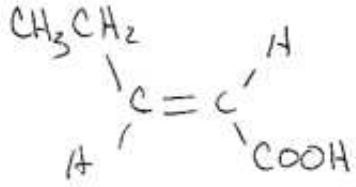
name:

Chemistry 3311-100
Organic Chemistry / Dr. Barney Ellison
Thursday: March 10th **@ 7:00pm → 9:00** / 2nd Exam / Math 100

Name: Key (please print)

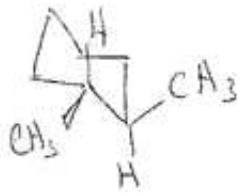
1. (5 pts) The acid $CH_3CH_2CH{=}CHCOOH$ exists as the *E* isomer. Draw a correct geometric representation of this molecule.



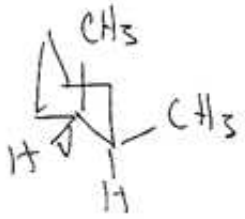
2. (15 pts) Explain why the indicated isomer is the more stable one.

a) *Trans*-1,2-dimethylcyclohexane is more stable than the *cis* isomer.

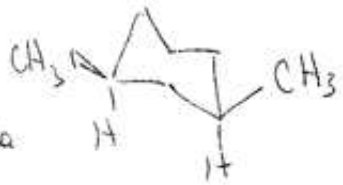
trans

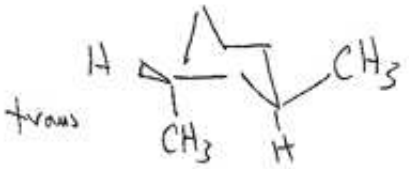


cis

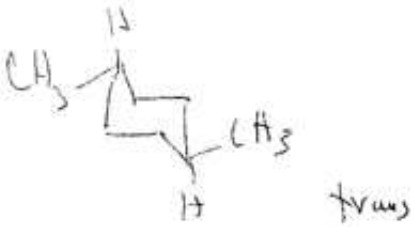


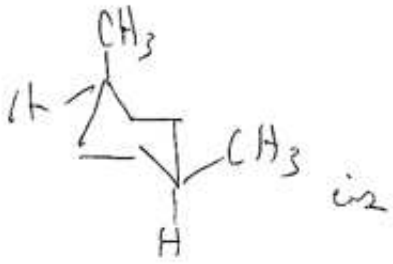
b) *Cis*-1,3-dimethylcyclohexane is more stable than the *trans* isomer.



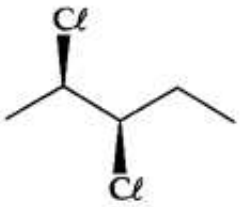


c) *Trans*-1,4-dimethylcyclohexane is more stable than the *cis* isomer.

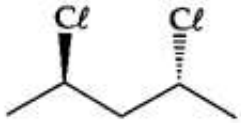




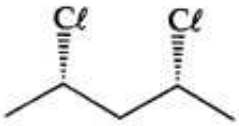
3. (10 pts) Provide a complete name, including assignment of absolute configuration to all centers of chirality, for each of the following compounds.

a) 

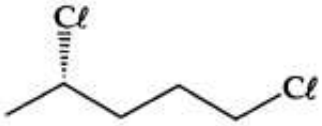
(2R,3R) -2,3- dichloropentane

b) 

(2R,4R) – 2,4- dichloropentane

c) 

(2R, 4S)
~~(2S,4R)~~ 2,4- dichloropentane

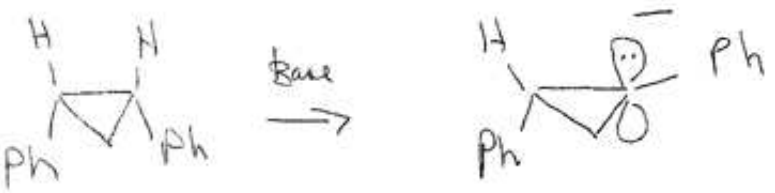
d) 

5
(~~R~~) –1,4- dichloropentane

e) 

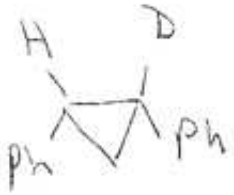
1,5 - dichloropentane

4. (10 pts) Upon treatment with a strong base at low temperature, *cis*-1,2-diphenylcyclopropane forms an anion at the benzylic position. When quenched with D_2O, a mixture of 1-deutero-*cis*-1,2-diphenylcyclopropane and 1-deutero-*trans*-1,2-diphenylcyclopropane is formed. Draw three-dimensional structures of the intermediate anion and the product. Does the structure of the product allow you to say anything about whether the carbanionic carbon in the intermediate is a center of chirality?

