Today

More Arrow Pushing

Next Class

Section 6.1 and 6.2
Electrophilic Addition and Carbocation Stability

Rework test 2 by Wednesday 11/16

Reactions occur between e^- rich + e^- deficient areas of molecules or atoms

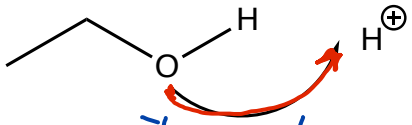
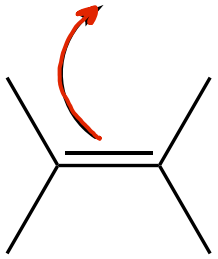
So arrows help us imagine how e^-'s might go from an e^- rich spot to form a bond with an e^- deficient spot

Arrows start at a source of e⁻'s and point to where the electrons will go.

Arrows represent the **imagined movement** of **e⁻'s**. They are not an attempt to show a literal path.

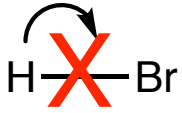
Arrows are **not** used to **move atoms**.

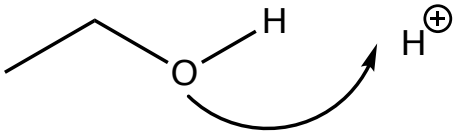
there are no e⁻'s on H+ so an arrow cannot start here

Arrows start at lone-pair e⁻ 's  or bonds. 

lone-pair e⁻'s make a new bond to the H+

π bond is breaking and we will use those e⁻ to make a new bond to H+

Arrows cannot start at an H atom 

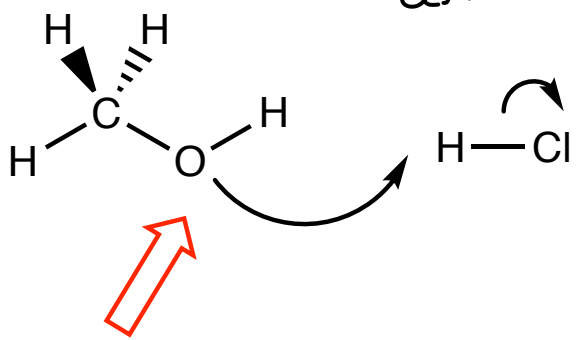
Arrows that make a bond point to between the atoms 

Arrows that break a bond and point to an atom puts the e⁻ 's on the atom 

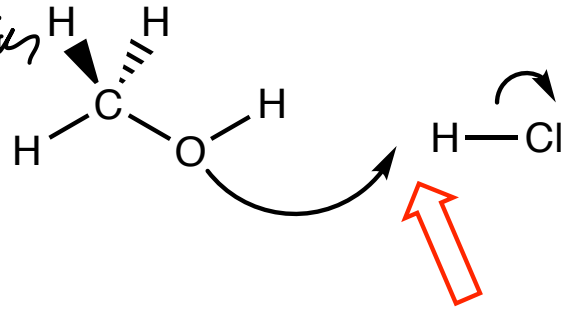
the e⁻'s in this bond are moving onto the Br atom

$H^{\oplus}$ $Br^{\ominus}$

arrows to help us think of a mechanism

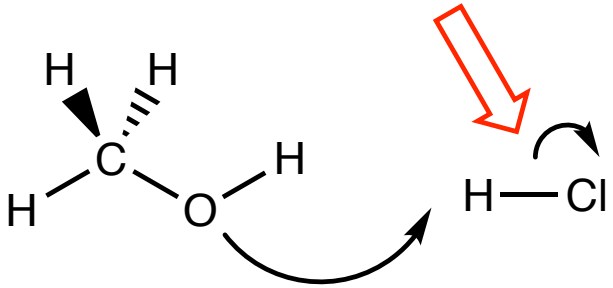


Beginning the arrow at the O atom tells us that a pair of lone-pair e⁻'s are going to make a bond.

