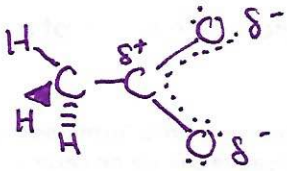
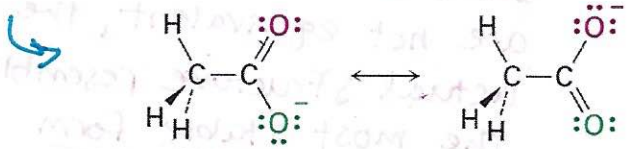
Intermediate drawing aka "Resonance Hybrid"

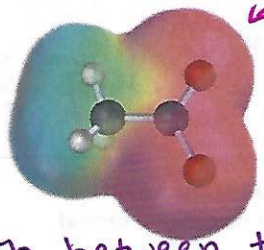


Chapter 2: Resonance

The two structures may appear different in a line-bond structure but they are equivalent experimentally



Acetate ion—two resonance forms



← oxygen share the negative charge, they have equal electron densities

Note: it doesn't jump back and forth between the two, rather it is a single, unchanging structure called a resonance hybrid, repretations on paper are inaccurate alone

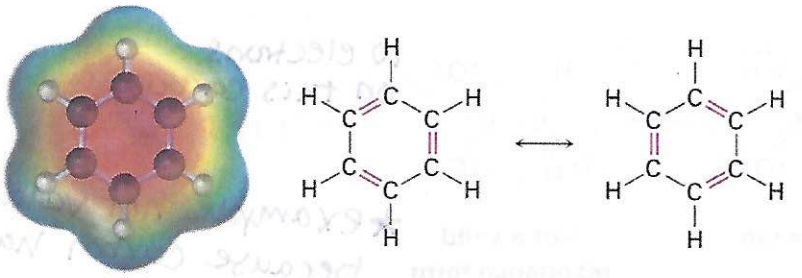
Resonance structures are indicated by a double headed arrow. The atoms themselves take up the exact same space, only placement of pi bond and non-bonding valence electrons is what differs

Rules for Resonance

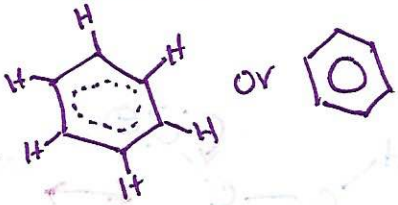
1. Individual resonance forms are imaginary, not real at all.

neither of the two structures is accurate alone, true structure is an intermediate between 2 drawings

↳ "Resonance Hybrid"



Benzene (two resonance forms)

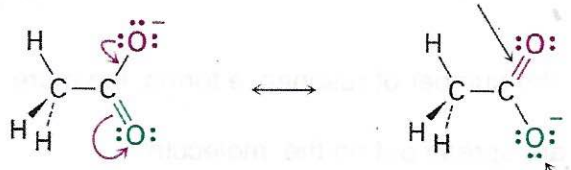


The real structure is a composite or resonance hybrid of the different forms.

2. Resonance forms differ only in the placement of their π bond or non-bonding electrons

The red curved arrow indicates that a lone pair of electrons moves from the top oxygen atom to become part of a C=O bond.

The new resonance form has a double bond here...

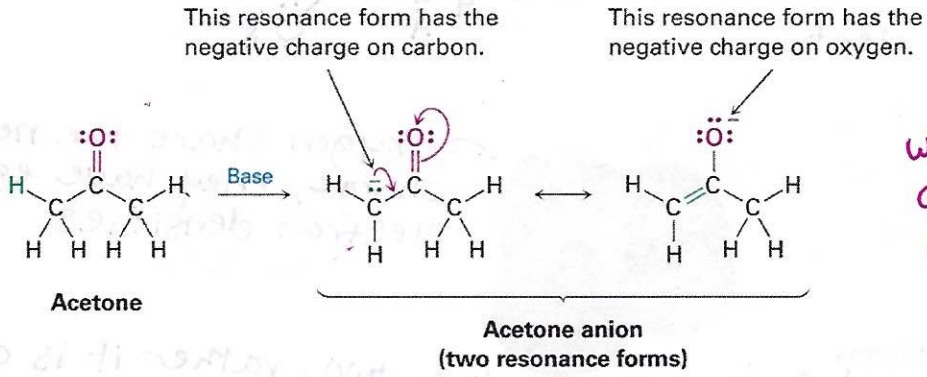


Simultaneously, two electrons from the C=O bond move onto the bottom oxygen atom to become a lone pair.

and has a lone pair of electrons here.

