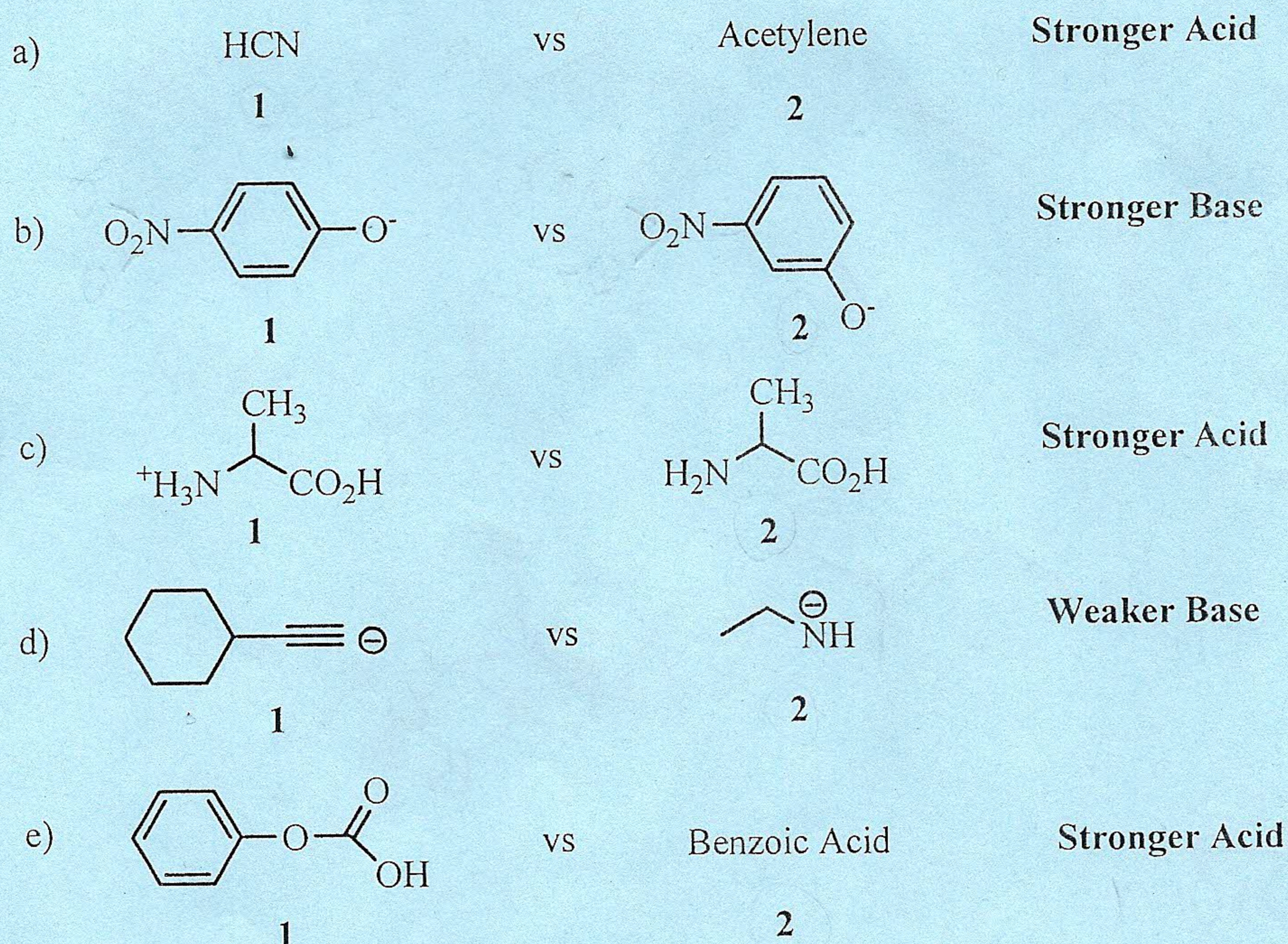


CHEM 2210 – Fall 2010 – Exam #2

1. Consider the pairs of molecules drawn below for each case (a-e) and place the number that corresponds to the molecule that best satisfies the question on your answer sheet. **JUST THE NUMBER!**



2. Answer **True** or **False** for the following statements:

- All Bronsted acids are Lewis acids.
- The ΔS for HCl addition to styrene is negative.
- Benzoic acid has a lower pKa value than acetic acid due to additional resonance stabilization of its conjugate base.
- ΔG is approximately equal to ΔH at low temperatures.
- Ozonolysis/Reduction of trans-4,5-dimethylcyclohexene generates a single achiral molecule.
- Proton transfer to an alkene is a concerted process but is non-regioselective.
- HCl addition to Styrene is a 3-step carbocation mechanism where the rate determining step occurs in step #1.

