Midterm 2 Review

11/9/2025

MECHANISMS TO KNOW:

Alkene

- Hydrohalogenation, Hydration, Halogenation, Halohydrin formation, Hydroboration-oxidation, Hydrogenation, Ozonolysis, Epoxidation, Dihydroxylation (syn and anti*), ozonolysis

Alkynes

- All the applicable mechanisms from alkenes.
- Addition of hydrogen halides (via pi complex)
- Addition of halogens (same as alkenes via cyclic bromonium ion)
- Acid-catalyzed keto-enol interconversion
- Removal of a proton from a terminal alkyne, followed by alkylation

Other:

- SN1/SN2/E1/E2 (with alkanes / alkyl halides) - More problems on this week's PILOT Set.
- Isolated diene with excess HBr
- Conjugated diene with 1 equiv. of HBr (1,2 and 1,4-additions) - therm/kinetic products

Helpful Chart

Strong base Weak nucleophile	Strong base Strong nucleophile	Weak base Strong nucleophile	Weak base Weak nucleophile
NaH DBN DBU	HO^- MeO^- EtO^-	I^- Br^- Cl^- RS^- HS^- RSH H_2S	H_2O MeOH EtOH

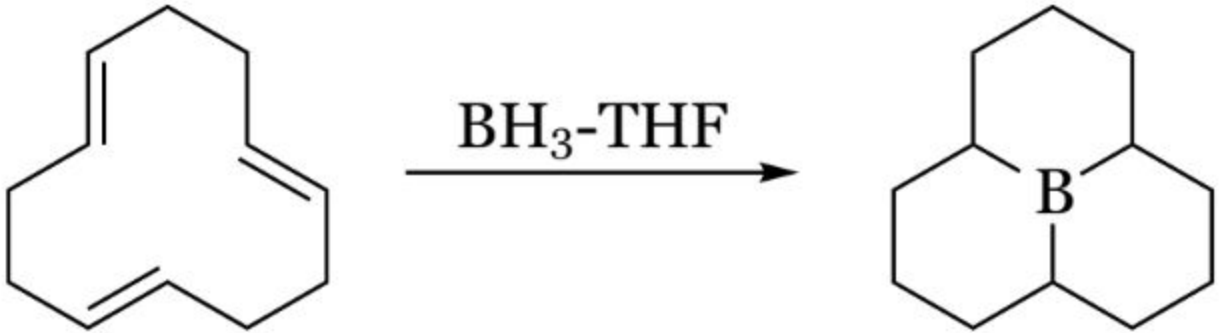
Substrate Type	Strong base Weak nucleophile	Strong base Strong nucleophile	Weak base Strong nucleophile	Weak base Weak nucleophile
1°	E2	E2 S_N2	S_N2	
2°	E2	E2 S_N2	S_N2	SN1 and E1
3°	E2	E2	S_N1	S_N1 E1

