

Inorganic polymer

Ferdowsi University of Mashhad

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SECTION ONE

91/11/16



منابع:

Inorganic Polymers (Second Edition).

By: James E. Mark / Harry R. Allcock / Robert West

Inorganic and Organometallic Polymers

By: Vadapalli Chandrasekhar

An Introduction to Polymer Physics

By: David I. Bove.

What Is a Polymer?

A chemical compound or mixture of compounds consisting of repeating structural units created through a process of polymerization.

High molecular weight molecule made up of a small repeat unit (monomer).

colloids (colloids are close relatives of polymers)

What Is a Polymer?

A polymer is a very-long-chain macromolecule in which hundreds or thousands of atoms are linked together to form a one-dimensional array.

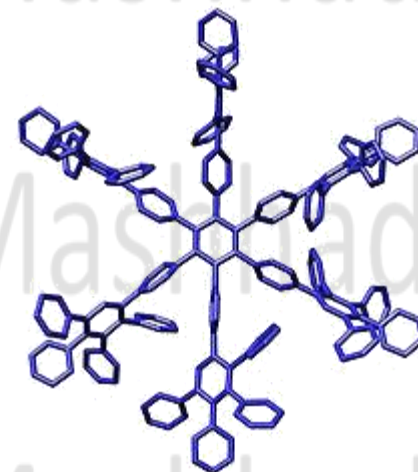
The skeletal atoms usually bear side groups, often two in number, which can be as small as hydrogen, chlorine, or fluorine atoms or as large as aryl or long-chain alkyl units.

What Is a Polymer?

Cascade polymers are also known as dendrimers. This remains one of the hottest areas of macromolecular science. Co-invented at LSU, it is still practiced here.

(McCarley, Warner, Daly, Russo)

The poly(phenylene) dendrimer has actually been crystallized (Muullen).



Poly = many

mer = unit (repeat unit (building blocks))

} many units

Ancient Polymers

Naturally occurring polymers (those derived from plants and animals) have been used for centuries.

Wood

Rubber

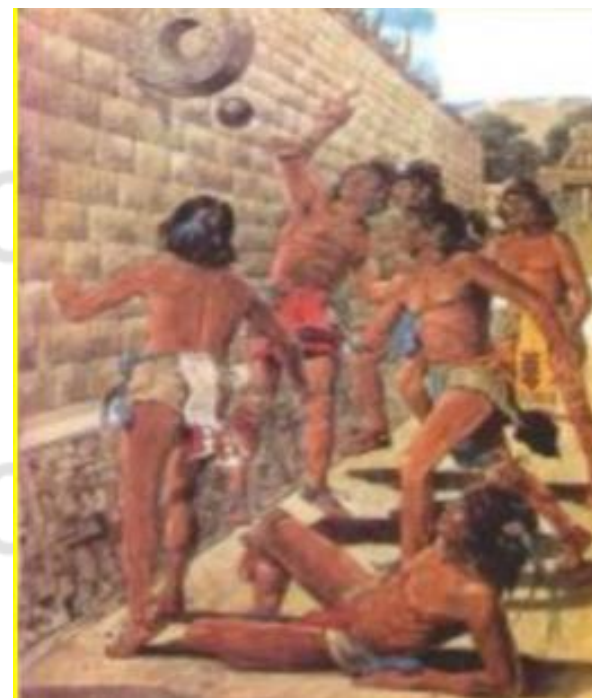
Cotton

Wool

Leather

Silk

Oldest known uses Rubber balls used by Incas



Biopolymers : proteins, enzymes, DNA ...

Noah used pitch (a natural polymer) for the ark

gum based resins extracted from **pine trees**



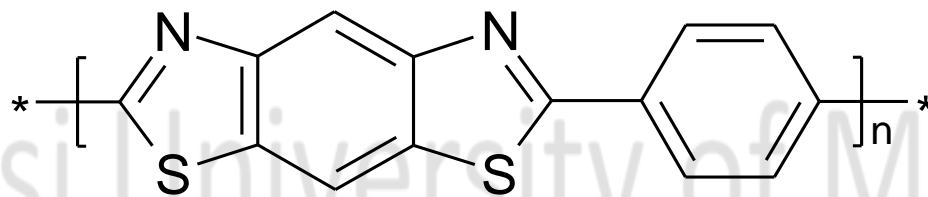
Hevea brasiliensis



Polymers as Long Molecular Chains



Electron microscope picture of bacterial DNA partially released from its native shell. (Source: *Dictionary of Science and Technology*, Christopher Morris, ed. , San Diego, CA: Academic Press, 1992.)



