β-Eliminations that follow an E2 mechanism have stereochemical implications that need to be addressed. Elimination MUST occur from a conformation with an “anti periplanar” between the leaving group and β-hydrogen. This corresponds to a staggered conformation in acyclic systems and “trans-diaxial” in cyclohexane chairs.

A. Examples of acyclic systems

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\text{Et} & \quad \text{Et} \quad \text{Et} \quad \text{Br} \\
\text{NaOCH}_3 & \quad \text{NaOCH}_3
\end{align*}
\]

\[
\begin{align*}
\text{Br} & \quad \text{H} \quad \text{CH}_3 \\
\text{Ph} & \quad \text{H} \quad \text{t-Bu} \\
\text{NaOH} & \quad \text{NaOH}
\end{align*}
\]

\[
\begin{align*}
\text{H} & \quad \text{H} \quad \text{Br} \\
\text{Ph} & \quad \text{Ph} \quad \text{H} \\
\text{Ph} & \quad \text{Ph} \quad \text{H} \\
\text{NaOH} & \quad \text{NaOH}
\end{align*}
\]
B. **Examples of cyclic systems** (give all products and label major/minor). If there is no reaction likely, simply write “NO REACTION”.

Note: recall that large bulky groups (i.e. tBu) DO NOT occupy the axial position...

![Reaction 1](image1)

![Reaction 2](image2)

![Reaction 3](image3)
1. Draw all possible elimination products of the following reactions involving alkyl halides. If there is more than one product possible, circle the major product (Zaitsev's Law).

- \( \text{Br} \) \( \text{C}_6\text{H}_{11} \) \( \text{NaOCH}_3 \) \( \text{CH}_3\text{OH} \) \( \) 

- \( \text{Cl} \) \( \text{CH}_3\text{CH}-(\text{CH}_2)_2\text{CH}_3 \) \( \text{t-butoxide} \) \( \) 

- \( \text{Br} \) \( \text{C}_5\text{H}_{11} \) \( \text{(CH}_3)_3\text{COK} \) \( \) 

2. Draw the E2 Elimination Mechanism for the formation of the major product of the reaction shown below. Remember: LG and eliminated-H must be “anti-periplanar”!

- \( \text{CH}_3 \) \( \text{CH}_3\text{CH}-(\text{CH}_2)_2\text{CH}_3 \) \( \text{(CH}_3)_3\text{COK} \) \( \) 

3. Draw the E1 Elimination Mechanism for formation of the major product of the reaction shown below.

- \( \text{Br} \) \( \text{CH}_3\text{CH}-(\text{CH}_2)_2\text{CH}_3 \) \( \text{H}_2\text{O} \) \( \)
4. E2 Elimination in cyclohexanes: Draw the product(s) of the following reactions. If there are two products possible, circle the major product. If no elimination products are possible, simply write N.R.

```
C\text{H}_3
\text{Cl}
\text{CH}_3
\begin{array}{c}
\text{t-butoxide}
\end{array}
```

```
C\text{H}_3
\text{Cl}
\text{CH}_3
\begin{array}{c}
\text{t-butoxide}
\end{array}
```

```
\text{CH}_3
\text{Br}
\text{CH}_3
\begin{array}{c}
\text{t-butoxide}
\end{array}
```

5. When cis-1-iodo-2-methylcyclohexane is treated with potassium tert-butoxide, the major product is 1-methylcyclohexene, a trisubstituted alkene. However, when the corresponding trans isomer is subjected to the same conditions, the reaction progresses at a slower rate and the major product is 3-methylcyclohexene, a disubstituted alkene. Explain these observations.

```
\begin{array}{c}
\text{cis-1-iodo-2-methylcyclohexane}
\hline
\text{t-butoxide}
\hline
\text{1-methylcyclohexene}
\end{array}
```

```
\begin{array}{c}
\text{trans-1-iodo-2-methylcyclohexane}
\hline
\text{t-butoxide}
\hline
\text{3-methylcyclohexene}
\end{array}
```
6. Both vicinal and geminal dihalides can undergo two consecutive elimination reactions produce the two $\pi$ bonds of an alkyne. A very strong base (NaNH$_2$ or t-butoxide) is needed to facilitate this reaction.

Draw the mechanism for two sequential E2 eliminations of the following vicinal dihalide to give the alkyne product:

\[
\begin{align*}
\text{Ph} & \quad \text{Ph} \\
\text{Br} & \quad \text{Br}
\end{align*}
\]