3. Which of the following conditions cannot produce ether functional groups from alkenes? **Circle all that apply.**

- a. $\text{Cl}_2/\text{H}_2\text{O}$ b. $\text{Br}_2/\text{CH}_3\text{OCH}_3$ c. $\text{Hg}(\text{OAc})_2, \text{CH}_3\text{OH}$ d. $\text{H}_2\text{SO}_4/\text{isopropanol}$

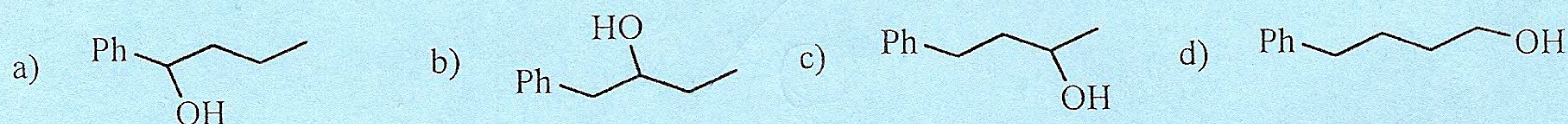
4. Ozonolysis/Reduction would NOT produce acetaldehyde with which alkene? **Circle all that apply.**

- a. isoprene b. trans-2-butene c. 2,3-dimethyl-2-butene d. 1-butene

5. Which condition in the presence of norbornene would produce only one product? **Circle all that apply.**

- a. Br_2 b. H_2/Pt c. $\text{OsO}_4/\text{H}_2\text{O}_2$ d. $\text{O}_3/\text{CH}_3\text{SCH}_3$

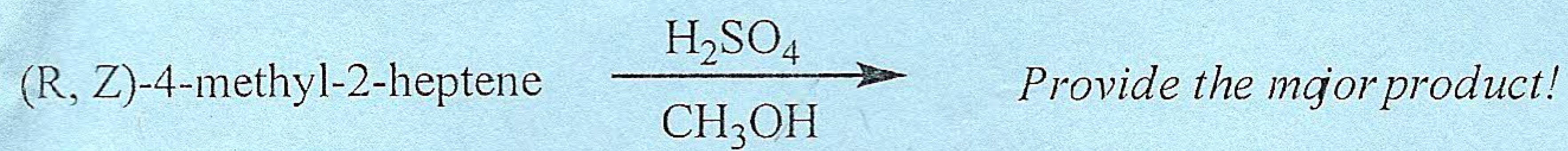
6. Acid-catalyzed hydration of 4-phenyl-1-butene would yield which of the following as the major product?



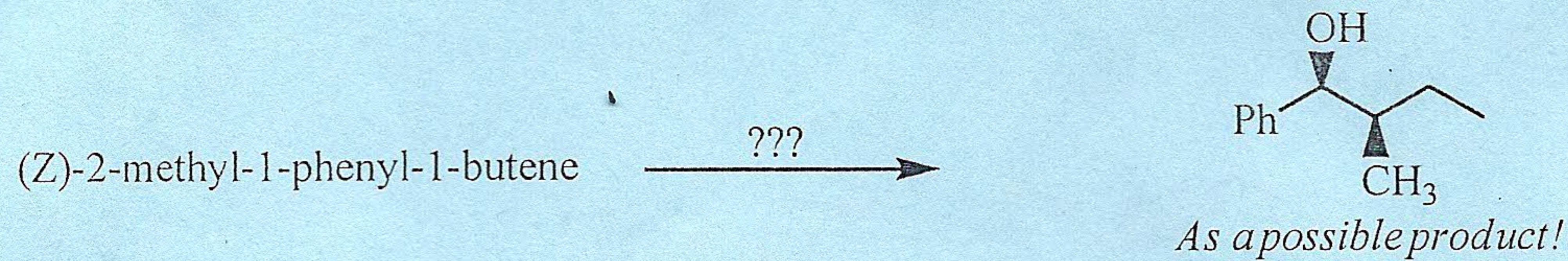
SHORT ANSWER QUESTIONS

7. Give the **major** organic product(s), missing conditions or starting materials for the following reactions. Be sure to clearly indicate stereochemistry (using dashes and wedges, etc.) where needed. Drawing enantiomers is not necessary but if your product contains more than one chiral center make sure to clearly demonstrate its stereochemistry.

