1. (14 pts) Draw a mechanism to account for this reaction, including all arrows, intermediates, and resonance structures.

[Chemical structure image]

+6 alkene attack on \( \text{Br}_2 \) arrow
+3 resonance of intermediate
+2 attack of water on intermediate
+1 deprotonation

How does your mechanism explain the observed regiochemistry of the product?

The bromonium ion is attacked by water on the more substituted carbon because it is more \( S^+ \), as demonstrated by the major resonance structure having the more stable, 3° carbocation.

\( +1 \) regiochem argument \( +1 \) Greater \( S^+ \) \( +1 \) why that carbon is more 8

How does your mechanism explain why the reaction is an \textit{anti} addition?

Water has to attack from the backside of the bridged bromonium in a coplanar attack (or because bromonium blocks one face)

\( +1 \) Attack from opposite side
\( +2 \) A steric or coplanar attack argument
2. (16pts) Predict the major product(s) of 4 of the following 5 problems. Clearly mark the one that you do not want graded or the first 4 will be graded. Include proper stereochemistry, and indicate if both enantiomers are formed.

3. (4pts) The following reaction breaks the Markovnikov rule. Use the mechanism to explain why the anti-Markovnicov product forms in this case.

Explanation: less stable intermediate doesn't form because carbocation destabilized by carbonyl.
4. (16pts) Provide the missing starting materials or reagents for 4 of the following 5 problems. Clearly mark the one that you do not want graded or the first five will be graded.

A. 

\[
\begin{array}{c}
\text{Br}_2 \\
\end{array}
\]

\[
\text{2,3-dimethyl-1-butene} \rightarrow \text{2-iodo-2,3-dimethylbutane}
\]

B. 

\[
\text{HI}
\]

\[
\text{2,3-dimethyl-1-butene} \rightarrow \text{2-iodo-2,3-dimethylbutane}
\]

C. 

\[
1 \text{ equiv. Cl}_2 \\
\]

\[
\text{1-butyne} \rightarrow \text{2,2-dibromobutane}
\]

D. 

\[
2 \text{ HBr}
\]

\[
\text{1-butyne} \rightarrow \text{2,2-dibromobutane}
\]

E. 

\[
1. \text{ O}_3 \\
2. \text{ DMS}
\]

\[
\text{or}
\]

\[
\text{c} + \text{c}
\]
6. (5pts) Provide a mechanism for this reaction.

7. (4pts) The molecule below could potentially be protonated on any one of three oxygen atoms. Circle the major product of the reaction, and explain why this oxygen is the most basic.

The most stable conjugate acid forms or

Most stable because of resonance

\[
\begin{align*}
&\text{HO} \\
\text{HO} &\rightarrow \text{HO} \\
\text{OH} &\rightarrow \text{OH}
\end{align*}
\]
8. (6pts) Provide all the reagents necessary for this multistep reaction.

\[
\begin{align*}
\text{HC} &= \text{CH} \\
1) \text{NaH} & \quad \text{+3} \\
2) \text{CH}_3 \text{CH}_2 \text{X} & \\
3) \text{HBr} & \quad \text{+2} \\
4) \text{ONO}_2/\text{H}_2\text{O}_2 & \quad \text{+3}
\end{align*}
\]

9. (6pts) Name the following molecule. How many stereoisomers does it have?

\[
\text{(2R,3\text{Z})-2-bromo-3-chloro-3-hexene}
\]

\[
\# \text{stereoisomers} = 2^1 \times 2^2 = 4
\]