Give the products or missing reactants of the following reactions. Include stereochemistry.

1. \[
\text{allylbenzene} \rightarrow \text{NBS} \rightarrow \text{major product}
\]

2. \[
\text{HBr} \rightarrow \text{Light, peroxides} \rightarrow \text{NaCN} \rightarrow \text{H}_2 \rightarrow \text{catalyst}
\]

3. \[
\text{Base} \rightarrow \text{Ph} \rightarrow \text{Br} \rightarrow \text{CH}_3 \rightarrow \text{C}_2\text{H}_5 \rightarrow \text{CH}_3 \rightarrow \text{Ph}
\]
4. 

\[ \text{C}_2\text{H}_5\text{Br} \rightarrow_{\text{PPh}_3} \rightarrow_{\text{C}_4\text{H}_9\text{Li}} \rightarrow \text{ketone} \]

5. 

\[ \text{amine} \rightarrow \text{acetone} \rightarrow \text{acid} \]

6. 

\[ \text{acetone} \rightarrow_{\text{NaOCl}} \rightarrow \text{product} \]

7. 

\[ \text{what is missing reactant} + \text{cyclohexanone} \rightarrow_{\text{dry HCl}} \rightarrow \text{product} \]
8. Complete the templates for both reactants for the most efficient reaction.

9. 

\[
\text{excess} \quad \text{NaIO}_4
\]

10. Provide a brief explanation of the regiospecificity (basic vs acidic) shown below.

11. Water is usually regarded as a poor nucleophile. The following reaction is unexpectedly fast. Write a mechanism to rationalize the rapidity of the reaction. Use the curved arrow notation consistently.

12. Provide reasonable mechanisms for the following reactions. Use the curved arrow notation consistently.
13. Which of the following compounds is expected to undergo faster E2 reaction to yield a substituted cyclohexene? Explain your reasoning briefly.

![Chemical Structures](image)

Provide a synthesis of the following compounds using ethanol and/or any inorganic as the source of all carbons in the target molecules. You may use the requested products of earlier questions in subsequent questions even if you were not able to make the compound in the earlier questions.

14. 2-butanone

15. 3-methyl pentane

16. Consider two distillations. In the distillation of a mixture of methanol and water (completely miscible) the boiling point of the mixture is between that of pure methanol and that of pure water. In the distillation of a mixture of cyclohexene and water (completely immiscible) the boiling point is below that of either cyclohexene or water. Briefly explain.

Show how to accomplish the following transformations. You may use any additional reagents of your choice. You may use as many reactions as necessary.

17.
### Answer Sheet

Chemistry 51, Fall 2005
Questions 1-9: 5 pts; all others: 7 pts.       Your Name___________________________

Recitation Instructor____________________________

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\[
\text{C}_2\text{H}_5 + \text{C}_3\text{H}_7
\]