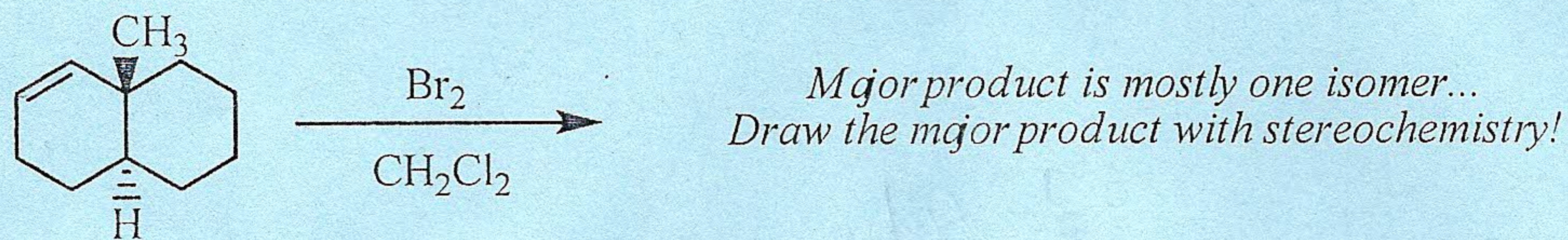
a)



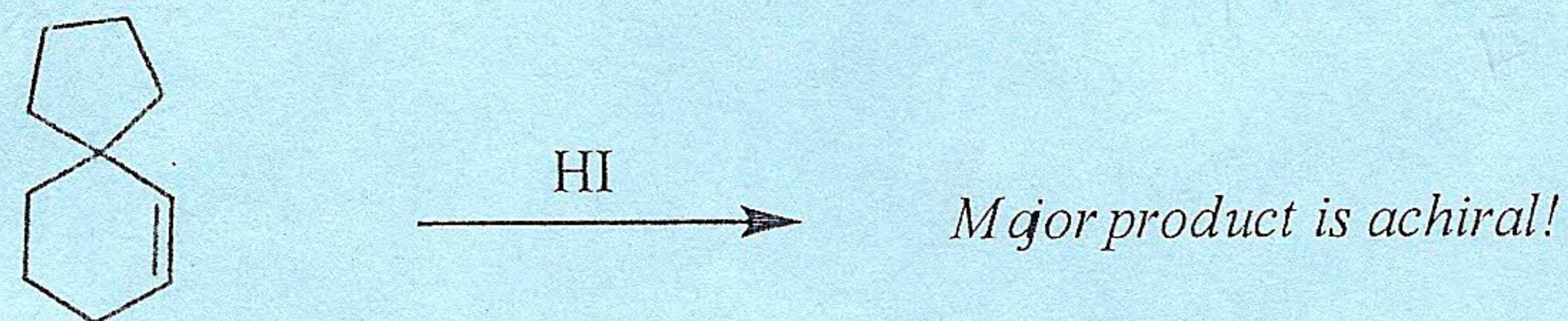
b)



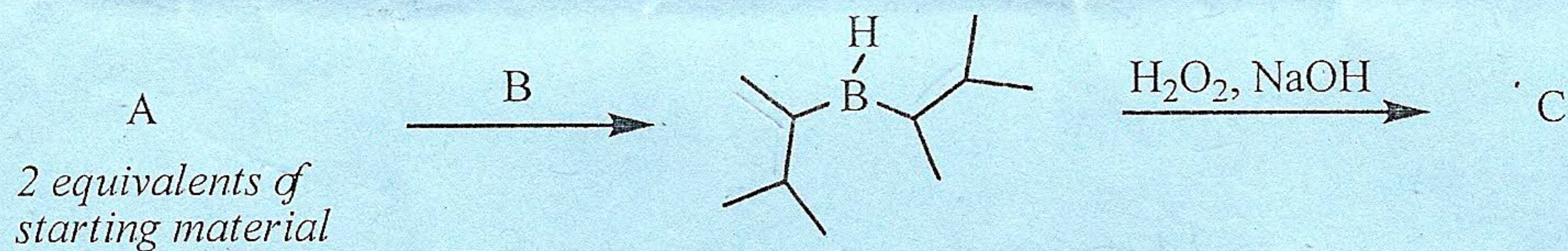
c)



d)