Curved arrows indicate the movement of electrons

3. Different resonance forms of a structure don't have to be equivalent

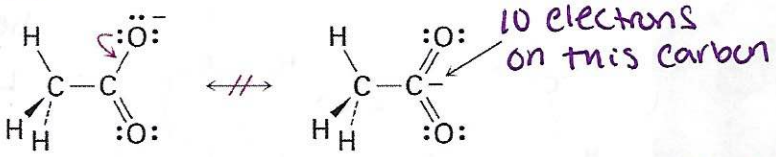


when 2 resonance structures are not equivalent, the actual structure resembles the most stable form

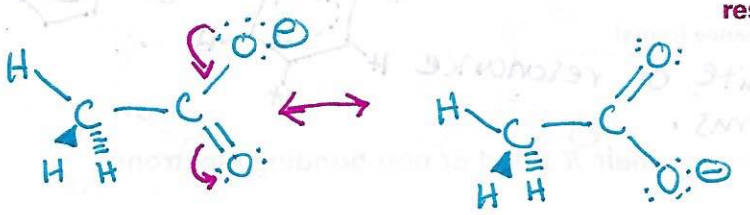
In this example the negative charge will more likely sit on the electronegative oxygen atom rather than the carbon

4. Resonance forms obey normal rules of valency

octet rule still applies!!



*example not valid because carbon has 5 bonds



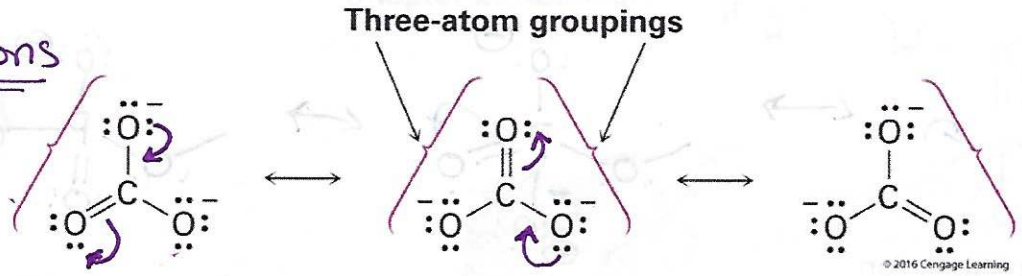
True resonance structure

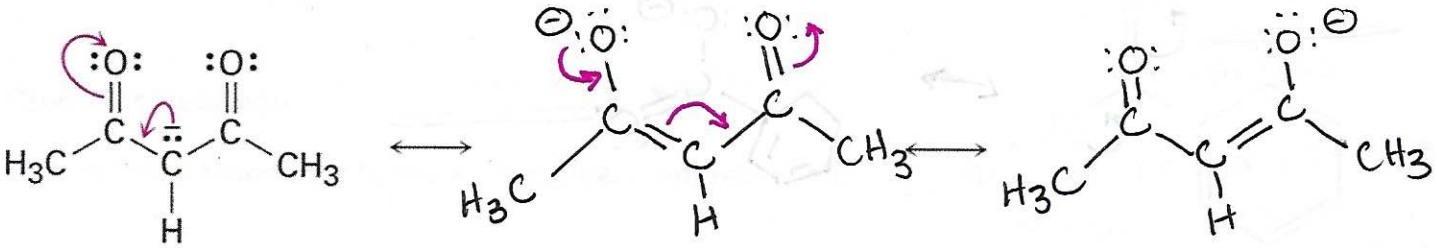
5. The resonance hybrid is more stable than any individual resonance form

The larger the number of resonance forms, the more stable a structure because the electrons are spread out on the molecule.