Dependent on Heat

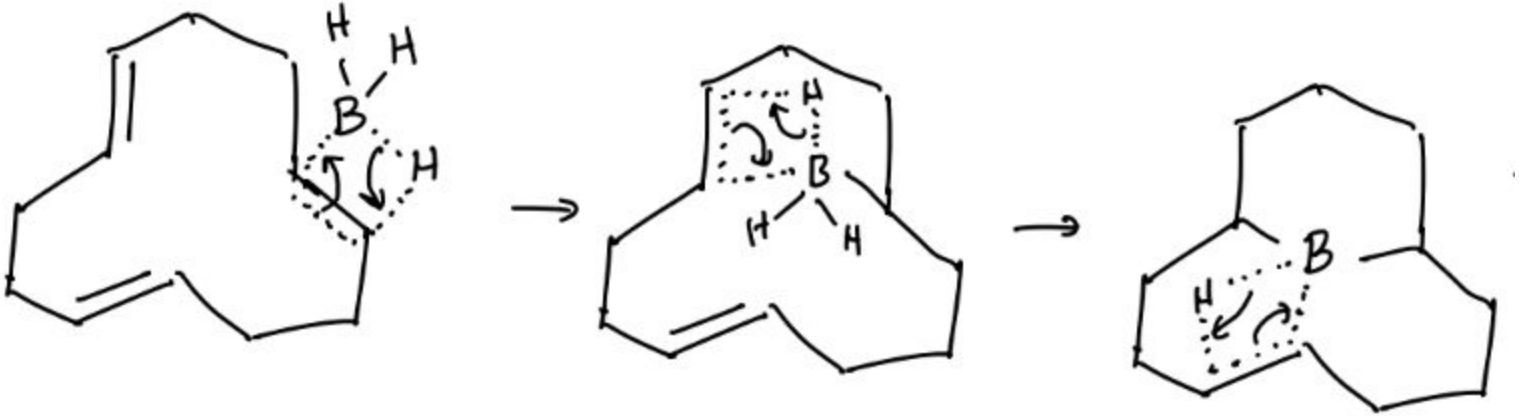
Trickier Alkene Mechanisms

Question 1

Draw the mechanism, based on the hydroboration-oxidation mechanism.

