

LEC (13)

CHEM 30A

May 4th (1)

① STRUCTURE & ACIDITY

- no OH Thursday
(Fri?)

② LEWIS ACIDS/BASES

③ ALKENES INTRO

organic rxns

④ TYPES

⑤ MECHANISMS

⑥ ENERGY DIAGRAMS

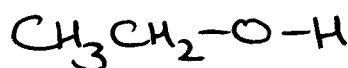
Finish Ch4 problems +
acid/base web worksheetRead Ch5 and do
problems

① STRUCTURE & ACIDITY

inductive effect

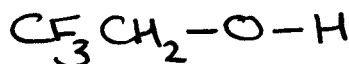
(Don't worry too much
about naming)

Read 6.1-6.3



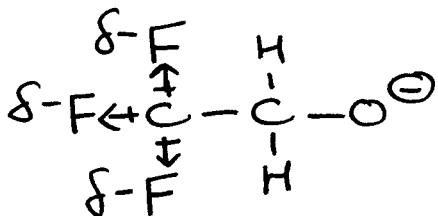
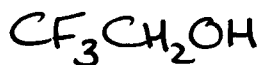
15.9

vs

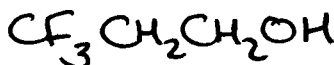


12.4

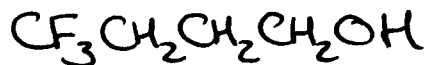
pKa

 $\text{CF}_3\text{CH}_2\text{O}^\ominus$ is more stable than $\text{CH}_3\text{CH}_2\text{O}^\ominus$ THROUGH BOND EFFECT
falls off rapidly with
distance

pKa 12.4

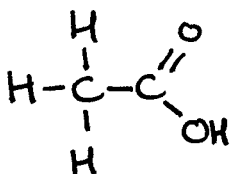


14.6

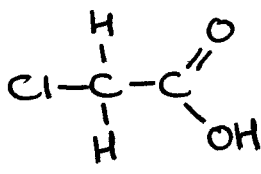


15.4

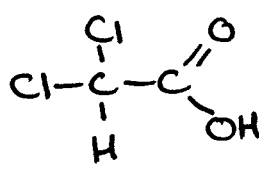
Same effect w/ CARBOXYLIC ACIDS



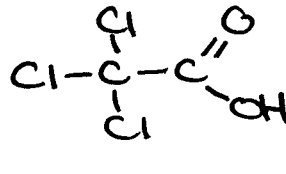
4.75



2.85



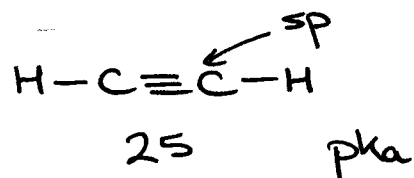
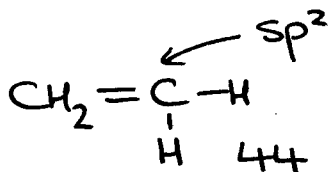
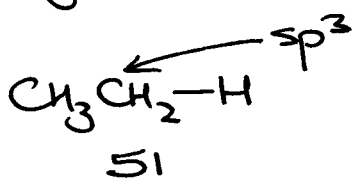
1.48



0.64

2

hybridization



→ ACIDITY INCREASES

s character of orbital 25% → 33% → 50%

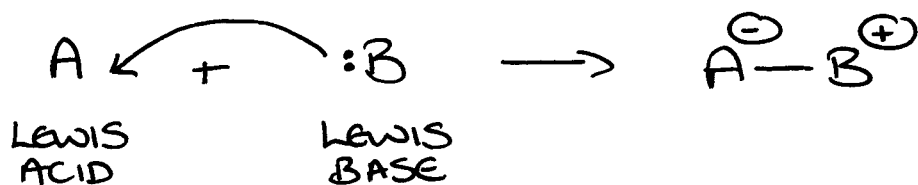
- electrons held closer to the nucleus
- more stable anion
- more acidic

