What are main types and sources of energy?

Renewable

1. Solar Energy
2. Wind Energy
3. Hydropower
4. Geothermal
5. Biomass

Non-renewable

1. Coal
2. Oil
3. Natural gas
4. Nuclear

Renewable energy-Any natural energy resource that can replace itself quickly and dependably.

Non-renewable energy-Source of energy that will eventually run out. Mostly all the fossil fuels.

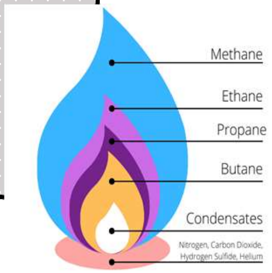
Coal	Charcoal
• Natural Fossil fuel	Produced by slow/controlled burning of carbon woods
• It is a mineral	It is not a mineral
• Industrial energy source	Domestic Energy source
• Causes pollution and lesser hear	Cleaner and more heat
• Calorific value 25-33 kJ/g	Calorific value 35 kJ/g

Main types of non-renewable sources of energy

1. Coal
- Comes from the remains of plants that died hundreds of millions of years ago
- Has the highest level of carbon of all fossil fuels

2. Oil
- Obtained from the plant remains being decomposed for several millions years
- Extracted in crude form, refined to obtain gasoline, diesel, jet fuel, chemicals, etc.

3. Natural Gas
- Formed from the remains of sea plants and animals that died millions of years ago
- Mainly composed of methane




Kudankulam Nuclear Power Plant

4. Nuclear Energy
- Energy released when atoms' nuclei are fused together (fusion) or split apart (fission)
- Nuclear power plants produce electricity through nuclear fission

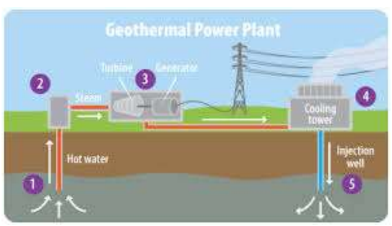
Main types of renewable sources of energy

1. Solar Energy
•The energy obtained directly from sunlight
•This sunlight is converted into electricity, heat and light

2. Wind Energy
•The energy is obtained from blowing air, harnessed using wind turbines
•Utilized extensively to produce electricity even at remote areas

3. Hydropower
•The energy obtained from the force of water
•Hydropower plants on large dam structures generate electricity

Lower Subansiri



4. Geothermal Energy
•This energy is obtained from the heat generated by the Earth
•Primarily to produce electricity and can provide heat and hot water

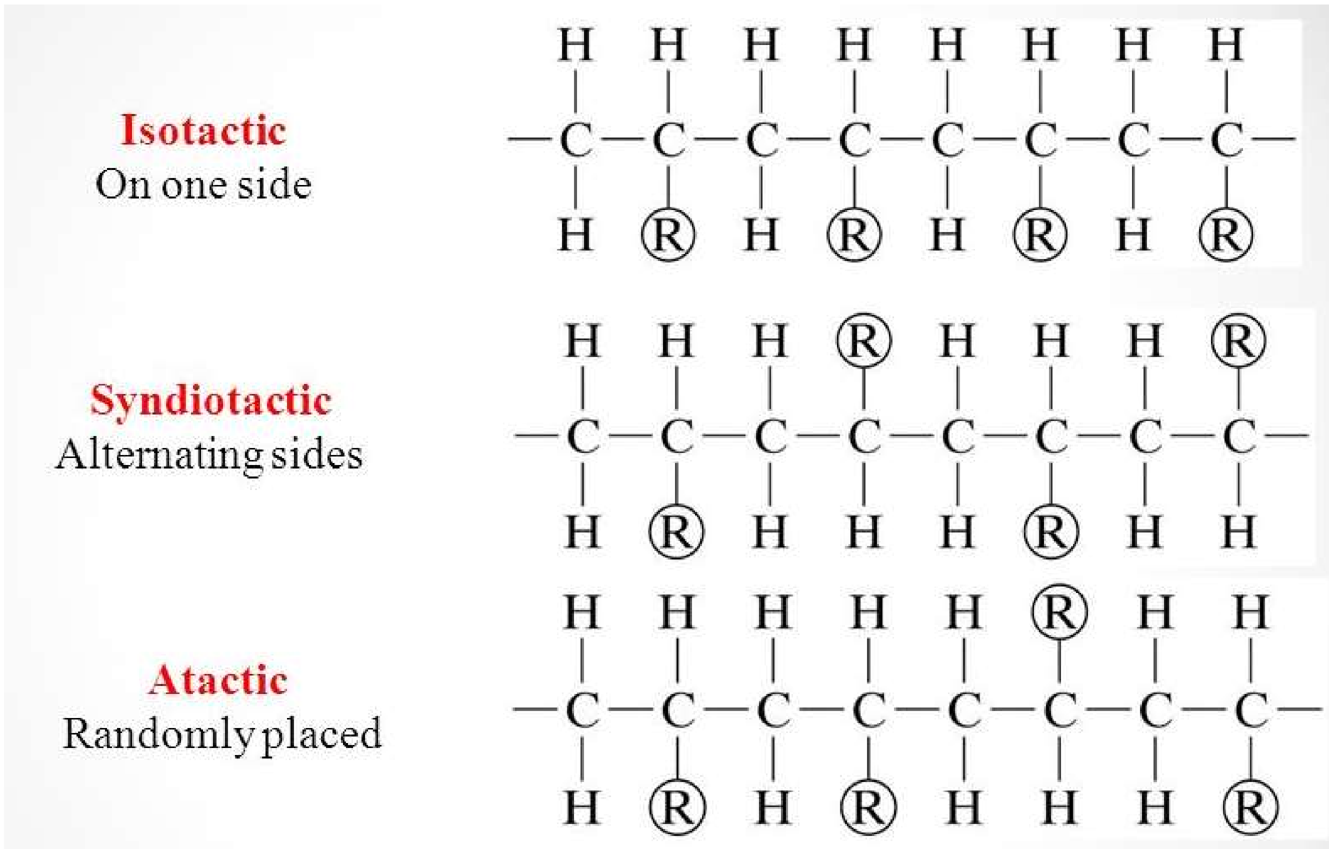
5. Biomass
•This energy is stored in the organic matter of the earth
•Mainly used to generate electricity

Forests, Agriculture, Sewage, Solid waste, Animal residue, Industrial residue

Why Organic Materials ? (Luminescent / Electronics & Devices)