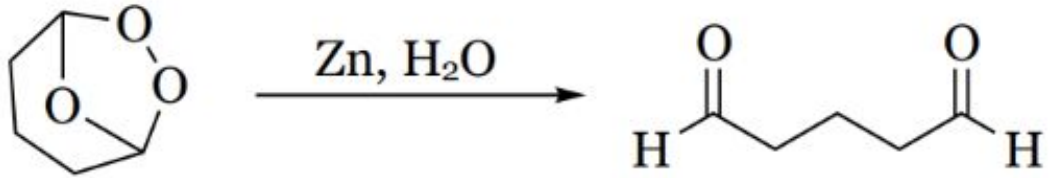


Question 1 - Answer

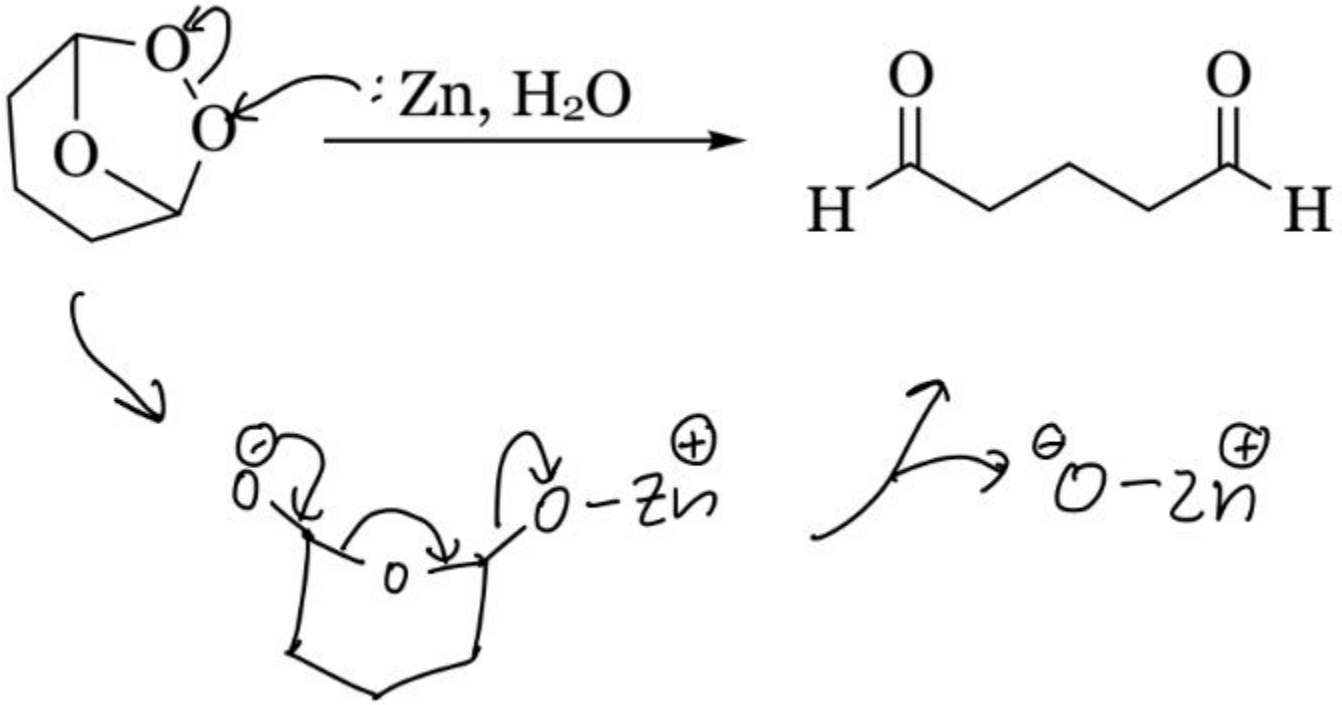


Question 2

Draw the mechanism, based on the ozonolysis mechanism (reductive workup step)



