Week 3
CHE 3331- Organic Chemistry

This week is Week 3 of class, and typically in this week of the semester, your professors are covering these topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135.

Keywords: Bond Line Structures, Formal Charge, Resonance

Chapter 1: Gen Chem review

- Chapter 1 is all general chemistry review, so this resource will not cover any of these topics. If you need a refresher on some of these topics there are general chemistry resources available on our website, and there are some helpful videos linked below • http://leah4sci.com/intro
- https://www.khanacademy.org/science/a-to-orgo-video-series/p-chemistry

TOPIC OF THE WEEK: RESONANCE

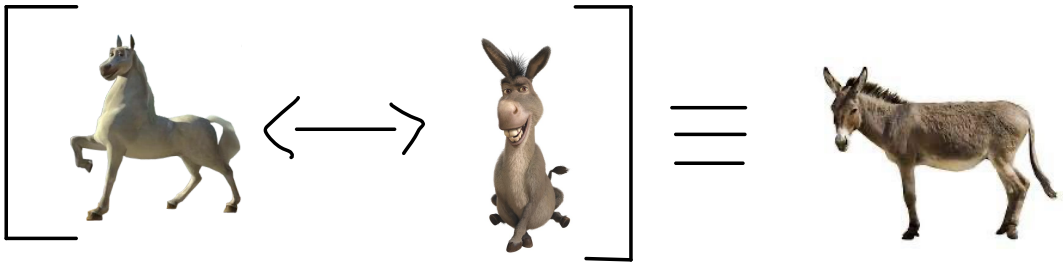
Resonance is one of the most important concepts that you will learn in organic chemistry, and it is related to every topic you will learn from here on out, so if you remember anything from this chapter make sure it's resonance!

What is resonance? MOVEMENT OF ELECTRONS IN A MOLECULE

Resonance helps explain the inadequacy of bond line drawings (they are not perfect for every occasion). With bond line drawings, it is assumed that a line represents 2

bonding electrons between a certain pair of atoms and that the electrons are localized, meaning that they are stuck where they are. In some cases, this assumption is not correct, and the electron density can be spread throughout the entire molecule or delocalized. Resonance is several drawings that represent one reality. There is ALWAYS one way that the molecule is situated, but in drawing, we cannot draw electrons in more than one place at a time, so we draw several structures and mentally meld them together.

Resonance analogy: A Mule is a cross between a donkey and a horse. A mule will never be more like a donkey or more like a horse because it is an equal combination of the two. Just drawing a donkey or just drawing a horse will never be a good representation of a mule. But if we draw both and put the two images together in our minds, we can come up with a mule would look like.

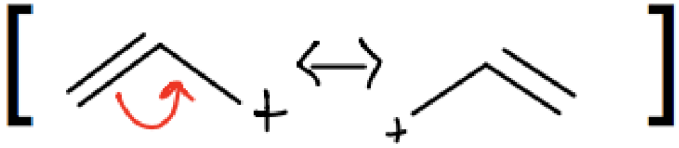


How do I know if a molecule has resonance structures? THERE ARE 5 PATTERNS THAT YOU NEED TO BE ABLE TO RECOGNIZE.

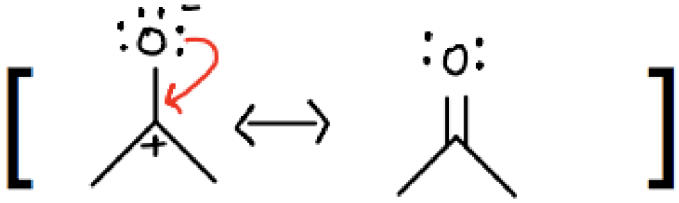
If a molecule exhibits one or more of these patterns, it will have a resonance structure.