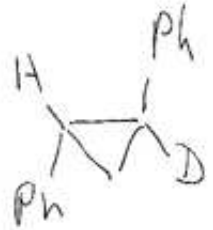


D_2O (top)

D_2O (bottom)



cis

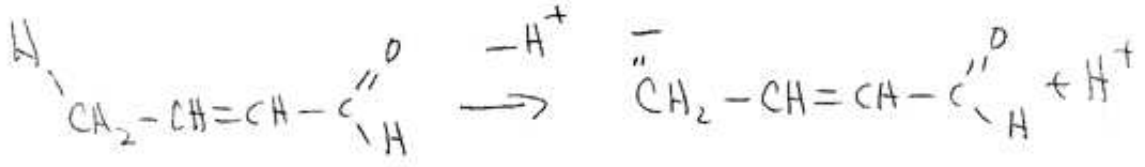


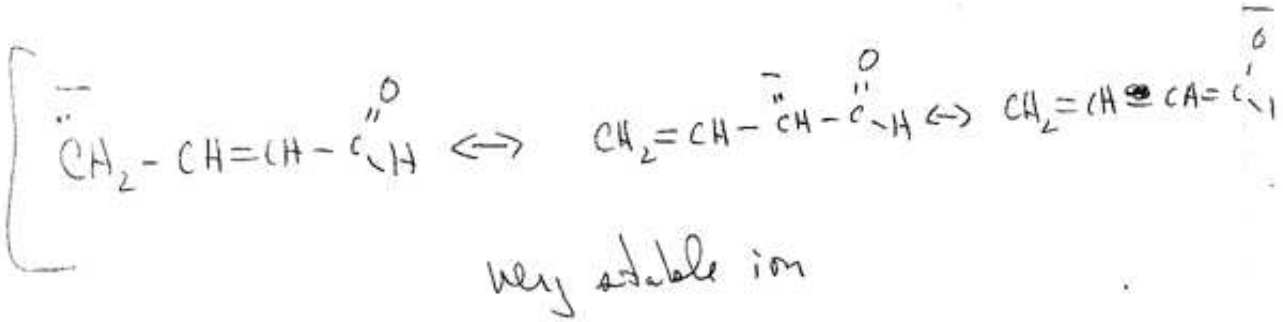
trans

Products cannot reveal the nature of the carbanion.

The benzylic anion can be:

5. (5 pts) Crontonaldehyde, $CH_3CH{=}CHCHO$, has a pK_a of 20, despite the fact that it lacks enolizable hydrogens α to the carbonyl group. Which proton is abstracted by the base? Draw resonance structures to account for the stability of the anion.

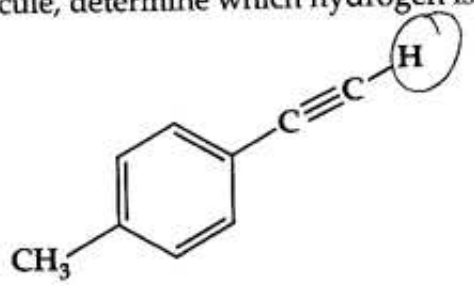




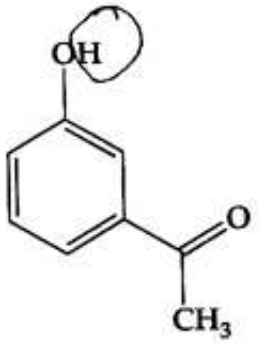
very stable ion

6. (15 pts) In each molecule, determine which hydrogen is most acidic.

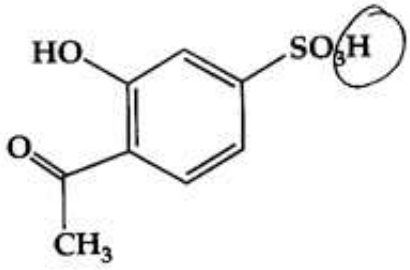
a)