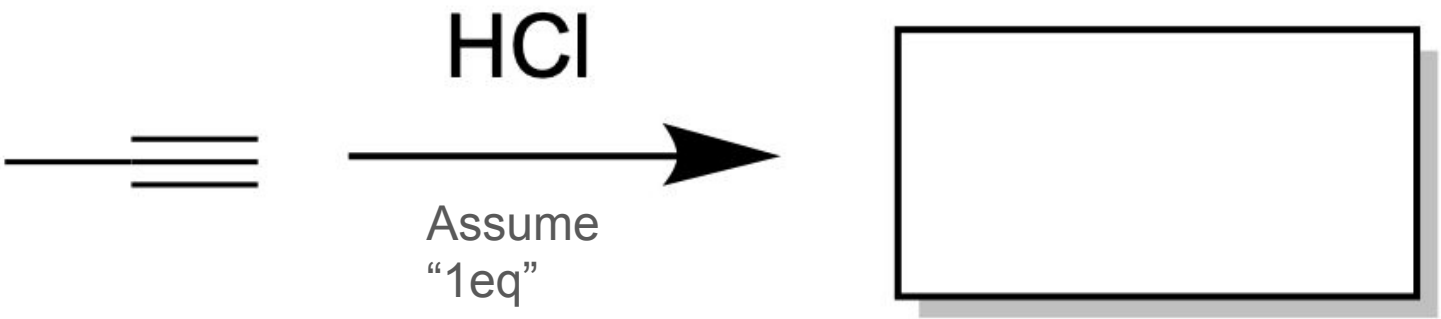
Question 2 - Answer



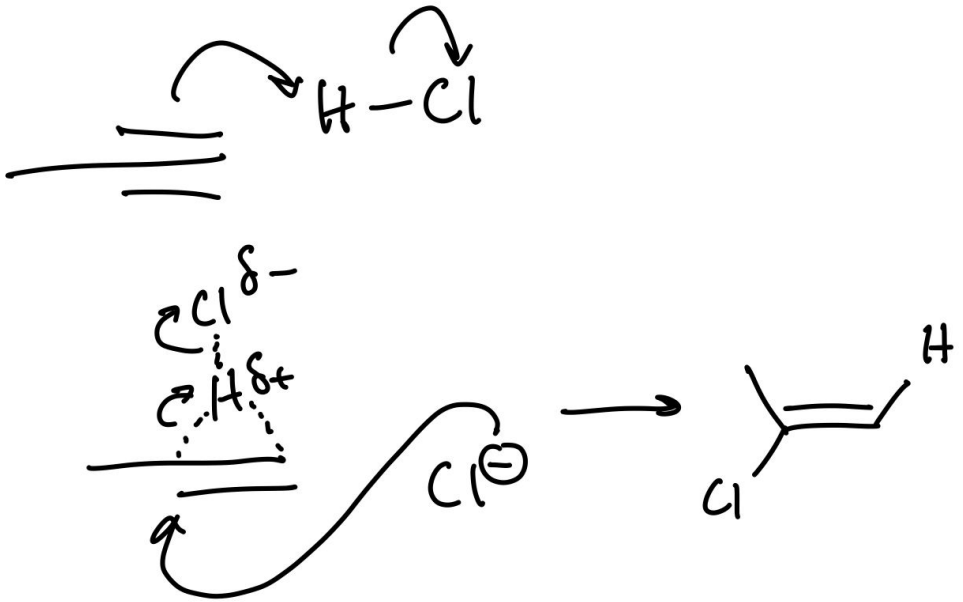
Alkynes

Question 1

Draw the product and mechanism

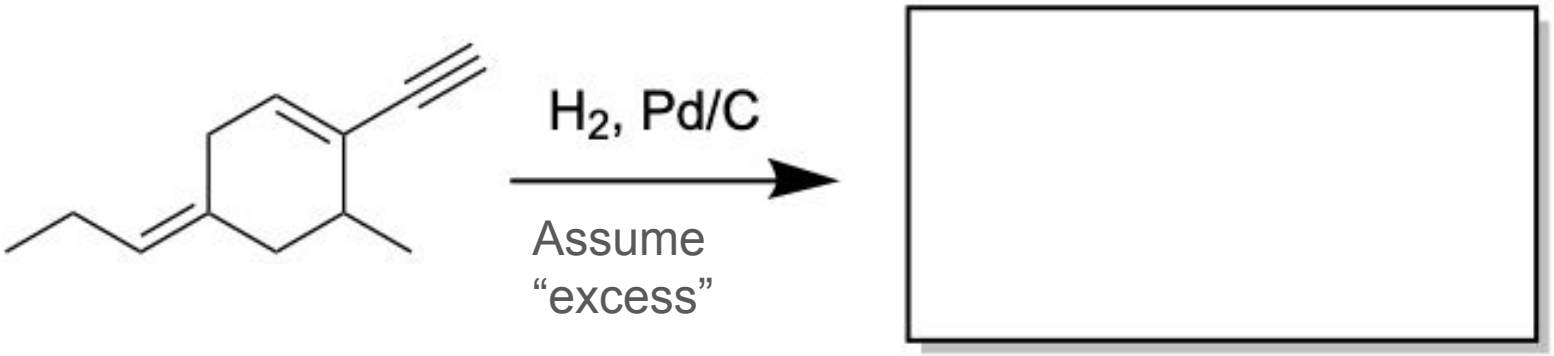


Question 1 - Answer

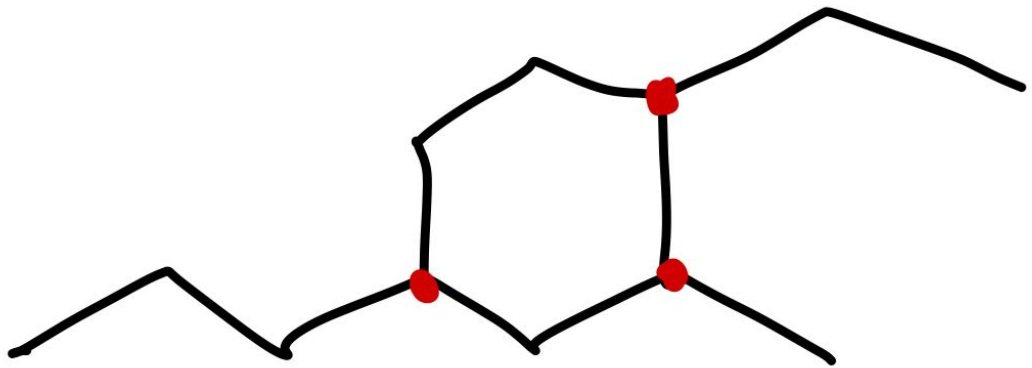


Question 2