1. **Allylic lone pair**

2. **Allylic positive charge**

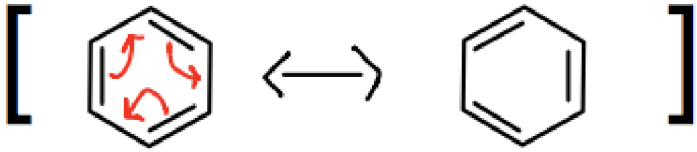


3. **Lone pair adjacent to a positive charge**

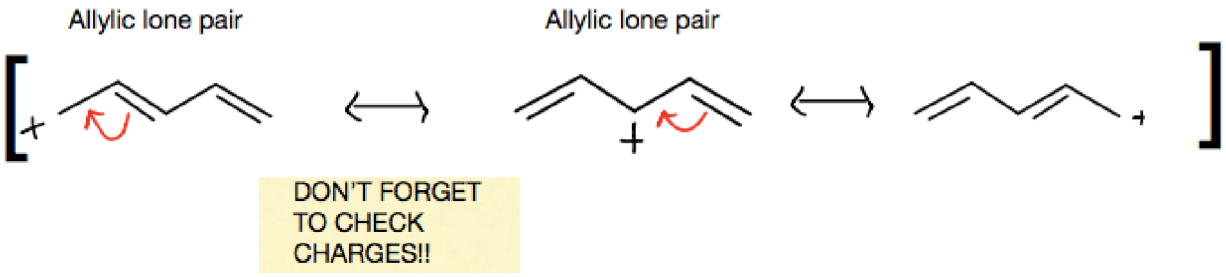


4. **Pi bond between two atoms of differing electronegativity**

5. **Conjugated pi bonds in a ring**



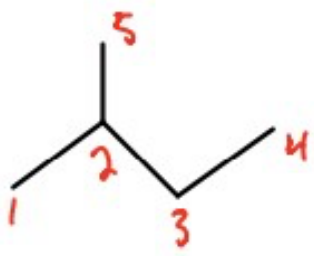
Example of drawing resonance structures



HIGHLIGHT 1: Let's back track a little bit and see what we need to know to fully understand resonance

In order to understand resonance, it is important that you are first able to read and **draw bond line structures.** **What is a bond line structure?** This is a way to draw out molecules that is more efficient than writing out every single atom. So here's what you need to know:

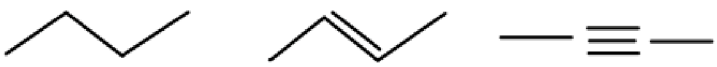
- Each carbon in a bond line structure is represented by an endpoint or corner of the lines (draw in zig zag form)



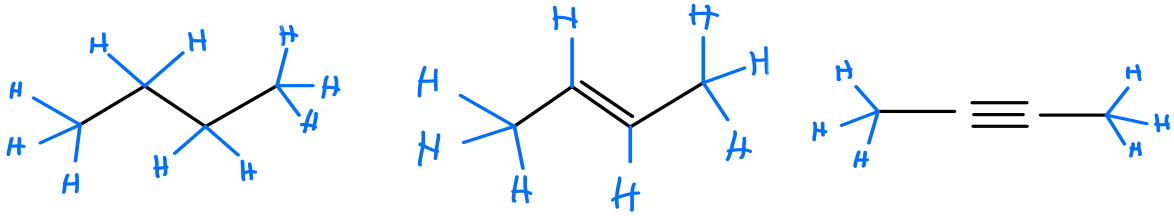
This molecule has 5 carbons

- Single bonds are denoted by one line, double bonds with two lines, and triple bonds by three lines

REMEMBER: triple bonds have sp hybridized orbitals which are linear

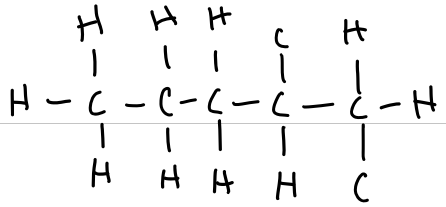


- You might be wondering where all of the hydrogens are. IT IS ASSUMED THAT THERE ARE ENOUGH HYDROGENS TO SATURATE THE CARBON (each
carbon needs 4 total bonds.) You do not draw the hydrogens in the bond line structures. They are assumed to be present

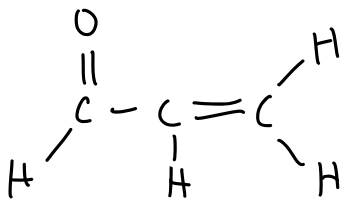


Practice #1 Draw the bond line structure of the following molecules:

a.



b.



