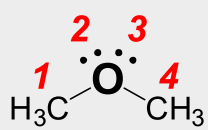
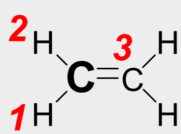
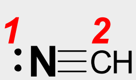
Determining Hybridization Organic Chemistry Style

1. To assign the hybridization to any given atom, start by doing what you would have done in general chemistry: figure out the domains (steric number) of the atom, then assign the *p* superscript as (domains -1).

General chemistry taught us that the number of atoms and lone pairs attached to an atom is called the **domains** of that atom. Another term used for domains is **"steric number"**. With the domains (steric number), we assigned hybridization as follows:

General chemistry way of assigning hybridization		
Domains (also called "steric number")	**Example molecule, let's focus on the bolded atom**	**Hybridization** note that the *p* superscript is (domains *[or steric number]* -1)
4	 *The oxygen has 2 atoms and 2 lone pairs attached to it. This means the steric number of the oxygen is 4.*	*sp^3*
3	 *The carbon has 3 atoms and 0 lone pairs attached to it. This means the steric number of the carbon is 3.*	*sp^2*
2	 *The nitrogen has 1 atom and 1 lone pair attached to it. This means the steric number of the nitrogen is 2.*	*sp*

VERY HELPFUL:

If an atom has no lone pairs on it, the *p* superscript of the hybridization always works out to be (domains - 1).

Where things can be tricky is when the atom DOES have at least one lone pair. This is where we need to recognize if the lone pair can do resonance; if it can, the p superscript gets adjusted down as outlined on the next page.

Be careful, because we are not done!

If this is the full extent of how you assign hybridization, you WILL be getting markdowns. We need to consider if a lone pair on the atom can form a pi bond via resonance. See next slide.

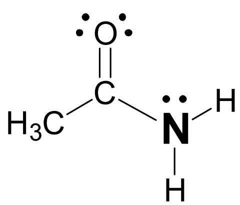
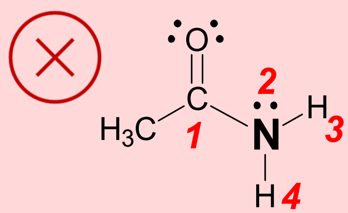
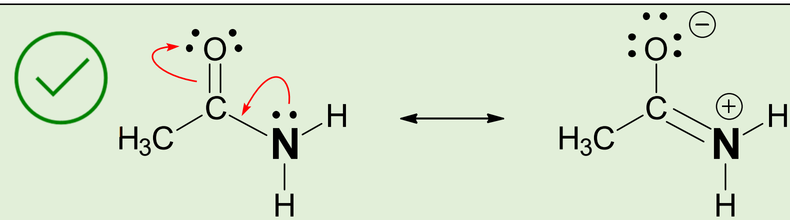
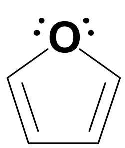
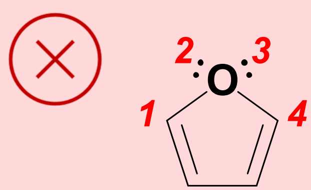
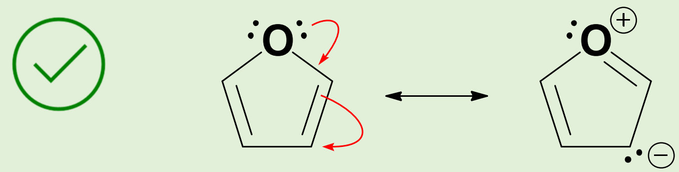
Determining Hybridization Organic Chemistry Style (page 2)

2. Determining hybridization in organic chemistry involves an important modification from how we did things in general chemistry: you must consider if the atom you are assigning hybridization to has a lone pair that can form a pi bond via resonance. If there is a lone pair that can become a pi bond via resonance, the atom needs to be labeled as *sp*^{2} and not *sp*^{3}.

Ideally, you understand that when a molecule can do resonance, the molecule is not flip-flopping between pictures of individual resonance structures. Instead, the molecule is, at all times, one structure that is a blended hybrid of all the resonance structures.

This concept is the same for the hybridization of atoms. The atoms need to have the proper orbital infrastructure at all times if pi bond formation is possible, so the hybridization is also not flip-flopping back and forth between *sp*^{3} and *sp*^{2} depending on which resonance structure you are drawing.



Sample Molecule	**What NOT to do!!** The general chemistry approach:	**Correct way of doing things in organic chemistry:** we always consider if the atom can use a lone pair in resonance.
 The nitrogen of an amide	 4 domains, so nitrogen is *sp*^{3}	 The nitrogen **does** have a lone pair that can participate in resonance, **so the nitrogen is *sp*^{2} hybridized, not *sp*^{3}.**
 The oxygen of the compound called furan	 4 domains, so oxygen is *sp*^{3}	 The oxygen **does** have a lone pair that can participate in resonance, **so the oxygen is *sp*^{2} hybridized, not *sp*^{3}.**