

GTQ on Nylon. (40 points, synthesis, mechanism, polymers)

(a) Nylon is a polyamide formed by condensation of a carboxylic diacid with a diamine. The commonly used “Nylon” is **Nylon-6,6** where the numbers indicate the number of carbons in the diacid and in the amine. Hence, Nylon-6,6 is the polyamide formed from **adipic acid** and **1,6-hexanediamine** (HMDA) under high pressure (250 psi) and at high temperature (300 °C). Give the structures of both starting materials and draw the structure of the resulting polymer. For the polymer, just draw the smallest piece of the polymer that represents the polymer fully (the repeating unit).

adipic acid	HMDA
Polymer:	

(b) In the industrial production of nylon-6,6, the required HMDA is made from adipic acid. Suggest a synthesis of the diamine from adipic acid. Provide reagents, structures, and names of the compounds involved in this transformation.

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(c) A second synthetic route to HMDA involves the synthesis of 1,4-dicyanobutane from butadiene. This is interesting as it presents another case of 1,2- versus 1,4-addition. Write down the structures of the 1,2- and of the 1,4-addition products obtained by chlorination of butadiene. Provide a detailed mechanism for the formation of 1,4-dichlorobutene-2. Suggest a synthesis (give all structures and reagents) of HMDA from 1,4-dichlorobutene-2.

1,2-addition product:	1,4-addition product:
Mechanism:	
Synthesis of HMDA from 1,4-dichlorobutene-2:	