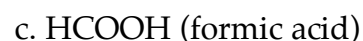
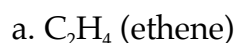


Exercise 7: Redox, alcohols, epoxides, organometallics

General rules:

- Atoms in elemental form, like C or O₂, are assigned an oxidation number of 0.
- In compounds, the more **electronegative** element (p. 137) is assigned the negative oxidation number.
- Hydrogen in an organic compound is assigned an oxidation number of +1.
- Oxygen in an organic compound *generally* is assigned an oxidation number of -2.
- The sum of all of the oxidation numbers of atoms in a neutral compound should be zero. The sum of all of the oxidation numbers of atoms in an ion should equal the ionic charge.
- Carbon's oxidation number is calculated by applying the rules above.

1. Calculate the oxidation number of **carbon** in each of the following molecules:



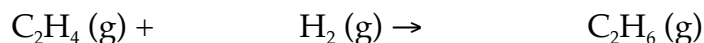
More rules:

- When carbon is **oxidized** in a reaction, it loses electrons; in other words, it ends up with a more positive or less negative oxidation number.
- When carbon is **reduced**, it gains reaction and ends up with a more negative or less positive oxidation number.

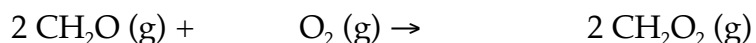
2. As you know, the **combustion** of an organic molecule is considered an oxidation. Determine the oxidation numbers of the carbons in all carbon-containing molecules below, and show that this reaction is indeed an oxidation.



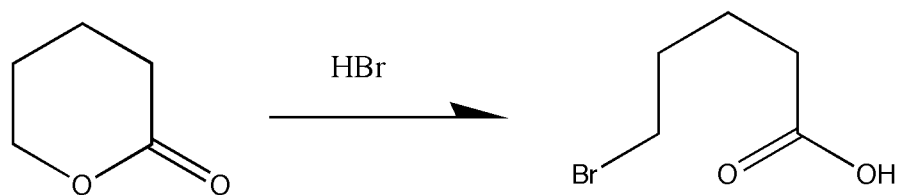
3. Determine whether the following reaction involves carbon oxidation or reduction. Please show the oxidation numbers of each carbon.



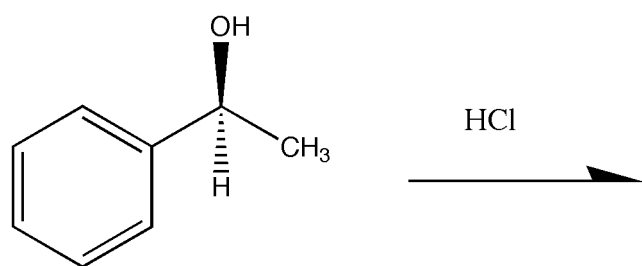
4. Determine whether the following reaction involves carbon oxidation or reduction. Please show the oxidation numbers of each carbon.



5. Give the steps in the mechanism:

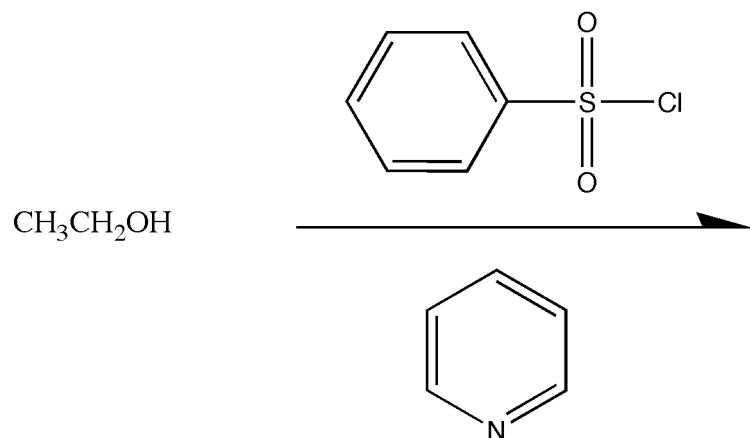


6. Predict the intermediate and then the product.



7. Thionyl chloride (and its analogs benzenesulfonyl chloride and methanesulfonyl chloride) is an excellent reagent for “gently” (that is, without extreme temperature or pH conditions) converting an alcohol into a good leaving group. It is used often in conjunction with a pyridine solvent, which acts as a base.

a. Predict the product:



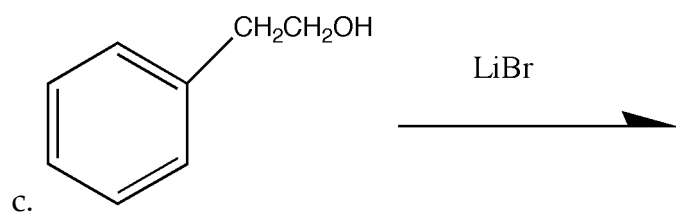
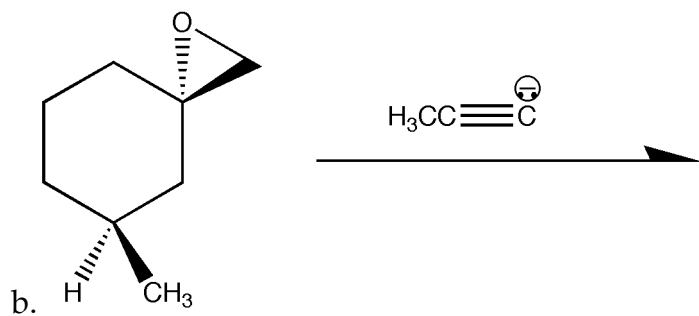
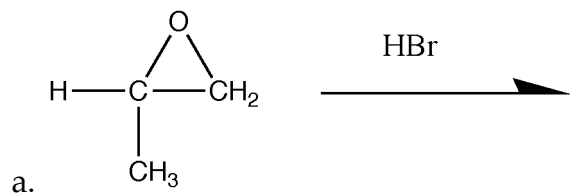
b. Now that you have a good leaving group on the molecule, what is the result of adding each of the following reagents to the product in part a?

i. NaI

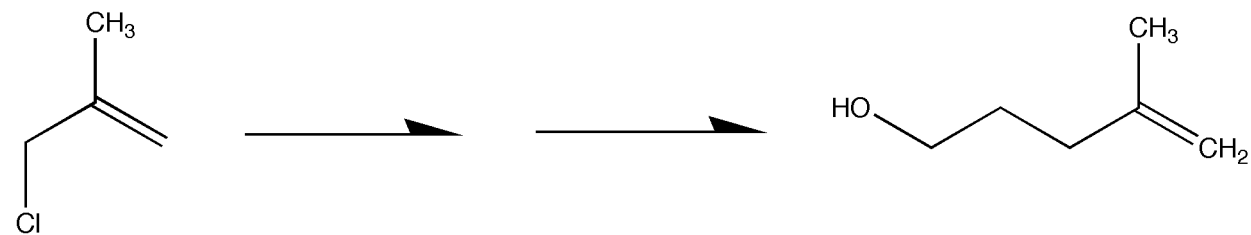
ii. $\text{RC}\equiv\text{C}^-$

iii. the acetate ion

8. Predict the main product of each reaction:



9. Write the reagents needed to carry out the two-step synthesis below:



10. Write the reagents needed to carry out the two-step synthesis below:

