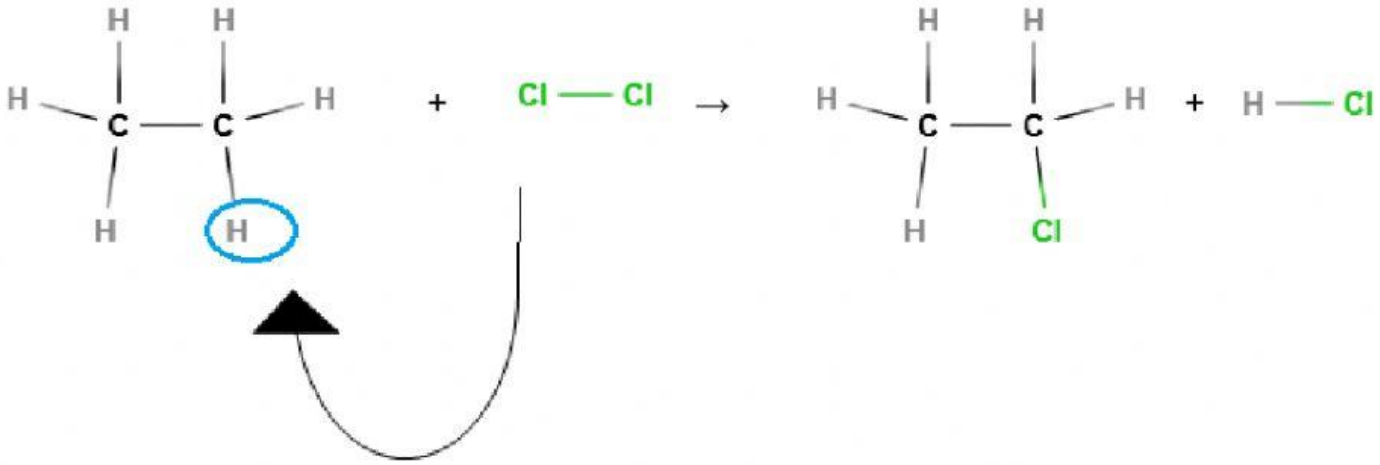
Substitution reactions

(where a saturated organic molecule becomes a different type of saturated organic molecule)

Halogenation (replacing one hydrogen with one halogen)



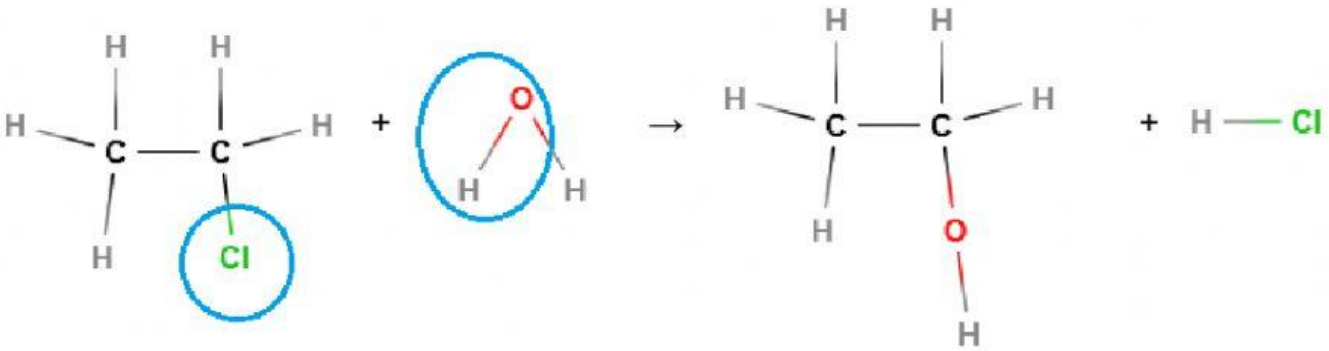
One Cl will 'kick out'/substitute one of the hydrogens and take its place.

The remaining Cl and the 'kicked out' H then join and form HCl

Reaction conditions;