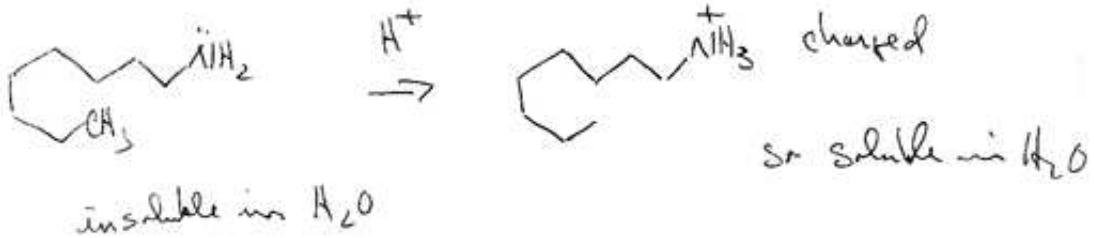
b)

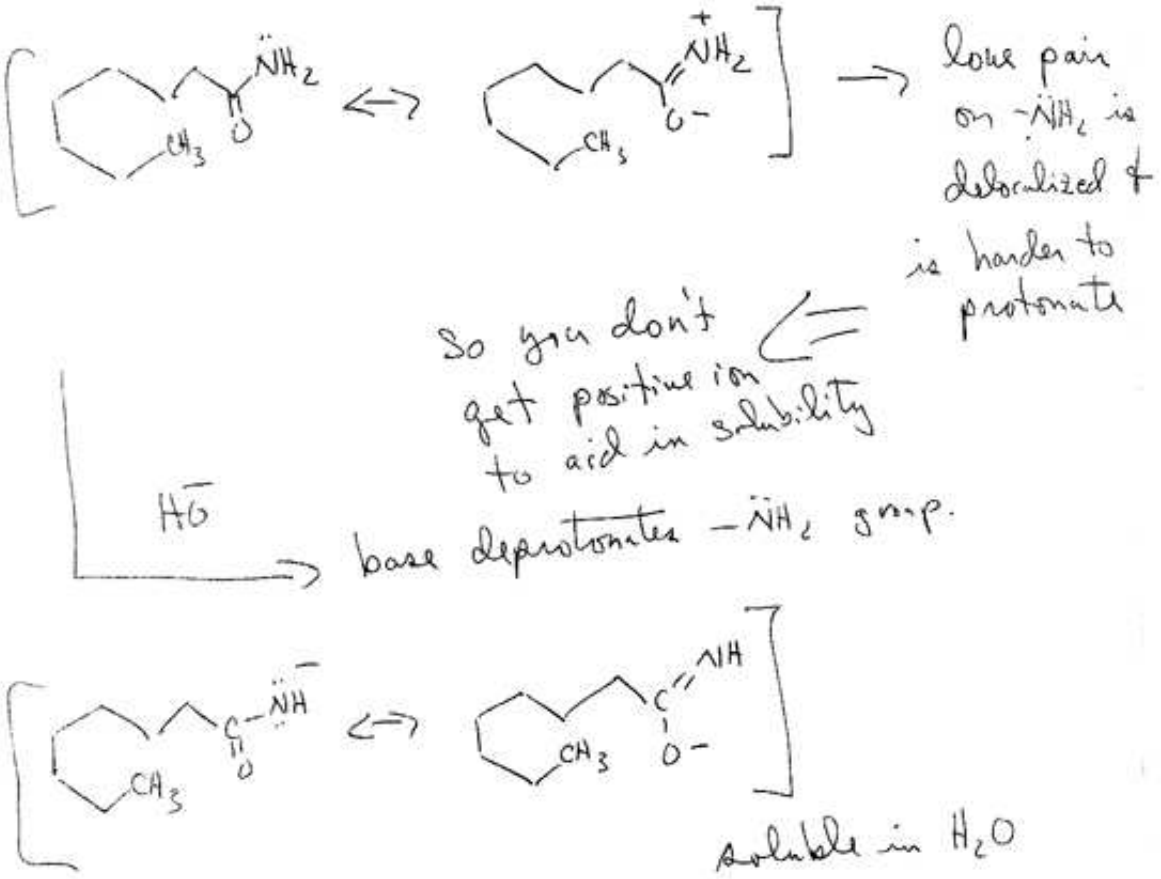


c)

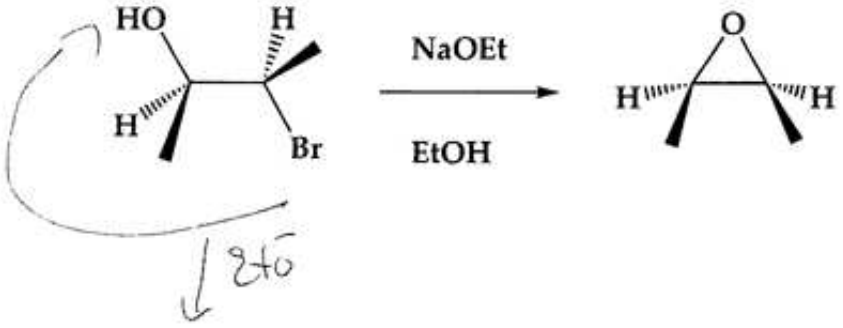


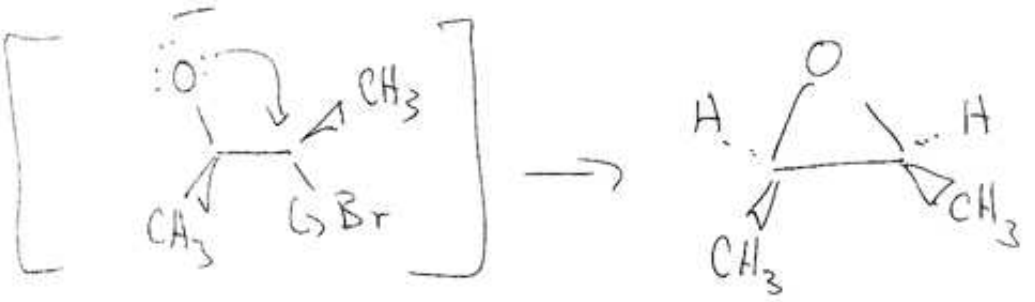
7. (10 pts) Octylamine is insoluble in water but dissolves in dilute aqueous sulfuric acid. Octanoamide, $C_7H_{15}CONH_2$, does not dissolve in either water nor dilute aqueous sulfuric acid. Rather octanoamide dissolves in aqueous base. Propose an explanation.





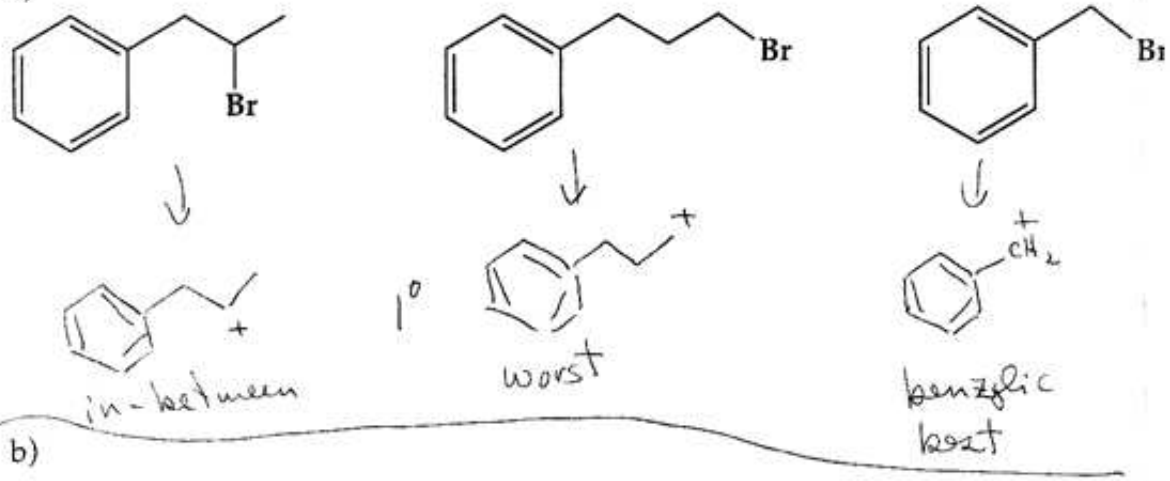
8. (10 pts) Epoxides can be formed through an intermolecular S_N2 reaction. Using what you know about pK_a values, write a mechanism for the following reaction:



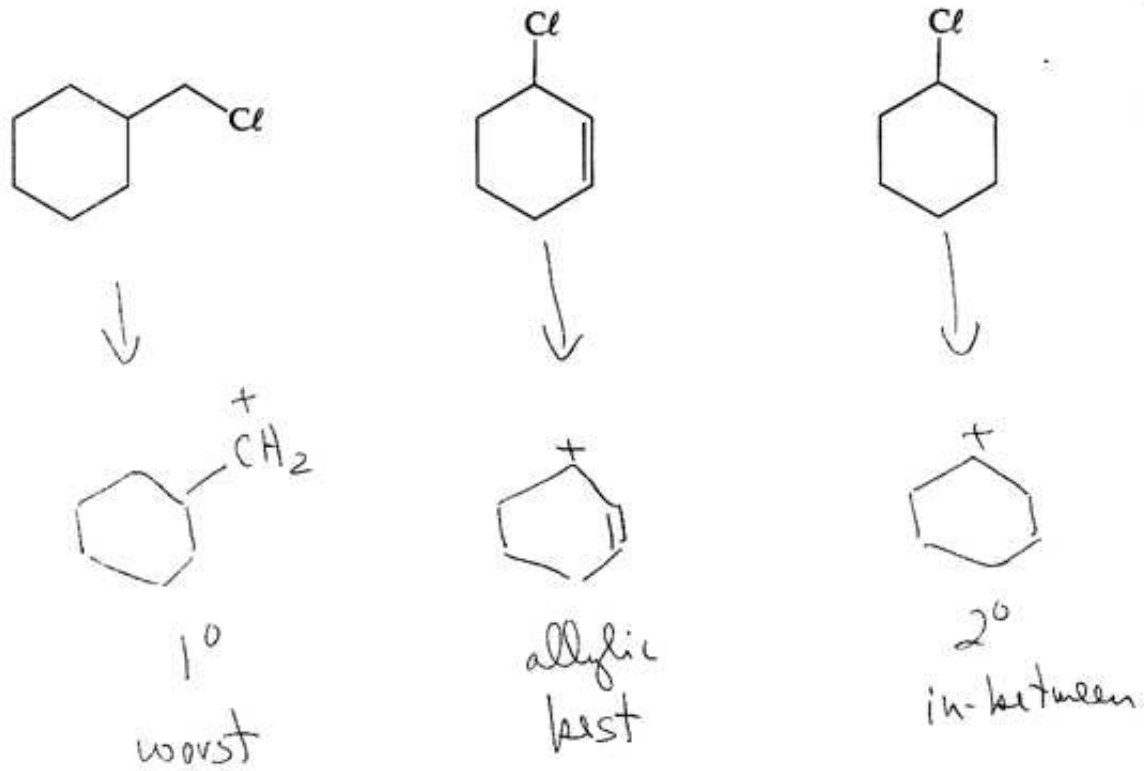


9. (10 pts) Heating many alkyl chlorides or bromides in water converts them to alcohols through an S_N1 reaction. Order the following sets of compounds with respect to this solvolytic reactivity.

a)

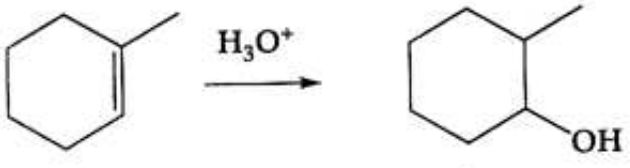


b)

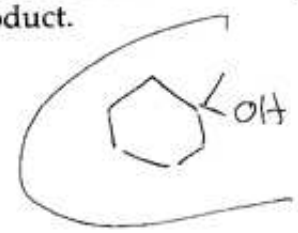


10. (10 pts) Suppose the following reactions were proposed as routes for making the indicated products. Determine whether each reaction is likely to proceed as written. If not, write the expected product.

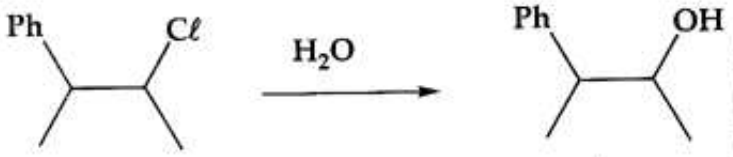
a)



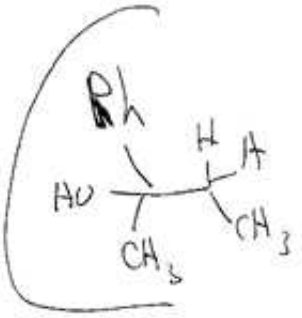
no



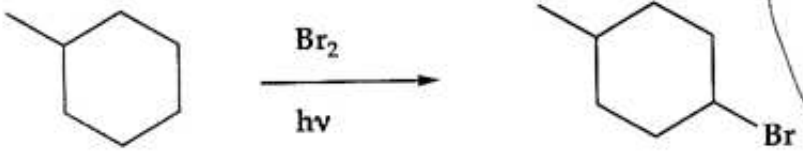
b)



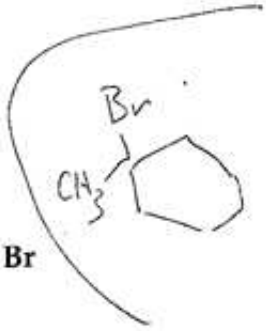
no



c)



no



d)

e)