Used in stealth bomber? Maybe.



Is polymer a molecule? **BIG ONE**

The polymers are long-chain molecules.

The presence of chains cause to:

molecular characteristics

- entangled in solution or in the solid state
- specific macromolecular structures
- lined up in regular arrays in the solid state.

Is polymer a molecule? **BIG ONE**

The molecular characteristics in polymer give rise to solid-state materials properties:

Strength

Elasticity

Fiber-forming

Film-forming

High molecular weights

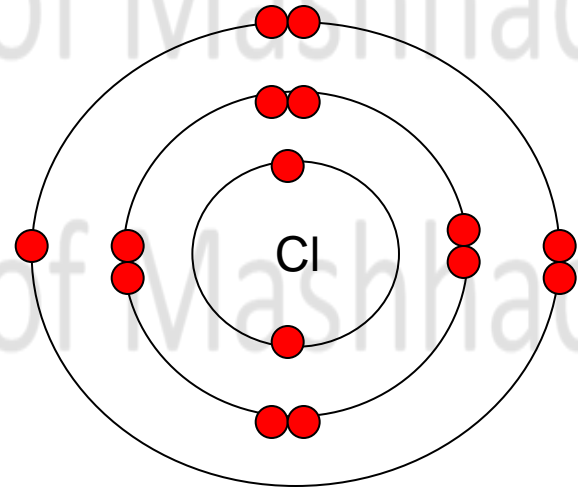
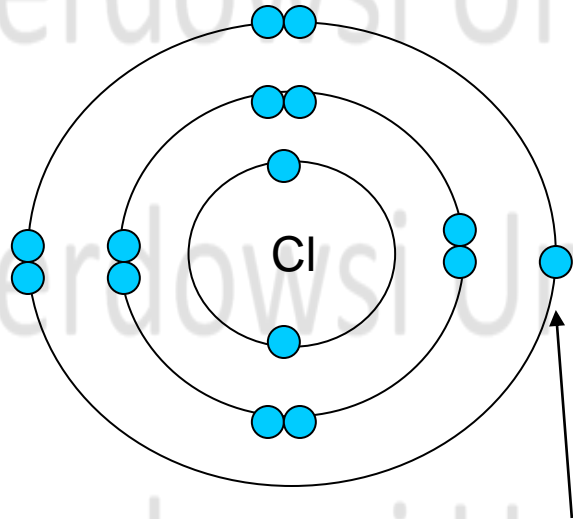
Nonvolatile

Small molecule NOT

Covalent

Non-metal : Non-metal

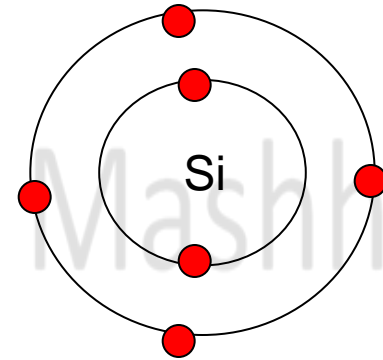
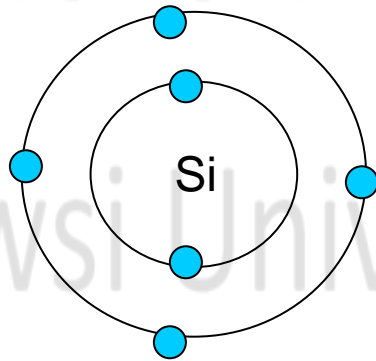
polymer a molecule!?