Draw the product. Note any new chiral centers



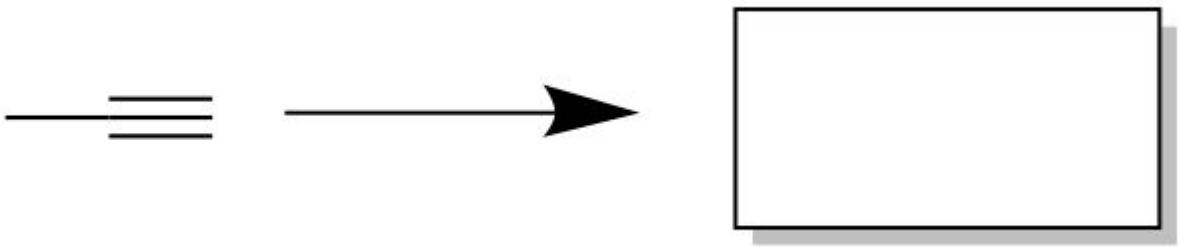
Question 2 - Answer



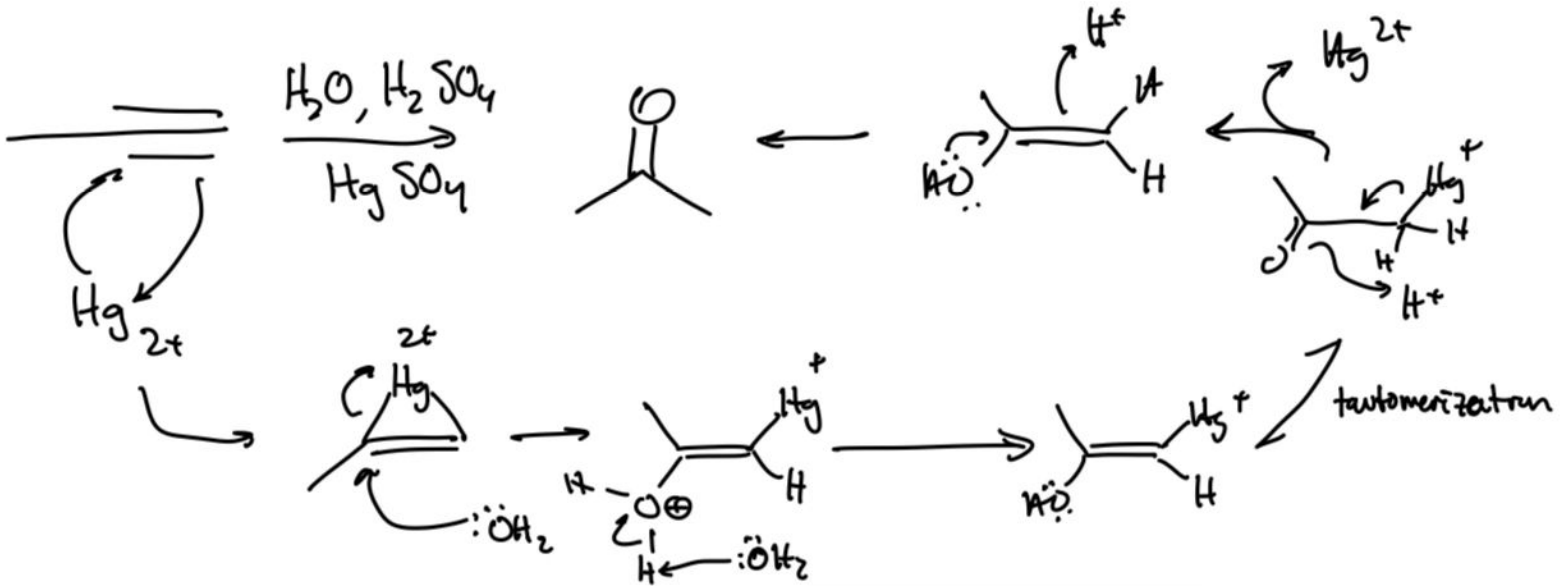
Note that the bottom right carbon was already chiral!

Question 3

Fill in BOTH the reagents and the product if we wanted to produce a ketone AND draw the mechanism.

