



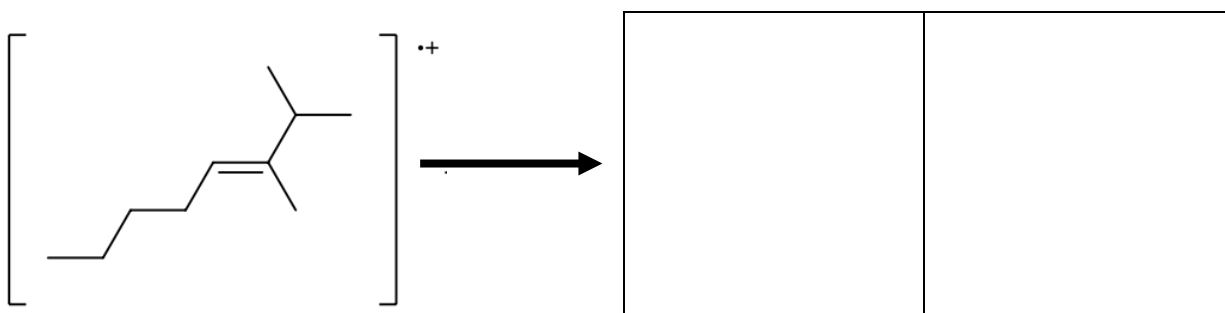
Polytechnic Tutoring Center

Midterm I REVIEW – CM 2223, Spring 2022

Disclaimer: This mock exam is only for practice. It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the Academic Department.

Problem 1:

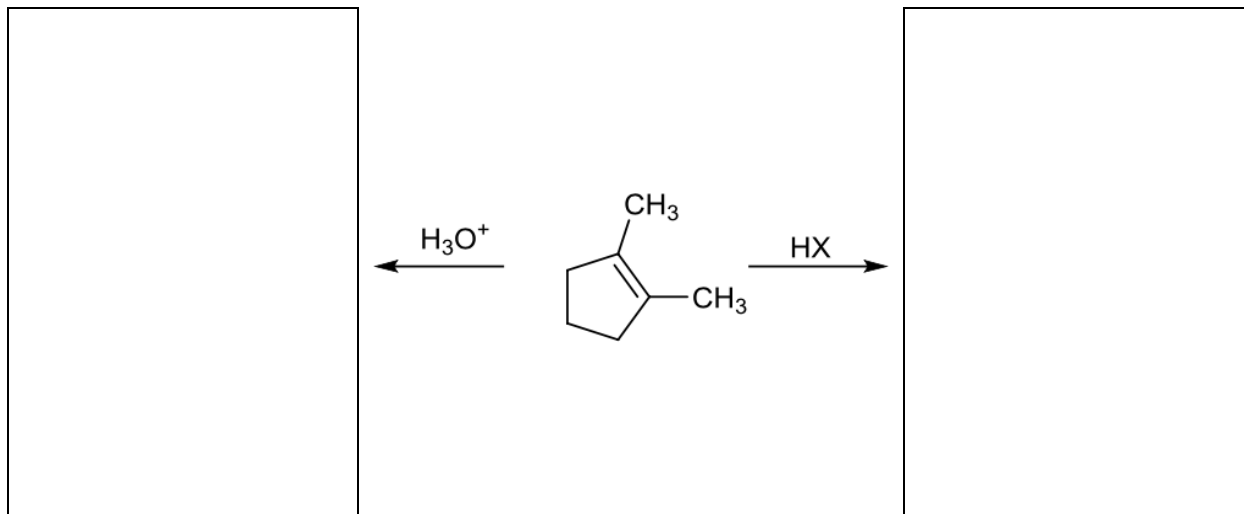
- a. Draw in two of the major fragmentation products of the radical cation of this alkene in the boxes. Clearly indicate if each compound is a radical, cation, or radical cation.



