# Addition of X<sub>2</sub> to alkenes (Halogenation)





Alkyl groups donate electrons and stabilize positive charge.

- The more substituents, the more stable the carbocation.

#### Reaction of alkenes with halogen and water/alcohol

General reaction



Eg 1.



Eg. 2



Eg. 3





**For A-B addition**: most positive end adds to least substituted end of C=C (to give most stable carbocation).

Eg. 1



Eg. 4



### Hydrogen Halide Addition (HX)

General reaction

Eg.



Carbocation

#### Markovnikov rule in Addition reactions

- positive species adds to the least substituted end of C=C
- negative species adds to the more substituted end of C=C (stabilized positive charge)

# Carbocation Stability:



### Hydration and Ether formation

Addition of  $\begin{array}{ccc} \delta^{\oplus} & \delta^{\ominus} & & \delta^{\oplus} & \delta^{\ominus} \\ H-OH & or & H-OR \end{array}$ 

### General Reactions:

 $\begin{array}{c} C = C + HOH & \xrightarrow{\text{No Acid}} & \text{No reaction} \\ \hline C = C + HOH & \xrightarrow{\oplus} & H \\ \hline eg) HBr, HCI \\ H_2SO_4, HI & H \\ \hline H & OH \\ H & OH \\ \hline H & O$