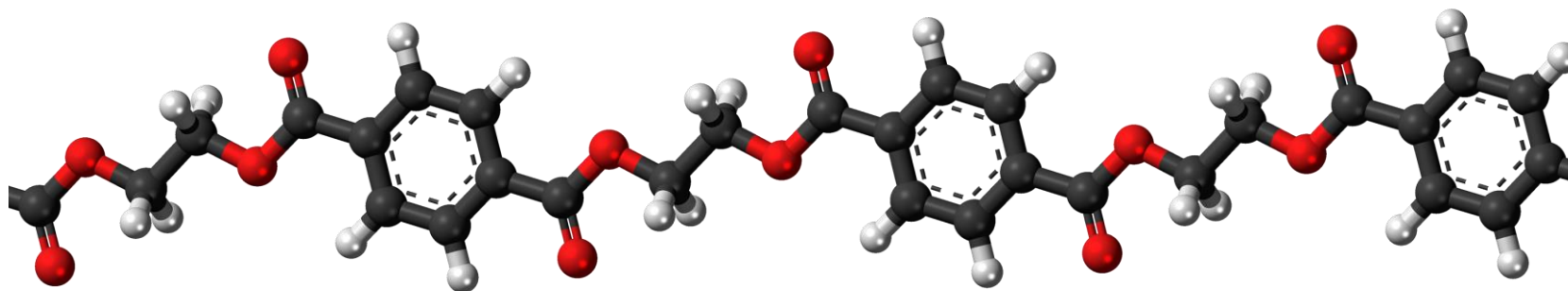


Polymers – Condensation Polymers



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Recommended Textbook:

Chapter 26 in *Organic Chemistry*, 8th Edition, L. G. Wade, Jr., **2010**, Prentice Hall (Pearson Education)

Condensation Polymers

- Condensation polymers result from formation of **ester** or **amide** linkages between **difunctional molecules**

Option 1

Option 2

- Usually proceeds by **step-growth polymerization**, in which any two monomer molecules may react to form a dimer, and dimers may condense to give tetramers, and so on
- Each condensation is an individual **step** in the growth of the polymer, and there is **no chain reaction**

Condensation Polymers

Four most common types :

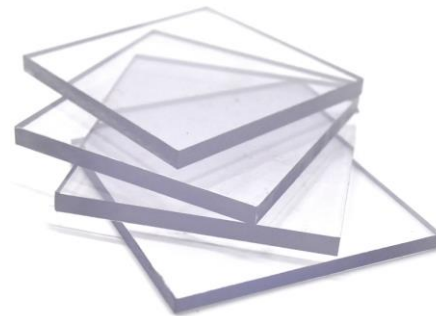
1) Polyamides



2) Polyesters



3) Polycarbonates

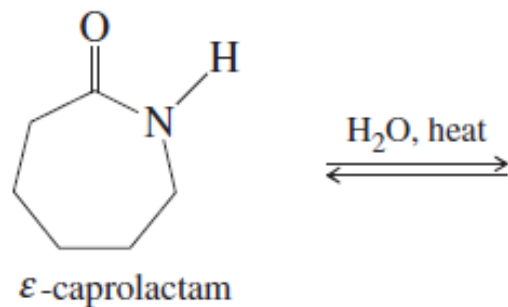


4) Polyurethanes



1) Polyamides : Nylon

- Nylon can also be made from a single monomer having an amino group at one end and an acid at the other (**amino acids**)



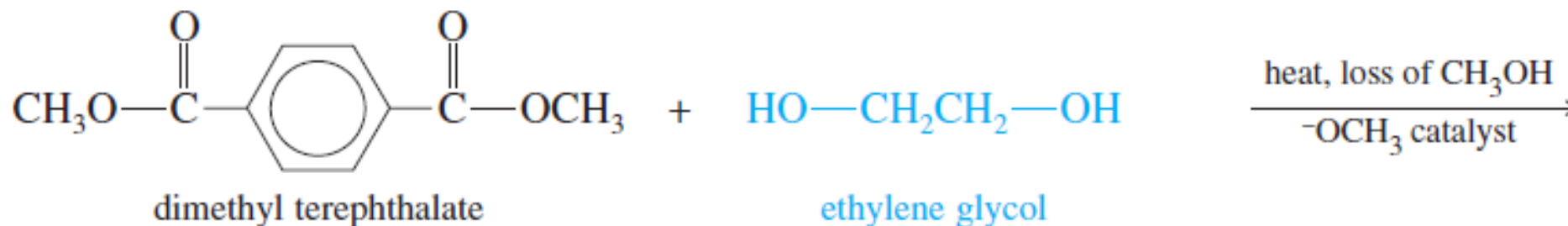
- When caprolactam is **heated with a trace of water**, some of it hydrolyses to the free amino acid. Continued heating gives condensation and polymerization to molten nylon 6
- Nylon 6 (also called *Perlon*®) is used for making **strong, flexible fibres** for ropes and tire cord

2) Polyesters

- The most common polyester is **Dacron®**, the polymer of **terephthalic acid** (paraphthalic acid or benzene-1,4-dicarboxylic acid) with **ethylene glycol**
- In principle, this polymer might be made by mixing the diacid with the glycol
- In practice, however, a better product is obtained using **transesterification**