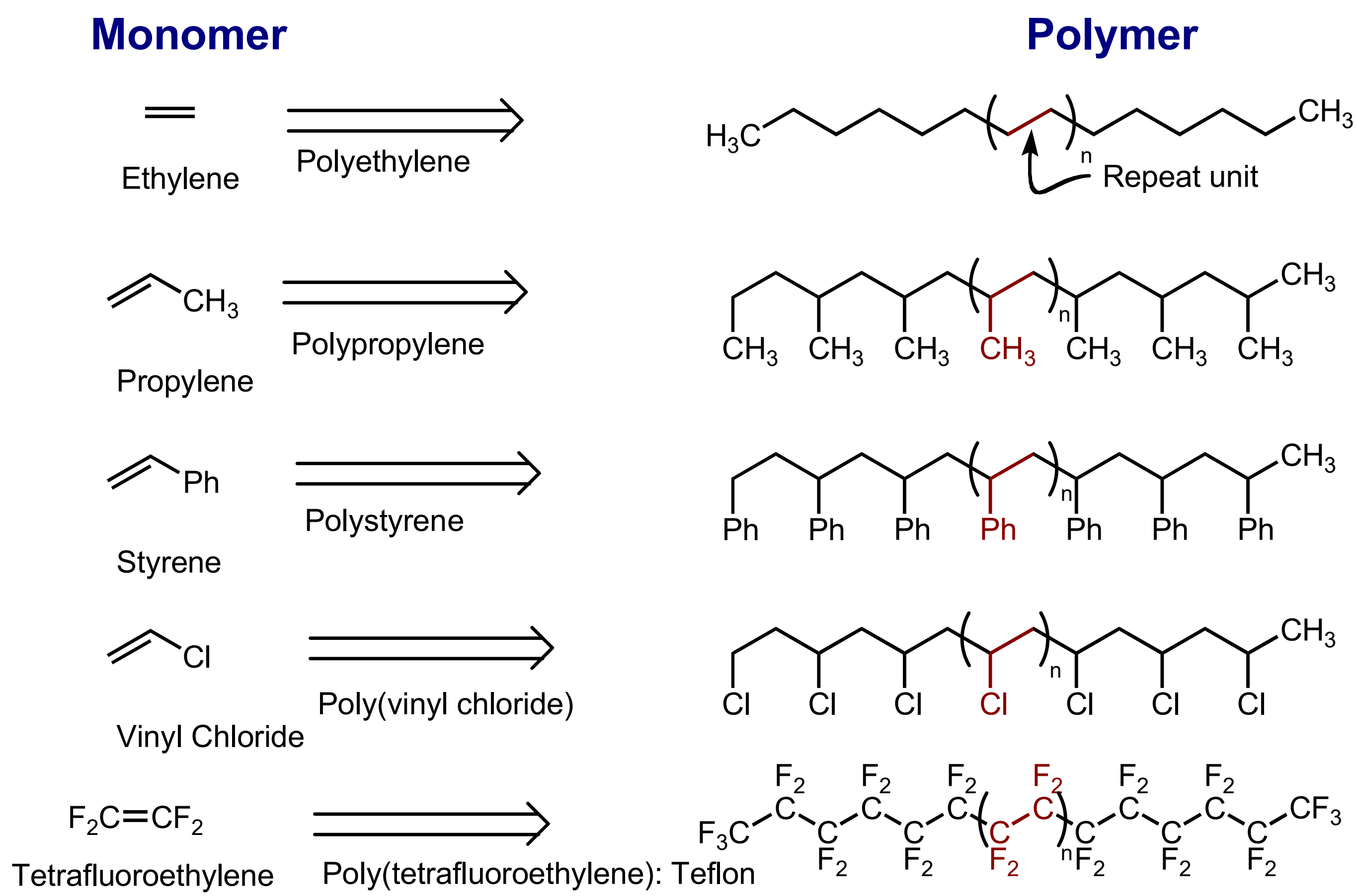
- Can be designed on molecular level leading to well-defined structures
- Thin and light weight devices and displays for portable electronics
- High brightness and low operating voltage (2-6 V) (LEDs)
- High power conversion efficiency and stability (Photovoltaics)
- Easy processability and band-gap tunability
- Fast response and no viewing angle limitation
- High resolution and full colors
- Flexible substrates and all shapes and non-planar displays possible
- Large area flat-panel displays and photovoltaic devices possible
- Biocompatible, implantable, rapid responsive, selective and sensitive
- Economical, reliable, Mass production at desired location

Polypropylene Tacticity

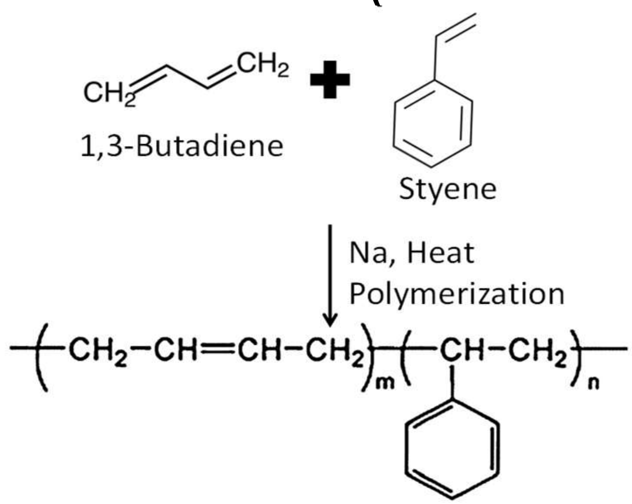


Isotactic and Syndiotactic polypropylene are semi- crystalline and crystalline whereas Atactic polypropylene is amorphous.

