Alkene Reactions - 3- Oxidation Reactions

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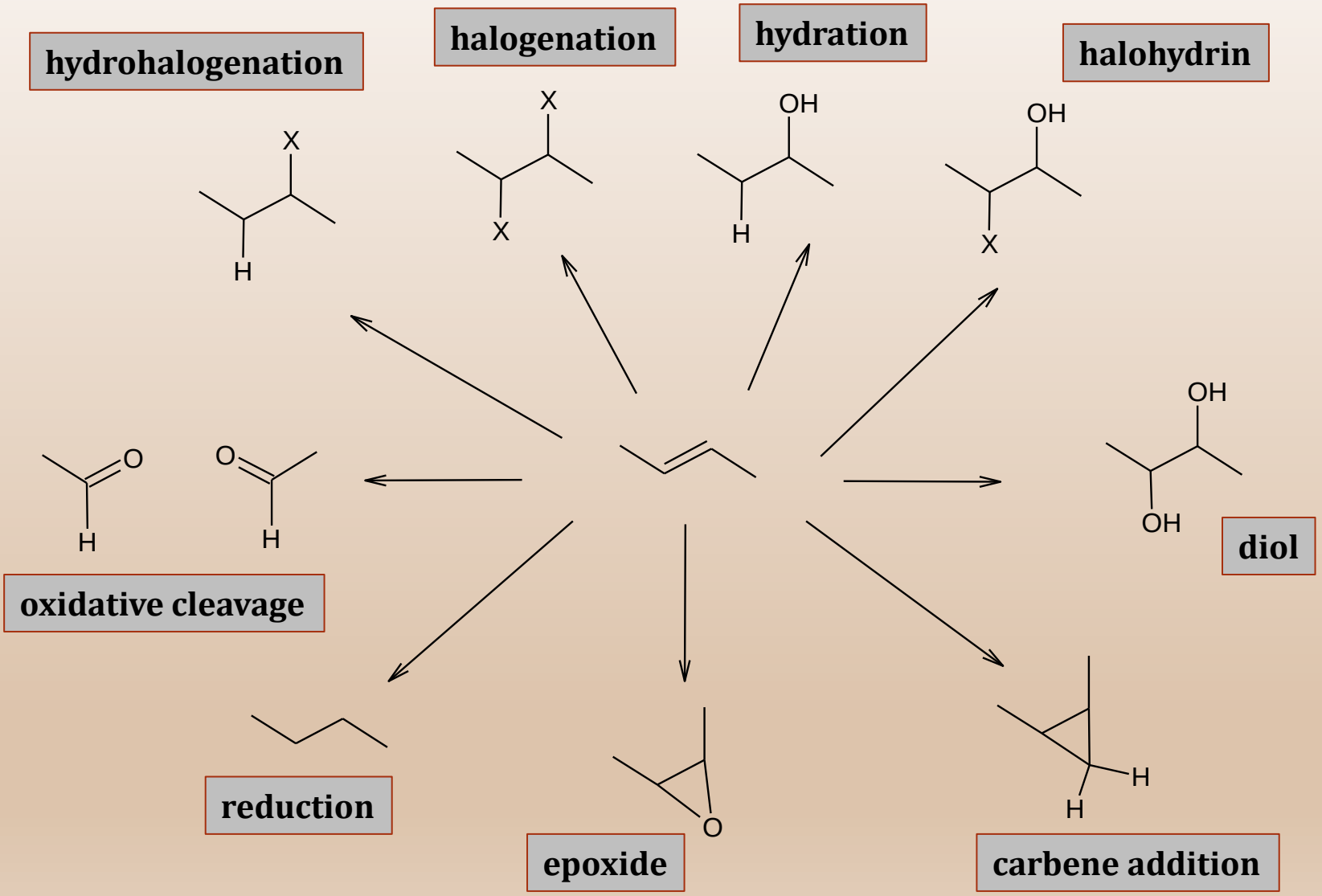
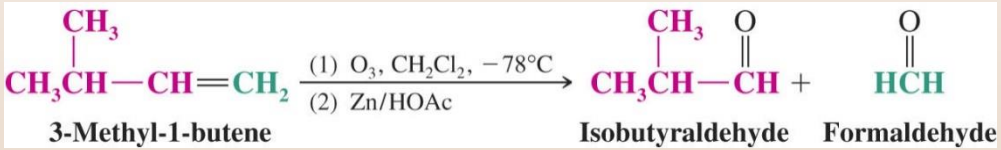
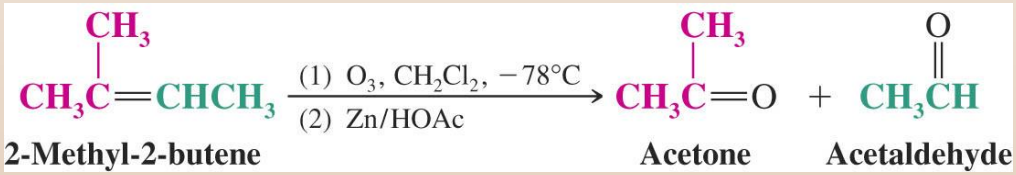
All Reactions



