Final Test Prep, Part 2

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1) What are the four types of hydrocarbons and the ten types of functional groups that we have gone over?

   Hydrocarbons: Alkane, alkene, alkyne, and aromatic

   Functional Groups: Alkyl halide, alcohol, ketone, aldehyde, carboxylic acid, ether, ester, nitrile, amide, amine.

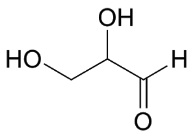
2) What are enantiomers and diastereomers?

   Enantiomers are nonsuperimposable mirror images of each other. Diastereomers are just not mirror images of each other (cis and trans isomers would be diastereomers).

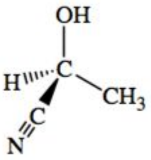
3) What is the term for a molecule that has chiral centers, but also an internal plane of symmetry?

   Meso

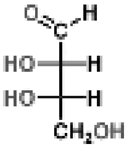
4) Determine the R or S configuration of the following compounds.



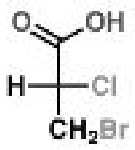
R configuration (apparent S, but we switch it because H is a solid wedge)



S configuration (apparent r, but we switch it because H is a solid wedge)



2-S, 3-S (apparent R, but we switch it because H is a solid wedge)



R-configuration (apparent S, but we switch it because H is a solid wedge)

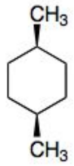
5) If a solution of a compound (40.0g/100 mL of solution) has a measured rotation of +14° in a 3.5 dm tube, the specific rotation is:

$\frac{14°}{(0.4 \, x \, 3.5)}$ = 10°

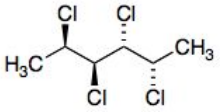
6) Which of the following represents a meso compound?

A & B

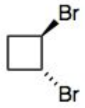
(A)



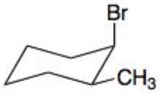
(B)



(C)



(D)



7) List all of the things you can think of that constitute an S_N2 reaction?

Type of alkyl halide: methyl, primary and secondary
Type of base/nucleophile: strong
Type of reaction: 1 concerted step, bimolecular reaction rate (substrate and base/nucleophile)
What happens: halide is replaced with base/nucleophile by a backside attack and an inversion of configuration occurs

8) List all of the things you can think of that constitute an S_N1 reaction?

Type of alkyl halide: secondary and tertiary (because carbocation forms)
Type of base/nucleophile: weak
Type of reaction: multiple steps, unimolecular reaction rate (substrate only)
What happens: X is a leaving group that forms a carbocation, and base/nucleophile attacks the carbocation and replaces it (forms a racemic mixture)

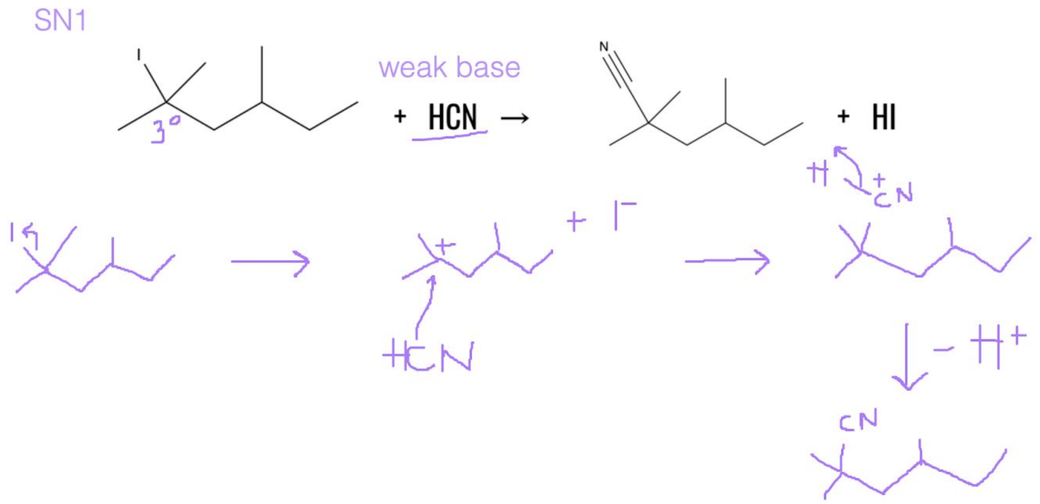
9) List all of the things you can think of that constitute an E2 reaction?