Common Polyolefins



BUNA-S Rubber (elastomer)



Styrene-Butadiene Copolymer – SBR or BUNA-S

- **Styrene-butadiene** or **styrene-butadiene rubber** (SBR) describes families of synthetic rubbers derived from styrene and butadiene.
- In Buna-S, **Bu** stands for butadiene, **Na** for sodium and **S** for styrene.
- Random co-polymer formed by the emulsion polymerization of a mixture of 1,3-butadiene and styrene in the presence of peroxide catalyst.
- These materials have good abrasion resistance and good aging stability when protected by additives.

Applications of SBR / Buna-S

- SBR elastomer – manufacture of pneumatic tyres, tubes, shoes / footwear heels and soles, flooring, conveyer belts, escalators, pharma and food industry, automobiles, brake and clutch pads, military tanks, gaskets, molded rubber toys and goods, cable insulation and jackets, surgical and sanitary items, etc.

- Latex (emulsion) SBR is extensively used in coated papers.

- Building construction applications, as a sealing, padding and binding agent, behind renders as an alternative to PVA, roof coating, flooring, earthquake resistant padding, panes of walls, window and doors in modern buildings

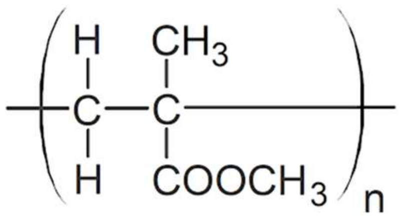
What is an elastomer? Name and describe their applications.

Well known applications of polymers

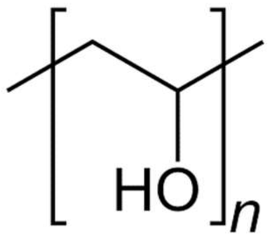
Low density polyethylene-	LDPE-	Grocery bags
High density polyethylene-	HDPE-	Bottles, toys
Polyester-	PE-	Fabric
Poly(ethylene terephthalate)-	PET-	Soft drink bottles
Poly(vinyl chloride)-	PVC-	Pipes, Floor mats
Polypropylene-	PPE-	Furniture
Polystyrene-	PS-	Molded articles
Polytetrafluoroethylene-	PTFE-	Non-stick cookware

Polymers in paints, glue, roofing, transport, construction, banking, pharmaceutical/medical industry, security, space and military.

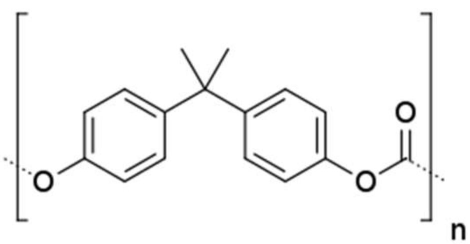
What is a polymer ? Explain well known applications with polymers (consumer products).



Polymethyl methacrylate (PMMA)
Known as acrylic or acrylic glass.
Transparent and rigid thermoplastic material.
Excellent light transmission, high resistance to UV light and weathering.
Used as shatterproof replacement for glass.
Possesses unlimited coloring options, in contact lenses and dielectic materials.



Polyvinyl alcohol (PVA)
Water-soluble synthetic polymer.
Colourless, crystalline polymer with high tensile strength.
Thickener and emulsion stabilizer in PVAc adhesive formulations, pharmaceuticals and in coatings.
Dielectric material, paper & textile manufacture



Polycarbonates
Optically transparent, strong group of synthetic polymer.
Data storage, CD and DVD manufacture, dielectric layer, electronics and mobile industry.
Manufacture of large water bottles in consumer market.
Green house sheet as walls and roofing due to its transparency.

