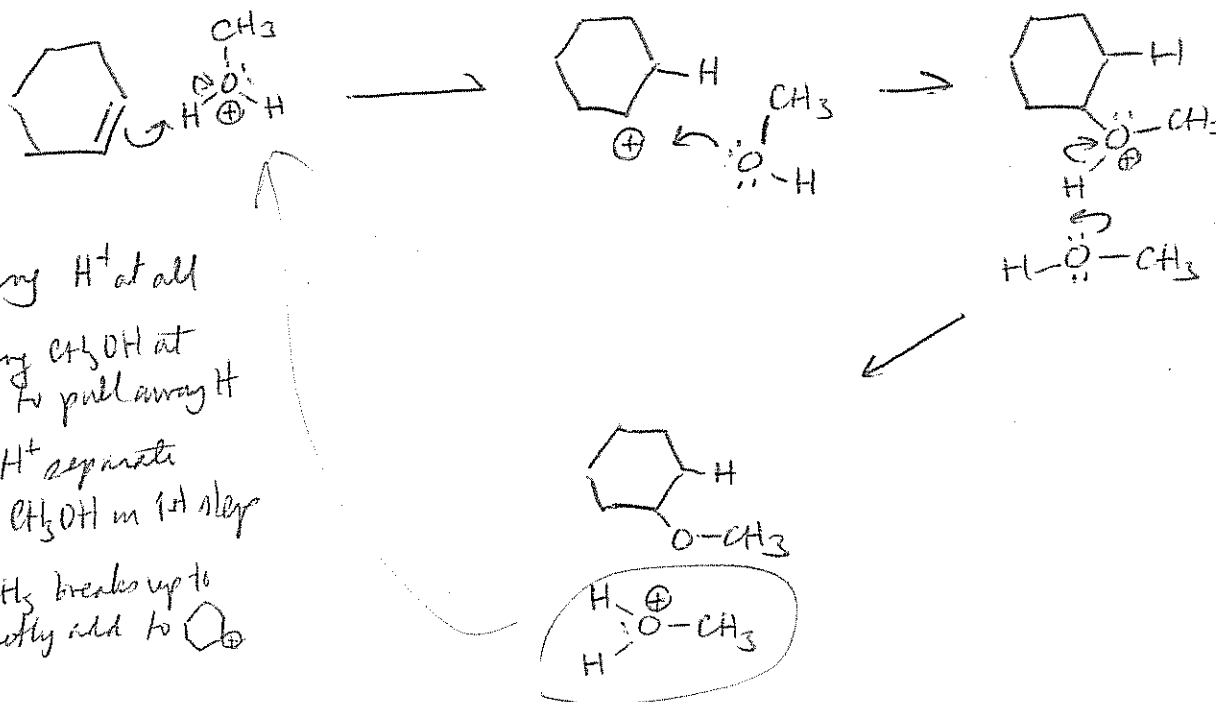


Longer questions:

7. Cyclohexene is reacted with methanol under acidic conditions, resulting in the product shown:

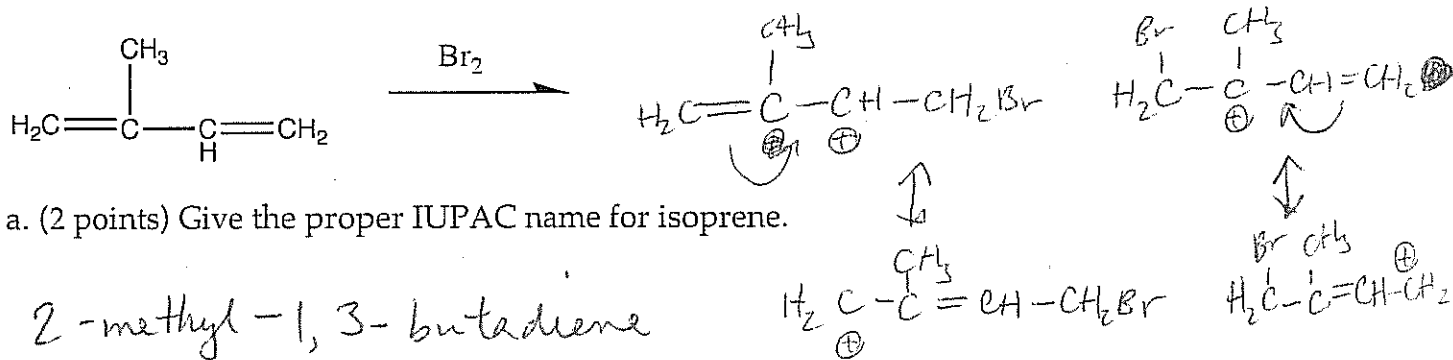


(10 points) Please give the mechanism for this reaction. Remember, on the main molecule, anytime a bond is made or broken, there should be a curved arrow to account for it!



