

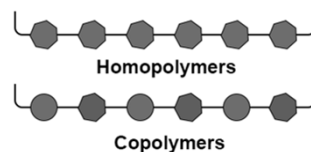
POLYMERS

SCH4U

Plastics and Fabrics

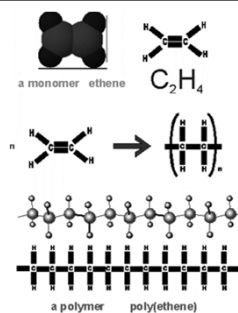
Classification based on Monomer:

- Polymers that contain only a single type of repeat unit are known as **homopolymers**
- While polymers containing two or more types of repeat units are known as **copolymers**.



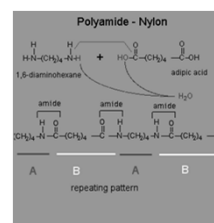
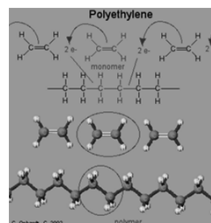
What is a Polymer?

- Made up of **monomers** (single unit)
- long chains of many monomers (generally 10 or more) are called **polymers**
- The chemical process by which monomers are joined to form polymers is called **polymerization**.
- The monomers in any polymer might be identical, or they may occur in a repeating pattern.



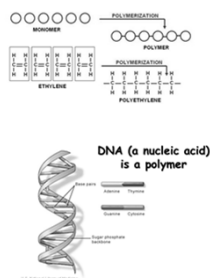
Two Main Types of Polymers

1. Addition Polymer (addition across a double bond)
2. Condensation Polymer (contains polar functional groups with oxygen)



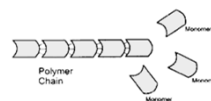
Synthetic or Natural???

- Synthetic:
 - i.e. created in a lab – all plastics, Styrofoam, nylon, etc.
- Natural:
 - In biological contexts, essentially all biological macromolecules - i.e., proteins (polyamides), nucleic acids (polynucleotides), and polysaccharides - are polymers or composed of polymers.



Type 1: Synthetic Addition Polymers

- The formation of a polymer by addition polymerization is an example of a chain reaction. Once a chain reaction gets started, it is able to keep itself going.
- The starting materials are **short alkene** molecules (may have other functional groups attached)
- The resulting polymer often contains only **single bonds**

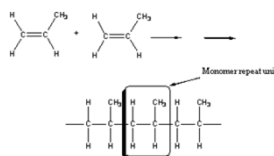


- <http://www.tvo.org/igmp/plastic/animations.html#>

More Examples – FYI Only

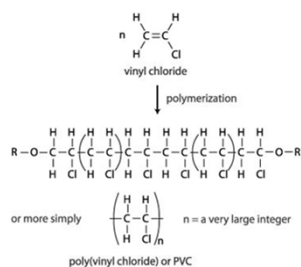
□ Polypropylene

- You may have used polypropylene rope, or walked on polypropylene carpet.



Condensed Form:

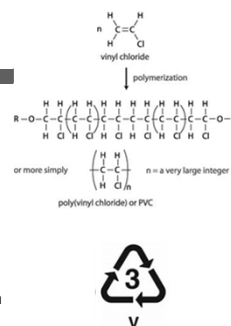
- The structure of a polymer can be written in condensed form, the repeating unit being bracketed and a subscript “n” denoting the number of repeating units.



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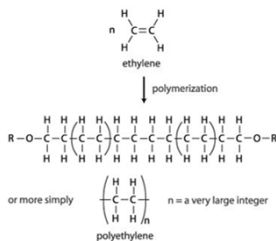
□ Polyvinyl Chloride

- Ethene molecules with chlorine groups produce polyvinyl chloride, commonly known as PVC
- A common name for chloroethene is vinyl chloride.
- PVC is used as insulation for electrical wires and as a coating on fabrics used for raincoats and upholstery materials.



Polyethylene – FYI Only

- Used in plastic wrap, plastic bags, plastic bottles, toys



PETE



HDPE

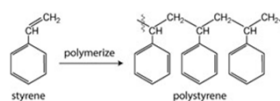


LDPE

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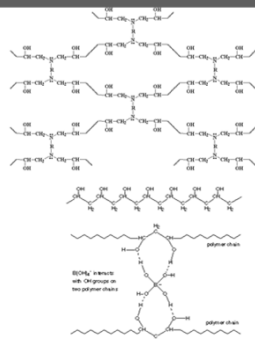
□ Polystyrene

- When a benzene ring is attached to an ethene molecule, the molecule is vinyl benzene, commonly called styrene. An addition polymer of styrene is polystyrene.
- General purpose polystyrene is clear, hard and brittle.
- Typical applications include protective packaging, containers, lids, bottles, trays and tumblers.



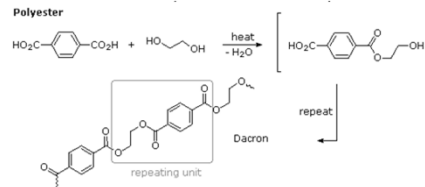
Cross-linking

- Cross-linking makes the polymer stronger.
- Cross-linking can be achieved by reactions happening on both sides of the chain or by adding functional groups.



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- Polyester
 - ▣ Carboxylic acid + alcohol
 - ▣ Mylar

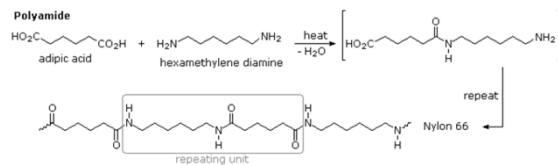


Type 2: Synthetic Condensation Polymers

- Condensation polymers form more slowly than addition polymers, often requiring heat
- The presence of polar functional groups on the chains often enhances chain-chain attractions, particularly if these involve hydrogen bonding
- Condensation = water as a product, therefore needs oxygen in its formula!

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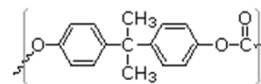
- Polyamides
 - ▣ Carboxylic acid and amines
 - ▣ Nylon & Kevlar



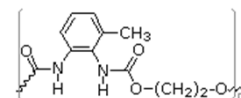
- <http://www.tvo.org/iqm/plastic/animations.html#>

– FYI Only

- Polycarbonate
 - ▣ Lexan



- Polyurethane
 - ▣ Spandex



A review...

- <https://www.youtube.com/watch?v=rHxxLYzJ8Sw>

Seatwork

- Pg. 83 #2a, 3
- Pg. 87 #1-3
- Pg. 93 #1-5
- Pg. 98 #1
- Pg. 99 #1-5