Applications of these polymers will be discussed in the next few slides

THE CHEMISTRY OF SUPERGLUE

Superglue is vital for quick repair jobs, but was actually discovered by accident – twice! It owes its strong adhesive nature to the particular chemicals it's composed of. In this graphic, we take a look at them, and how they react to keep things solidly stuck together.

THE HISTORY OF SUPERGLUE

1942

Cyanoacrylates discovered during WWII search for gun sight plastics. Stick to everything, so discarded.

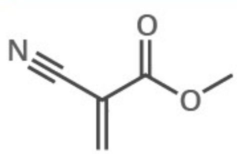
1951

Cyanoacrylates are rediscovered during research looking for polymers for jet canopies.

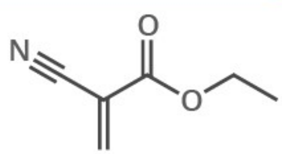
1958

Their potential finally realised, the cyanoacrylates are developed into a glue which eventually becomes available commercially in 1958. Numerous other manufacturers follow suit.

THE CYANOACRYLATES



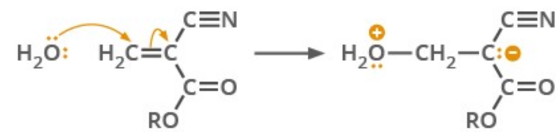
METHYL CYANOACRYLATE



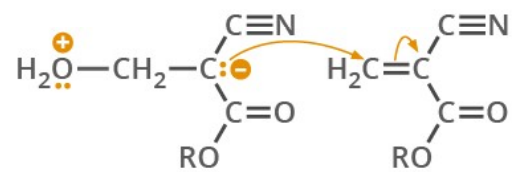
ETHYL CYANOACRYLATE

The most commonly used cyanoacrylate in superglue today is ethyl cyanoacrylate, but others, such as methyl cyanoacrylate, can also be used. Medical grade cyanoacrylates such as 2-octyl cyanoacrylate can be used to close up wounds.

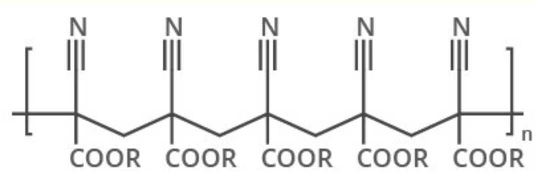
HOW SUPERGLUE WORKS



Cyanoacrylates 'cure' in the presence of water. Only a small amount of water is required to kick off the reaction – even the water vapour in the air is enough.



The reaction produces an anion which can add to more of the original cyanoacrylate, a process that repeats to form the adhesive polymer chains.



EXAMPLE SECTION OF THE CYANOACRYLATE POLYMER STRUCTURE

Properties and Applications of Cyanoacrylates

Properties of Cyanoacrylates:

Has low shearing strength

Temporary adhesive, pieces can easily be sheared off at a later time, e.g. (mounting/pasting a work piece to a sacrificial glue block on a lathe, and tightening pins and bolts).

Effectiveness in bonding metal and general versatility

Popular for preparing modeling and miniatures shapes, (e.g. prototype electronics devices, model aircraft and drones)

Ability to resist water once they are polymerized {Cyanoacrylate adhesive does not functionally bond well with smooth glass}

Specialized applications of Cyanoacrylates:

Longer-chain cyanoacrylates (2-octyl cyanoacrylates) used in healthcare applications in place of stitches to stop bleeding immediately on application since they dry of on skin immediately.

Forensic science for latent finger print development. Exposing fingerprints to ethylcyanoacrylate vapor results in a white polymeric layer forming over the ridges.

Commercial superglue consists of short-chain cyanoacrylates such as methylcyanoacrylate or ethylcyanoacrylate

These short chain acrylates are incompatibile with human tissue but can be used for gluing other substances rapidly.