

Draw your answers on a separate sheet of paper. Write clearly.

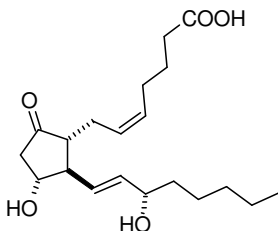
#1. Loudon problems from chapter 4: 43B, 49, 51, 52

#2. The rate of reaction of HBr with 2-methyl-1-butene (**A**) differs substantially from the rate of reaction of HBr with 1-butene (**B**).

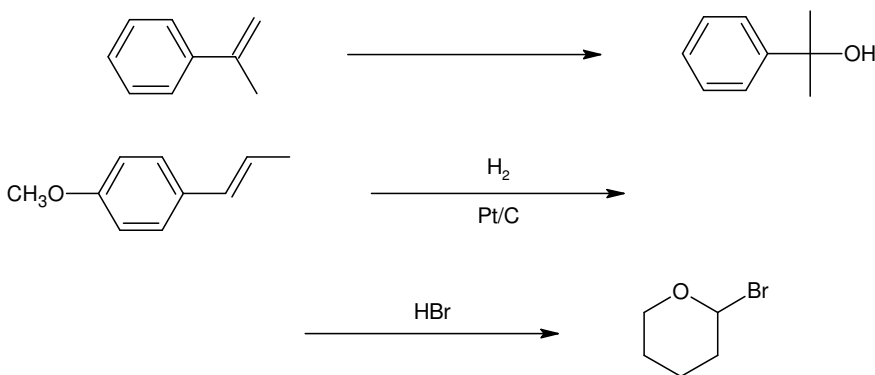
- Which reaction is faster? Explain.
- Draw a reaction energy diagram for each "HBr + alkene" reaction that is consistent with your prediction. Identify the rate-determining step on your diagrams and make sure your diagram includes formulas for the species found at each energy *minimum*.
- Which acid should react faster with **B**, HBr or HCl? Justify your answer with a reaction energy diagram.

#3.

- Prostaglandins are a family of highly active biological molecules found in all animal tissues and responsible for a range of physiological effects. One member of the family is shown below. Label all of its functional groups.
- Based on the positions of the alkene hydrogens, label each alkene as *cis* or *trans*. Next, using the Cahn-Ingold-Prelog (CIP) rules, label each alkene as *Z* or *E*.



#4. Draw the missing item (reagent, starting material, or product).

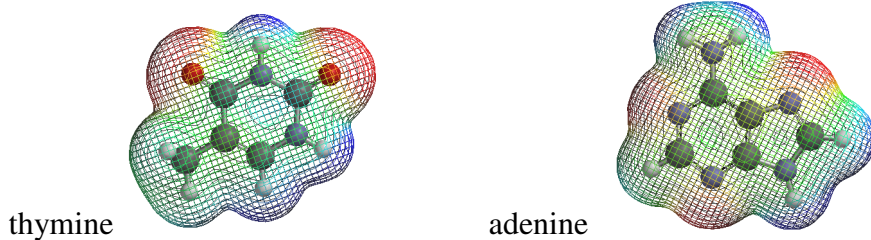


#5. Two of the reactions in #4 are regioselective and involve carbocation intermediates.

- These intermediates are resonance hybrids. Draw all of the important resonance structures for each (four structures for one, two for the other)

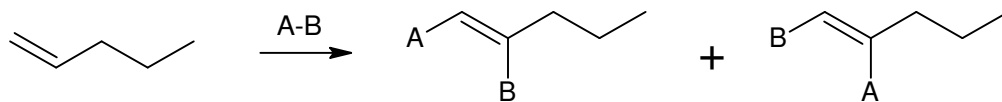
- b. Draw the carbocations that lead to the unobserved regioisomers<sup>1</sup>. Briefly explain why these reactions are regioselective.

#6. Biochemists have found that thymine and adenine can hydrogen bond to each other by simultaneously forming *two* hydrogen bonds. Based on the potential maps (-200 to +200), draw at least *two* different structures showing this kind of hydrogen bonding.



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<sup>1</sup> A **regioselective** reaction (p. 148) is any *addition* reaction in which addition of A-B actually occurs more in one direction than the other.



The two products that might form in a reaction of this type are called **regioisomers**.

## ANSWERS

#1.

Loudon 2.27A – carbons are labeled primary, secondary, etc., using standard chemical symbols,  $1^\circ$ ,  $2^\circ$ , etc.