Reaction must be done in the presence of UV light

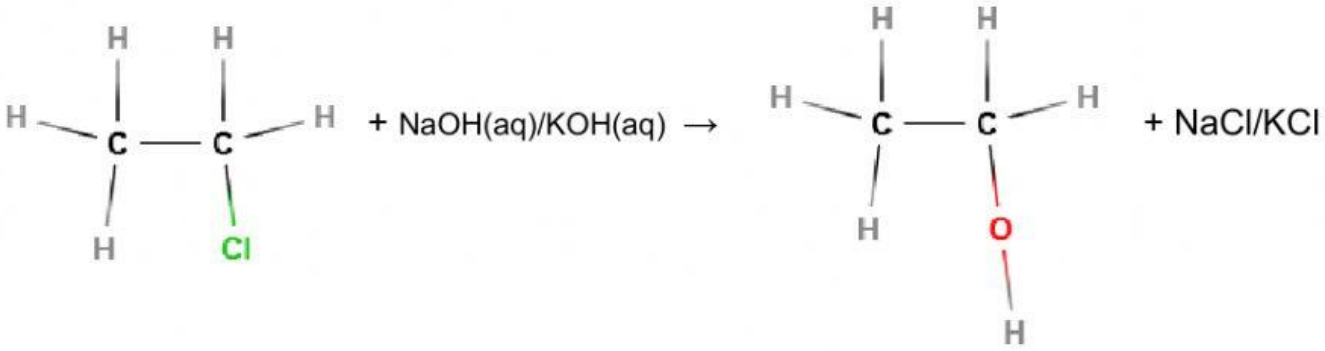
Hydrolysis (replacing a halogen with a OH)



Reaction conditions;

- Haloalkanes must be dissolved in ethanol

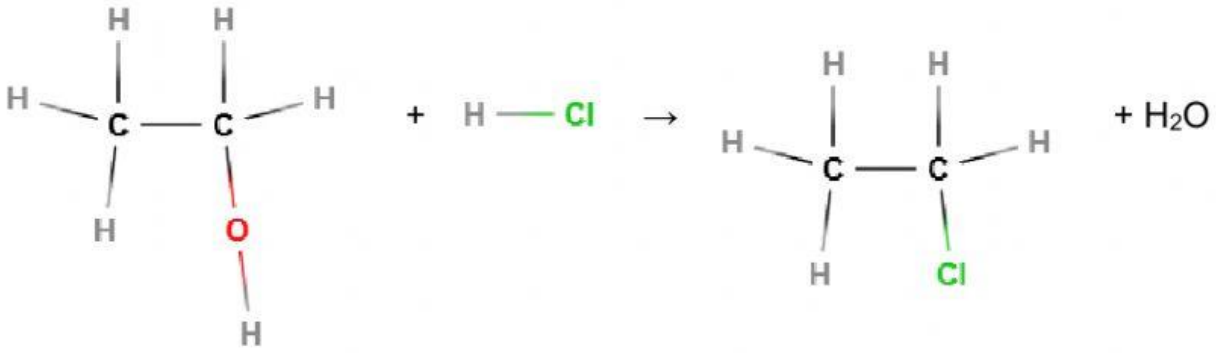
Or



Reaction conditions;

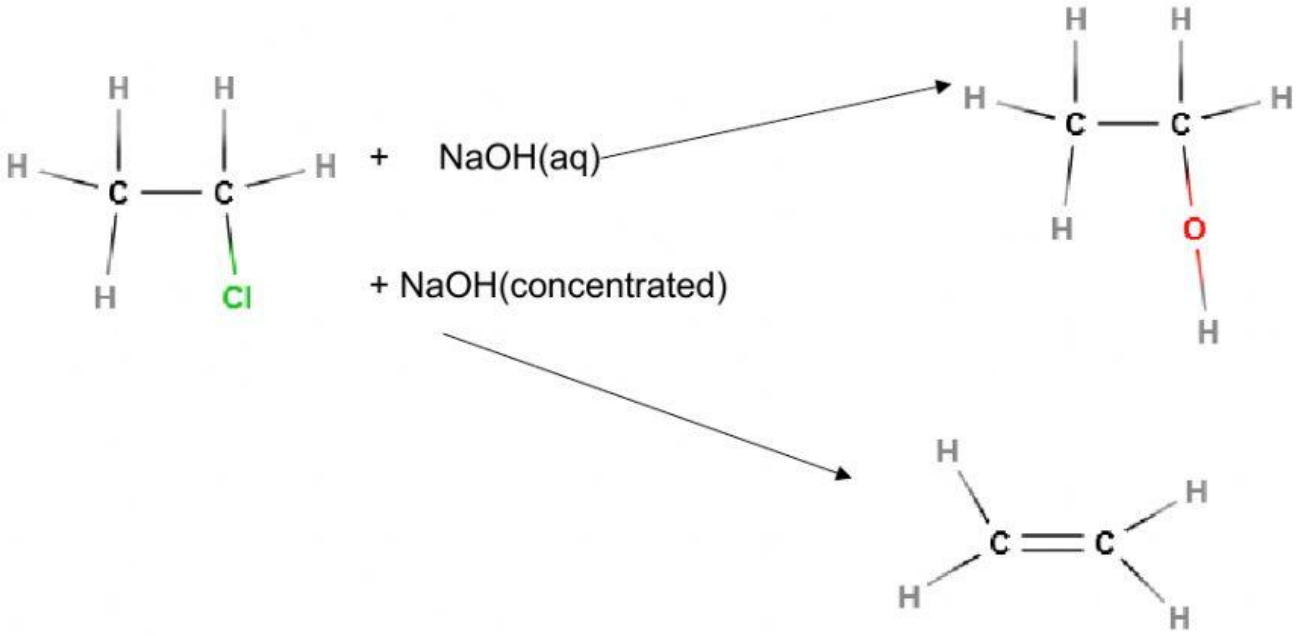
- The strong base must be diluted
- Reaction must be heated

Substitution with hydrogen halides (replacing a OH with a halogen)



Notice the 2 reactions dehydrohalogenation (in elimination) and hydrolysis (in substitution) both need NaOH or KOH to react.

