1. In each of the following reactions with alkenes the starting reagent(s) is(are) missing. Draw all the structures that will produce the desired product in a high yield.

a) 

\[ \text{1)} \text{Hg(OAc)}_2 / \text{THF, CH}_3\text{OH} \]
\[ \text{2)} \text{NaBH}_4 / \text{NaOH} \]

b) 

\[ \text{Br}_2 / \text{CCl}_4 \]


c) 

\[ \text{Cl}_2 / \text{H}_2\text{O} \]


d) 

\[ \text{1)} \text{BH}_3 / \text{THF} \]
\[ \text{2)} \text{H}_2\text{O}_2 / \text{NaOH} \]


e) 

\[ \text{HBr} \]
2. Draw the structure of the expected major product from each of the following reactions. If the major product is a mixture of enantiomers draw one product and write + enantiomer. If the product is a mixture of diastereomers in approximately the same amount draw all of them.

(a) \[ \text{cyclohexene} \xrightarrow{\text{H}_2 / \text{Pd (C)}} \text{product} \]

(b) \[ \text{1,3-pentadiene} \xrightarrow{\text{1) BD}_3 / \text{THF, 2) H}_2\text{O}_2 / \text{NaOH}} \text{product} \]

(c) \[ \text{furan} \xrightarrow{\text{HBr / H-O-O-H}} \text{product} \]

(d) \[ \text{cyclohexene} \xrightarrow{\text{1) Hg(OAc)}_2 / \text{THF, H}_2\text{O, 2) NaBH}_4 / \text{NaOH}} \text{product} \]

(e) \[ \text{phenylacetylene} \xrightarrow{\text{HBr (excess}}} \text{product} \]
3. Circle all the stereogenic centers in simvastatin (a cholesterol lowering drug).

4. The enzyme aconitase, present in the Krebs cycle, can add water across the double bond of aconitic acid (shown below) producing 2 compounds. One of the compounds isocitric acid is optically active, the other, citric acid is optically inactive. Draw the structure of each citric acid and isocitric acid in their respective boxes. Briefly explain your choices.
5. An unknown alkene with molecular formula C₈H₁₆ is submitted for analysis to determine its structure. Ozonolysis under reducing conditions produces a ketone (shown below) as the only product. Hydrogenation of the unknown alkene with platinum affords a meso alkane. Determine the structure of the unknown alkene.

\[ \text{meso alkane} \xrightarrow{\text{H₂/Pt}} \text{C₈H₁₆} \xrightarrow{1) \text{O₃, -78°C}} \xrightarrow{2) (CH₃)₂S} \]

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