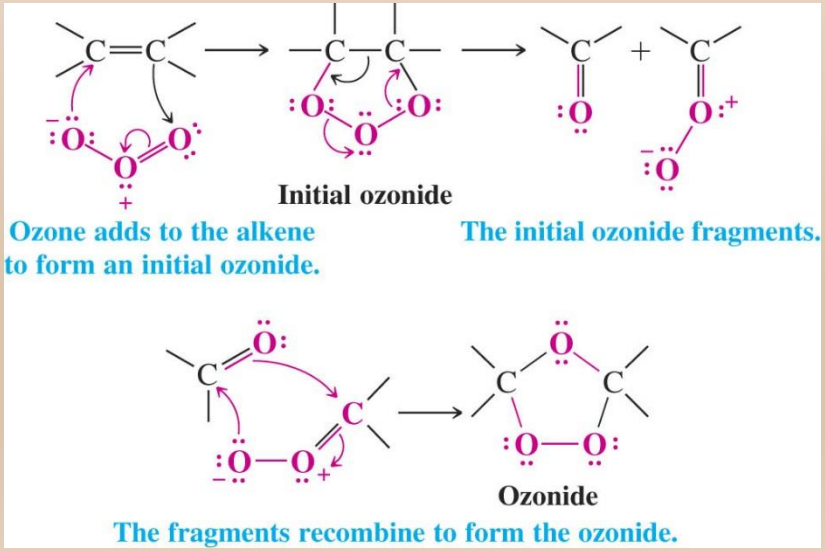
Oxidation of Alkenes (oxidative cleavage) - O_3

- Cleavage of alkenes with ozone and workup with zinc in acetic acid (or dimethyl sulfide – Me_2S) leads to less highly oxidized carbons than products from cleavage with hot $KMnO_4$ (next slide)