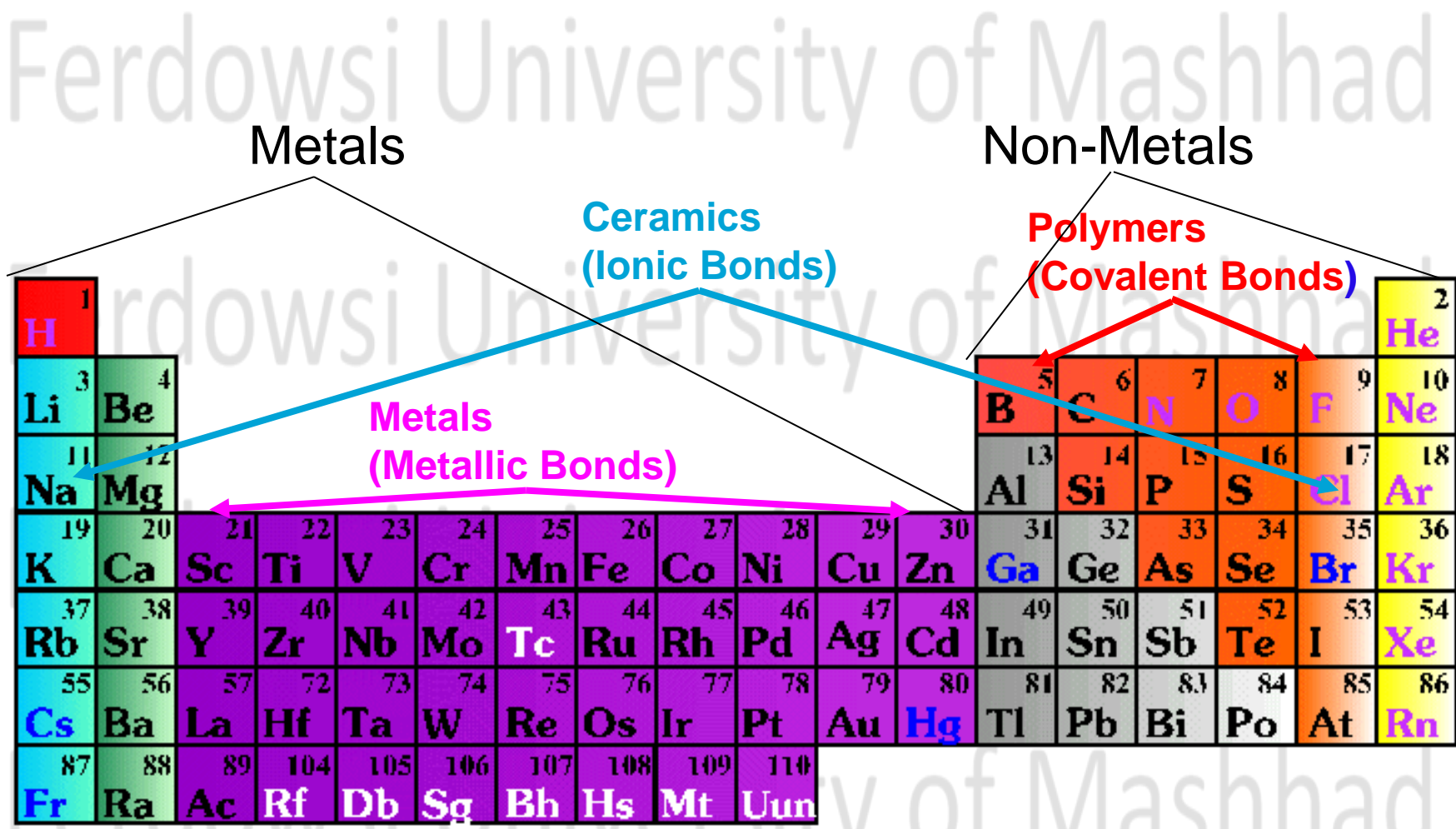
Shared electrons

Covalent

Non-metal : Non-metal



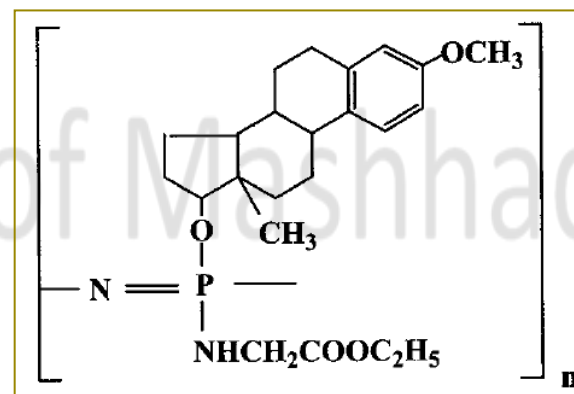
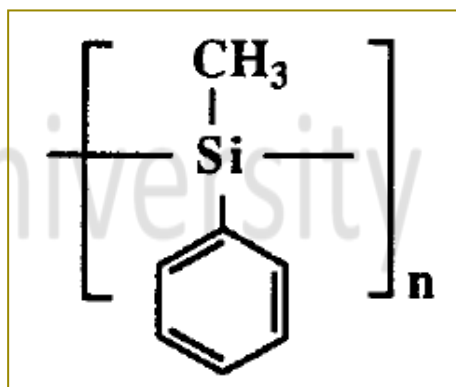
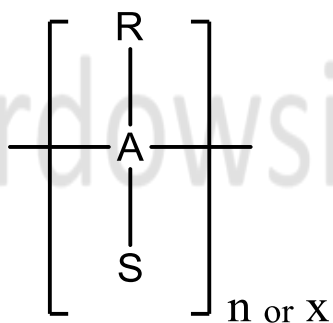
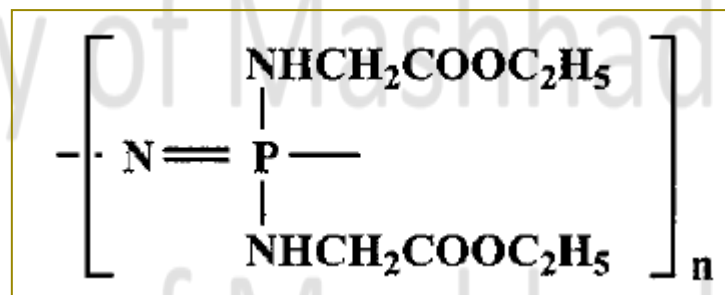
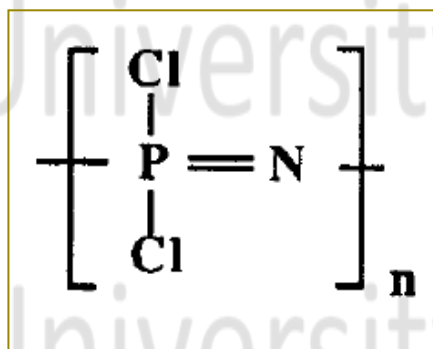
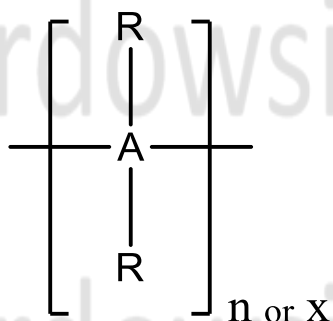
