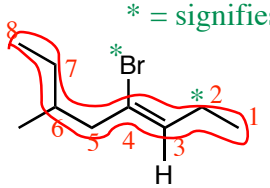
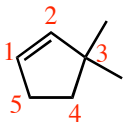
Chapter 8 Practice Problems
Solutions

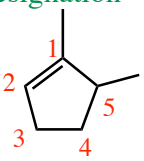
* = signifies higher ranked substituent for E/Z designation



(Z)-4-bromo-6-methyl-3-octene

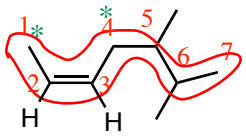


3,3-dimethylcyclopentene

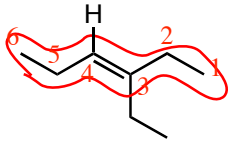


1,5-dimethylcyclopentene

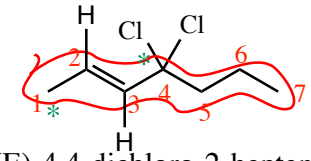
1



(Z)-5,6-dimethyl-2-heptene



3-ethyl-3-hexene



(E)-4,4-dichloro-2-heptene

- *since the two substituents on one end of the double bond are equivalent (ethyl groups) there are no stereoisomers possible (i.e. no E/Z)*

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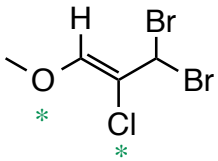
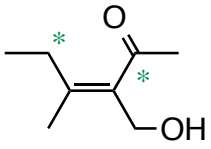
* = signifies higher ranked substituent for E/Z designation

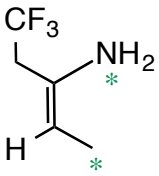
2



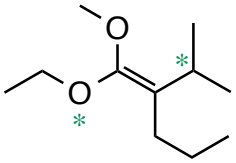
(Z)



(Z)

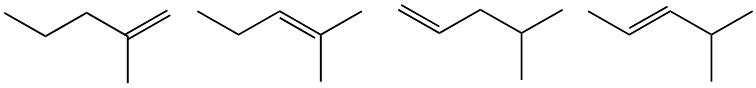


(Z)



(E)

3



A **B** **C** **D**

geminal-disubstituted | trisubstituted | monosubstituted | trans-disubstituted

most stable **B > A > D > C** *least stable*

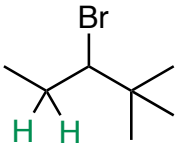
4

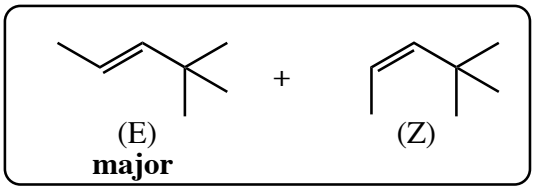
greatest **C > D > A > B** *least*

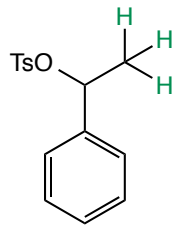
- *we can use the ordering of stability as determined in question 3*
- *more stability translates into lower relative energy = lower heat of combustion*

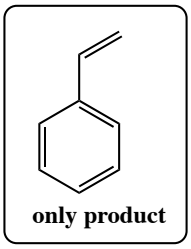
For each of the following, H's highlighted in green are β-hydrogens capable of being eliminated along with the leaving group