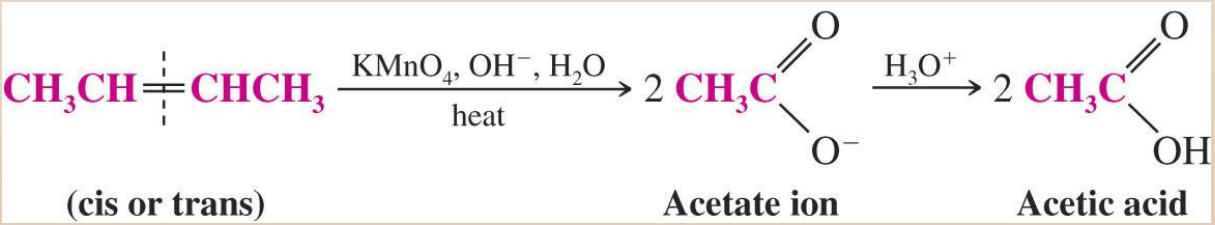


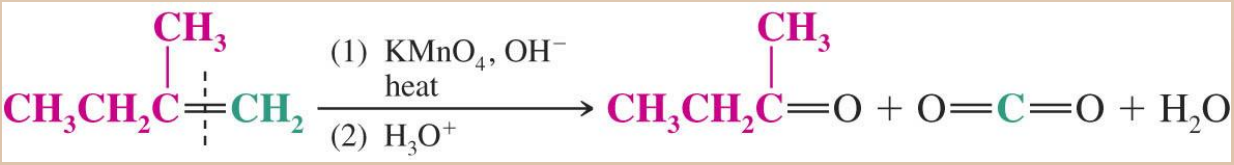
- Mechanism



Oxidation of Alkenes (oxidative cleavage) - $KMnO_4$

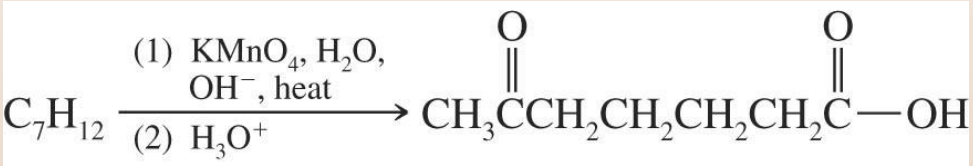
- $KMnO_4$ is a powerful oxidizing agent that cleaves (break) the double bond and oxidizing them in the process giving aldehydes (alkenes with hydrogens on it) and ketones (substituted alkenes) as products.
- Terminal alkenes give CO_2 with $KMnO_4$
- It is a useful technique in determining structure of molecule
- It is a also a good ***QUALITATIVE TEST***



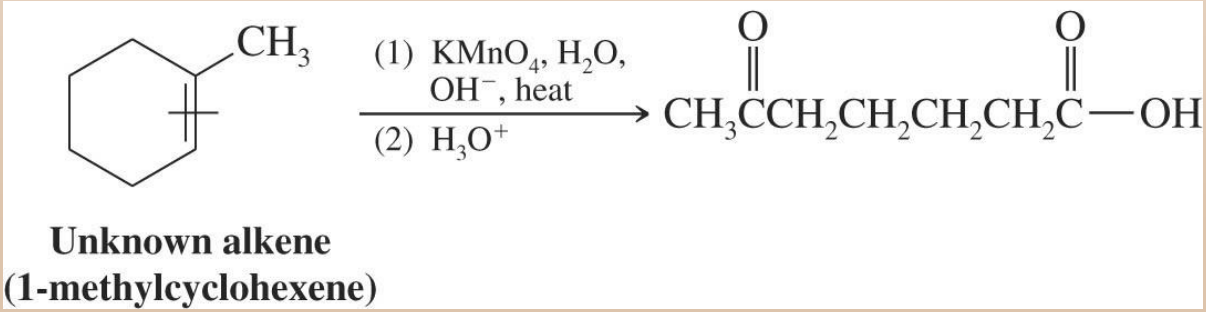


Worked Example - 1

Question: An unknown alkene with formula C_7H_{12} yields only the following product on oxidation with hot $KMnO_4$

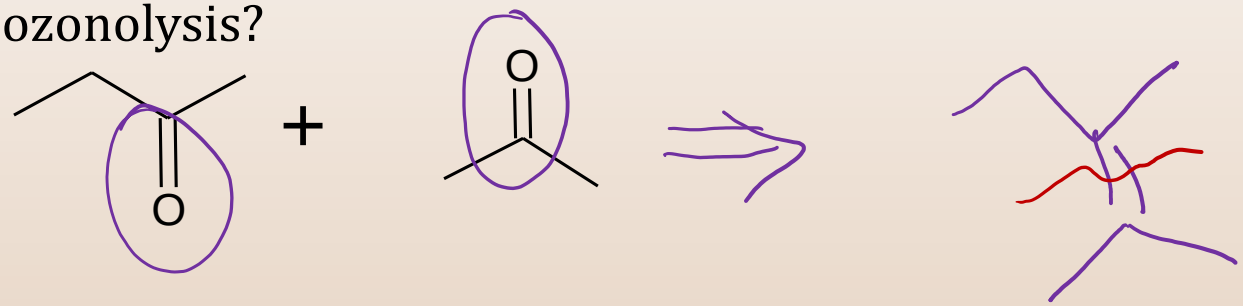


Answer: Since no carbons are missing in the product, the alkene must be part of a ring in the original molecule