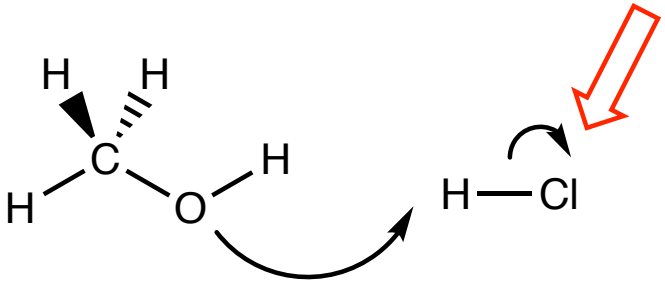


Ending the arrow between the O and the H tells us that the e⁻'s will be between the O and H; thus, a bond.

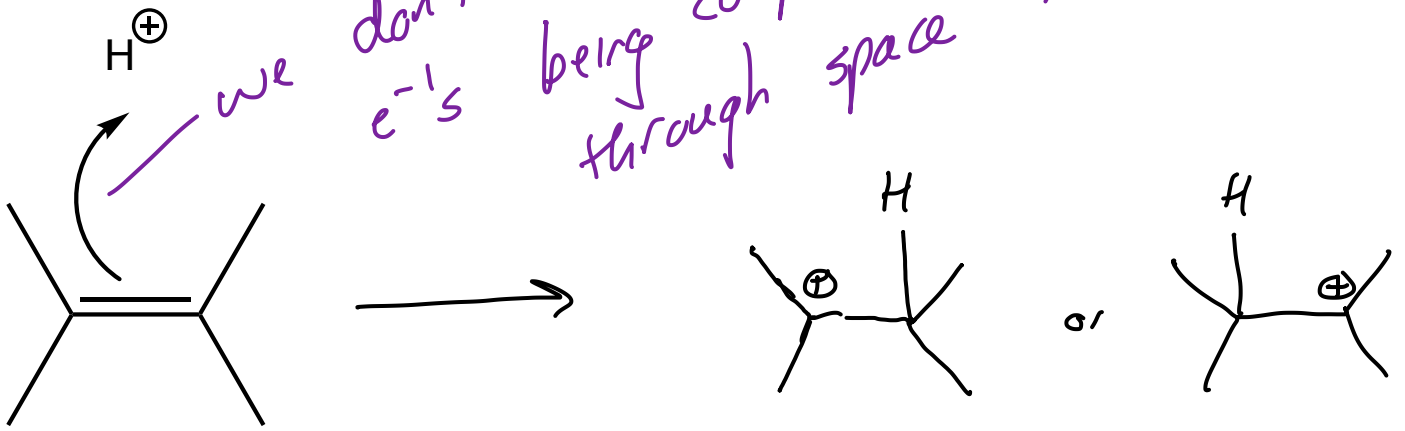
Begining the arrow here tells us that the e⁻ in the H to Cl bond are going somewhere Cl.



Since the arrow ends on the Cl, the two electrons in the bond wind up as lone pair e⁻'s.



$CH_3OH + HCl \rightarrow CH_3\overset{\oplus}{O}H_2 + Cl^{\ominus}$ single step mechanism



we don't use arrows to show e⁻'s being completely transferred through space to another atom or molecule