Shared electrons



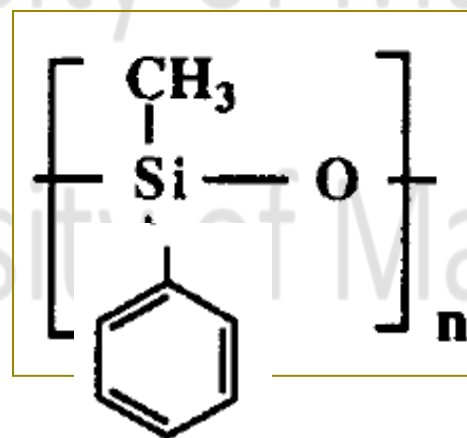
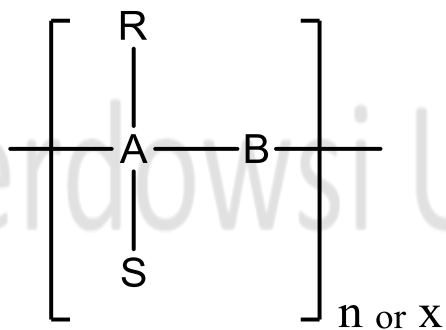
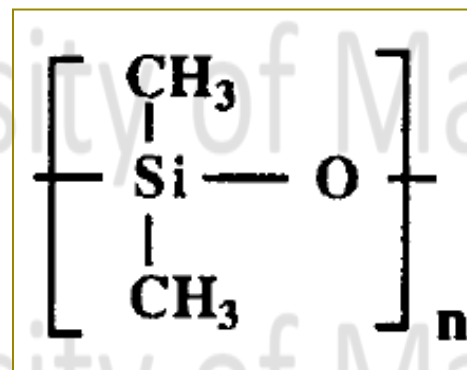
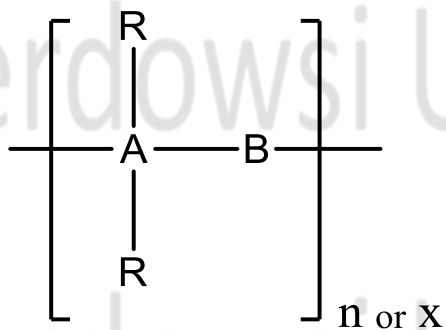
58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr



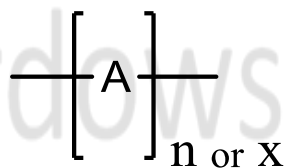
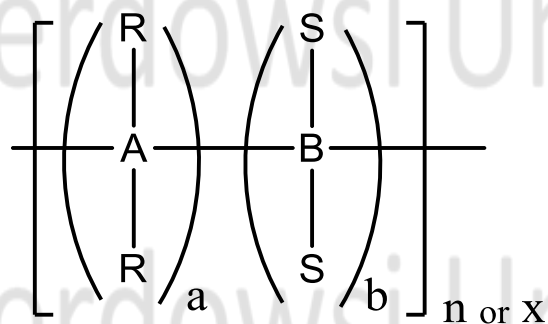
How Polymers Are Depicted



