Exam 2: What would have been...

The following is a take home practice exam. When you are ready, set a timer for 1 hour and 15 minutes. You can check your answers against the answer key. Answers will be ranked as easy (*), medium (**), and hard (***) Have fun!

1. Show the curved arrows illustrating the following reactions. Make sure to show all bond breaking and bond forming events (10 points).*

a. 

\[ \text{Br} \quad + \quad \text{C≡N} \quad \rightarrow \quad \text{SN2} \quad \text{C} \quad + \quad \text{Br} \]

b. 

\[ \text{H} \quad - \quad \text{Br} \quad \rightarrow \quad \text{H} \quad - \quad \text{Br} \quad \rightarrow \quad \text{Br} \quad - \quad \text{H} \]

c. 

\[ \text{HO} \quad - \quad \text{OH} \quad \rightarrow \quad \text{HO} \quad - \quad \text{OH} \quad \rightarrow \quad \text{O} \quad - \quad \text{H} \]

2. When 3-hexene is treated to Br\(_2\) followed by NaNH\(_2\), an alkene is formed. However, when cyclohexene is treated to the same conditions, a cyclohexadiene is formed. Explain this difference? (9 points)**

\[ \text{Br}_2 \quad \text{then} \quad \text{NaNH}_2 \quad \rightarrow \quad \text{Br}_2 \quad \text{then} \quad \text{NaNH}_2 \]

\[ \text{is unstable} \quad \text{more stable} \]
3. Show the products or reagents for the following reactions. Make sure to address stereochemistry when appropriate. (4 points each, 24 points). **

a. \[ \text{ } \xrightarrow{\text{H}_2\text{SO}_4, \text{H}_2\text{O}} \text{ } \]

b. \[ \text{ } \xrightarrow{\text{MeMgBr}} \text{ } \]

c. \[ \text{ } \xrightarrow{\text{CrO}_3, \text{H}_2\text{SO}_4, \text{H}_2\text{O}} \text{ } \]

d. \[ \text{ } \xrightarrow{\text{OsO}_4; \text{NaHSO}_3} \text{ } \]

e. \[ \text{ } \xrightarrow{\text{Na/NH}_3} \text{ } \]

f. \[ \text{ } \xrightarrow{\text{Br}_2} \text{ } \]
5. A *trans* double bond can be converted to a *cis* double bond by treatment of a peroxycacid followed by treatment with triphenylphosphine. Explain the stereochemical outcome of this process, using mechanisms throughout the second step (10 points)***
4. Show the mechanisms of the following reactions, using curved arrows to illustrate your reactions. (16 points, 8 points each)**

a. 

\[
\begin{align*}
&\text{H}_2\text{SO}_4 \quad \rightarrow \quad \text{H}-\text{OSO}_3\text{H} \\
&\text{OH} \quad \rightarrow \quad \text{H}^+ \\
&\overset{\text{+}}{\text{C}} \quad \text{osO}_3\text{H} (\text{Some base... you have options})
\end{align*}
\]

b. 

\[
\begin{align*}
&\text{NH}_2 \quad \rightarrow \quad \text{H}-\text{OSO}_3\text{H} \\
&\overset{\text{+}}{\text{C}} \quad \text{NH}_2 \\
&\overset{\text{+}}{\text{H}} \quad \rightarrow \quad \text{NH}^+ \\
&\overset{\text{+}}{\text{C}} \quad \text{H}_{2}\text{O} \quad \rightarrow \quad \text{H}^+ \\
&\overset{\text{+}}{\text{C}} \quad \text{OSO}_3\text{H}
\end{align*}
\]
6. The following syntheses can be carried out in 3 or fewer steps. Show a synthesis. (If you use more than 3 steps, it is ok). (7 points each, 21 points)**

a. 

\[ \text{CH}_2=\text{CHCH}_2=\text{CHCH}_3 \overset{\text{PCC}}{\longrightarrow} \text{CH}_2=\text{CHCH}_2=\text{CHCH}_2=\text{CHCH}_3 \]

- \[ \text{PCC} \]

b. 

\[ \text{C}_6\text{H}_{12} \overset{\text{PCC or Jones}}{\longrightarrow} \text{C}_6\text{H}_{12} \]

- \[ \text{PCC or Jones} \]

c. 

\[ \text{CH}_2=\text{CHCH}_2=\text{CHCH}_3 \overset{\text{HBr, reflux}}{\longrightarrow} \text{CH}_2=\text{CHCH}_2=\text{CHCH}_3 \overset{(\text{CH}_3)_2\text{CuLi}}{\longrightarrow} \]

- \[ \text{HBr, reflux} \]

- \[ (\text{CH}_3)_2\text{CuLi} \]
7. Show a synthesis of hexane using methanol (H₃COH) as your only carbon-based starting materials. (10 points)***

One option. Many, many others