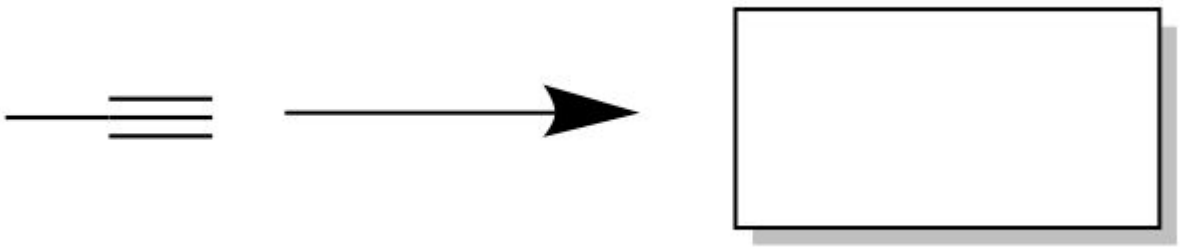


Question 3 - Answer

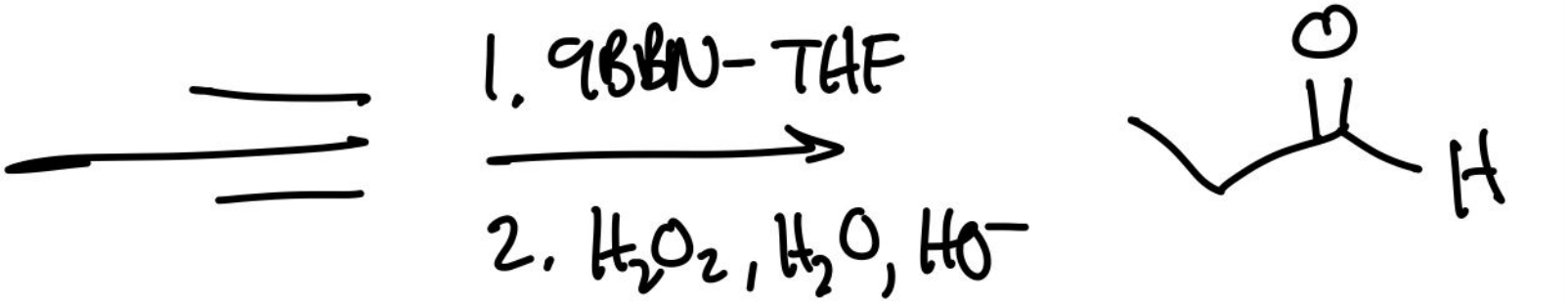


Question 4

Fill in the reagents if we wanted to produce an aldehyde.

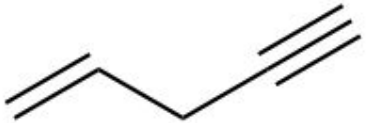


Question 4 - Answer



Question 5

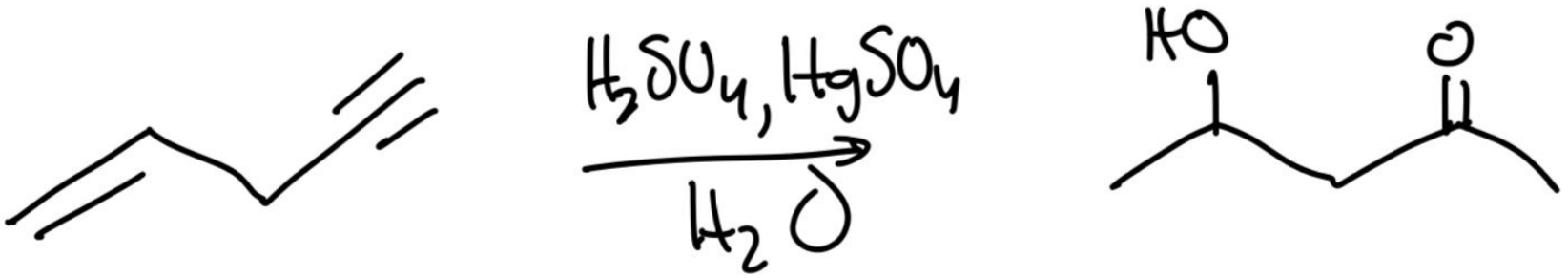
Please draw the product



H_2SO_4, $HgSO_4$, H_2O

Assume
“excess”