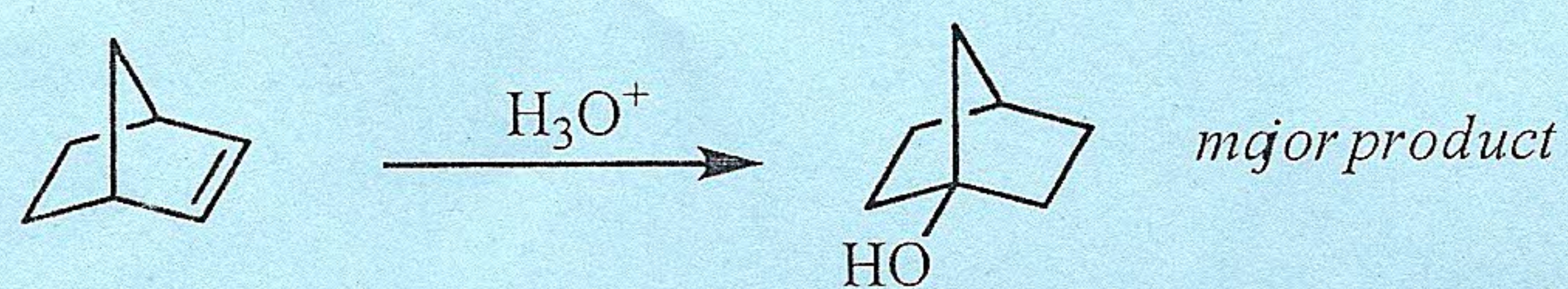


8. Fill in the missing information for the synthesis scheme below:



9. Consider the following:

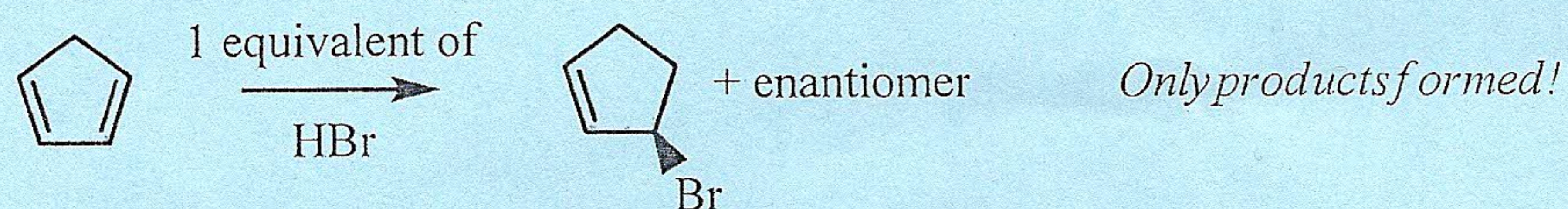
a) Is the reaction and statement below **True or False**?