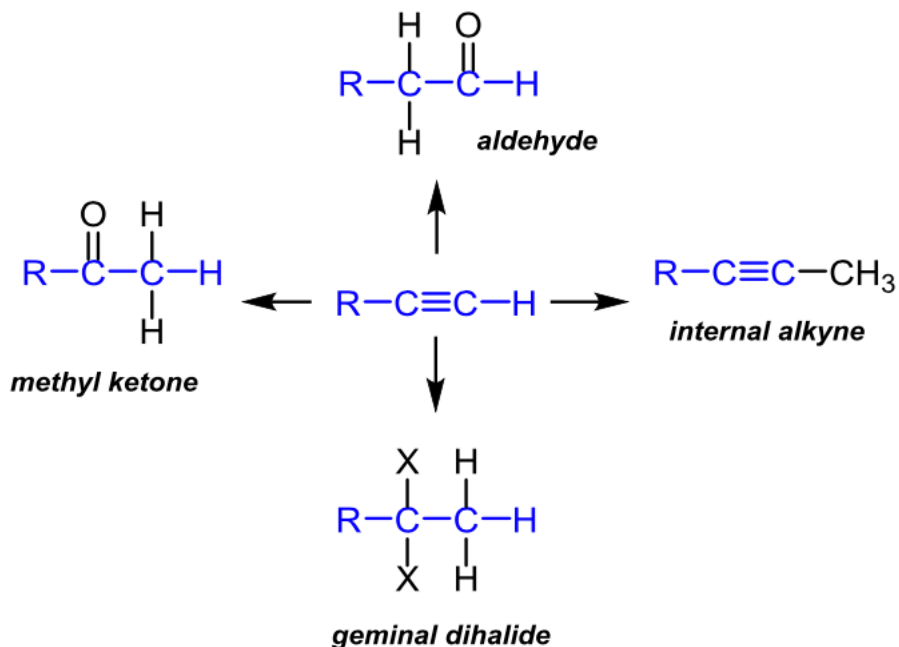
- b. Briefly describe the diagnostic peaks for the alkene from part a) in the IR spectrum including where you would look (cm⁻¹ region) and what you would see. Ignore the fingerprint region.
- c. Draw an alkene isomer with the formula C₁₀H₂₀ that would have 4 peaks in the ¹³C NMR Spectrum.
- d. Predict the ¹H NMR data of your alkene from part c). Include chemical shift multiplicity and integrations.

Problem 2:

- A) Draw the major product of each reaction in the box provided. Indicate the relative stereochemistry (with dashes/wedges) if the reaction is stereoselective. Write “racemic” if the product is racemic.

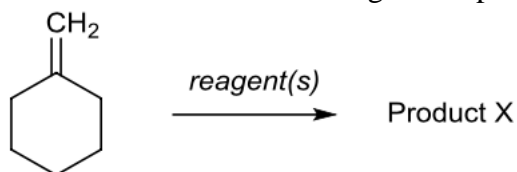


- B) Please explain the stereoselectivity from part A).

Problem 3:

- A) To produce the aldehyde, you would do a hydroboration-oxidation reaction. To produce the methyl ketone, you would do a mercury-catalyzed hydration reaction. Which of these reactions proceeds with Markovnikov regioselectivity? Explain.
- B) To convert propyne into but-2-yne, you would treat propyne with $NaNH_2$, followed by CH_3I . The first reaction is acid-base. The second reaction is SN_2 . Draw the mechanisms for both reactions. Include all lone pairs and non-zero formal charges.

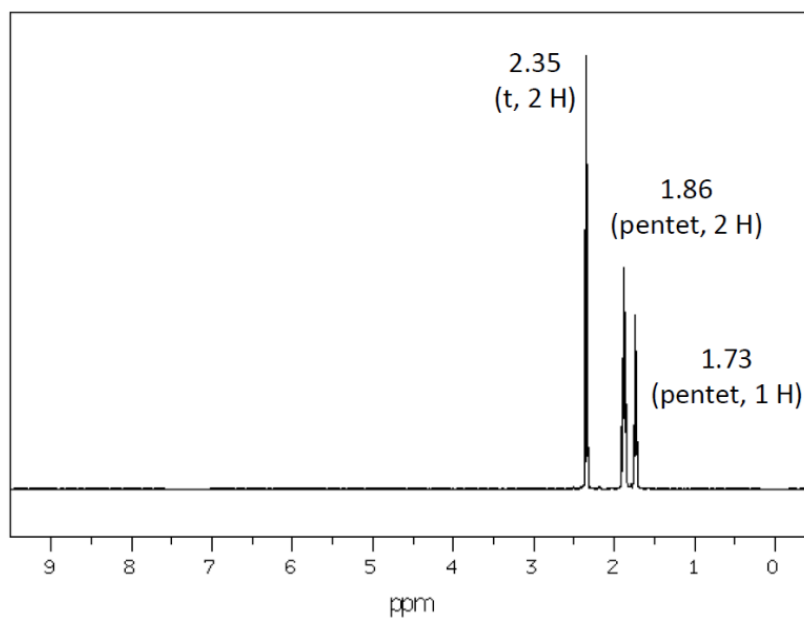
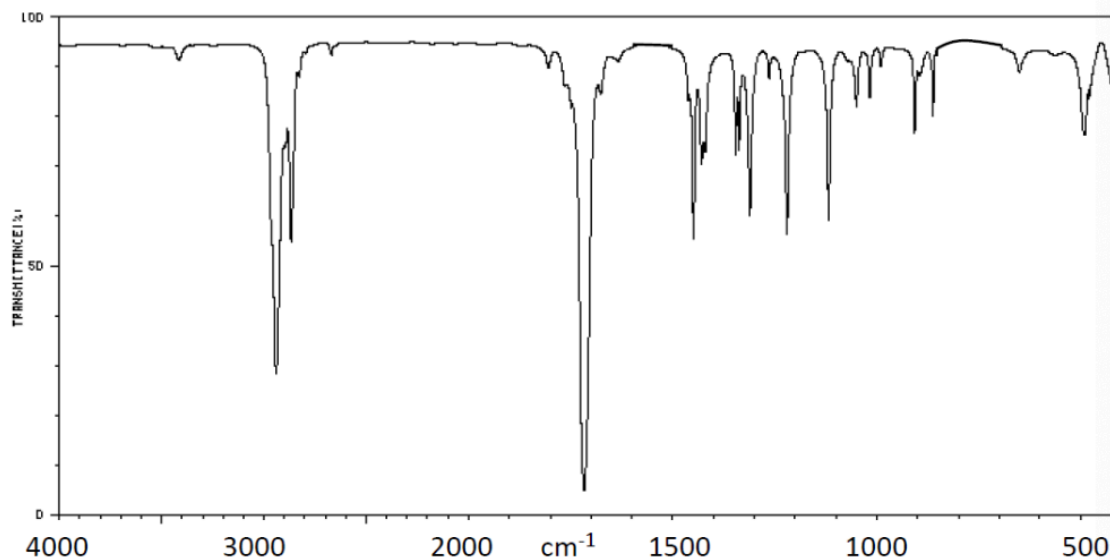
Problem 4: The alkene shown was treated with some reagents to produce Product X.



