Key

Session 16 - Elimination and Dehydration Reactions

1) Use the following word bank to describe each of the reactions.

~~Concerted~~
~~Unimolecular~~
~~Bimolecular~~
~~Primary Alkyl Halide~~
~~Secondary Alkyl Halide~~
~~Tertiary Alkyl Halide~~
~~Strong Bases~~
~~Weak Bases~~
~~Anti-Elimination~~
~~Carbocation Intermediate~~
~~Promoted by Heat (Δ)~~
~~One Step~~
~~Two Steps~~

S_N2

Concerted
Bimolecular
1°, 2°
Strong bases
One step

E1

Unimolecular Δ
2°, 3°
Weak bases
Carbocation
two steps

S_N1

Unimolecular
2°, 3°
Weak bases
Carbocation
two steps

E2

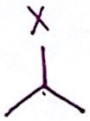
Concerted
Bimolecular Δ
1°, 2°, 3° one step
Strong bases
Anti elimination

X = halogen

2) Fill out the following flowcharts.

Order of Alkyl Halide	Type of Base	Reaction
1°	Small base	S_N2
	Bulky base	E2

→ Can't react as S_N1 or E1 because it can't form a stable carbocation



Order of Alkyl Halide	Type of Base		Reaction
2°	Strong Base	Δ	S_N2
			E2
	Weak Base	Δ	S_N1
			E1

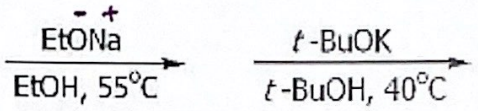
Order of Alkyl Halide	Type of Base		Reaction
3°	Strong Base		E2
	Weak Base	Δ	S_N1
			E1

→ can't react as S_N2 because of steric hindrance

3) What is Zaitsev's Rule and what type of reaction does it affect?

Zaitsev's Rule exists when you are trying to do an E2 reaction w/ a base that has equal access to 2 separate hydrogens. It will essentially form 2 separate alkenes, but will favor the most stable (most-substituted) one.

4) What do these reagents mean?

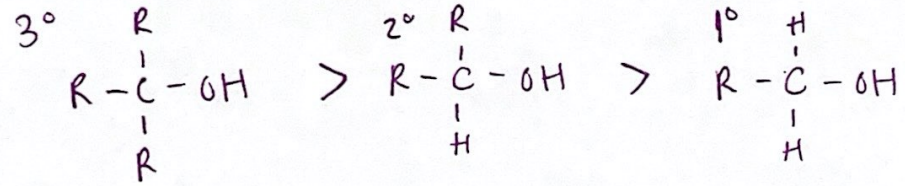


The one on top is the nucleophile/base & the one on the bottom is the solvent.

5) Out of the previous four reactions that we have looked at, what type of reaction is the dehydration of alcohols?

2° & 3° → E1 1° → E2

6) What is the order in which alcohols prefer to undergo dehydration reactions?

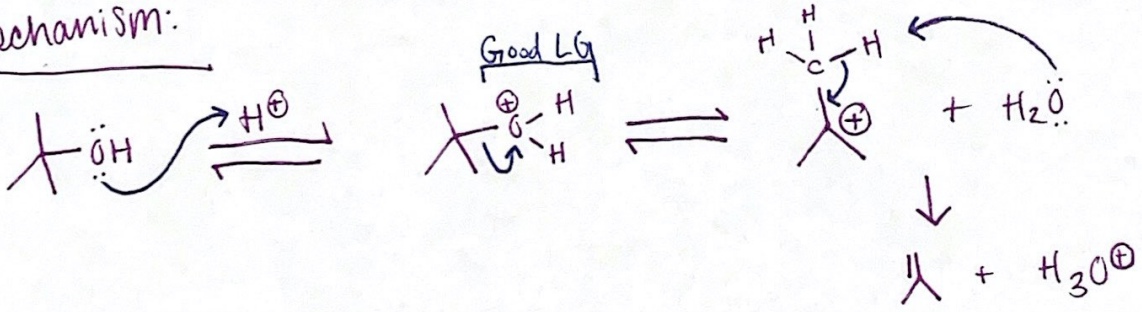


7) Show the general mechanism of an alcohol dehydration reaction.

Dehydration reactions are reversible

Reaction:

Mechanism:



8) What conditions promote dehydration reactions for the different orders of alcohol.

3° → Acid + Δ

1° & 2° → strong acid + Δ

9) Give the products for the following reactions and explain which would be more stable.