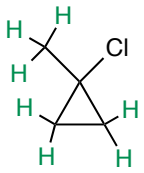
5

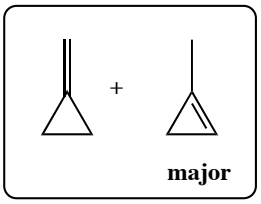






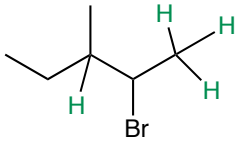


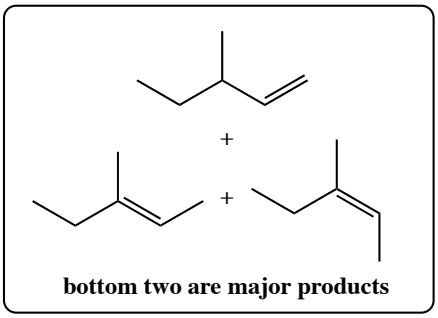


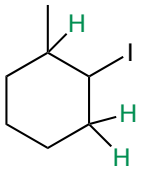


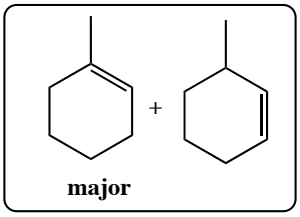
• *beware of duplicate products!*

5









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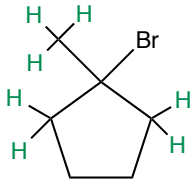
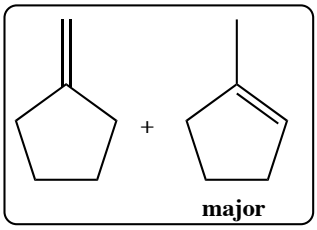
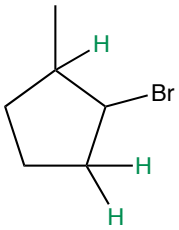
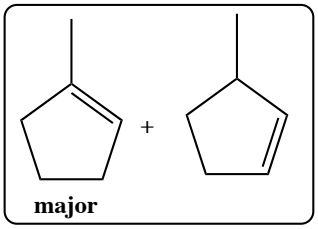
6

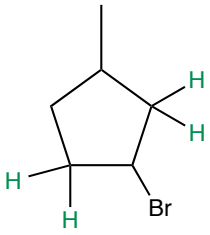


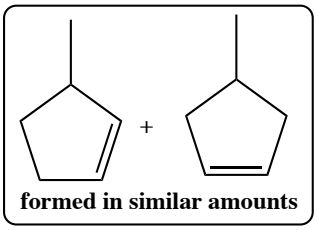


• *beware of duplicate products!*









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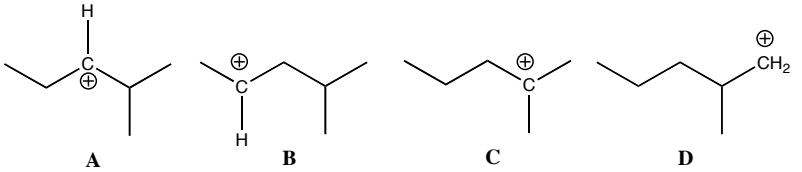


A 2° carbocation

B 2° carbocation

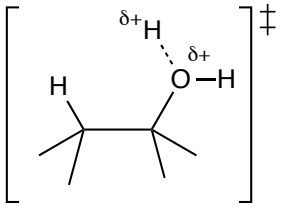
C 3° carbocation

D 1° carbocation

highest energy (least stable) **D > A ~ B > C** *lowest energy (most stable)*

8

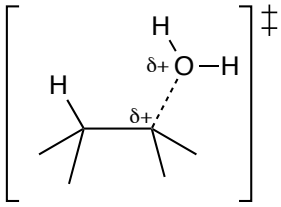
TS1



• *forming O–H bond*
• *H losing positive charge*
• *O gaining positive charge*

bimolecular reaction step

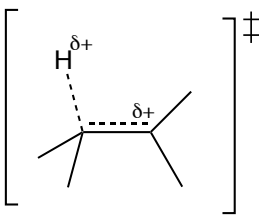
TS2



• *breaking C–O bond*
• *O losing positive charge*
• *C gaining positive charge*

unimolecular reaction step

TS3

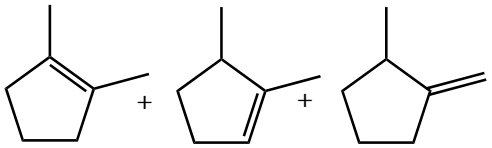


• *breaking C–H bond*
• *forming C–C π bond*
• *C losing positive charge*
• *H gaining positive charge*