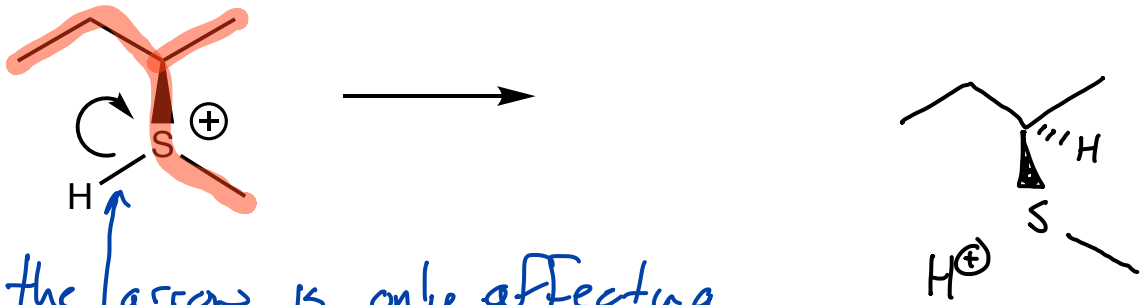
these are the same result

are we losing a bond? yes, the π bond is lost

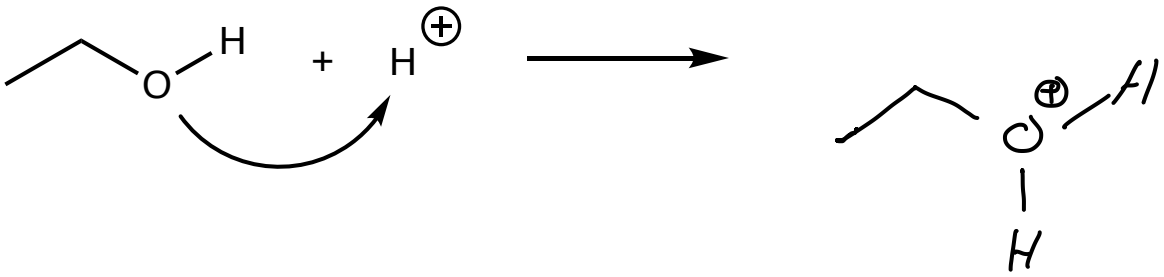
are we making a bond or moving e⁻'s to a single atom?

we are making a bond

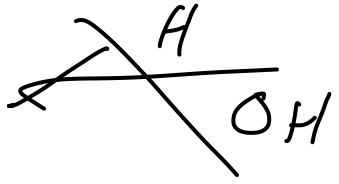
why can't the arrow mean that a C to S π bond is forming?



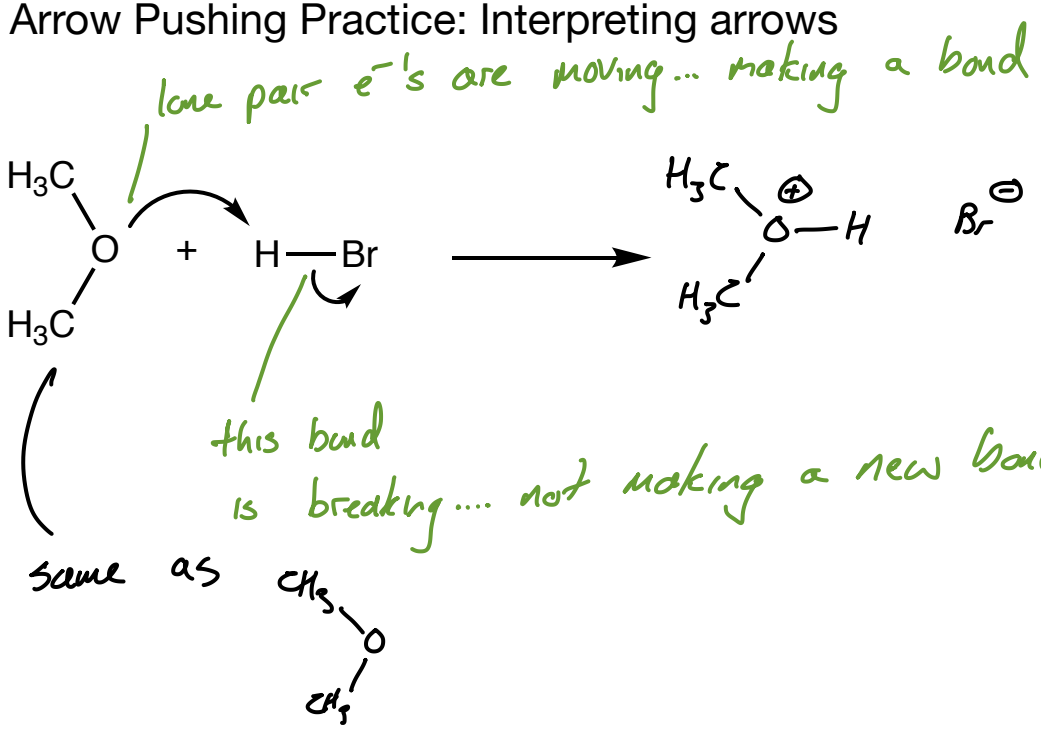
the arrow is only affecting this bond. The rest of the molecule will stay in 1 piece