- 3/4 not using H^+ at all
- 1 not using CH_3OH at end to pull away H^+
- 2 using H^+ separate from CH_3OH in 1st step
- 5 $\text{H}-\text{O}-\text{CH}_3$ breaks up to directly add to C^+

8. Isoprene is reacted with bromine:



a. (2 points) Give the proper IUPAC name for isoprene.

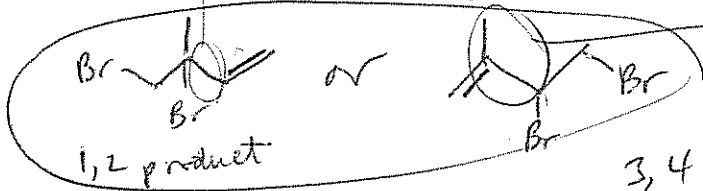
2-methyl-1,3-butadiene

1 sp² alkyl

b. (5 points) Draw the structure of the major product if the reaction is run at very low temperatures.

2nd Br missing -1

~~thermodynamic~~ kinetic product



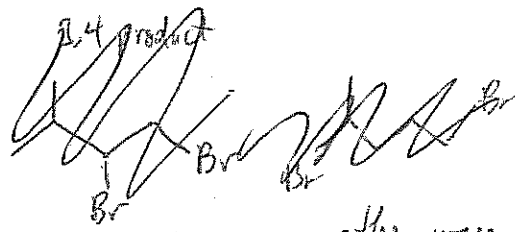
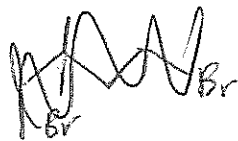
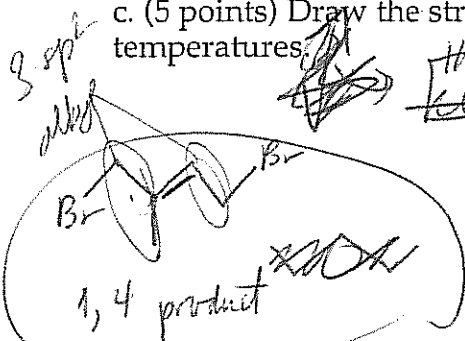
2 sp² alkyl

proximity

switch kinetic + thermodynamic -5

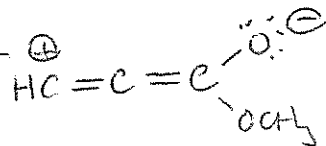
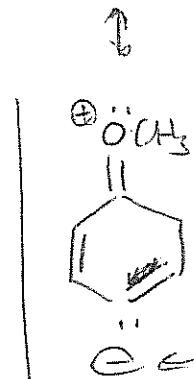
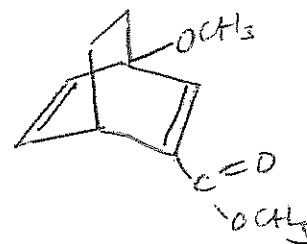
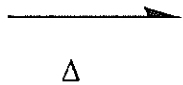
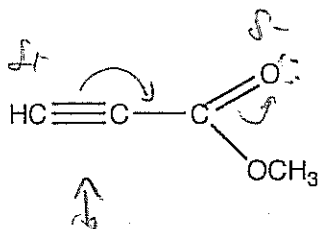
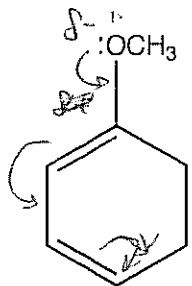
c. (5 points) Draw the structure of the major product if the reaction is run at very high temperatures.

~~kinetic~~ thermodynamic product



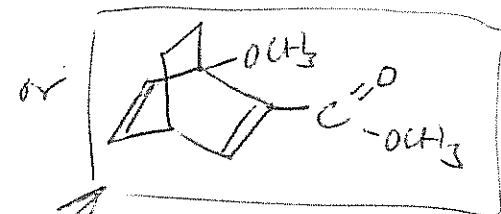
other way -3

9. (15 points) The following reaction can make two Diels-Alder products. One of them is preferred. Show the resonance contributors that lead to the preferred product, then draw the preferred product itself. (Hint: you may wish to start by drawing the two possible products.)



