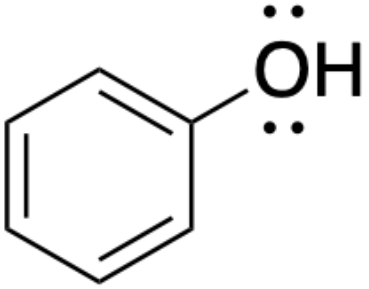
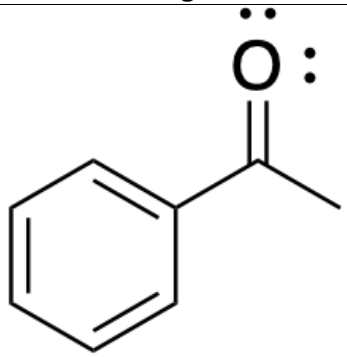
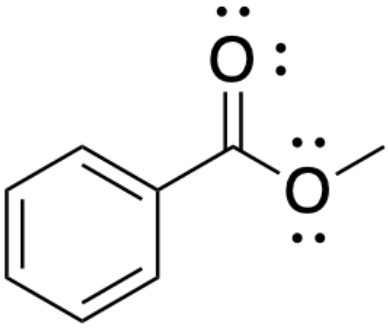
CHEM 202

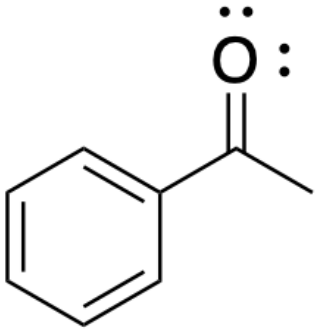
EDG v. EWG

	Electron Donating Group (EDG) *by resonance	**Electron Withdrawing Group (EWG)** *by resonance
Properties	Lone Pair of electrons directly attached to the ring.	'Carbonyl like' group, or a positive charge directly attached to the ring.
Example		
What effect does it have on the ring?	Activation	Deactivation
Directing	Ortho/Para director	Meta Director

- Two properties are considered when classifying a substituent as electron donating or withdrawing
  - **Resonance:** Can the functional group donate a pair of electrons into the ring? Or is it deficient in electrons, resulting in electrons being pulled out of the ring.
  - **Inductive:** Is the functional group more or less electronegative than the ring?
  - **Resonance has a greater effect than Inductive.** Occasionally, the inductive effect that a functional group has on the ring is different than the resonance effect, but the resonance effect is stronger.
    - **Example:** R-NH_2 Nitrogen is more electronegative than the ring, so it is inductively withdrawing, however there is a lone pair of electrons that can be pushed into the ring via resonance. Overall NH_2 is an electron donating group.

- **To know the strength of the withdrawing or donating group** look to see if the electrons are being "shared"
    - **Example:** An ester vs. a ketone





While they are both withdrawing groups, a ketone is a stronger withdrawing group than an ester. A ketone can only pull electrons from the ring, where the carbonyl of the ester can pull the electrons from the ring and the oxygen next door.

- **When do we care about the inductive effect? (Not resonance)**
    - Halogens: The electronegativity of a halogen causes it to be an electron withdrawing group via inductive effect. Halogens are EWG's even though they have lone pairs present. *Halogens are an exception in that, even though they are electron withdrawing groups, they are ortho/para directors.
    - Alkyl groups: The electronegativity of the ring is greater than a carbon chain, making any alkyl group an electron donating group via inductive effect. Inductive effect is used in this case because alkyl groups do not have any resonance effect.
- **Applications**
    - A strong electron withdrawing group can deactivate the ring to the point where some reactions do not happen. For example, Friedal-Crafts alkylation will not occur on a ring if there is a strong electron withdrawing group, such as NO_2.
    - When undergoing synthesis, it is important to know what directing groups are present. For example, if the two substituents are oriented para to each other, an ortho/para director needs to be put on the ring first.
    - When undergoing Diels-Alder, the reaction will proceed faster if the **diene has an EDG and/or if the dienophile has an EWG**