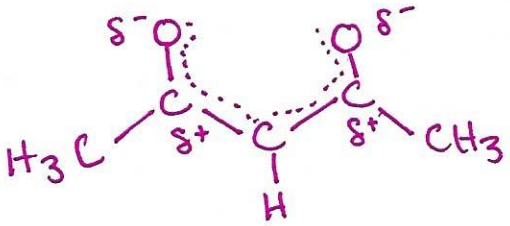
Drawing Resonance Forms

push electrons



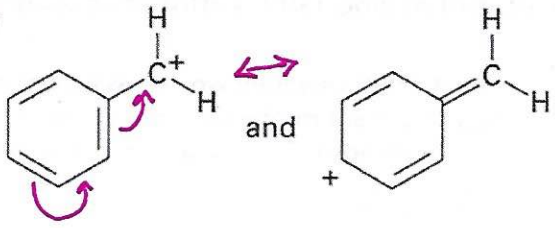


Hybrid =



Which of these are pairings of resonance structures? Why or why not?

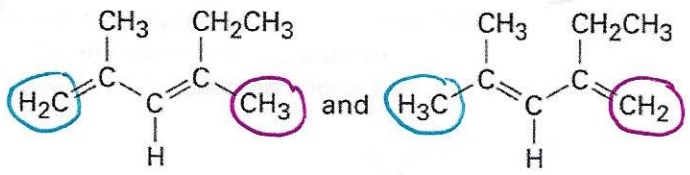
(a)



yes

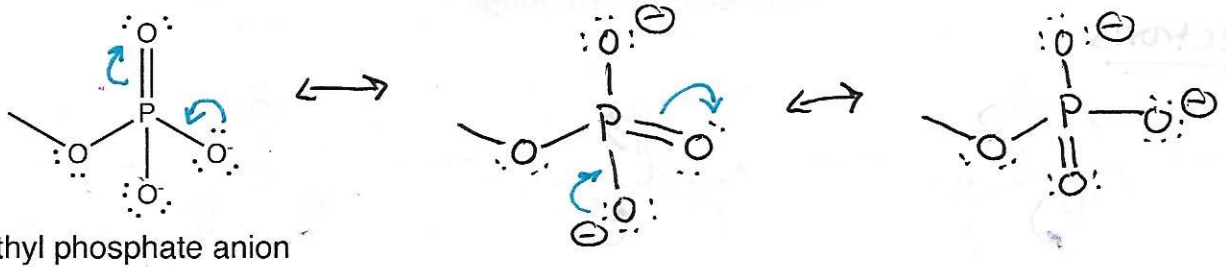
* Note: Chapter 2 #10, 37-39, 56 & 57 are good practice for resonance

(b)

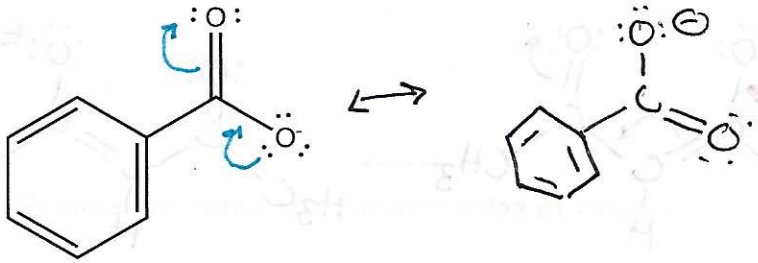


NO

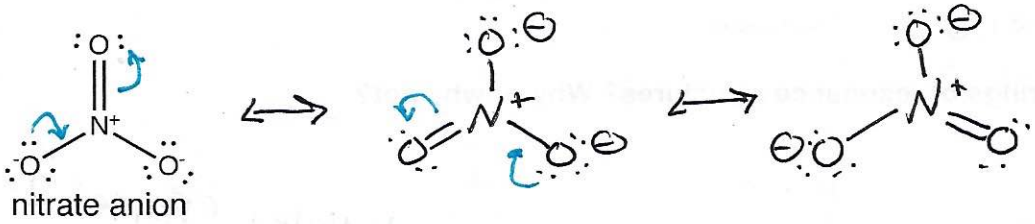
Drawing Resonance Forms



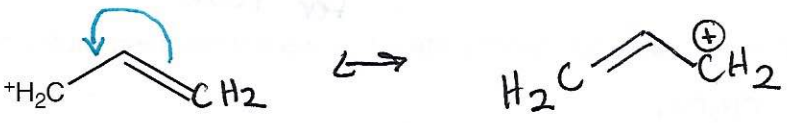
methyl phosphate anion



benzoate anion



nitrate anion



allyl cation