CHEM-C3420, Basics of polymer technology

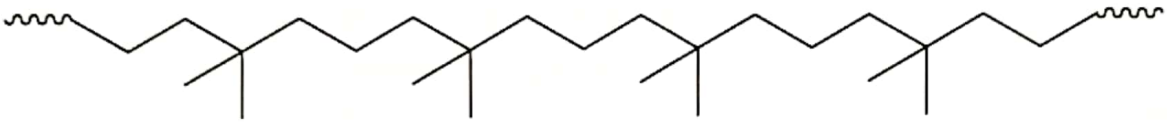
Exam 5.12.2023 (open book)

6 Questions, max 32 p.

Mark the **name, student number, signature** on each answer sheet

1) (Max 7p)

You have made a **co**polymerization reaction. Below is described part of formed **co**polymer



- What are the monomers You used? Draw or name.
- Draw the polymer structure in 'general form', i.e. $-(A)_n-$
- Name the formed polymer
- What was the polymerization mechanism?
- What can you conclude about the polymer's ability to crystallize?

2) (Max 5p)

You prepared PA 66 by reacting 300 g hexamethylenediamine and 300 g adipic acid in a bulk reactor (at 200°C for 5 hours). However, the molar mass of your final product was low. **Name 4-5 things** that you should change, check or do differently next time, in order to get a significantly higher molar mass for your product. **Justify your answer**

3) (Max 4p)

You have two different thermoplastic polymers, one of which (Polymer A) has a high degree of crystallinity, while the other (Polymer B) is completely amorphous. Both polymers are solid at room temperature. Your task is to determine the glass transition temperatures for both samples and you have access to NMR, DSC, DMA and GPC analysis equipment. **With which analysis device(s) you can determine the glass transition temperatures of the samples. Justify your choice**.

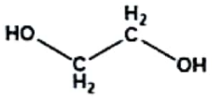
4) (Max 5p)

Your task is to produce 1,000,000 plastic hammers made of PP. You choose injection molding as the processing method and special PP-grade, specified for injection molding, as the material. **However, the stiffness of your final product is too low. Suggest 4 things** you could do differently to make your final product more rigid. Also tell how these changes would negatively affect your task. **Justify your suggestions**

5) (Max 6p)

You have access to the chemicals described below (+ all necessary calatyst&initiators if required). Describe 2 **different** routes, how you can make polyurethane **thermosets** from them. **In one of the routes, you should use chemical number 5**. The chemicals are numbered, and you can use the numbers as an aid in your description. **Justify briefly your answer**

1



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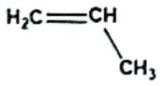

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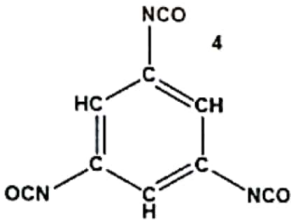

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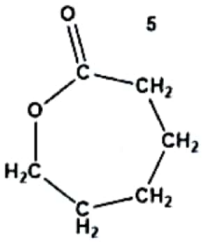

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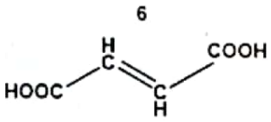

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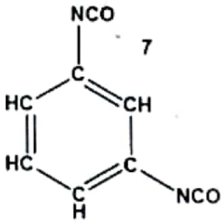

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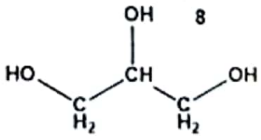

6) (max 5p)

The picture shows a typical test piece used in the tensile test of polymers (dimensions are in mm). Below is also the force/strain graph given by the polymer material X in the tensile test

A) Calculate the Young's modulus of the material X.

B) What polymer material could it be? **Justify Your answer**

NOTE: For the calculation, you must make some estimates from the graph