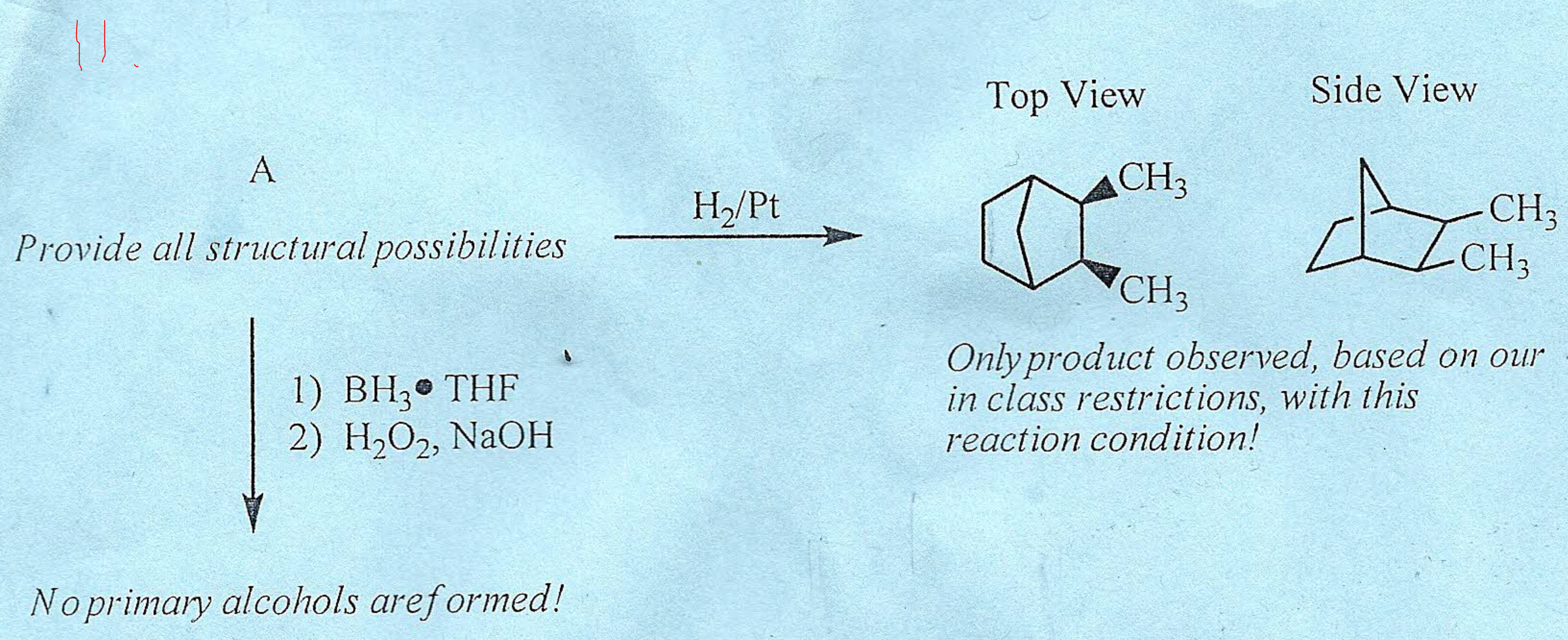
b) If you chose **False** then provide a brief explanation why?

10. Consider the following:

a) Is the reaction and statement below **True or False**?