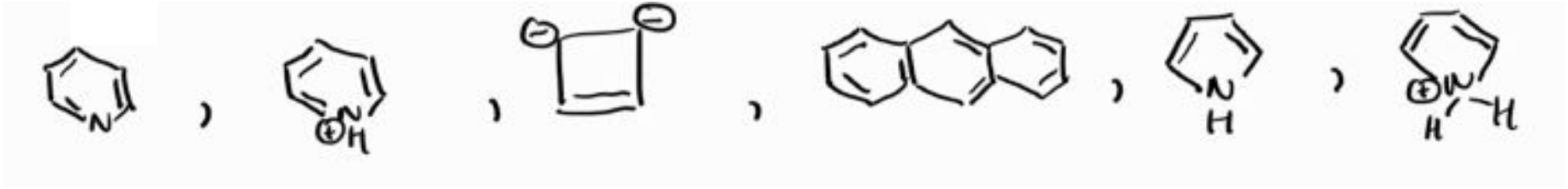
Question 5 - Answer

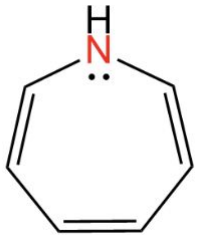


Other

Question 1

Assign aromatic/anti-aromatic/non-aromatic to the following molecules:
(assume all are planar)





Aromatic

unusually stable

- **Cyclic**
- **Conjugated**
- **(4n+2) Pi electrons**
- **Flat**

Anti-Aromatic

unusually unstable

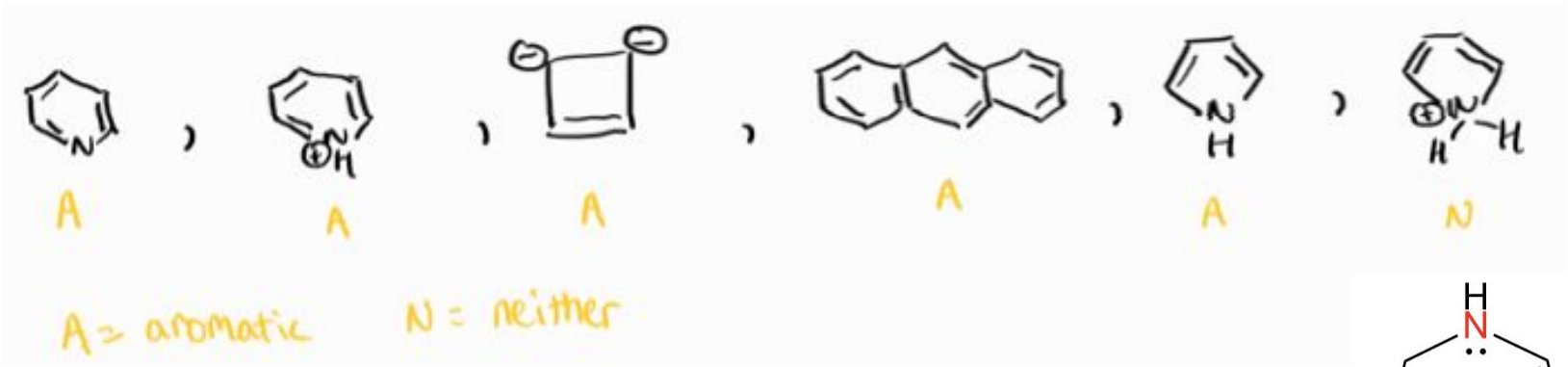
- **Cyclic**
- **Conjugated**
- **(4n) Pi electrons**
- **Flat**

