Part II. Reactions. Draw the reactant, product, or reagents, in the boxes as indicated. Clearly indicate the regiochemistry and stereochemistry when appropriate. (Each box is worth 4 points.)

1. \( \text{CH}_2\text{CH}_2\text{C}≡\text{CCH}_3 \) \( \xrightarrow{\text{1 equiv. Br}_2/\text{CH}_2\text{Cl}_2} \) \[ \text{Br} \quad \text{CH}_3 \]
   \[ \text{C}=\text{C} \quad \text{Br} \]
   \[ \text{CH}_3\text{CH}_2 \]

2. \( \text{CH}_3\text{CH}_2\text{C}=\text{CH} \) \( \xrightarrow{\text{H}_2\text{SO}_4, \text{H}_2\text{O}/\text{HgSO}_4} \)
   \[ \text{O} \]
   \[ \text{CH}_3\text{CH}_2\text{CCH}_3 \]

3. \( \text{CH}_3\text{CH}_2\text{C}=\text{CCH}_3 \) \( \xrightarrow{\text{Li}/\text{NH}_3} \)
   \[ \text{H} \quad \text{C}=\text{C} \quad \text{CH}_3 \]
   \[ \text{CH}_3\text{CH}_2 \]

4. \( \text{CH}_3\text{CH}_2\text{C}=\text{CH} \) \( \xrightarrow{1. \text{BH}_3} \)
   \( \xrightarrow{2. \text{H}_2\text{O}_2, \text{OH}^-} \)
   \[ \text{O} \]
   \[ \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \]

5. \( \text{CH}_3\text{CH}_2\text{C}=\text{CCH}_3 \) \( \xrightarrow{\text{H}_2/\text{Lindlar catalyst}} \)
   \[ \text{H} \quad \text{C}=\text{C} \quad \text{H} \]
   \[ \text{CH}_3\text{CH}_2 \]

6. \( \text{CH}_3\text{CH}_2\text{C}=\text{CH} \) \( \xrightarrow{2 \text{HBr/ether}} \)
   \[ \text{Br} \]
   \[ \text{CH}_3\text{CH}_2\text{CH}_2\text{C} \quad \text{Br} \quad \text{CH}_3 \]

Part III. Mechanism. (6 points)

Show the complete mechanism for the reaction of 1-butene with HBr in ether, paying particular attention to the stereochemistry of the transition state and product(s). Use curved arrows to indicate each bond broken and each bond formed. Name the product or products.
Part IV. Synthesis. Show how the following syntheses could be performed. More than one step may be required. Show all reagents and all intermediate compounds in your synthetic scheme. (6 points each)

1. 2-bromopropane → cis-2-butene

2. H—C≡C—H →

3. acetylene → 2-bromopropane

4. CH₃CH₂C≡CH → CH₃CH₂CH₂CH₂OH

Part V. Short Answer. (6 points)

Compound A, C₅H₁₂, was found to be optically active. On catalytic reduction over a palladium catalyst, one equivalent of hydrogen was absorbed, yielding compound B, C₅H₁₂. When compound A was treated with KMnO₄ in an acidic solution, CO₂ bubbled out and compound C was formed. Compound C has the formula C₅H₁₀O₂, and it is an optically active carboxylic acid. Draw the structures of compounds A, B, and C.