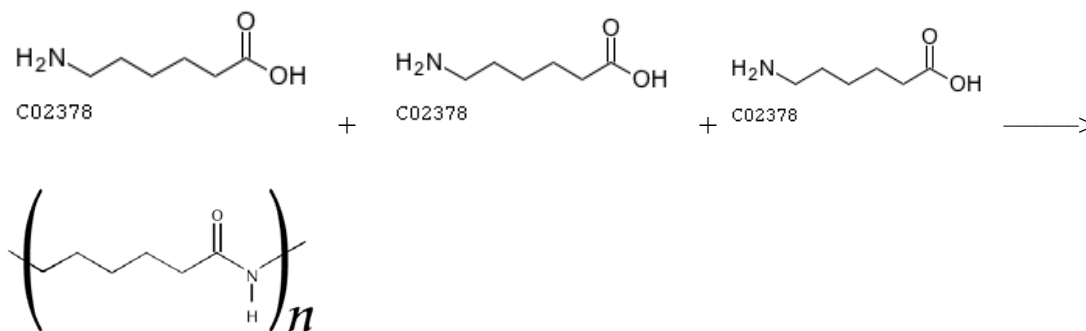


**7.9 Other polyamide polymers.** Man-made polyamide polymers can be made by reacting the carboxylic acid and amine functional groups of multiple monomers and linking them together by means of amide linkages. Some well known examples are shown below:

**Nylon 6**

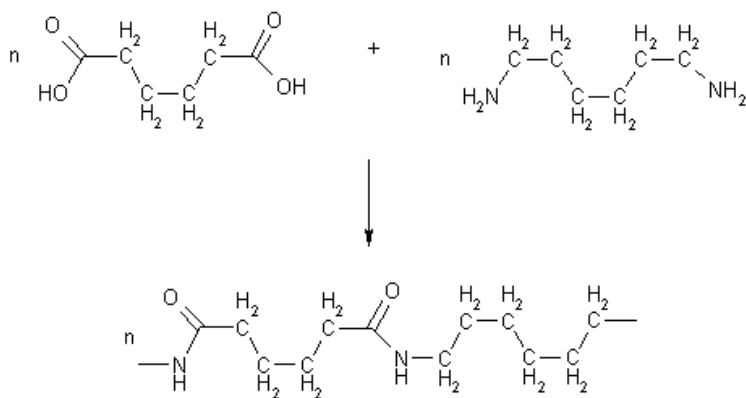


In Nylon6 the 6-carbon 6-aminohexanoic acid can react end to end in a fashion very similar to what we saw with amino acids and produce a long polyamide chain. It is referred to as Nylon 6 because the monomer has 6 C atoms.

Draw a representative structure of the polyamide formed from

- a) 4-aminobutanoic acid, forming Nylon 4
- b) 8-aminooctanoic acid, forming Nylon 8

**Nylon 66 is formed from alternating subunits of hexanedioic acid (adipic acid) and 1,6 diaminohexane.(Developed and patented by Dupont in 1937)**



In Nylon 66 the 6 C dicarboxylic acid(hexanedioic acid) is reacted with a 6-C 1,6-diaminohexane to form a molecule very similar but not identical to Nylon 6.

The 6 refers to the number of C atoms in each monomer. Nylon is in fact a general name for polymers similar to those shown, linked together by amide linkages. Nylon was first synthesized in 1935 by Walter Carothers, working for DuPont Corporation. It was rapidly perfected and used in nylon stockings, tooth brushes and more recently in dental floss and a large assortment of plastic devices.



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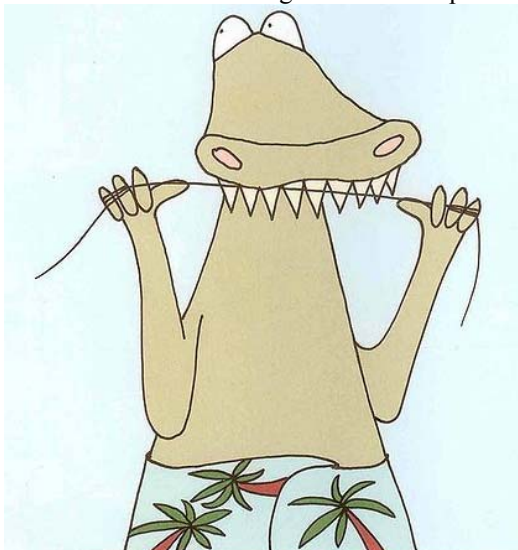
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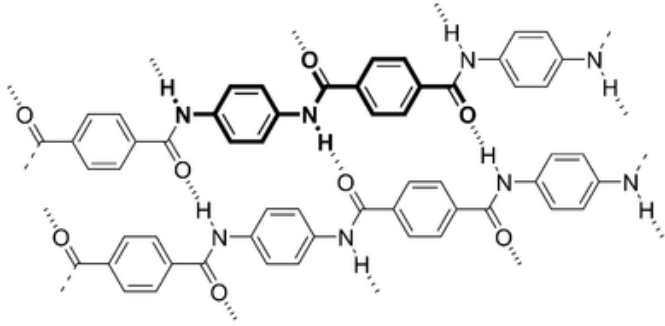
alessi-dental-floss.jpg.

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Specific properties of the nylon compound can be varied by adjusting the length of the C chains. Nylon 12 is used to make fuel and brake linings. An explosion in the only plant making nylon 12 (in Germany) has created a major shortage of brake lines for auto manufacturers.

Draw the starting molecules and final products for Nylon 44.

**Kevlar** is an extremely strong amide polymer made from 1,4 benzenedicarboxylic acid and 1,4-diaminobenzene. It is used in bulletproof vests, Kevlar belted radial tires, high performance skis, and other uses that require high strength and low weight. There are attractions between chains of Kevlar formed by the repeated attractions between the  $\delta^-$  on the O of the C=O carbonyl group on one chain and the  $\delta^+$  on the H of a N atom on another chain. See diagram below.



(So can aliphatic nylon)



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