



## **Types of Reactions in Organic Chemistry**

**Chemistry – Leaving Cert**

**Quick Notes**

## Types of Reactions in Organic Chemistry

The mechanism of a reaction is the detailed step-by-step description of how the overall reaction occurs. A substitution reaction is a chemical reaction in which an atom or group of atoms in a molecule is replaced by another atom or group of atoms. A substitution reaction takes place when methane reacts with chlorine. A chlorine atom has replaced a hydrogen atom in a molecule of methane. This is known as halogenation of alkanes or more specifically the chlorination of methane is referred to as a free radical substitution reaction and it involves four steps: initiation, propagation, propagation and termination. Evidence for this mechanism is that it only takes place in UV light and the addition of tetramethyl lead increases the rate. The formation of an ester may be regarded as an example of a substitution reaction since the hydrogen atom of the hydroxyl group of the carboxylic acid has been replaced by an alkyl group. It is also known as a condensation reaction because water is produced. The reverse reaction of esterification is known as hydrolysis. The base catalysed hydrolysis of esters is called saponification. The naturally occurring ester glyceryl tristearate, found in animal fats, may be hydrolysed to form sodium stearate (soap) and the alcohol glycerol. An addition reaction is one in which two substances react together to form a single substance. The most common addition reaction is when a molecule adds across a carbon-carbon double bond. The reaction between ethene and bromine is an example of an addition reaction and it involves four steps – polarisation, heterolytic fission, carbonium ion formation and bromide ion attack on carbonium ion. There is certain evidence that this mechanism occurs. Firstly, when the bromination reaction is carried out in the presence of chloride ions, 1-bromo-2-chloroethane is formed. And when ethene reacts with bromine in water, 2-bromoethanol is formed. Both of us provide evidence for the existence of the carbonium ion. Polymers are long-chain molecules made by joining together many small molecules called monomers. Polymers like polythene and polypropene are categorised as addition polymers because their manufacture involves addition reactions of the monomer ethene. An elimination reaction is one in which a small molecule is removed from a larger molecule to leave a double bond in the larger molecule. When water is removed, the elimination reaction is called a dehydration reaction. In redox reactions, primary alcohols are oxidised to aldehydes which are further oxidised to carboxylic acids. Ethanal is produced by oxidising ethanol using sodium dichromate. By using excess alcohol and by distilling off the ethanol as it is formed, further oxidation of the ethanal to ethanoic acid is kept to a minimum. There is a colour change from orange to green as the reaction proceeds. Ethanoic acid may be prepared

by oxidising ethanol to ethanoic acid. This is done by refluxing ethanol with a mixture of sodium dichromate and dilute sulfuric acid. There is a colour change from orange to green as the reaction proceeds. The use of excess oxidising agent and refluxing the mixture ensures that complete oxidation to ethanoic acid occurs. Chromatography is a separation technique in which a mobile phase moves in contact with a selectively adsorbent stationary phase. Paper chromatography may be used to separate the different colours in ink. Thin-layer chromatography may be used to separate the components of food dyes. In column chromatography, the stationary phase consists of a solid adsorbent material like silica gel packed into a long glass tube. There are two other more advanced types of chromatography – gas chromatography and high performance liquid chromatography. Infra-red spectrometry and ultraviolet spectrometry are used for identification purposes by chemists e.g. IR spectrometry may be used to identify plastics or drugs.