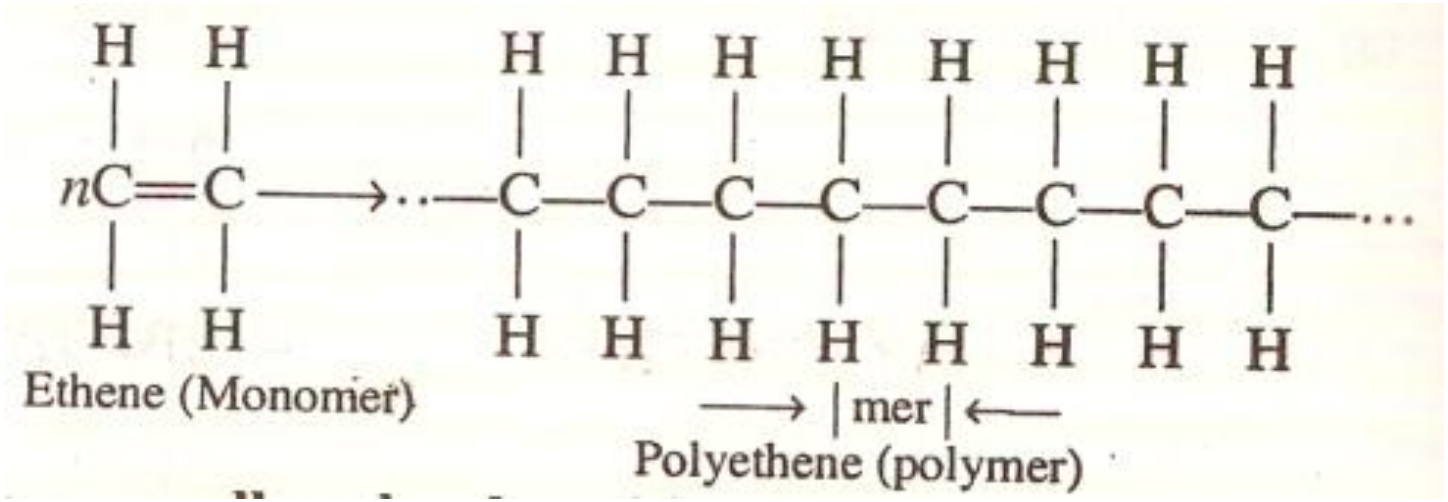
POLYMERS

Introduction : The word "**polymer**" is derived from two Greek words, **polys (= many**) and **mers (= parts or units).** A polymer is a large molecule which is formed by repeated linking of small molecules called "**monomers**".
Example: Polyethene is a polymer formed-by linking together of a large number of ethene (C_2H_4) molecules.



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Thus, small molecules which combine with each other to form polymer molecules, are termed monomers ; and the "re-peat unit" in a polymer is called mer.

Characteristics of Polymers :

1. Polymeric molecules are very big molecules. There average molecular weights may approach 10^5 or more. That's why, they are also known as **macromolecules.**
2. Polymers are semi-crystalline materials. It means they have both amorphous and crystalline regions. In fact, polymers have regions of crystallinity, called crystallites, embedded in amor- phous regions. Crystallites provide strength and hardness and the amorphous regions provide flexibility to the polymeric material.

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3. The intermolecular forces in polymers can be Vander Waals' forces, dipole-di-pole attractions or hydrogen bonding. These intermolecular forces are in addition to covalent bonds which connect the repeating units into a macromolecule.
4. The chemical, electrical, optical, mechanical and thermal properties of polymers depend on (i) size and shape of polymers, and (ii) the presence or absence of characteristic intermolecular forces. These parameters not only determine the properties of the polymers, but also the performance of these materials in a given applications.
5. Polymers show time-dependent properties.

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6. Polymers are combustible materials.
7. Polymers have low densities and they show excellent resistance to corrosion.
8. Generally, polymers are thermal and electrical insulators.
9. Polymeric materials are easily mouldable even into complex shapes with reproducible dimensions with a minimum of fabrication and finishing cost.

CLASSIFICATION OF POLYMERS :

1. Based on Number of Monomers : Polymers can be homopolymer or copolymer when the number of monomers are one and two respectively.

(i) Copolymers : Molecules which are built up of at least two different kinds of monomer are known as co-polymers. Thus, a co-polymer is obtained when two or more suitable monomers are polymerised together.

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The chains of co-polymer consist of repeating units derived from each monomer. Following are some common types of co-polymers :

(a) Alternating co-polymers (c) Block co-polymers

(b) Random co-polymers (d)Graft co-polymers

(a) Alternating co-polymers: In such Co-polymers, the different repeating units alternate in each chain. If A and B represent two different units then an alternating co-polymer will be represented as,

-ABABABAB-

(b) Random Co-polymers: In this type of copolymers, the different repeating units are not arranged in a systematic manner but are randomly arranged, e.g.

-ABAABABBAAABA-

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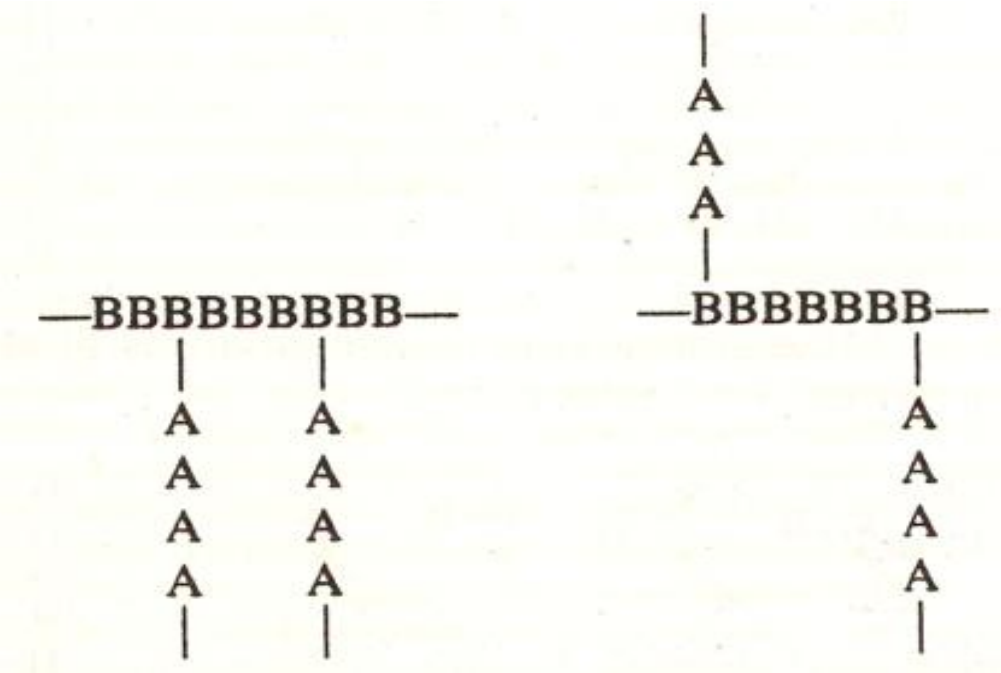
(c) Block Co-polymers: In such co-polymers, block of repeating units of one type alternate with block of another type, *e.g.*

-AAAABBBBAAAABBBB-

(d) Graft Co-polymers: In such co-polymers, blocks of one repeating units are attached or grafted to a block of linear polymer, *e.g.*



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(ii) Homopolymers: If the polymers consist of monomer of identical chemical structure then they are called homopolymers, *e.g.*,