② LEWIS ACIDS/BASES

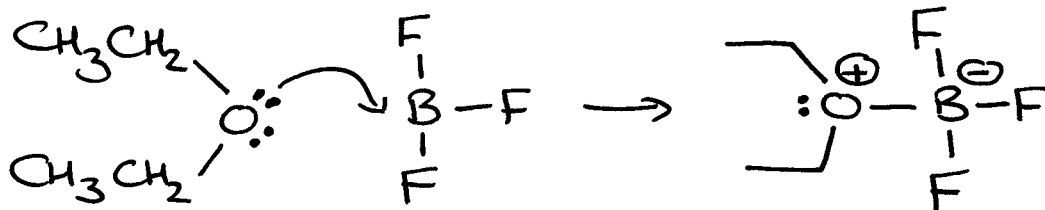
about e⁻ pairs, not H⁺

LEWIS ACID accepts an e⁻ pair

LEWIS BASE donates an e⁻ pair



e.g.



LEWIS BASE LEWIS ACID

③ Chapter 5 - Intro to Alkenes

Structure / Cis/Trans E/Z / Naming / Natural C=C

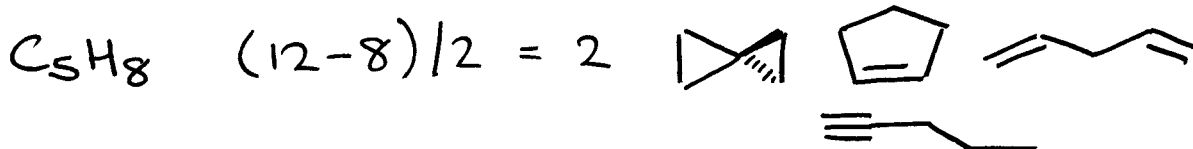
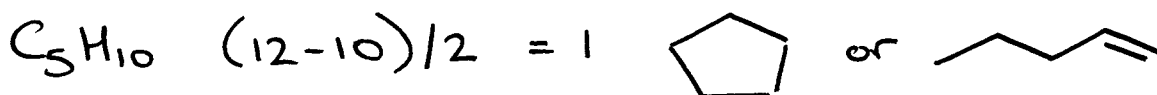
- Index of Hydrogen Deficiency
(Degrees of Unsaturation)

1 per ring / π BOND

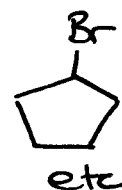
- max Hs in a structure C_nH_{2n+2}

$$\text{Deg Unsat} = \frac{\text{max H} - \text{actual H}}{2}$$

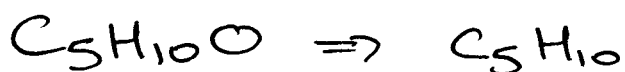
(i) C and H only



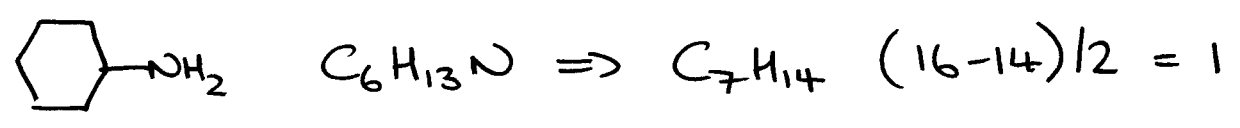
(ii) F, Cl, Br, I \rightarrow replace for H