Type of alkyl halide: doesn't really matter
Type of base/nucleophile: strong, bulky works best to choose E2 over S_N2
Type of reaction: 1 concerted step, bimolecular
What happens: H and X are removed from an alkyl halide (must be anti of each other) to produce a double bond between those carbons

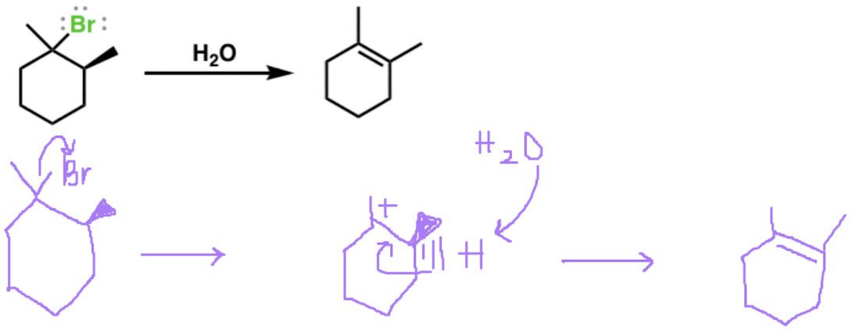
10) List all of the things you can think of that constitute an E1 reaction?

Type of alkyl halide: secondary or tertiary (because carbocation forms)
Type of base/nucleophile: weak, there is no way to choose either E1 or S_N1
Type of reaction: multiple steps, unimolecular
What happens: X is a leaving group that forms a carbocation, and base/nucleophile removes a hydrogen from an adjacent carbon to form double bond

11) Provide the mechanism for the following reaction.



12) Provide the mechanism for the following reaction.



13) We went over more than 20 reactions in chapter 8, list as many as you can, and describe what happens in them. Also, provide the reagents for the reactions.

Hydrogenation:	H_2 and a metal (Pb, Ni, or Pt) Gets rid of double and triple bonds	(alkene/alkyne → alkane)
Dehydrohalogenation:	Gets rid of a hydrogen and a halogen	(-HX) (alkyl halide → alkene)
Dehydration of alcohol:	Gets rid of a hydrogen and a -OH	(-H_2O) (alcohol → alkene)
Double E2:	E2 reaction happens twice ($NaNH_2$)	(dihalide → alkyne)
Deprotonation of a terminal alkyne:	$NaNH_2$ Forms a carbanion which can be used as a nucleophile	
Formation of a geminal dihalide:	PCl_5	(ketone → geminal dihalide)
Formation of cis alkenes from alkynes:	Lindlar's catalyst or P-2 catalyst (alkyne → cis alkene)	
Formation of trans alkenes from alkynes:	Li°, liquid NH_3	(alkyne → trans alkene)
Hydrohalogenation:	anti addition of HX (opposite of elimination) (alkene → alkyl halide)	(alkyne → geminal dihalide)
Hydration:	addition of H and -OH (H_2O) Rearrangement possible, Markovnikov addition	(alkene → alcohol)
Oxymercuration-demercuration:	1. $Hg(OAc)_2$, H_2O 2. $NaBH_4$	(alkene → alcohol), Markovnikov Rearrangement not possible
Hydroboration-oxidation:	1. BH_3-THF 2. H_2O_2, OH^-	(alkene → alcohol) Anti-markovnikov
Halogenation:	anti addition of X_2 (X = Cl or Br)	(alkene → vicinal dihalide) (alkyne → tetrahalide)
Halohydrin:	anti addition of X_2 (X = Cl or Br) Markovnikov	(alkene → alkyl halide/alcohol)

Carbene formation:	CH_2N_2 + Δ, CHX_3 (X = Cl or Br) + tBu^-, or Simmons-Smith reagent Forms carbene or carbenoid	
Cyclopropanation:	addition of a carbene Retains cis/trans configuration	(alkene → cyclopropane)
Dihydroxylation:	cold, dilute $KMnO_4$ or 1. OsO_4 and 2. $NaHSO_3$ Syn addition of two -OH groups	(alkene → cis di-ol)
Oxidative cleavage:	Hot, conc. $KMnO_4$, cleaves the double bond (alkenes can form either ketone, carboxylic acid or CO_2)	
Ozonolysis of alkenes:	1. O_3 2. $(CH_3)_2S$	Cleaves the double bond into two carbonyls (either aldehyde or ketone)
Ozonolysis of alkynes:	1. O_3 2. HOAc	Cleaves the triple bond into two carboxylic acids