

Overtime:

What Not To Do With EASE

Where the method will be less effective:

Through the course of this book, we have tried to show you a systematic way to look at many organic chemistry reactions to figure out how they are working and what your reaction product would be. The system works because it forces you to examine why the reactions would proceed a certain way and tries to keep you from just giving a product that looks like it should be right. When the system works, it is a beautiful thing. But now that you are an organic chemistry all-star, we need to have a tough conversation about when it doesn't make sense to use the EASE method. There are several classes of reactions that do not work easily with the EASE method. It's not that they won't work with the EASE method (it is still ***always*** about electron flow), as much as it is that it is easier just to learn what the reactant is and what it does rather than why it does it in some cases.

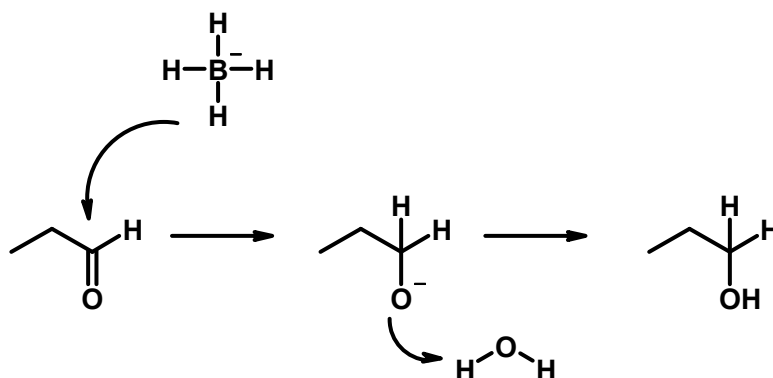
Oxidation and Reduction:

The first type of reactions that you should not use the EASE method for are most reduction and oxidation (RedOx) reactions. Again, we want to stress that the method could work for these reactions, but it is just easier to memorize a couple of reagents and apply them, rather than slogging through the whole EASE method.

As you learned in general chemistry, losing electrons is oxidation and gaining electrons is reduction. The mnemonic for this is "LEO the Lion goes GER" ...LEO = Losing Electrons is Oxidation, GER = Gaining Electrons is Reduction. There are a limited number of RedOx reagents and reactions that you will have to familiar with, so it makes sense to just learn them right now. Here are some:

Reaction	SM	Product	Reagents	Note
Oxidation	1° Alcohol	carb acid	CrO ₃ /H ₂ SO ₄	Harsh oxidation
Oxidation	1° Alcohol	aldehyde	PCC or PDC	Soft oxidation
Oxidation	Alkene	diol	OsO ₄ tBuOOH	Dihydroxylation to cis diol
Oxidation	Alkene	ketone	O ₃ , Zn	Ozonolysis
Reduction	Ketone	2° alcohol	LiAlH ₄	Harsh reduction
Reduction	Aldehyde	1° alcohol	NaCNBH ₄	Soft reduction
Reduction	Alkyne	E-alkene	Na, NH ₃	Gives t-alkene
Reduction	Alkyne	Z-alkene	Lindlar	Give cis alkene
Reduction	Alkene	alkane	H ₂ / Pd-C	Full reduction

"SM" = Starting Material. We have tried not to overwhelm you with these reactions, as there are actually many more than on this list which will accomplish a range of RedOx reactions. As stated above, the EASE method will work just fine with many of these RedOx reactions. We think that it is easier for you to just know these reactions, as opposed to figuring your way through each one. Take the reaction below:

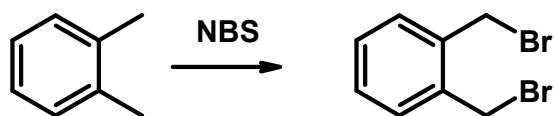
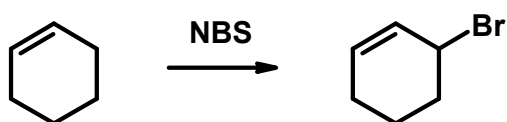
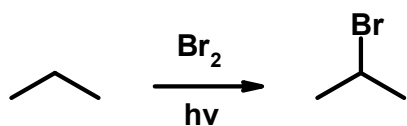
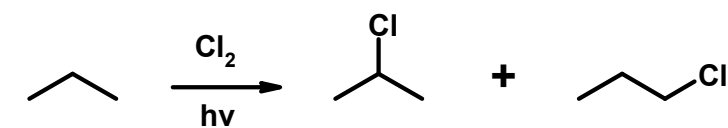


If you were going to do the full EASE method for this problem, you would see for step 1 you have a carbonyl as your electrophile and NaBH₄ as your nucleophile. Remember that NaBH₄ is sodium borohydride, and that hydride is H⁻ and can act as a nucleophile. In step 2, we see that hydride can be a base, but we really don't have an acid, as it is not strong enough to deprotonate at the alpha carbon of the carbonyl. There are no steric issues, so we can move to step 4 and have hydride attack the carbonyl to give us the intermediate shown. This intermediate will then find a proton from the water floating around to give the final product. The overall reaction is the reduction of the aldehyde to an alcohol.

OR.....you could just remember that NaBH_4 reduces aldehydes to alcohols and do it all in one step without using the EASE method. The upside to *not* using EASE here is you gain a little of time on your exam. The downside to not using EASE here is you might miss a nuance in the reaction which would give you a different product. It is up to you when you think it is best to use the EASE method. We just want you to be aware that there are circumstances where it might benefit you not to use it.

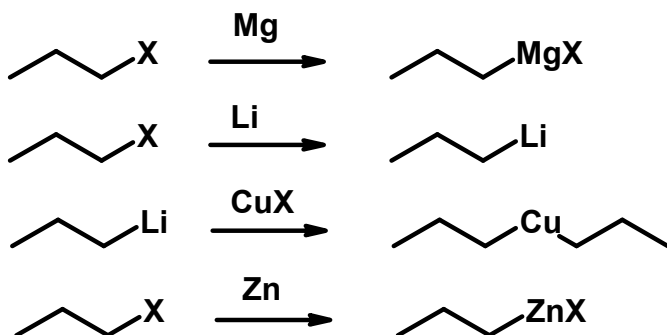
Radical Reactions:

Radicals are electron deficient species. While technically one could argue that this places them in the electrophile category, they don't behave like classical electrophiles, which makes them poor candidates for the EASE method. Since we are trying to be brief with this book, we will not go into radical chemistry here. Suffice it to say that you if learn the three main types of radical steps (initiation, propagation, and termination), and several of the major types of radical reactions (shown below), you will be just fine with this and not need to use the EASE method.



Organometallic Reagent Formation:

This is one more place where you don't need to rely on the EASE method, you should just know the reagents and what they form. There are four major types of organometallic reagents you should know, all shown in the figure below. As the metal insertion of these reactions in some cases behaves a lot like a radical species, it is just easier to know that the metal insertion occurs and not worry about how or why. [Note: "X" is a halogen, almost always Cl, Br, or I.]



So there you have it. The EASE method for organic chemistry is designed to force you to think about the basic tenets of organic chemistry when you look at a problem. The most basic elements of any organic chemistry problem never change: 1) Find out who has the electrons, 2) label any acids or bases around and move the proton if you can, 3) identify any steric issues, and 4) let the electrons flow. Then rinse and repeat, if needed. The beauty of the method is that you learn a step-wise methodology which can be applied in almost any organic chemistry situation.

Hopefully you found this helpful. We take feedback (questions, comments, complements and/or hate mail) at admin@aceorganicchem.com. Thanks a lot for purchasing this book, good luck with your studies and happy reacting.