(iii) O, S \rightarrow IGNORE



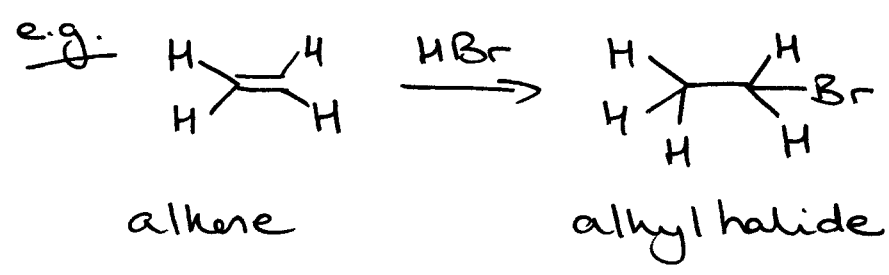
(iv) For N, P add a C and H



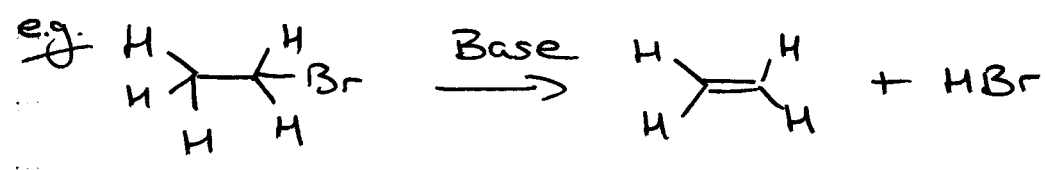
ORGANIC REACTIONS

4 TYPES

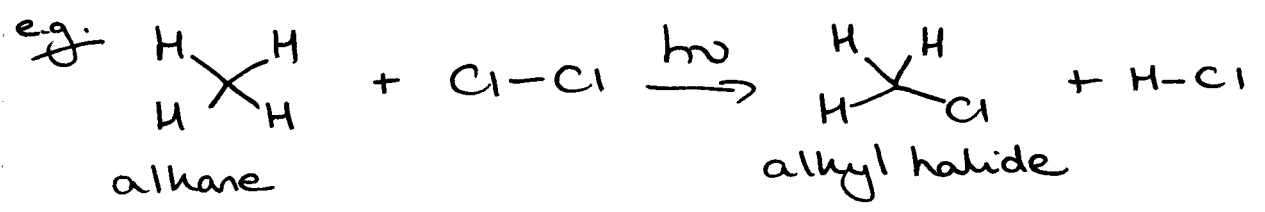
a) ADDITION ($A + B \rightarrow C$)



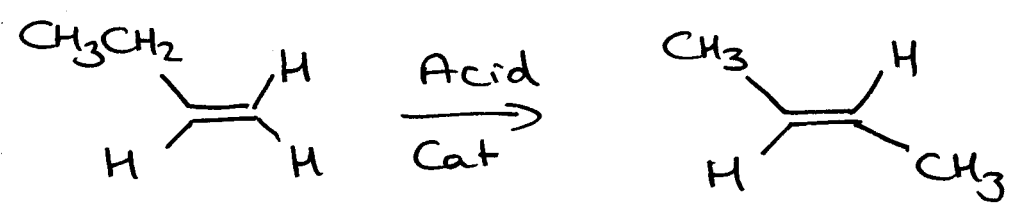
b) ELIMINATION ($A \rightarrow B + C$)



c) SUBSTITUTION ($A-B + C-D \rightarrow A-C + B-D$)



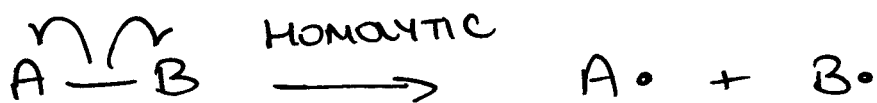
d) REARRANGEMENT



⑤ MECHANISMS

(Bond making / bond breaking)

- BREAKING



(\curvearrowright $1e^-$ arrow)

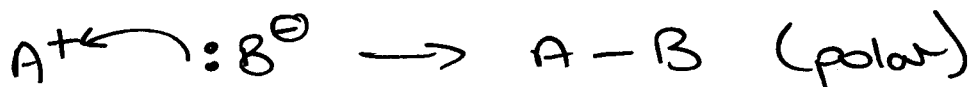
Radical reactions
(radicals \rightarrow species containing unpaired electrons)



(\curvearrowright $2e^-$ arrow)

