

## Practice Midterm Exam

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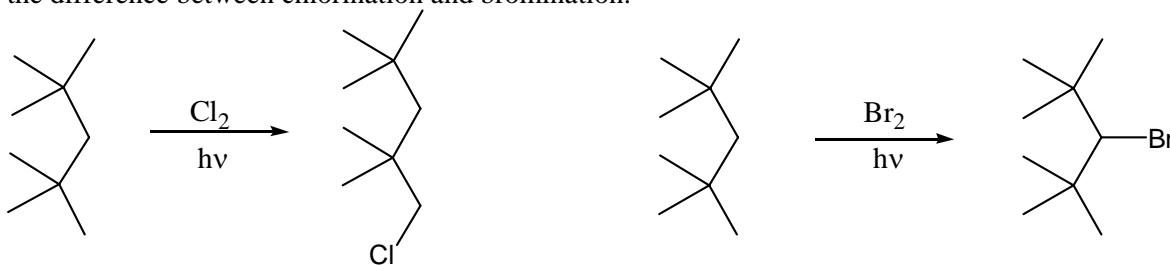
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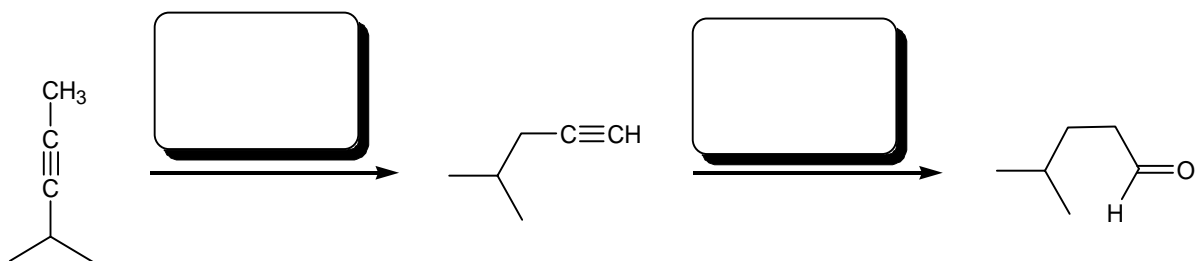
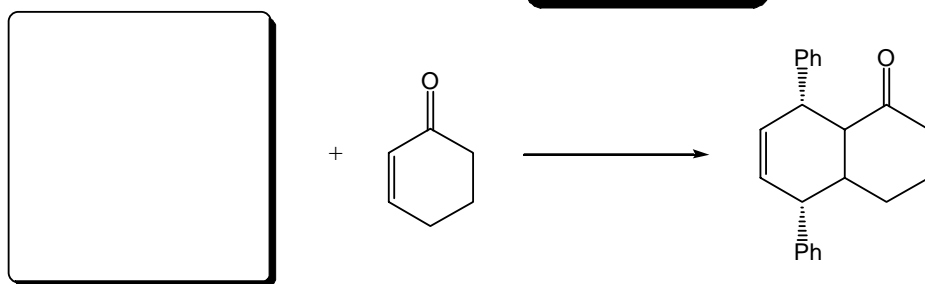
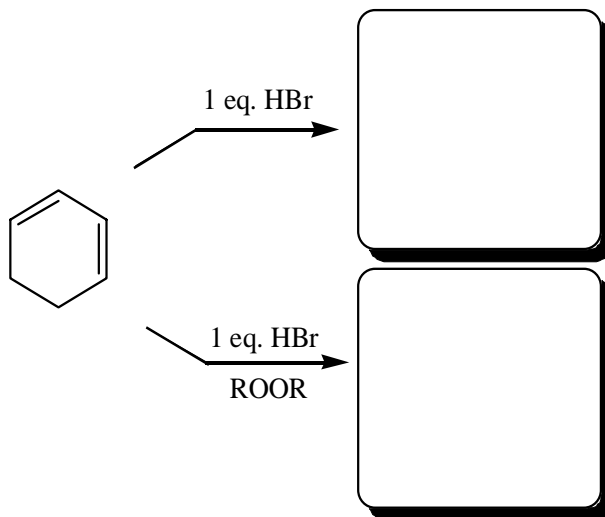
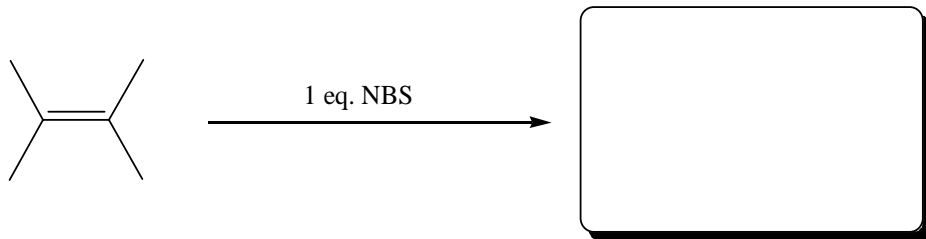
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1. (30 pts.) 2,2,4,4-tetramethylpentane (shown below) gives a different major product for photochemical chlorination than photochemical bromination. (a) Draw the mechanistic steps for one of these reactions (include only one possible termination step, please show each balanced reaction on a separate line, and include all arrows for movement of electrons); (b) circle the step that determines the regiochemical outcome; and (c) briefly explain the difference between chlorination and bromination.



2. (30 pts.) Provide the missing reactants, reagents, and products.



3. (30 pts.) Determine the structure represented by each of the following NMR spectra. Show your work. Next to each signal write what you can determine about the molecular fragment that it represents. Write your answer in the box and assign each peak by placing the appropriate chemical shift next to each nucleus.

(a)  $C_6H_{10}O$

$\delta$   $^{13}C$  NMR

151 s

107 t

70 t

41 t

$C_6H_{10}O$

(b)  $C_5H_8O_2$

$\delta$   $^{13}C$  NMR

208 s

93 d

39 t

24 t

14 t

$C_5H_8O_2$

(c)  $C_3H_6O_2$

$\delta$   $^1H$  NMR

11.9 broad s, 1H (exchanges)

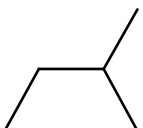
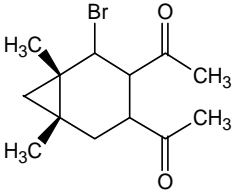
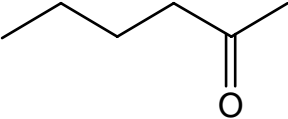
2.4 q, 2H

1.2 t, 3H

$C_3H_6O_2$

4. (30 pts.) Propose syntheses for **any two** of the target molecules. Any reagent that does not contribute carbon to the final structure may be used but molecules that contribute carbon to the final structure must meet the requirements listed. Each reaction should give the desired product in >50% yield and should be shown with all reagents necessary. **Box your answer and label it with the letter corresponding to your target.** [Partial credit will be awarded retrosynthetically—starting from the target molecule and working backwards.]

**TWO** of the following three targets:

<p><b>A. Synthesize</b></p>  <p>from <b>alkanes</b> containing <b>three</b> or fewer carbon atoms.</p>	<p><b>B. Synthesize</b></p>  <p>from any <b>acyclic</b> molecules containing only <b>CHNO</b>.</p>	<p><b>C. Synthesize</b></p>  <p>from <b>hydrocarbons</b> containing <b>four</b> or fewer carbon atoms.</p>
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