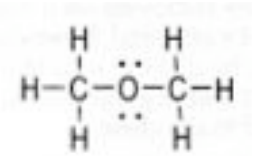
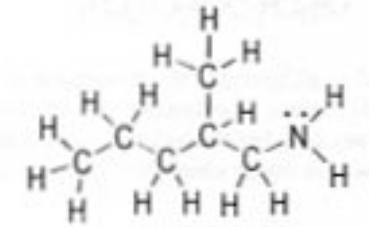
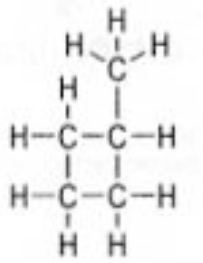
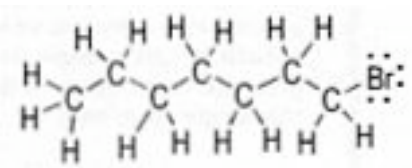
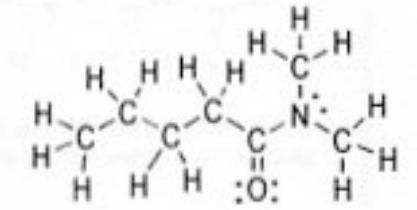
ORGO/BIO CHAPTER 3 HW

1. Draw Lewis structures for the following molecules:
a. CH_4
b. $C_2H_6O_2$
c. $C_6H_{12}O_6$
d. C_4H_8O
e. C_5H_{10}

2. Draw line-bond structures for the following molecules. Hint: you worked with them above.
a. $C_2H_6O_2$
b. $C_6H_{12}O_6$
c. C_4H_8O
d. C_5H_{10}

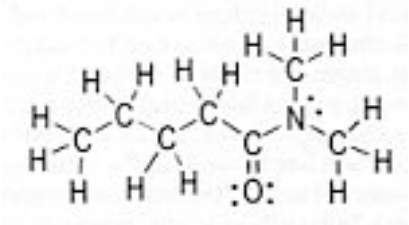
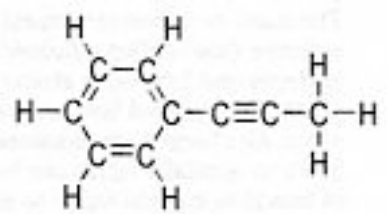
3. Draw Lewis structures for the following ions.
a. H_3O^{+1}
b. NO^{+1}
c. NH_4^{+1}
d. CO_3^{-2}

4. Abbreviate the following Lewis structures by using condensed structures.

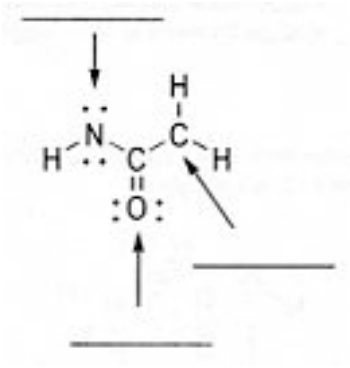






5. Draw line-bond structures for the following molecules. Then write their condensed structures.
a. C_4H_8O
b. C_5H_{10}
c. C_7H_{16}

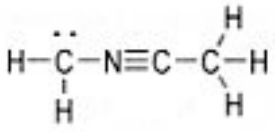
6. Draw the line-bond representations for the following two molecules.

7. Determine the formal charges on each of the indicated atoms in the following molecule.



8. For any atom in the following molecule that does not have a formal charge of zero, indicate its formal charge.

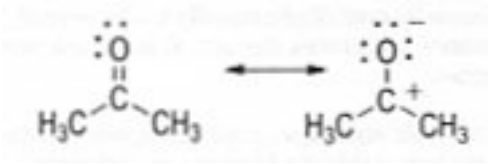


9. Why was the concept of resonance developed?

10. In terms of formal charges, what makes one resonance structure more stable than another?

11. Predict which resonance structure of each pair of the following resonance structures contributes more to the overall hybrid; i.e., which resonance structure is most stable?

a.