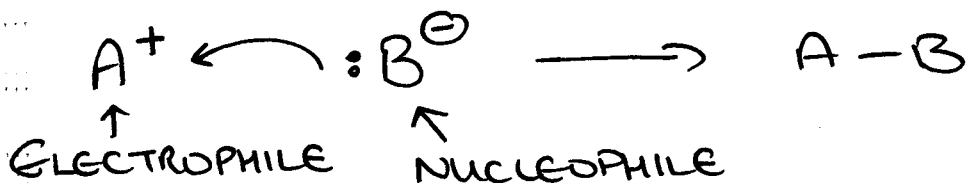
POLAR REACTIONS

- MAKING



- POLAR RXNS (RADICALS in wk 9/10)

e^- RICH sites in one molecule react with
 e^- POOR sites in another molecule



6

Nucleophiles

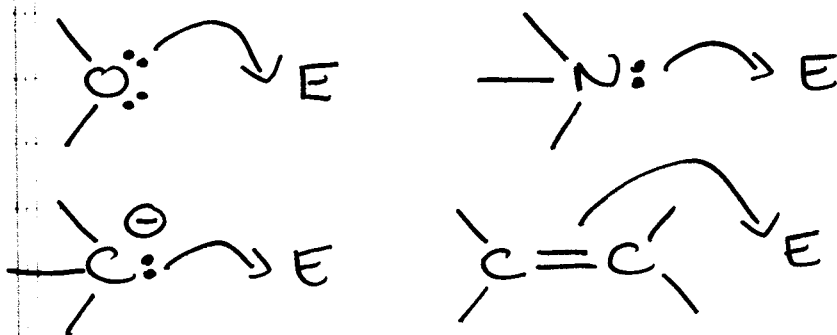
have an e⁻ RICH atom and are NEUTRAL or -VERY charged