The only difference between the initial reactions of both



This small difference makes a **BIG** difference in the type of product that forms.

They love testing this in exams!

Watch this video to help you before you carry on

Exercise 1: Multiple choice

1.1 When a substance goes from being unsaturated to saturated, what type of reaction took place:

Addition

Substitution

Elimination

1.2 If water is added during an addition reaction, it is called

Hydrogenation

Hydration

Hydrohalogenation

Halogenation

1.3 When a substance goes from being saturated to saturated, what type of reaction took place:

Addition

Substitution

Elimination

1.4 If hydrogen is removed during an elimination reaction, it is called

Dehydrogenation

Dehydration

Dehydrohalogenation

1.5 If H_2O is added during a substitution reaction and takes the place of a hydrogen, it is called

Hydrogenation

Halogenation

Hydrolysis

Substitution with hydrogen halides

1.6 If HI is removed during an elimination reaction, it is called

Dehydrogenation

Dehydration

Dehydrohalogenation

1.7 If hydrogen is added during an addition reaction, it is called

Hydrogenation

Hydration

Hydrohalogenation

Halogenation

1.8 When a substance goes from being saturated to unsaturated, what type of reaction took place:

Addition

Substitution

Elimination

1.9 If a halogen is added during an addition reaction, it is called

Hydrogenation

Hydration

Hydrohalogenation

Halogenation

1.10 If a halogen is added during a substitution reaction and takes the place of a hydrogen, it is called

Hydrogenation

Halogenation

Hydrolysis

Substitution with hydrogen halides

1.12 If KOH(aq) is added during a substitution reaction and takes the place of a hydrogen, it is called

Hydrogenation

Halogenation

Hydrolysis

Substitution with hydrogen halides

1.13 If a halogen is removed during an elimination reaction, it is called

Dehydrogenation

Dehydration

Dehydrohalogenation

1.14 If HBr is added during an addition reaction, it is called

Hydrogenation

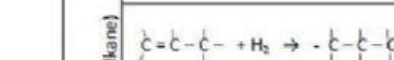
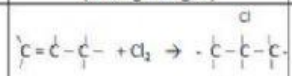
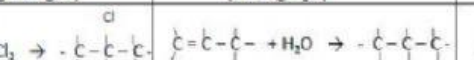
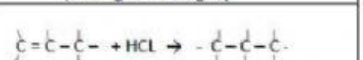
Hydration

Hydrohalogenation

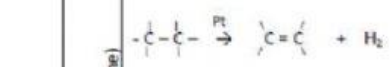
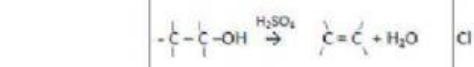
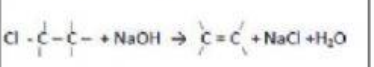
Halogenation

Below is a summary of all the reactions

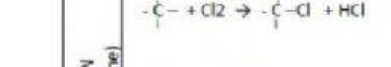
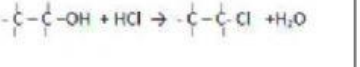
ADDITION (alkene to alkane)

1. Hydrogenation (adding H_2)	2. Halogenation (adding halogen)	3. Hydration (adding H_2O)	4. Hydrohalogenation (adding H + halogen)
			
*alkene dissolved in non polar solvent *catalyst of Ni,Pd or Pt *In a Hydrogen atmosphere	*alkene dissolved in unreactive solvent	*catalyst of H_2SO_4/H_3PO_4 *In excess H_2O	* no water must be present

ELIMINATION (alkane to alkene)

1. Dehydrogenation (remove H)		2. Dehydration (remove H_2O)	3. Dehydrohalogenation (remove H_2 and halogen)
			
* 800°C		* concentrated H_2SO_4	* concentrated NaOH/KOH base * heat under reflux

SUBSTITUTION (alkane to alkane)

1. Halogenation (swap H2 for halogen)	2. Hydrolysis (swap halogen for H2O)	3. Hydrolysis- with NaOH .	4. Substitution with hydrogen halides (swap OH for halogen)
			
* needs UV light	*haloalkane dissolved in ethanol	*base is dilute/ aqueous *must be heated	

* remember the Cl_2,F_2,Br_2, OH... goes to the Carbon with the least number of hydrogen bonds in addition

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