

*The final exam is cumulative. Much of the material studied before the midterm exam serves as prerequisite for the later part of the courses; therefore, review of the Quiz & Midterm checklist is strongly advised. This is not necessarily a comprehensive list; anything that was discussed in class might come up in the Final Exam.*

### Nucleophilic Substitution & Elimination

define/ describe  $S_N2$ ,  $S_N1$ , E1, E2 rxns in terms of  
rate law, transition state, rxn diagram,  
rxn mechanism, effect on chirality  
describe/ apply the effect of substrate structure,  
nucleophilicity, leaving group and solvent on the  
above rxn types  
predict preferred reaction type and product if  
substrate and rxn conditions are given, incl.  
stereochemistry  
determine product(s) if reaction type is given

### Alkenes

unsaturated fats as example  
degree of unsaturation, determine & apply concept  
naming alkenes; incl. vinyl substituent  
molecular features & *cis*, *trans* isomerism  
E, Z designation, incl. naming  
stability of substituted alkenes,  
prep. of alkenes: cracking, dehydrohalogenation,  
dehydration, alkyne hydrogenation  
electrophilic addition (E.A.) rxns, general principles  
Mark.'s rule, carbocation stability &  
hyperconjugation  
details of addition reactions  
1. Given 2 of the following:  
"substrate", "reaction conditions" or "product"  
find the third  
2. Describe/ predict rxn mech., regioselectivity,  
stereoselectivity and products of ....

- *Hydrohalogenation\**
- *Halogenation\**
- *halohydrin formation\**
- *direct hydration*
- *oxymercuration*
- *hydroboration*
- *hydrogenation*
- *epoxidation*

\* know detailed mech.

### Ozonolysis

predict products  
use in structure determination (potentially in  
combination w/ other info)

### Alkynes

molecular features  
naming  
preparation (2 methods)  
reactions  
addition:

- 1 or 2 HX
- 1 or 2  $X_2$
- $Hg^{2+}$  catalyzed hydration
- hydroboration
- hydrogenation:
  - w/ active cat.
  - w/ Lindlar cat.
- Li/NH<sub>3</sub> (or Na/NH<sub>3</sub>) reduction

use hydrogenation data for structure determination  
terminal alkyne acidity  
 $pK_a$  rankings  
synthesis w/ alkynides  
plan synthesis of org. cmpds using alkane, alkene  
and alkyne rxns (up to 3 steps)

### Alcohols

General molecular features; occurrence  
Systematic naming (incl. R, S, 'undefined' ...)  
Preparation: acidic hydration, oxymercuration,  
hydroboration, nucleophilic substitution  
Describe (& state consequences of) H-bonding,  
basicity, acidity  
Reactions: alkoxide formation, reactions with  
nucleophilic and non-nucleophilic acids  
(active ester methods, minimal)  
Detailed mechanisms for E & S rxns of alcohols

### Ethers

General molecular features; occurrence  
Selected common names.  
Systematic naming  
Prep. (3 methods): acid trtmt of alcohols, peracid  
trtmt of alkenes, Williamson synthesis  
General acidic cleavage of ethers  
Epoxide opening under basic and acidic conditions