1. (8) a. Give the IUPAC name or structure for each.

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>B.</td>
<td><img src="image1" alt="Structure B" /></td>
</tr>
<tr>
<td>(Z)-3-bromo-4,4-dimethyl-2-hexene</td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td><img src="image2" alt="Structure D" /></td>
</tr>
<tr>
<td>4-phenyl-1-butene</td>
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</tbody>
</table>

b. **Compound B** in question 1, is a

- E
- Z
- cis
- trans
- neither

2. (10) Circle the most; underline the least:

- reactive toward the acid-catalyzed hydration
- negative heat of hydrogenation, ΔH
- reactive substrate in a E1 reaction
- reactive substrate in a E2 reaction
- degree of unsaturation

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<tbody>
<tr>
<td><img src="image3" alt="Compound" /></td>
<td><img src="image4" alt="Compound" /></td>
<td><img src="image5" alt="Compound" /></td>
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<tr>
<td><img src="image6" alt="Compound" /></td>
<td><img src="image7" alt="Compound" /></td>
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<td><img src="image9" alt="Compound" /></td>
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<td><img src="image12" alt="Compound" /></td>
<td><img src="image13" alt="Compound" /></td>
<td><img src="image14" alt="Compound" /></td>
</tr>
<tr>
<td>$C_{18}H_{38}$</td>
<td>$C_{18}H_{32}O_3$</td>
<td>$C_{18}H_{34}NCl$</td>
</tr>
</tbody>
</table>
3. (5) Dehydration

a. Give a stepwise mechanism for the following dehydration reaction. Your mechanism should show individual steps in the reaction that lead to all the products formed. Use curved arrows and indicate all formal charges.

b. Draw a representative potential energy curve that correctly shows your mechanism. Label important intermediates and transition states on your potential diagram.

c. Identify two possible acid catalysts for this dehydration ___________________; ___________________.

![Dehydration reaction mechanism]

4. (5) The E2 Reaction

a. Using any isomer of butyl bromide, C₄H₉Br, as a starting material, give an appropriate example for an E2 reaction. Include correct reaction conditions and product(s) for the reaction.

b. Draw a reaction energy profile that supports the experimentally observed mechanism for the E2 reaction that you gave in part a.

c. Is your reaction endo- or exothermic? Use page 172 in your text to calculate ΔH.

d. Describe a kinetic experiment that would help support the E2 mechanism.

![E2 reaction mechanism]

e. What type of stereochemical evidence supports E2 mechanism as being single step concerted having an antitcoplanar transition state? Devise an experiment using as a starting material any isomer of butyl bromide, C₄H₈DBr with one hydrogen replaced with a deuterium that would help support your answer.
5. (16) Complete the following reactions and state the mechanism for the reaction:

\[
\text{CH}_3\text{Br} \xrightarrow{\text{giving conditions}} \text{CH}_3\text{Br} \xrightarrow{\text{NaOH, acetone, } \Delta} \text{Cl}_2
\]

mechanism:___

\[
\text{NaNH}_2 \xrightarrow{\text{acid-base}} \text{H}^+ \xrightarrow{\Delta} \text{NaOH, acetone}
\]

mechanism:___

\[
\text{Br} \xrightarrow{\text{NaOH, acetone}} \text{KOH}
\]

mechanism:___

6. (12) Place the appropriate starting material and reaction conditions above the reaction arrows in each sequence of reaction steps to complete each synthesis.

\[
\text{Cl} \xrightarrow{\text{starting material, conditions}} \text{Cl} \xrightarrow{\text{conditions}} \text{Cl}
\]

\[
\text{Br} \xrightarrow{\text{starting material, conditions}} \text{H}_3\text{C} \xrightarrow{\text{conditions, product}} \text{H}_3\text{C}
\]

\[
\text{CH}_3 \xrightarrow{\text{starting material, conditions}} \text{CH}_3 \xrightarrow{\text{conditions}} \text{CH}_3
\]
7. (4) Complete the reactions by writing in the conditions above the arrow.

A.

B.

8. (8) Complete the reactions and include proper stereochemistry for all four products.

include proper stereochemistry

include proper stereochemistry

9. (12) Synthesize the following compounds from the given starting materials.

A.

B.

C.