Electrophiles

have an e⁻ POOR atom and are NEUTRAL or +VERY charged

PATTERNS

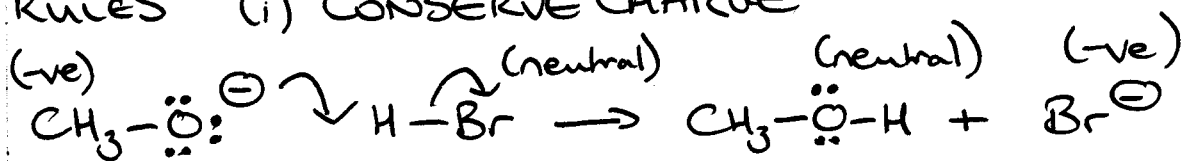
Electrons flow from nucleophiles



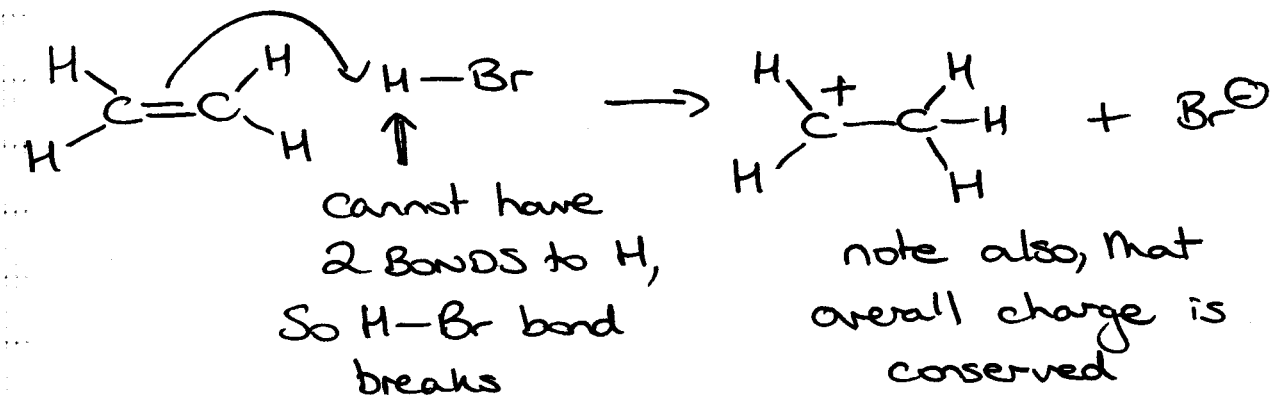
Electrons flow to electrophiles



Rules (i) CONSERVE CHARGE

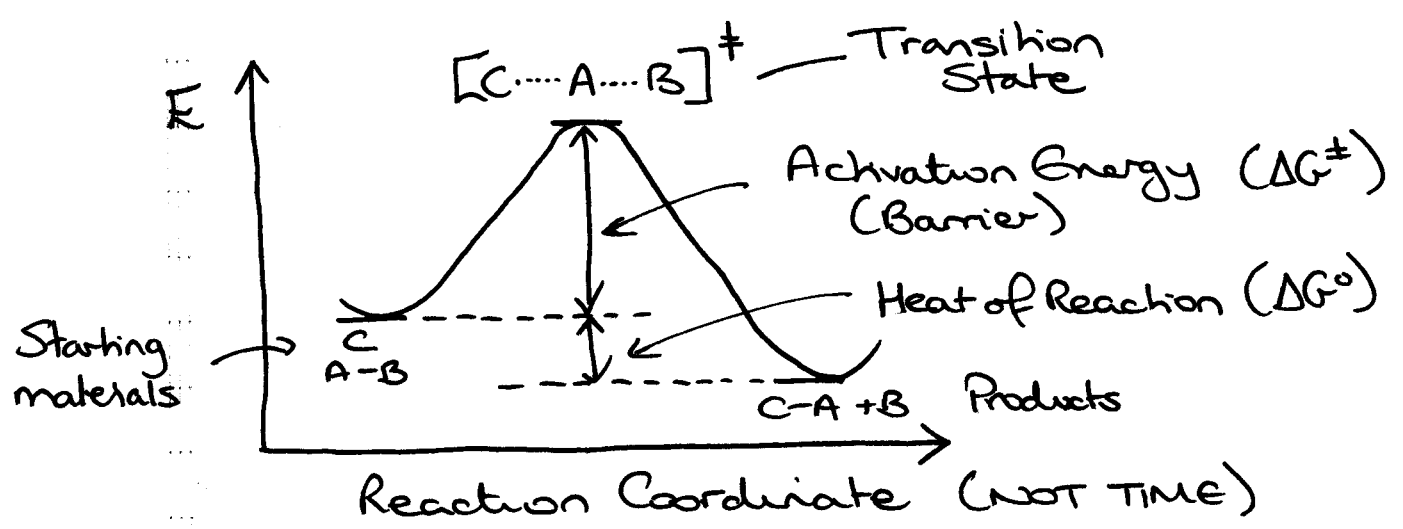
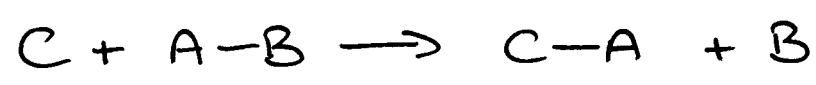


- octet rule must be obeyed (if necessary)



⑥ ENERGY DIAGRAMS

- one step reaction



For a reaction to occur as written $\Delta G^{\circ} < 0$ (proceeds spontaneously)

if $\Delta G^{\circ} > 0$ reaction does not proceed

- HEAT OF REACTION

8

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \leftarrow \begin{array}{l} \text{change in enthalpy} \\ \text{(can be measured directly)} \end{array}$$

change in entropy
(more significant
at higher T)

ΔH° (-ve exothermic rxn)
 ΔH° (+ve endothermic rxn)

- TRANSITION STATE

energy maximum on reaction coordinate

\Rightarrow definite GEOMETRY of atoms, but
cannot be ISOLATED - structure cannot be
determined experimentally (COMPUTATION)

- ACTIVATION ENERGY

difference in energy between starting
materials and the transition state

$$\Delta G^\ddagger \text{ or } E_A$$

Arrhenius equation

$$k = A e^{-E_A/RT}$$

\uparrow rate constant
of reaction

\nwarrow pre-exponential factor.