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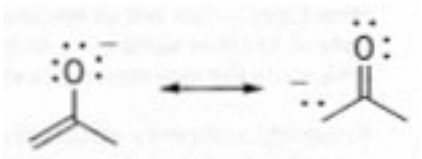
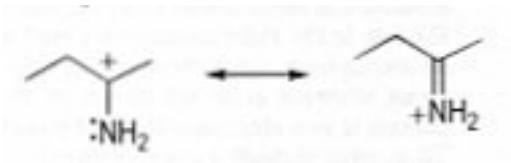


c.



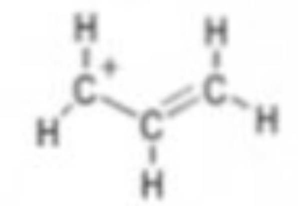
d.

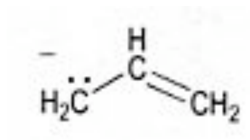
12. Without worrying about resonance patterns (coming shortly), draw three resonance structures for the carbonate ion, CO_3^{-2}. Show all formal charges. Is one resonance structure more stable than the others? If so, indicate that structure.

13. Without worrying about resonance patterns, draw three resonance structures for the ion OCN^{-1}. Show all formal charges. Is one resonance structure more stable than the others? If so, indicate that structure.

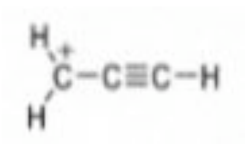
14. In terms of arrow-pushing, contrast a double-sided arrow with a single-sided arrow.

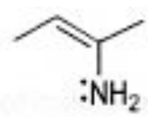
15. Fun with resonance structure <u>patterns</u>! Use pages 56-59 of <u>Dummies</u> to help you through this maze of patterns… Hint: try to recognize one of the four patterns. Heck, what are the four patterns? Draw one other resonance structure using arrow-pushing for each of the following.

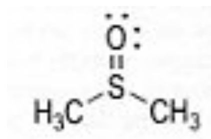


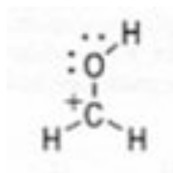


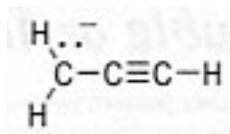
H−C≡N:

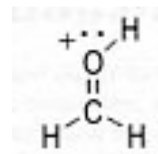


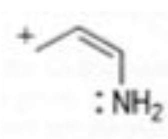


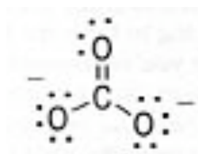


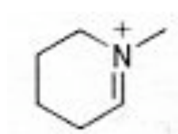


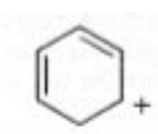


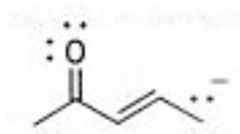


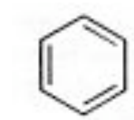


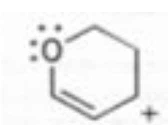


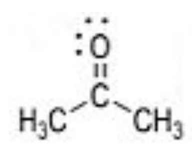


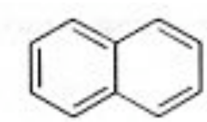






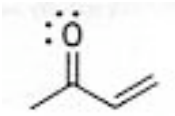




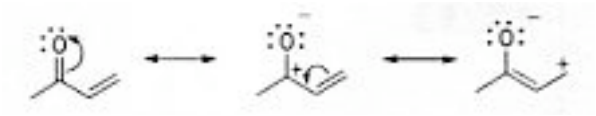


16. Here comes the fun stuff: drawing multiple resonance structures utilizing all four patterns. The key will be to spot one of the patterns in the initial molecule in order to make the first resonance structure. Then, look for a pattern in the *new* resonance structure to make a second resonance structure, and so on. Wahoo…

Here's a sample: Draw all the resonance structures for the following molecule by arrow-pushing.



Answer:



The logic behind the answer goes like this…
The first identifiable pattern is a double bond containing an electronegative element (oxygen). To draw the first resonance structure, you push the double-bond electrons (specifically the π electrons) on the oxygen to become a lone pair on the oxygen. Be sure to denote the charges in this new structure! This new resonance structure has another pattern – a cation next to a double bond. From this resonance structure, you can push the double-bond electrons over one bond to the left and reform the cation on the right-most carbon atom, again showing the charges. Voila'!

OK? Go for it: Draw all the resonance structures for the following molecules by arrow-pushing.