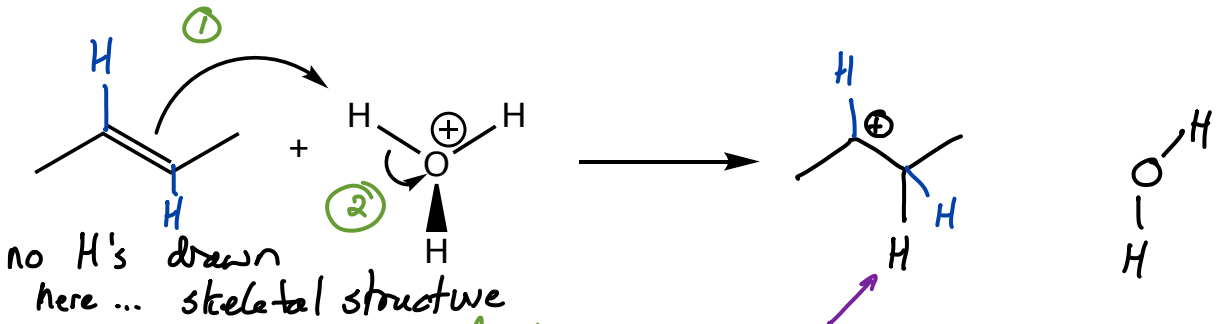


people often try to break the O atom free



don't break bonds when there is no arrow near them





① using a π bond to make a new bond to H⁺

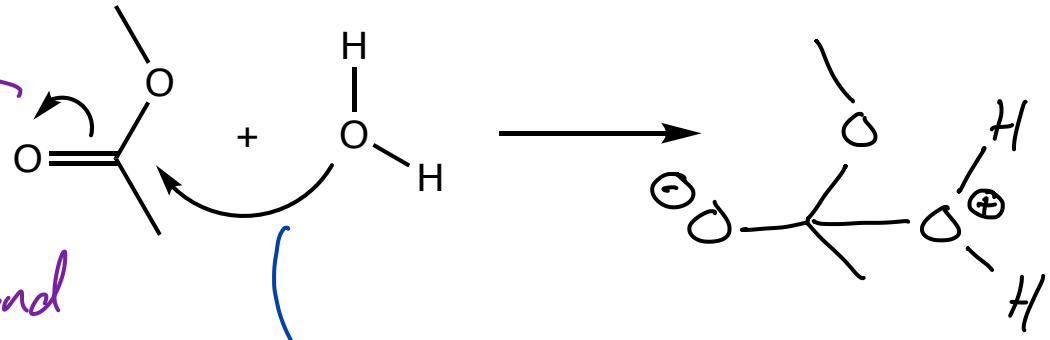
drawing H to emphasize bond formed

② the σ bond is breaking and the e⁻'s are going to the O atom

ester hydrolysis

check net charge because it can't change

neutral = 0 charge net charge = -1 + 1 = 0



e⁻'s in π bond are going... somewhere so we are losing one of the C to O bonds

lone-pair e⁻'s are going to be used to make a bond... to the C at the bottom of the C=O

