What is Polymer Chemistry?

Worksheet

A polymer is a chain of identical or near-identical monomers bonded together. Two main pathways: addition polymerization (monomer + monomer, no byproduct) and condensation polymerization (release of water or other small molecule).

Questions

1. Which of these undergoes addition polymerization?

A) Ethene (CH=CH)
B) Adipic acid (HOOC(CH)COOH)
C) Ethanol (CHCHOH)
D) Hexamethylene diamine

2. In condensation polymerization, what usually happens?

A) Monomers dissolve
B) A small molecule (like HO) is released
C) Heat is absorbed
D) Double bonds stay intact

3. Polyethene is made from ethene. How many atoms are lost per monomer?

A) 1 atom
B) 4 atoms
C) 0 atoms (none)
D) 2 atoms

4. What does a catalyst do in polymerization?

A) Provides energy to initiate monomer reaction
B) Gets consumed
C) Adds to the polymer
D) Removes water

5. Ethene (CH) undergoes addition polymerization. Write the monomer and resulting polymer.

6. Phenol (CHOH) and formaldehyde (CHO) react to form Bakelite. Is this addition or condensation?

7. Nylon is made from hexamethylene diamine and adipic acid. Does this release any byproduct?

8. Define: What is a monomer?

9. Define: What is the difference between addition and condensation polymerization?

10. Define: What does '(M)' mean in a polymer formula?

Answer Key

1. A) Ethene (CH=CH) - Only ethene has a C=C double bond. Addition polymers require unsaturation that can open.

2. B) A small molecule (like HO) is released - Condensation means two groups react and release a byproduct-usually water or HCl.

3. C) 0 atoms (none) - Addition polymerization: no byproduct. All C and H atoms of ethene stay in the polymer.

4. A) Provides energy to initiate monomer reaction - A catalyst lowers activation energy and helps monomers react, but is not consumed or incorporated.

5. Monomer: CH=CH (ethene) During addition polymerization, the C=C double bond opens: Polymer: (CHCH) (polyethene) No byproduct-only monomer units joined.

6. Two functional groups (phenolic OH and formaldehyde) bond together. A small molecule (water, HO) is released as a byproduct. This is CONDENSATION polymerization (releases HO).

7. Hexamethylene diamine (HN(CH)NH) + adipic acid (HOOC(CH)COOH) The amino and carboxyl groups form amide bonds (CONH) and release HO. Nylon is a CONDENSATION polymer (releases water).

8. A small molecule with repeating ability-typically has reactive double bonds or functional groups. Example: ethene (CH).

9. Addition: monomers join without byproduct (e.g., plastics). Condensation: monomers join and release small molecules like water (e.g., nylon, polyester).

10. n represents the number of repeated monomer units-often thousands or millions in a real polymer.