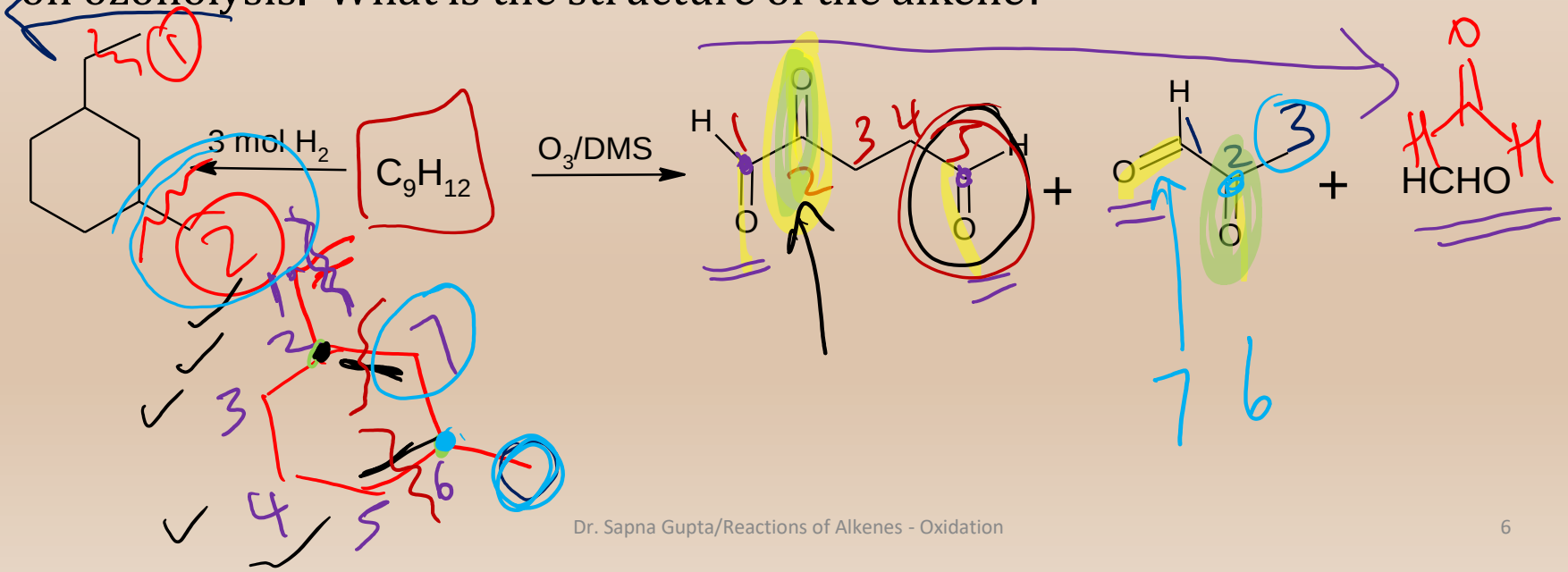


Worked Example - 2

1) What is the alkene that gives the following two products on ozonolysis?



2) An unknown alkene with formula C_9H_{12} reacts with 3 mols of hydrogen to give 1-ethyl-3-methylcyclohexane and the products below on ozonolysis. What is the structure of the alkene?



Qualitative Tests

- These tests are done to test for functional groups.
- Qualitative tests should be visual and as specific as possible for a functional group.

For alkenes:

- Addition of Bromine – dark red Br_2 will add to alkene and as reaction progresses the color will disappear. So disappearance of red color is the positive test for alkenes.
- Addition of $KMnO_4$ – $KMnO_4(aq)$ is a purple solution. Since it oxidizes the alkene, it itself gets reduced during the reaction to give MnO_2, which is brown in color. So disappearance of purple color and appearance of brown ppt is positive for alkenes.

Key Words/Concepts

- Oxidative Cleavage
- Ozonolysis
- Qualitative Analysis