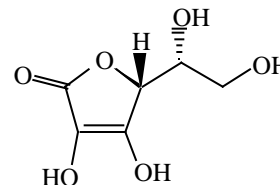
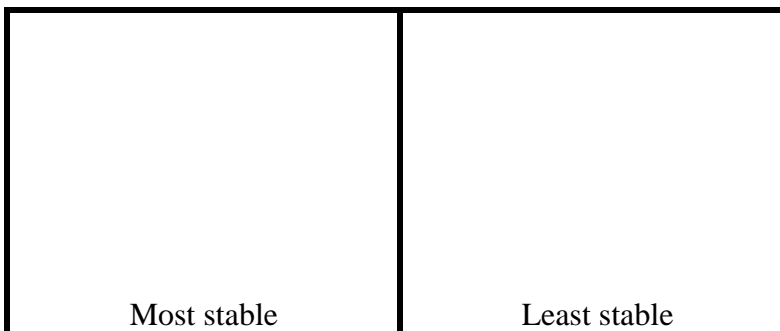
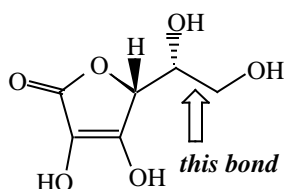


Most of the questions on the final exam refer to ascorbic acid:



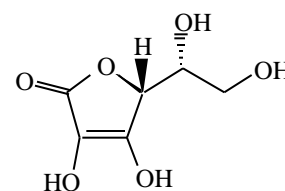
- (3 points) Circle and label the functional groups in the ascorbic acid structure above. If a functional group occurs more than once, circle it only once.
- (2 points) The best estimate for the O-C-C bond angle at the CH₂OH group is _____ degrees.
- (2 points) Fill in the appropriate numbers: Ascorbic acid has _____ sp^3 atoms and _____ hydrogen atoms.
- (6 points) Using Newman projections, draw the most and least stable conformations of the carbon-carbon bond indicated in the structure below. Put the CH₂OH group on the front carbon. The ring portion of ascorbic acid may be abbreviated as "ring."



- (1 point) Fill in the blank: In the previous question, the most stable structure has the lowest energy because it has the least amount of _____.
- (5 points) Circle the correct answers concerning ascorbic acid.
 - The stereochemistry of ascorbic acid is: R,R R,S S,S
 - Ascorbic acid is: Chiral Achiral Meso Cannot determine
 - The optical rotation of ascorbic acid is: (+) (-) Zero Cannot be determined
 - The number of ascorbic acid stereoisomers is: 0 1 2 3 4 5 6

7. (2 points) Draw any enantiomer of ascorbic acid.

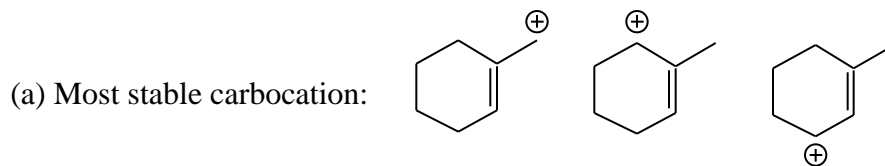
8. (8 points) Circle the **most acidic OH group** on this ascorbic acid structure. Briefly explain your answer.



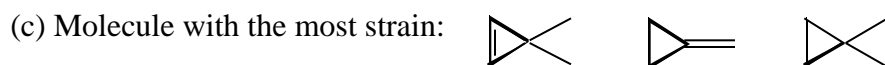
Ascorbic acid

Explanation:

9. (8 points) Circle the best answer in each case.

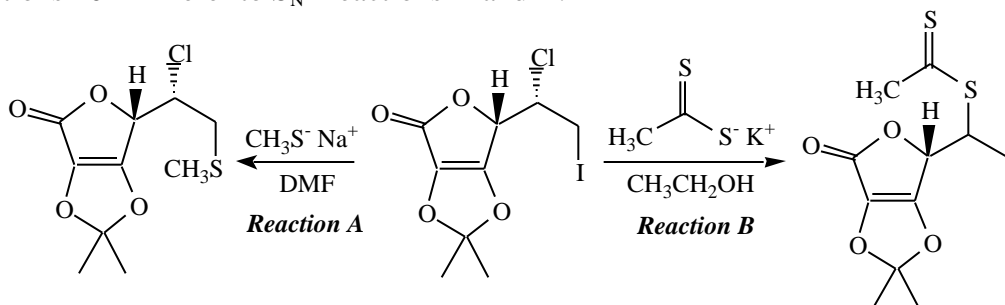


(b) Most acidic molecule: H_2SO_4 H_3O^+ $\text{CH}_3\text{CO}_2\text{H}$



(d) Poorest leaving group: I^- H_2O HO^-

Questions 10 - 12 refer to S_N2 reactions A and B:



10. (15 points) Give five *clear and precise one-sentence reasons* why reaction A is *faster* than reaction B.