Find the changes

Start arrows here

Identify atoms that are losing e⁻'s

donating lone-pair e⁻'s into a bond

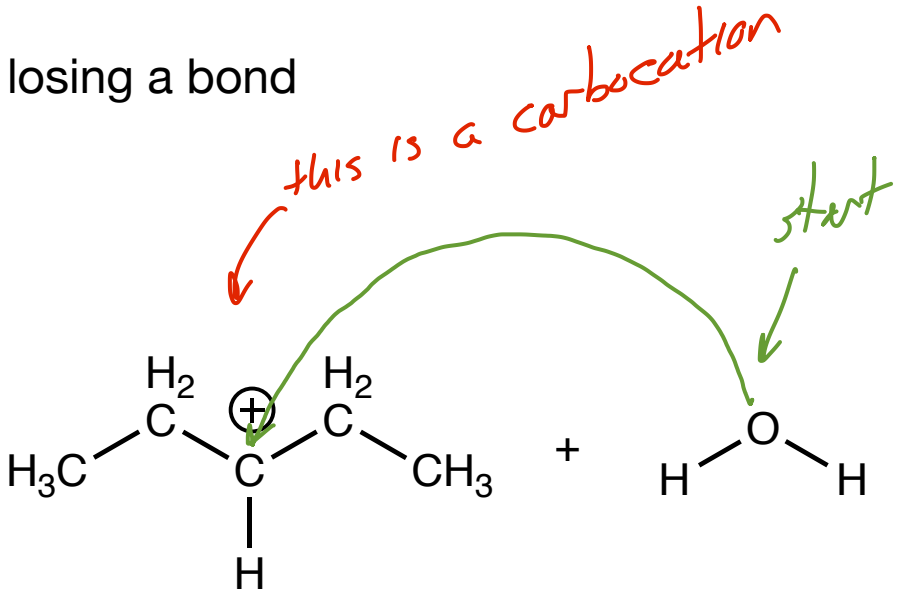
losing a bond

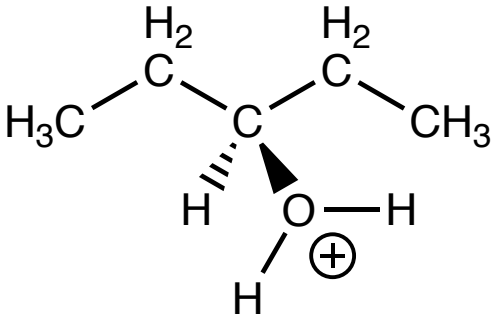
arrow ends here

Identify atoms that are gaining e⁻'s

gaining lone-pair e⁻'s

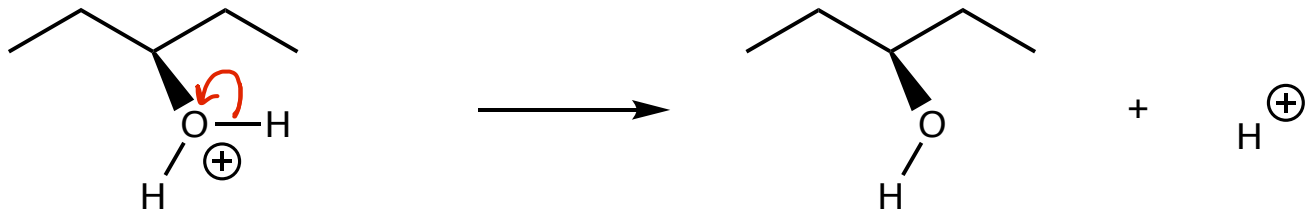
gaining a bond





How can you tell an atom has donated a pair of e's into a bond? The atom becomes more positive 0 → +1 -1 → 0

How can you tell? The atom becomes more negative 0 → -1 +1 → 0

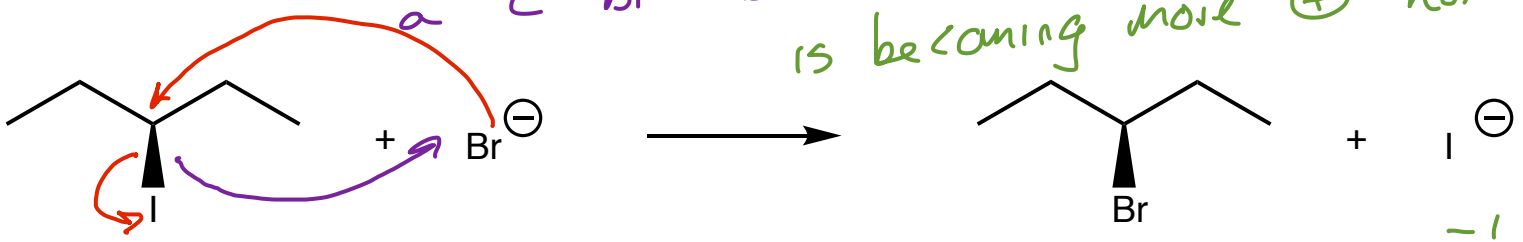


O atom goes from +1 to 0 - gained e⁻ ... doesn't start arrow here

H atom goes from 0 to +1 - lost e⁻'s

bond from O to H "disappears" - good place to start an arrow because the e⁻'s in the bond have to go somewhere

use e^- in C-I bond to make a C-Br bond? No, the Br charge is becoming more ⊕ not more ⊖



giving the Br more e^-'s would make it more ⊖!