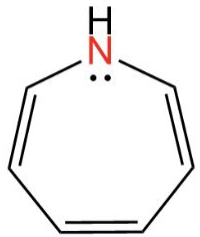
Non-Aromatic

everything else

Fails any one of the 4 criteria on the left

Question 1 - Answer

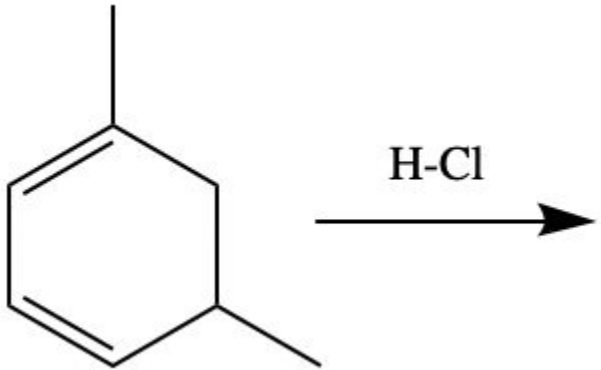




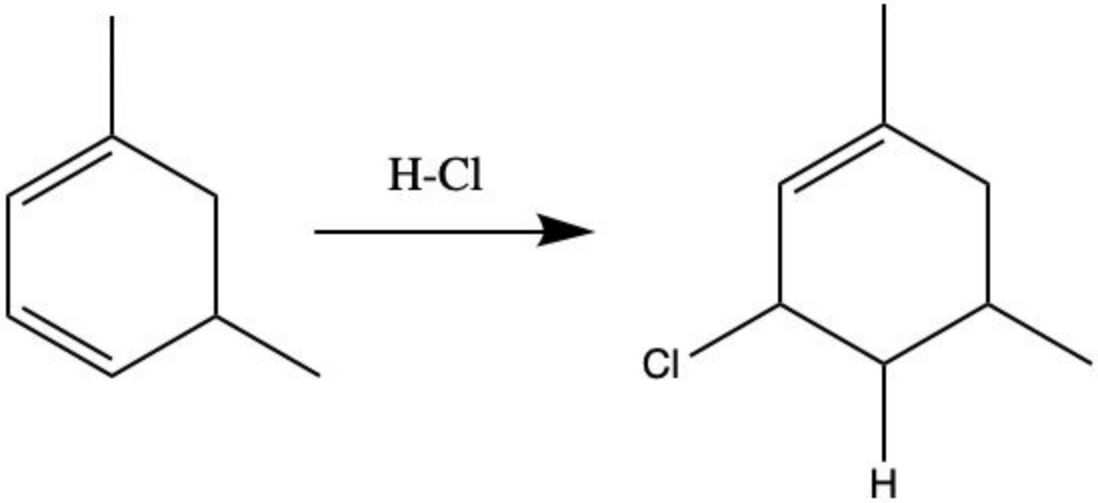
non-aromatic

Question 2

Write the major product and state whether it is kinetic or thermodynamic:



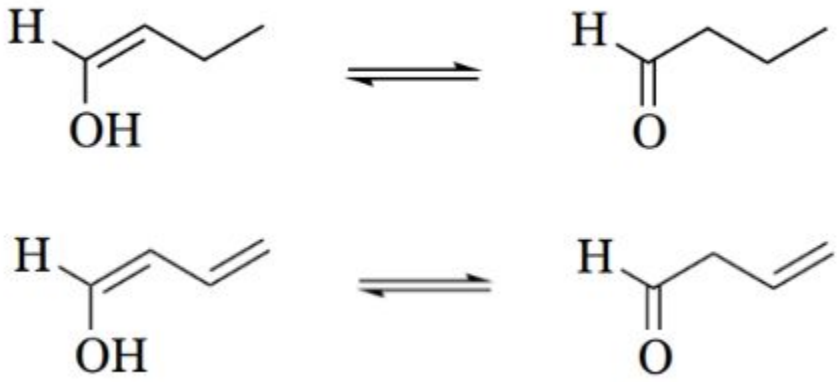
Question 2 - Answer



THIS 1,2 PRODUCT FOR BOTH KINETIC/THERMO!

Question 3

Which of the following enol-keto tautomerizations occurs faster? Explain why



Question 3 - Answer

The top enol is less resonance-stabilized, so it will convert to the keto form faster.