The spectra for Product X:

Mass Spec: $[M]^+ = 98$ m/z

^{13}C NMR: 25, 27, 42, and 212 ppm

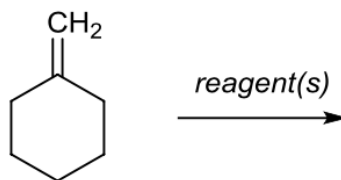


Problem 4, continued:

A) What is the structure of Product X?

B) What reagents must have been used in this transformation?

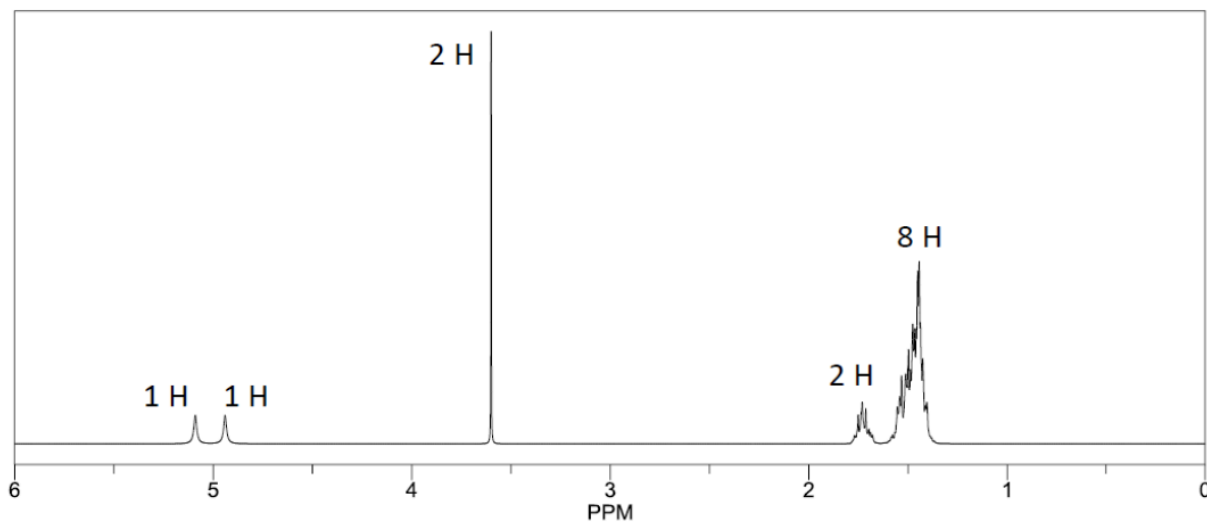
Problem 5: The alkene shown was treated with some reagents to produce Product Y.



The spectra for Product Y:

Mass Spec: $[\text{M}]^{++} = 130 \text{ m/z}$ ^{13}C NMR: 22, 26, 38, 70, and 72 ppm

IR (diagnostic peaks only): 3400 cm^{-1} (very broad)



A) What is the structure of Product Y?

B) What reagents must have been used in this transformation?