

## 2. Reactions of Ethers:

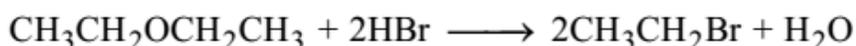
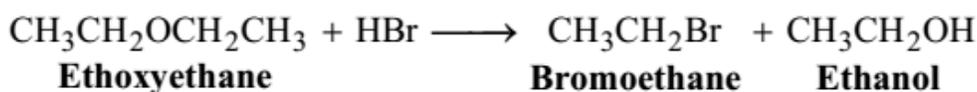
Ethers show good solvent properties for many nonpolar organic compounds. This makes them good medium to run reactions in.

Even though ethers are unreactive, and stable towards bases, oxidizing agents, and reducing agents, they actually undergo just one kind of reactions. It is acid cleavage reaction. Cleavage takes place only under extreme conditions like high temperatures and in concentrated acid (usually HI or HBr).

Cleavage reactions of ethers may happen according to two different mechanisms, Namely SN1 and SN2.

### **SN2 mechanism:**

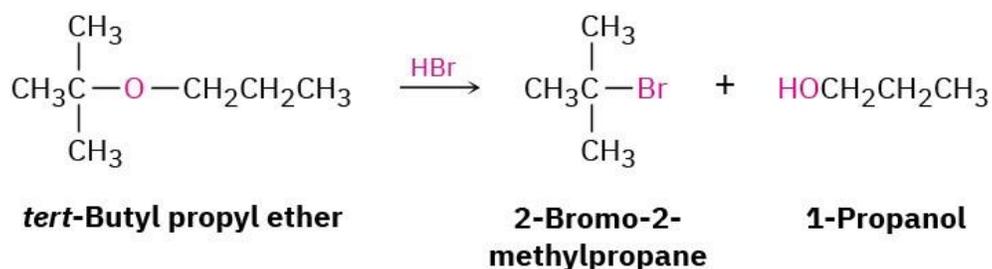
It is a single-step acid-cleavage reaction. Happens with ethers that have methyl and primary alkyl groups. This cleavage reaction happens in strong acids like HCl, HBr and HI. Alcohol and alkyl halide are the products. Alcohol is reacted in excess acid to give alkyl halide. Reaction of ethoxyethane with HBr and with excess HBr are shown below:



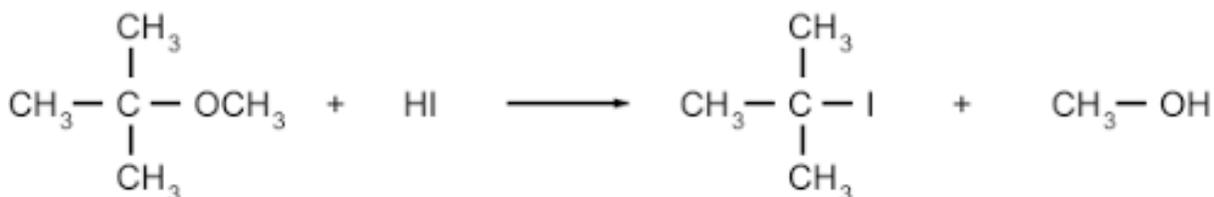
In excess acid (HBr), ethanol produced in the first step undergoes substitution reaction to give one more molecule of bromoethane so, two molecules of bromoethane are produced. (See substitution reactions of alcohols)

### **SN1 mechanism:**

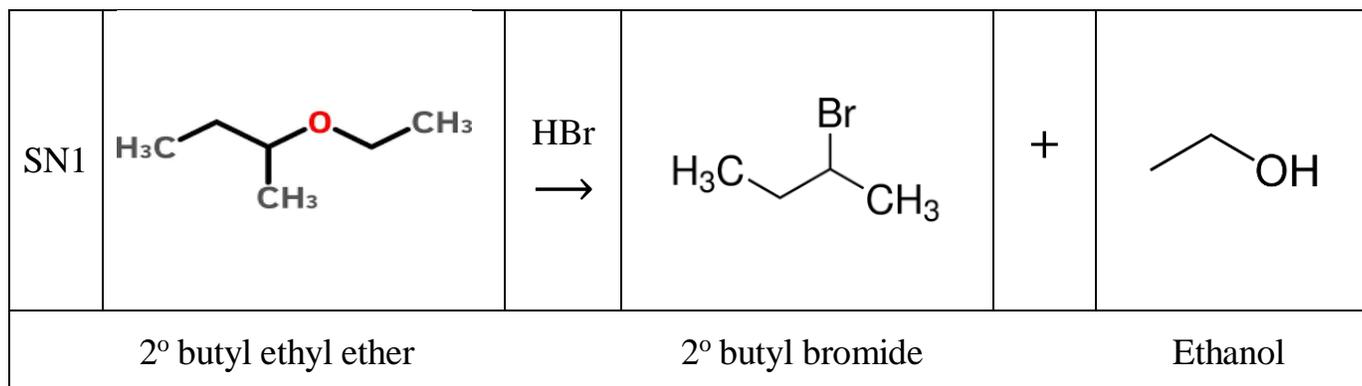
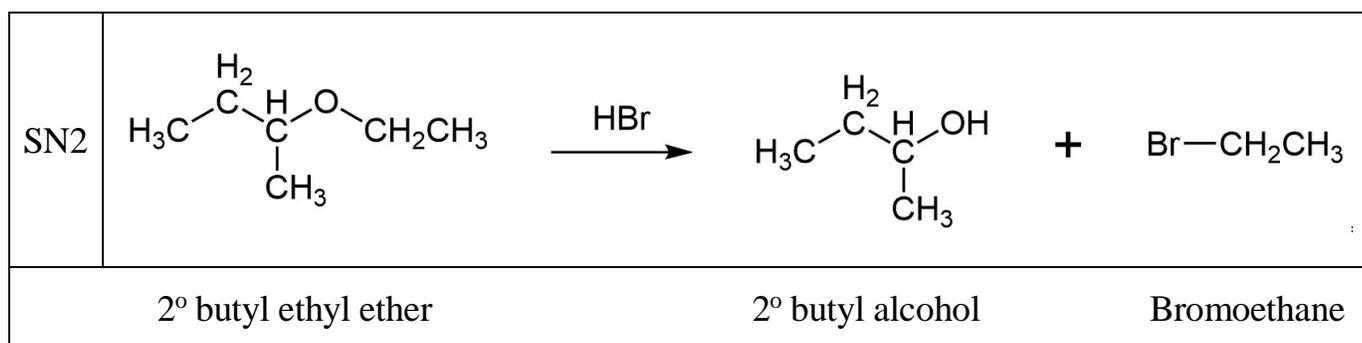
It is a two-step acid-cleavage reaction. Preferably happens with ethers' tertiary alkyl groups. Tertiary alkyl halide is produced. Reaction of tertiary butyl propyl ether in HBr produces tertiary butyl bromide and propanol. Details of the mechanism are out of the scope of the course. The reaction is shown below.



Another example:



Ethers with secondary alkyl groups undergo both SN1 and SN2 reactions. The reaction products of ethyl isopropyl ether with a strong acid (like HBr or HI) depend on whether the reaction follows an SN1 or SN2 mechanisms. This is determined by the reaction conditions (e.g., solvent, temperature).



The End