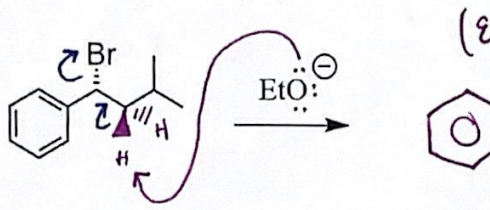
Strong base

↓

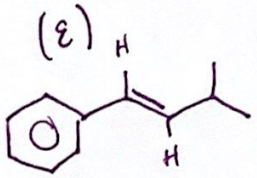
E2

↓

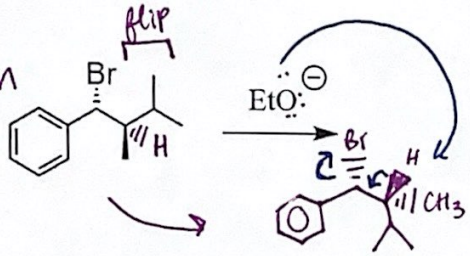
Anti elimination



(E)

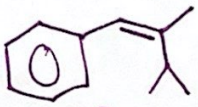


+ EtOH + $Br^{\ominus}$



(Z)

Most stable



+ EtOH

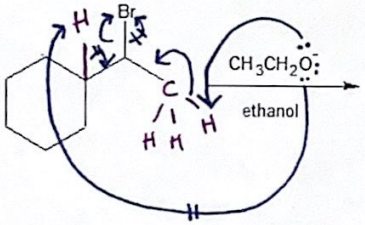
+ $Br^{\ominus}$

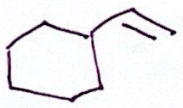
↑ steric hindrance

10) Show the mechanism and product for the following reactions.

E2

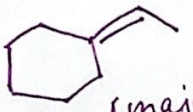
strong base





(minor)

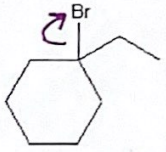
+



(major)

+ $Br^{\ominus}$ + EtOH

E1

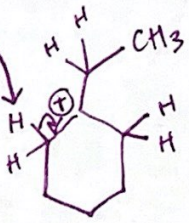


Weak base

ethanol

heat

EtOH



EtOH

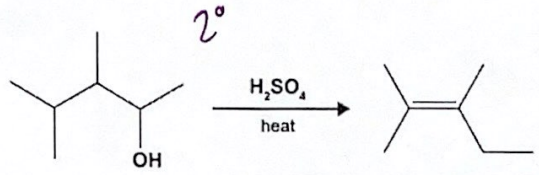
↑ ↑

Both trisubstituted,

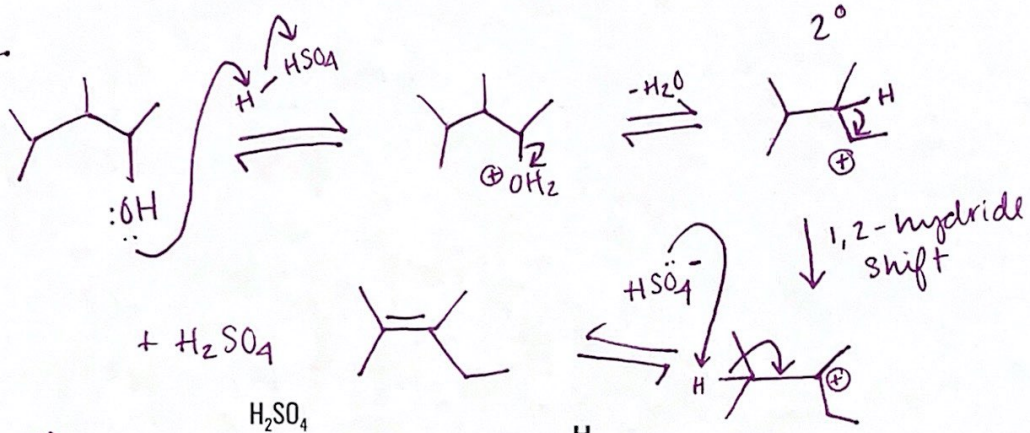
so ~50:50

Dehydration 11) Show the mechanism for the following reactions.