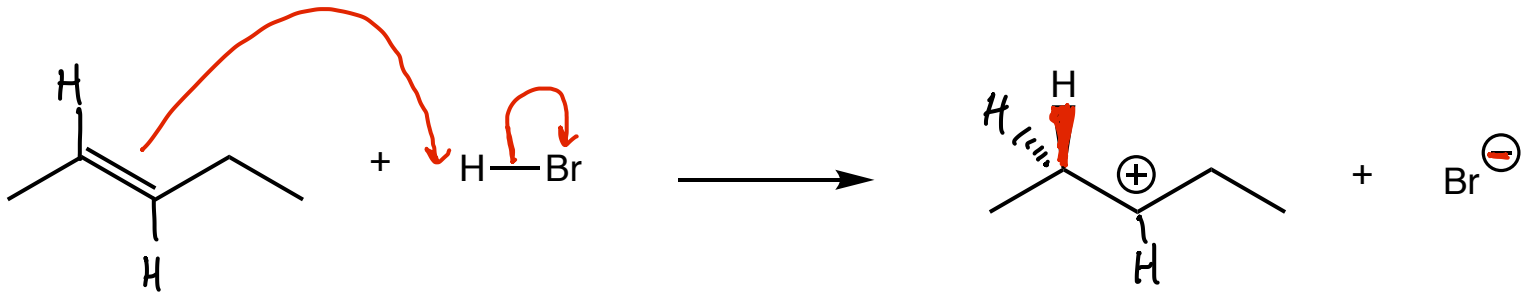
I goes from 0 to -1 gains e^- - good place to end arrow

Br goes from -1 to 0 donates e^- - good place to start arrow? yes

lost C to I bond - the e^- in the C to I bond are a good place to start an arrow

gained a Br to C bond - need an arrow to point to between the Br + C

e^- on Br^- are used to make a C to Br bond, and the the e^- in the C to I bond go to the I to make room for the new bond



Thinking

C goes from 0 to +1 - loses e^- - start arrow at C?

Br goes from 0 to -1 - gains e^- - end arrow at Br?

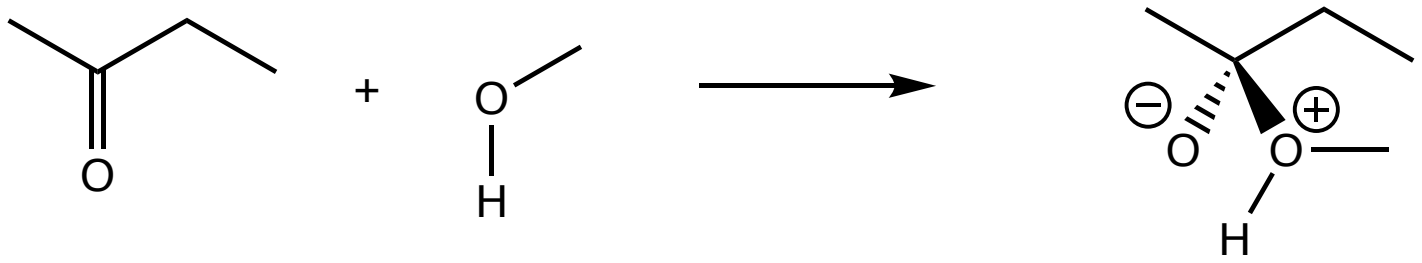
C to C db becomes a sb - bond "disappears" - start arrow here?

new C to H bond - bond "appears" - end arrow between C + H?

lost H to Br bond - bond "disappears" - start arrow here?

Result

e^-'s in the π bond reach out and bond to the H^+ and in the the e^-'s H to Br bond become a set of lp e^- on the Br and the C atom that lost the π bond becomes ⊕


O
+
O
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O
H