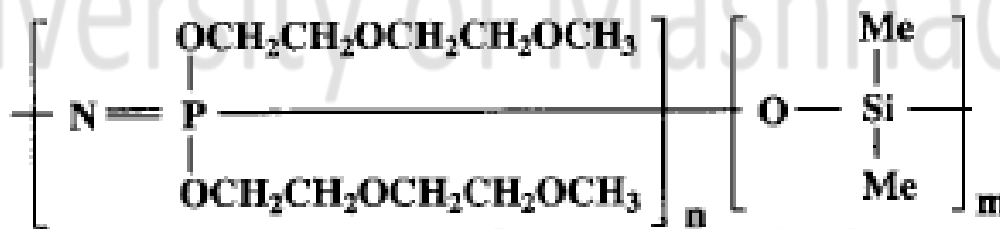
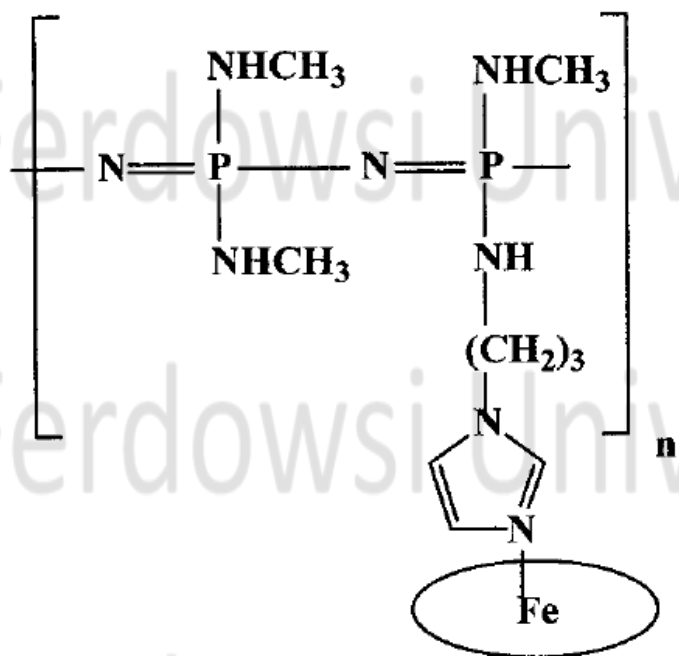
How Polymers Are Depicted



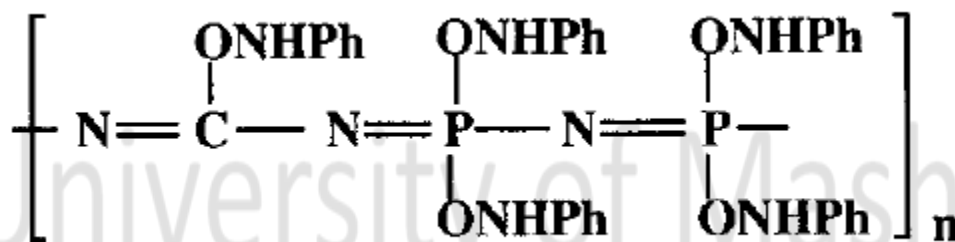
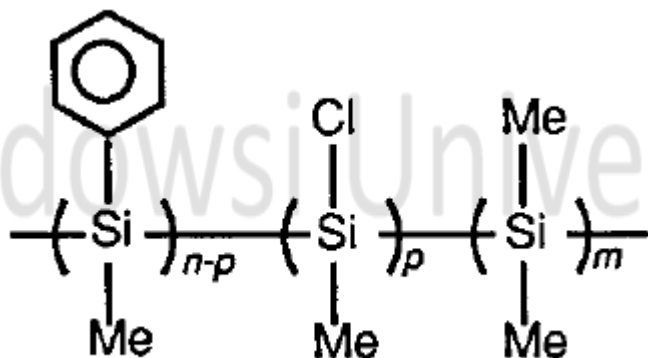
How Polymers Are Depicted



POLYMER CLASSIFICATIONS:



How Polymers Are Depicted



Reasons for Interest in Inorganic Polymers

Most of these polymers are organic materials.

Naturally occurring polymers

- Proteins
- Nucleic acids
- Cellulose
- Rubber

Synthetic polymers

- Nylon
- Dacron
- Lucite

Styrene-butadiene rubber