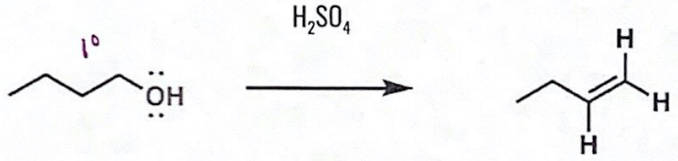
E1



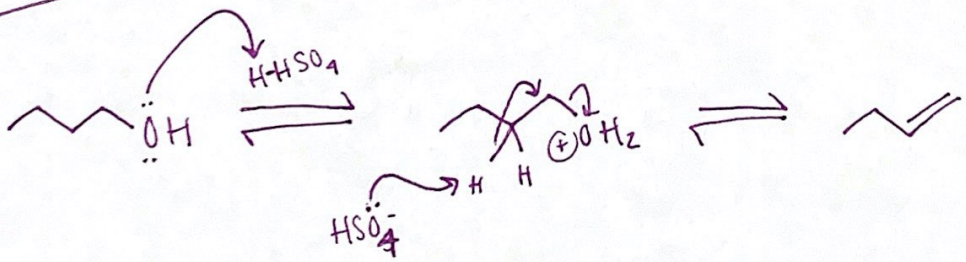
Mech:

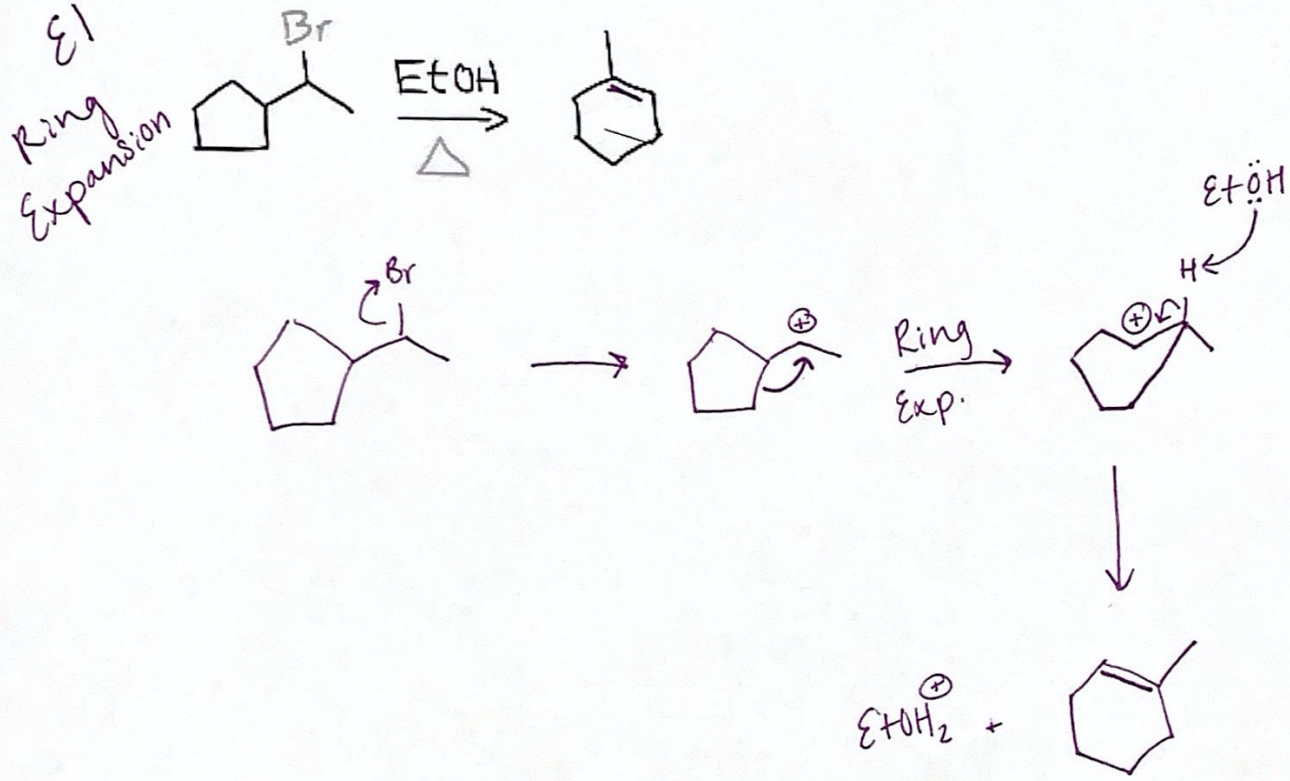


Dehydration



Mech:




E1
Ring Expansion
Br
EtOH
Br
Ring Exp.
EtÖH
H
EtOH2