

Polymers

Monomers, repeat units, addition and condensation

Name _____ Class _____ Date _____

DATA

$n = \text{molar mass of polymer} \div \text{molar mass of repeat unit}$

Molar masses (g/mol): C 12.01 · H 1.008 · F 19.00 · C₂H₄ 28.05 · C₃H₆ 42.08 · C₂F₄ 100.02 · CO₂ 44.01 · H₂O 18.02 · nylon-6,6 repeat unit C₁₂H₂₂N₂O₂ 226.32

Show units on every quantity in every step.

A. Understanding

1. Define (a) monomer (b) repeat unit (c) addition polymerization (d) condensation polymerization.

B. Repeat units and monomers

2. Draw the repeat unit of the polymer formed from: (a) propene, CH₂=CHCH₃ (b) chloroethene, CH₂=CHCl (c) tetrafluoroethene, CF₂=CF₂ (d) phenylethene (styrene), CH₂=CHC₆H₅

3. Give the monomer of each polymer: (a) $-\text{[CH}_2\text{-CH(CN)]}-$ (b) $-\text{[CH}_2\text{-CH(CH}_3\text{)]}-$ (c) $-\text{[CH}_2\text{-CCl}_2\text{]}-$

4. Classify each as an addition or a condensation polymer: poly(ethene), nylon-6,6, PET (a polyester), PVC, a protein, PTFE.

5. Nylon-6,6 is made from hexanedioic acid, $\text{HOOC(CH}_2\text{)}_4\text{COOH}$, and hexane-1,6-diamine, $\text{H}_2\text{N(CH}_2\text{)}_6\text{NH}_2$. (a) Name the type of link formed and draw it. (b) What small molecule is released?

C. Calculations

6. (a) A PTFE sample has an average molar mass of 3.00×10^5 g/mol. Find the average number of repeat units. (b) A poly(propene) chain has 3.00×10^3 repeat units. Find its molar mass.

7. Calculate the percentage by mass of fluorine in PTFE.

8. Forming each repeat unit of nylon-6,6 releases 2 molecules of water. What mass of water is released when 1.00 kg of nylon-6,6 is made?

D. Challenge

9. (a) Write a balanced equation for the complete combustion of poly(ethene), using one repeat unit, C_2H_4 . (b) What mass of CO_2 forms when 1.00 kg of poly(ethene) waste is burned? (c) Give one advantage and two disadvantages of burning plastic waste compared with recycling it.