Reason #1:

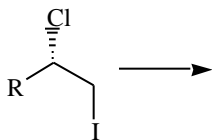
Reason #2:

Reason #3:

Reason #4:

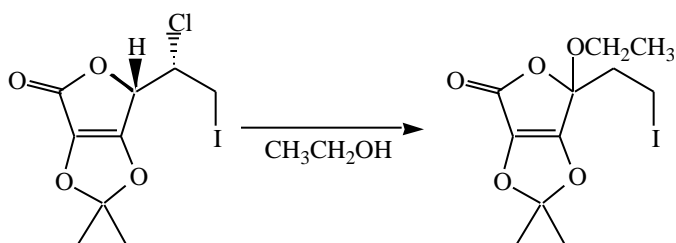
Reason #5:

11. (2 points) Write a mechanism for reaction B using the abbreviated structure shown below as the starting point.



12. (5 points) If the rate of reaction A is less than the rate of reaction B, what can be concluded about the transition states of these two reactions? Answer this question using only an energy profile diagram (with all important parts labeled). Do not include any explanation. Reactions A and B are both exothermic.

13. Consider this reaction:

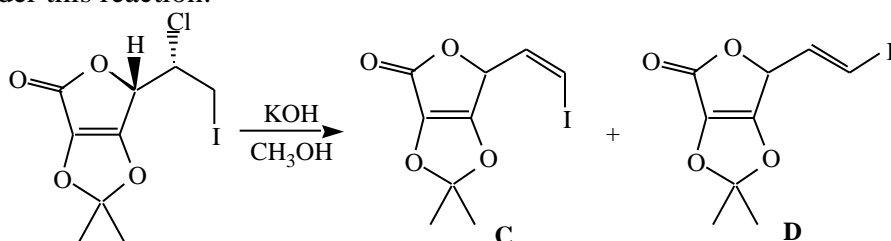


(a) (6 points) Write the most reasonable mechanism for this reaction.

(b) (2 points) If $\text{CH}_3\text{CH}_2\text{OH}$ is replaced with $\text{CH}_3\text{CH}_2\text{O}^-$ but the reaction product remains the same, then rate of this reaction (circle one):

Increases Decreases Has no measurable change

14. Consider this reaction:



(a) (2 points) The major reaction product is (circle one): **C** **D** Neither

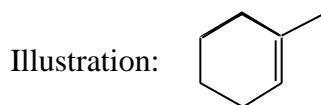
(b) (2 points) Write the most reasonable mechanism for the major product.

(c) (2 points) Draw another reasonable elimination product that is not shown above.

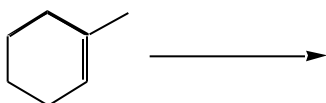
15. (2 points) State Markovnikov's Rule.

16. (8 points) Explain the mechanistic rationale for Markovnikov's Rule using the molecule show below.

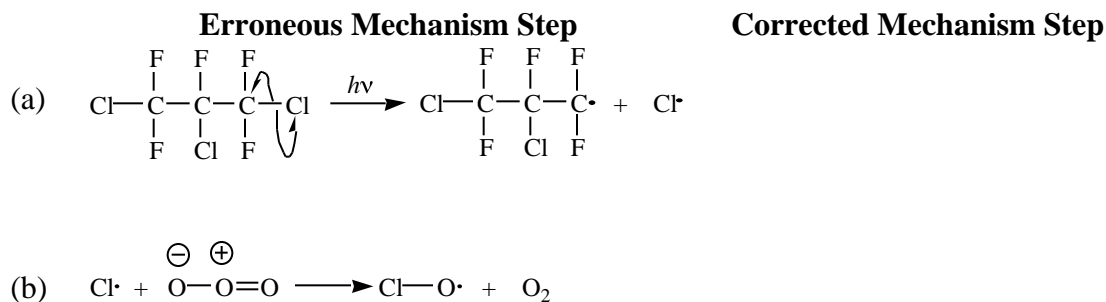
Explanation:



17. (3 points) Write the reactants and products (but not the mechanism) for an anti-Markovnikov reaction using the molecule shown below.



18. (6 points) Photolysis of chlorofluorocarbons in the upper atmosphere has been shown to lead to destruction of ozone. Portions of the mechanism are shown below, but each step contains a significant error. In each case, redraw the step so it is correct. Explanations are not necessary.



19. (8 points) After just one quarter of organic chemistry, you should have enough basic understanding of organic structures and reaction mechanisms to confidently tackle problems you have never seen before. As an example, suggest a reasonable mechanism for the reaction shown, called the pinacol rearrangement.