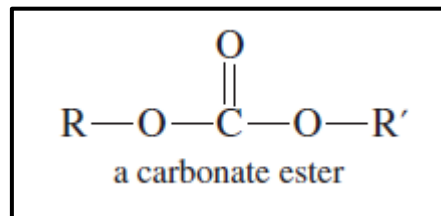


Wrinkle-free non-iron clothes

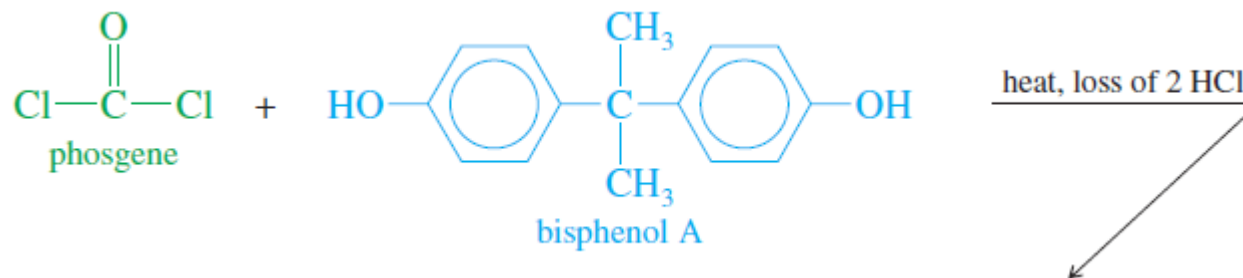


- Dacron® fiber is used to make fabric and tire cord

3) Polycarbonates:



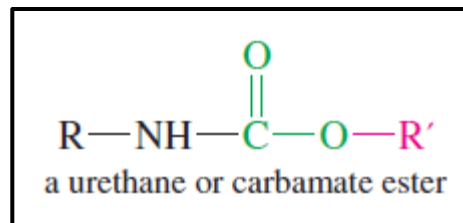
- **Phosgene** (the acid chloride of carbonic acid) reacts with a **diol** to give poly(carbonate ester) as a product



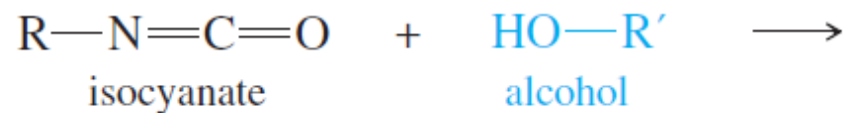
Lexan®

- bulletproof windows
- crash helmets

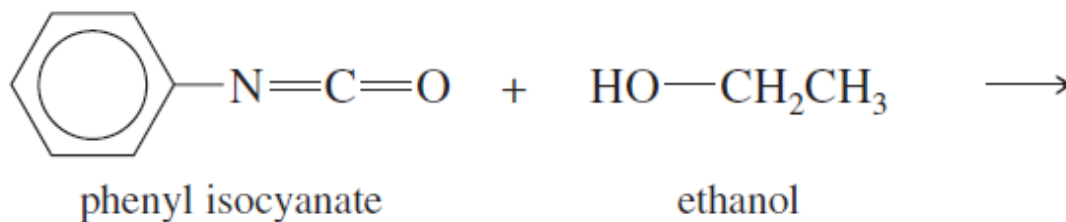
4) Polyurethanes:



- **urethanes** are most commonly made by treating an **isocyanate** with an **alcohol** or a **phenol**

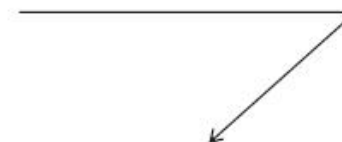
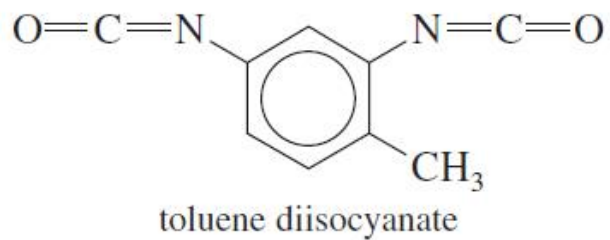


Example



4) Polyurethanes:

- Polyurethane results when a **diol** reacts with a **diisocyanate**



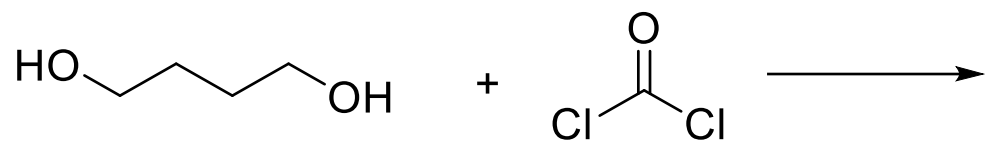
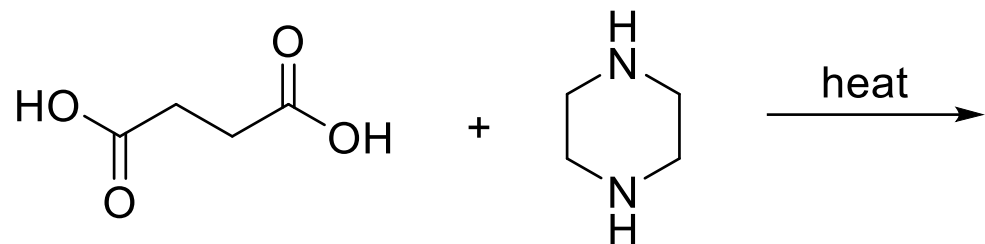
Polyurethane foams

- Mattresses
- Car seats
- Pillows



Condensation Polymers – Examples

- Suggest the product of the following reactions



Condensation Polymers – Examples

- Suggest the product of the following reactions