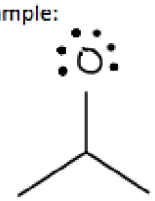
HIGHLIGHT 2: One last thing to know before jumping into resonance! Lone pairs and formal charge What is formal charge? The charge assigned to an atom in a molecule assuming that all of the electrons are being shared equally

FORMAL CHARGE EQUATION:

Formal charge = (how many electrons does the atom want?) - (How many electrons does the atom have?)

- Example:

Find the formal charge of oxygen



Step 1: look at periodic table to see how many valence electrons the oxygen wants to be happy. It wants six because it is in group 6A

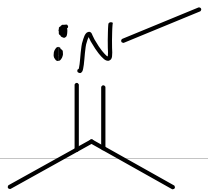
Step 2: how many electrons does it have right now? It has 7. 6 from the lone pairs and 1 from the covalent bond it shares with carbon

Step 3: 6-7= -1

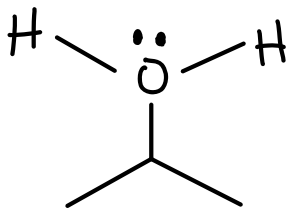
This oxygen has a formal charge of -1

Practice #2 determine the formal charge of the following nitrogen and oxygen atoms

a.

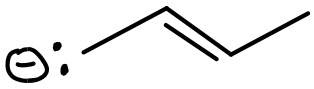


b.

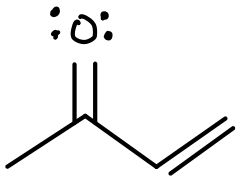


Practice #3 Draw resonance structures for the following molecules and identify what patterns are exhibited

a.



b.



THINGS YOU MAY STRUGGLE WITH

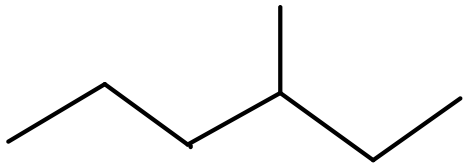
1. The hardest part of resonance is being able to recognize the patterns. This simply takes practice and repetition, so do every problem you can get your hands on. Having a good foundation with resonance will benefit you in the future!
2. Another thing that some struggle with is not drawing ALL of the resonance structures. Sometimes when you draw a resonance structure, a new pattern will emerge meaning that there is ANOTHER resonance structure of the molecule.

Thanks for checking out these weekly resources!
Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring ! Answers to check your learning questions are below!

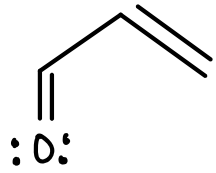
Answers to practice:

1.

a.

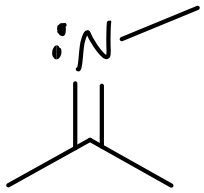


b.



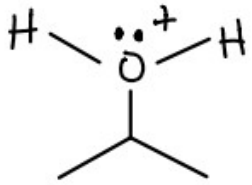
2.

a.



5 - 5 = 0

b.

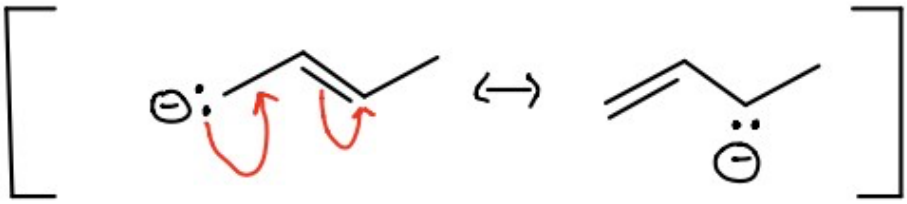


6 - 5 = +1

3.

a.

Allylic lone pair



b.

Pi bond between 2 atoms of differing electronegativity and allylic positive charge