UNIVERSITY OF RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

DEPERTMENT OF CHEMISTRY

BIO ORGANIC CHEMISTRY

LEVEL TWO

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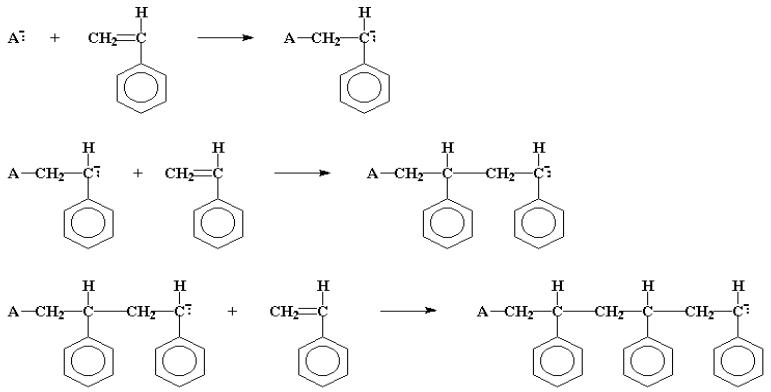
POLYMER CHEMISTRY AND TECHNOLOGY ASSIGNMENT 5

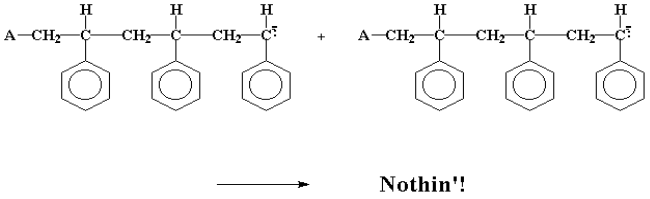
Q: Differentiate with examples the mechanisms between step growth and chain growth polymerization reactions:

Chain-Growth Polymerization

In a **chain growth** polymerization, monomers become part of the polymer one at a time, for example the anionic polymerization of styrene to make polystyrene.



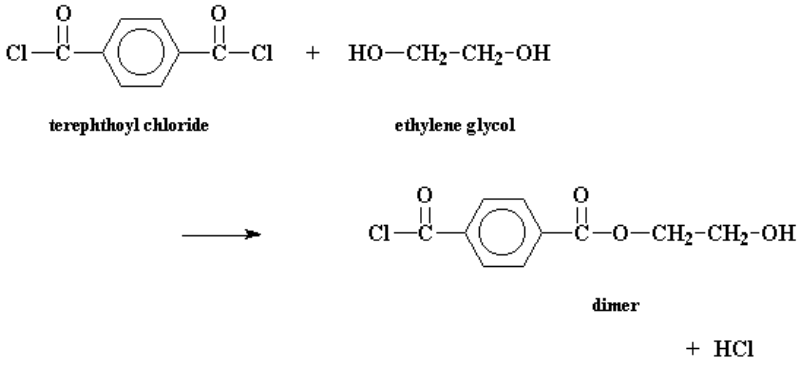
***A chain growth polymerization*: in the anionic polymerization of styrene, only styrene monomer can react with the growing polystyrene chain. Two growing chains won't react with each other.**



But in a **step growth** polymerization, things are more complicated

For example:

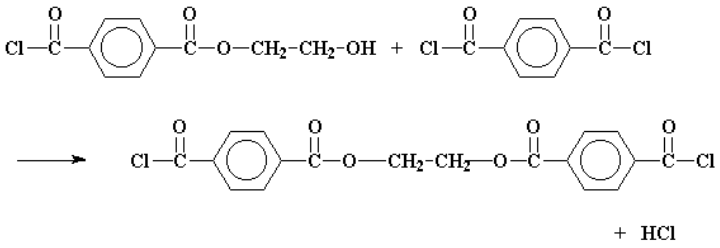
- polymerization of terephthoyl chloride and ethylene glycol, to make a polyester called poly(ethylene terephthalate)
    - The first thing that happens is that the two monomers will react to form a dimmer



Terephthoyl chloride and ethylene glycol react to form an ester dimer

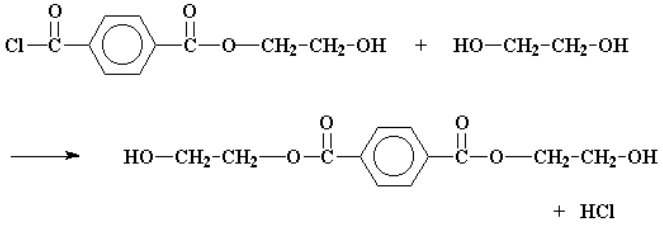
The dimer can do a lot of different things. It can of course react with one of the monomers to form a trimer:

Our little dimer can react with a molecule of terephtoyl chloride...



Or...

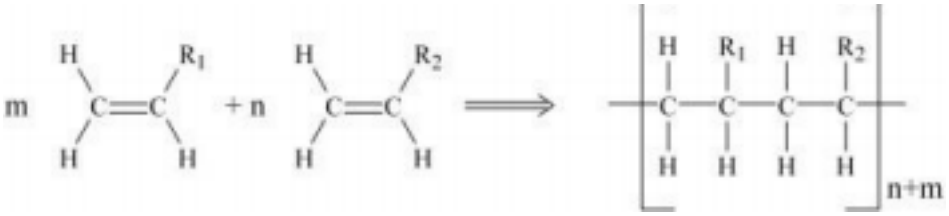
It can react with a molecule of ethylene glycol.



With chain polymerization, what are termed vinyl polymers are obtained, because the monomers from which it starts contain the vinyl group: (CH_2 ▁CH), in which the C ▁C double bond is present. The polymerization of vinyl monomers occurs by rupture of the double bond and creation of a simple covalent bond with the nearby monomer. Schematically:

2C=C→-C-C-C-C-

Usually an *initiator* compound reacts with the monomer to start the reaction, and the mechanism of chain polymerization consists of three phases, called *initiation*, *propagation*, and *termination*.



In a chain growth polymerization:

· only monomers react with growing chains

· Two growing chains can't join together the way they can in a step growth polymerization

While in step growth polymerization:

· the growing chains may react with each other to form even longer chains

· This applies to chains of all lengths

· The monomer or dimer may react in just the same way as a chain hundreds of monomer units long