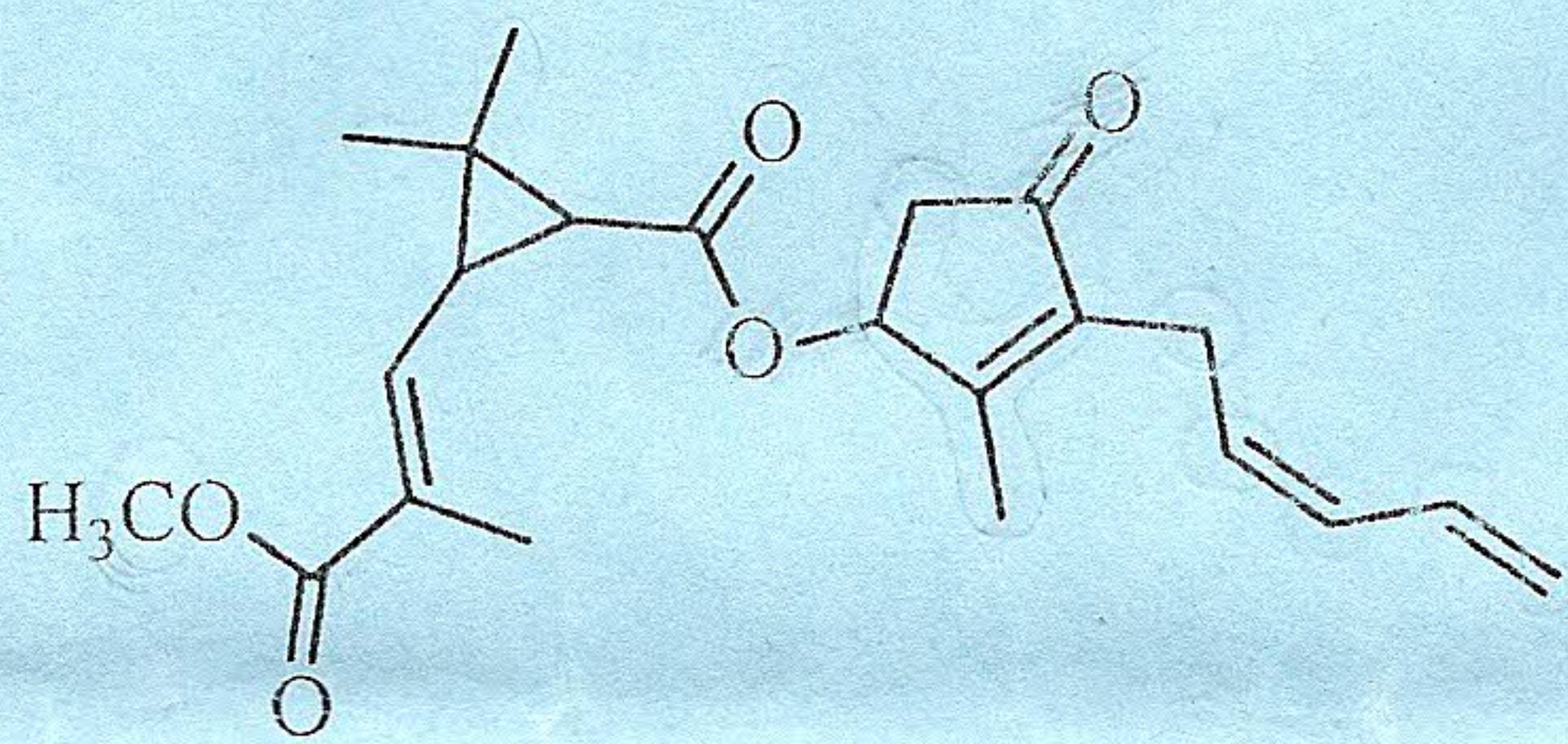


b) If you chose **False** then provide any additional products that are not shown.



b) When just one of the structural possibilities from A was treated with ozonolysis/reduction conditions, ketones and aldehydes were both produced. Provide the structure of the original molecule.

12. Pyrethrins are a class of natural products derived from the chrysanthemum family. They are known as natural insecticides and are found in wide variety of products including flea & tick shampoos, bug sprays, etc. Consider the terpene molecule below and determine the number of carbon atoms that are NOT a part of isoprene units?



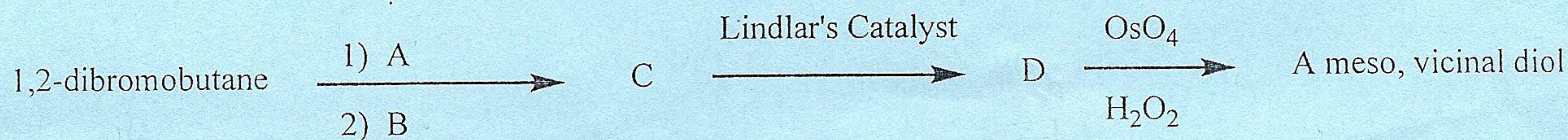
13. A sample of an unknown hydrocarbon was vaporized and separated into its individual components based on their boiling points in a process known as gas chromatography (you may have seen this on CSI). Six distinct molecules were detected and all were determined to have the same molecular formula, C_4H_8 . The individual molecules were isolated and stored in separate containers. Unknown A was treated with Br_2/CCl_4 and resulted in a racemic mixture of products but treatment with OsO_4/H_2O_2 provided a single optically inactive molecule. Unknown B was also individually treated with OsO_4/H_2O_2 and Br_2/CCl_4 but in both cases it only produced a single optically inactive molecule. Unknown C was treated with ozonolysis/reduction conditions and it resulted in the formation of only one product.

- A) Provide the line angle formula for Unknown A:
- B) Provide the line angle formula for Unknown B:
- C) Provide the line angle formula for Unknown C:

Unknown D and Unknown E both showed no reaction with Br_2/CCl_4 . In separate combustion experiments it was determined that Unknown D gave off less heat on a per carbon basis than Unknown E.

- D) Provide the line angle formula for Unknown D:
- E) Provide the line angle formula for Unknown E:
- F) Provide the line angle formula for Unknown F:

14. **Extra Credit.** Provide all missing information (names or structures) for the reactions below:



Hint: Reagent B is used for carbon increase!