+4

So

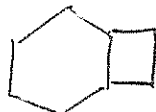


preferred

+7

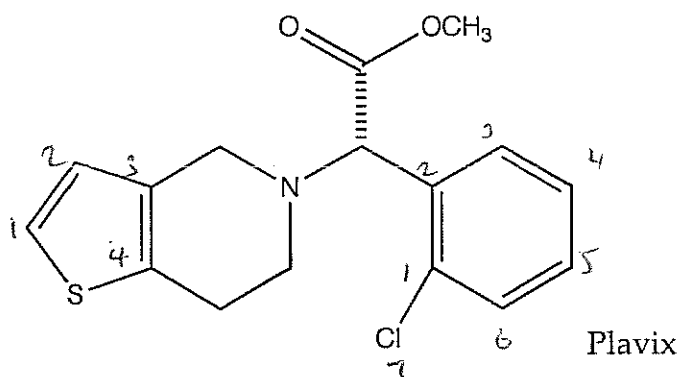
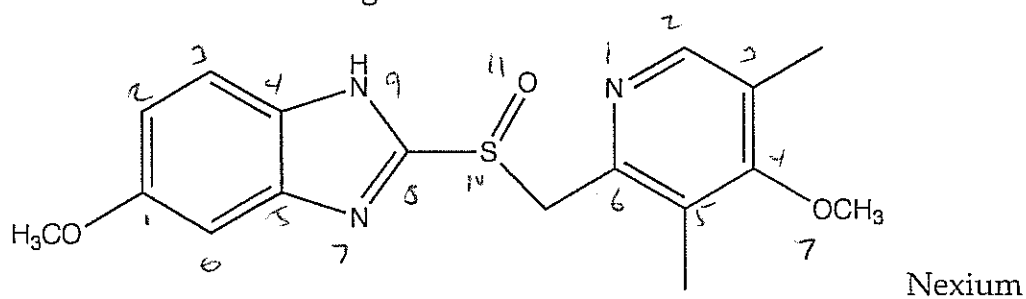
structure

+3



wrong one +3

10. Consider the two drugs below.

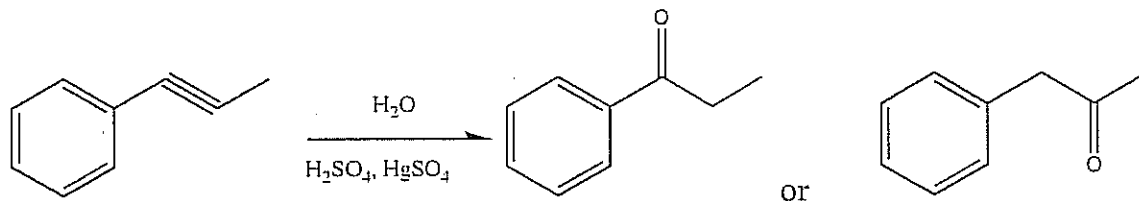


(6 points) Which molecule will absorb the longer wavelength? Give a justification for your choice.

Nexium — part of that molecule has 11 atoms in the π system, compared to a longest 7 atom π section in Plavix. The longer the π system, the longer the wavelength of light absorbed.

7

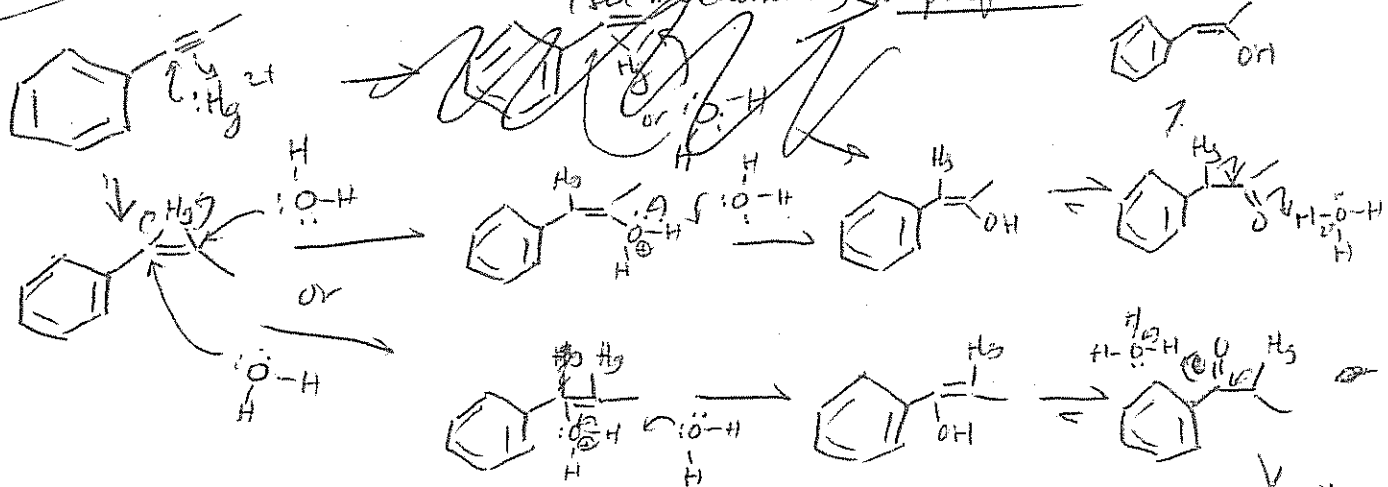
11. (10 points) In Exercise 5, question 1 e, many of you came up with the following answer:



I claim that one of those products is preferred. Am I crazy? Perhaps. But is there a preferred product? If you think so, circle it and give a justification, which may require drawing part of a mechanism. If you don't think so, give a justification for both products being equally favored, which may require drawing part of a couple mechanisms.

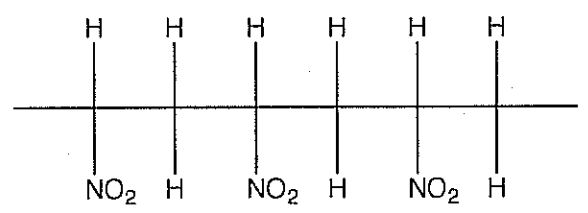
not from the
+5
arabuckton
forms
+5
steric hindrance
prefers
+7

since there is no carbocation formed, there is preference (see my Chemism)

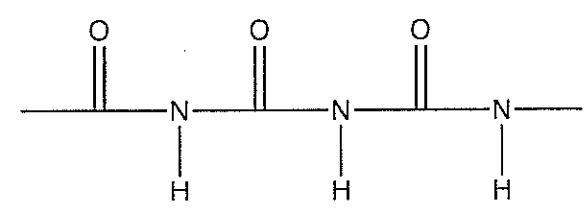


12. As you have seen from the numerous wonderful talks about various plastics, there seem to be two major mechanisms for making plastics: the addition method (which is usually radical-initiated) and the condensation method (in which the monomer(s) condense to form the polymer, losing water or another small molecule in the process).

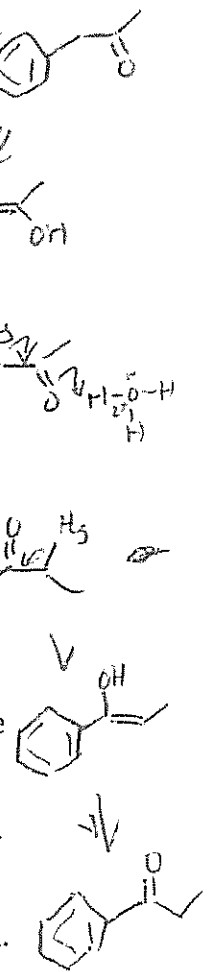
a. (2 points) Below are sections of two polymers, one made with the addition mechanism, the other with the condensation mechanism. Identify each by mechanism.



addition



condensation



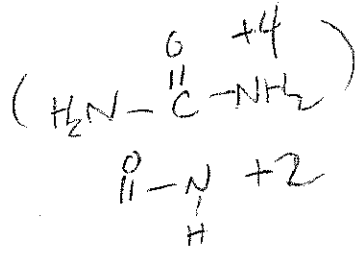
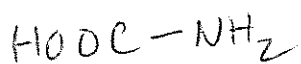
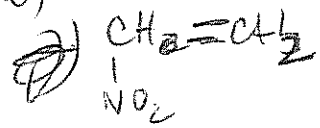
b. (6 points) For one of the polymers above, draw the structure of the monomer. Note that this is not simply a matter of breaking a couple of bonds; there may be functional groups and/or multiple bonds missing.

addition

condensation

not alkene

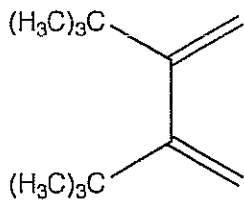
+2



not a monomer = 5

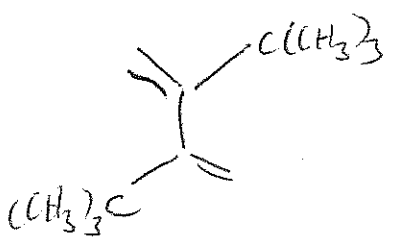
+2

13. (4 points) 2,3-di-t-butyl-1,3-butadiene (shown below) will not undergo Diels-Alder type cycloadditions with alkenes. Suggest a reason for this behavior.



won't find ~~the molecule~~ in the form shown
the t-butyl groups are large & will not form the ~~syn~~ ^(E) conformation shown

~~syn~~ much more likely to find it ~~syn~~



in which case the trans arrangement of the double bond prevents a Diels-Alder addition