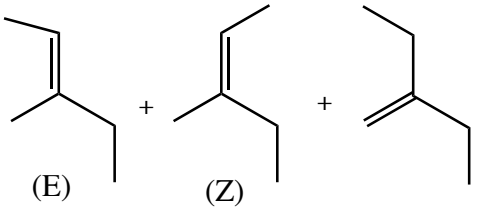
unimolecular reaction step

• *beware of duplicate products!*

9

A 

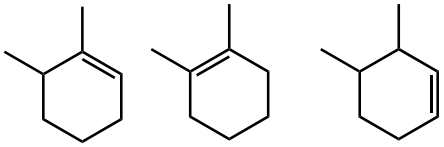
major

B 

(E) (Z)

the first two are the major products

10



A trisubstituted alkene

B tetrasubstituted alkene

C cis-disubstituted alkene

greatest yield **B > A > C** *lowest yield*

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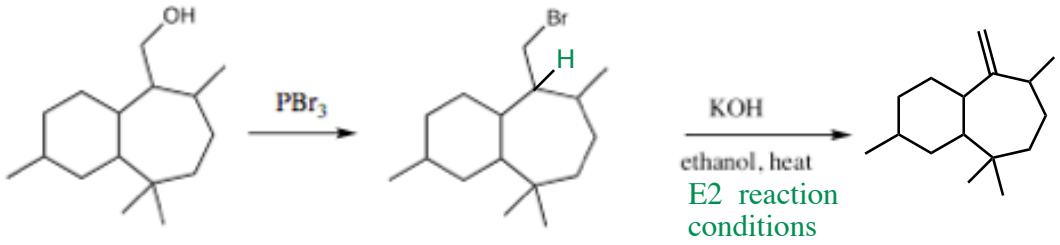
11 *greatest* **C > A >** B *least*

• *the least stable isomer will have the lowest relative energy which translates into the greatest heat of combustion*

• H's highlighted in green are β-hydrogens capable of being eliminated along with the leaving group

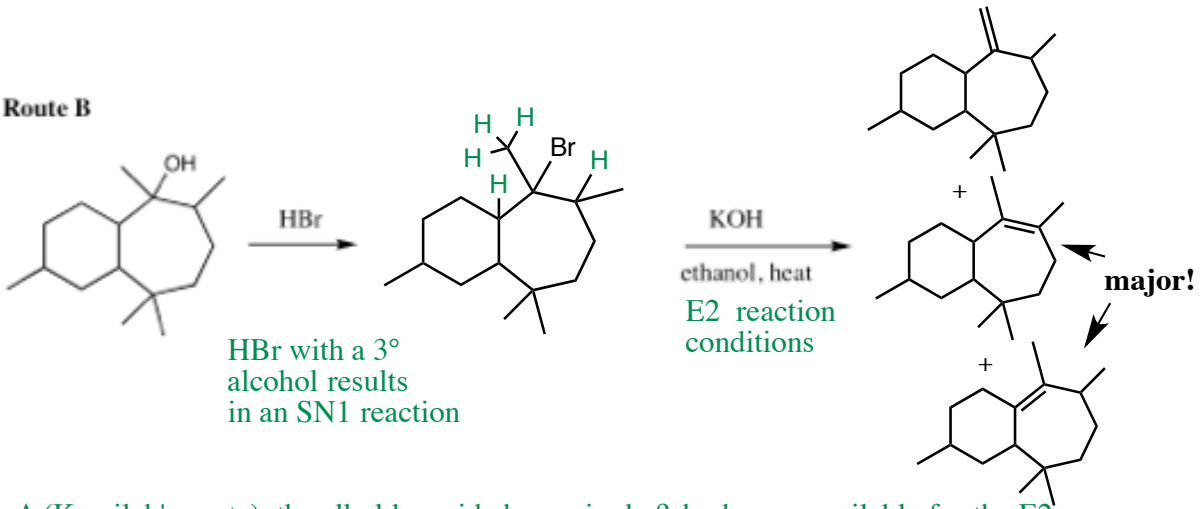
12

Route A



E2 reaction conditions

Route B



HBr with a 3° alcohol results in an SN1 reaction

E2 reaction conditions

• For route A (Kamilah's route), the alkyl bromide has a single β-hydrogen available for the E2 reaction. Therefore, only a single product, the desired pheromone, is formed!
• For route B (Jimmy's route), the alkyl bromide has two sets of β-hydrogens available for the E2 reaction. Therefore, THREE differnet products result from the reaction, and the major products are the unwanted tetrasubstituted alkene producst! The yield of the desired product will be small.
• **Sorry Jimmy, but Kamilah is getting the raise!**