Part I: Review of aromatic chemistry.

Complete each of the following syntheses. Provide the structure(s) of the product(s). Assume only monosubstitution occurs unless noted.
Part II. Alcohol chemistry.

Complete the following syntheses. Provide any necessary reagents, solvents, and intermediate products.

1. 
   \[
   \text{Br} \quad \text{CHCH}_3 \quad \text{OH}
   \]

2. 
   \[
   \text{O} \quad \text{CHCH}_3 \quad \text{OH}
   \]

3. 
   \[
   \text{O} \quad \text{CHCH}_3 \quad \text{OH}
   \]

4. 
   \[
   \text{CH=CH}_2 \quad \text{CH}_2\text{CH}_2\text{OH}
   \]

5. 
   \[
   \text{O} \quad \text{CH}_2\text{CH}_2\text{OH}
   \]

6. 
   \[
   \text{CH}_2\text{COOH} \quad \text{CH}_2\text{CH}_2\text{OH}
   \]
Part III: Review of syntheses of carbonyl from previous chapters.

A. When terminal alkynes are reacted in the presence of HgSO₄ and H₂SO₄, the product is different than when they are reacted in the presence of disiamylborane followed by oxidation with H₂O₂. Pick any terminal alkyne, and perform both reactions on it. Show the products, and explain how the same alkyne can give two different products.

B. Dehydration of 2,2,3,4,4-pentamethyl-3-pentanol gave two alkenes A and B. Ozonolysis of the lower boiling alkene A gave formaldehyde and 2,2,4,4-tetramethyl-3-pentanone. Ozonolysis of alkene B gave formaldehyde and 3,3,4,4-tetramethyl-2-pentanone. Identify A and B, and suggest an explanation for the formation of alkene B.

Formaldehyde 2,2,4,4-tetramethyl-3-pentanone 3,3,4,4-tetramethyl-2-pentanone

Part IV. Spectroscopy

Compounds A and B are isomers with the molecular formula C₁₀H₁₂O. Both compounds show a strong absorbance at 1710 cm⁻¹. Below are their ¹H NMR spectra. Propose structures for A and B.

**Compound A**
Multiplet 7.06-7.48 ppm, 5H; singlet 3.67 ppm, 2H; quartet 2.45 ppm, 2H; triplet 1.02 ppm, 3H.
Compound B
Multiplet 6.99-7.41 ppm, 5H; multiplet 2.75-2.87 ppm, 4H; singlet 2.11 ppm, 3H.