Illuminate NEBRASKA
POWERED BY NEBRASKA PUBLIC POWER DISTRICT

MATERIALS

PLASTICS

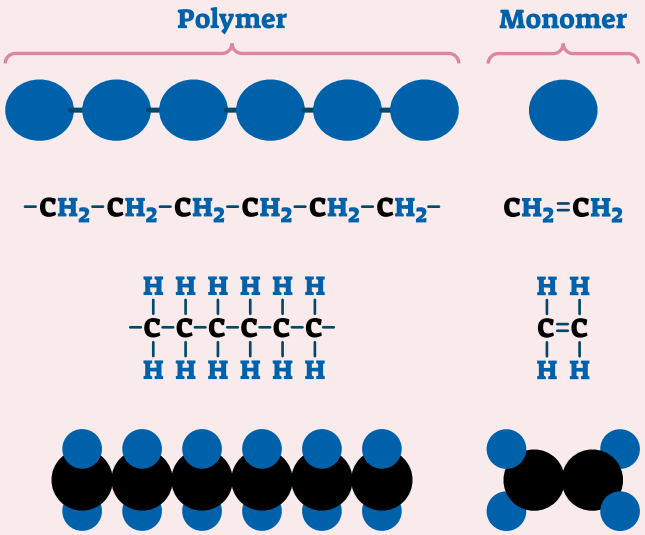
CONCEPT Plastics are a group of materials, either synthetic or naturally occurring, that may be shaped when soft and then hardened to retain the given shape. Plastics are polymers, which are substances made of many repeating units.

TERMINOLOGY

PLASTIC - Any of a series of materials that are easily deformable, or synthetic materials that have been made from polymers that tend to be lightweight, inexpensive and resistant to degradation.

POLYMERS - Large molecules made by bonding a series of building blocks. The word polymer comes from the Greek words for "many parts." Polymers are molecular chains, with monomers representing the links of the chain.

MONOMERS - Each part of a polymer chain is a monomer, which in Greek means "one part." Monomers can be as simple as one or two atoms, or they might be complicated ring-shaped structures containing a dozen or more atoms.



BACKGROUND

At the 1862 London International Exhibition, Alexander Parkes introduced the first manmade plastic. "Parkesine" was marketed as an alternative to ivory and horn that Parkes discovered while trying to develop a synthetic substitute for shellac for waterproofing. Though the product was not a commercial success, Parkesine represented an important first step in the development of manmade plastic.

Plastics are made from oil, which is a carbon-rich raw material. Plastics are molecules called polymers, which are composed of repeating units of shorter carbon-containing compounds called monomers. Chemists combine monomers in different arrangements to produce nearly infinite types of plastics, each containing unique material and chemical properties. Most plastic is chemically inert and will not react chemically with other substances. Because of this, plastics are great for storing alcohol, soap, water, acid or gasoline without dissolving the container itself. Plastic can be molded into an almost infinite variety of shapes, which is why it can be found in toys, cups, bottles, wiring, cars and even some consumables like bubble gum.

EXAMPLES

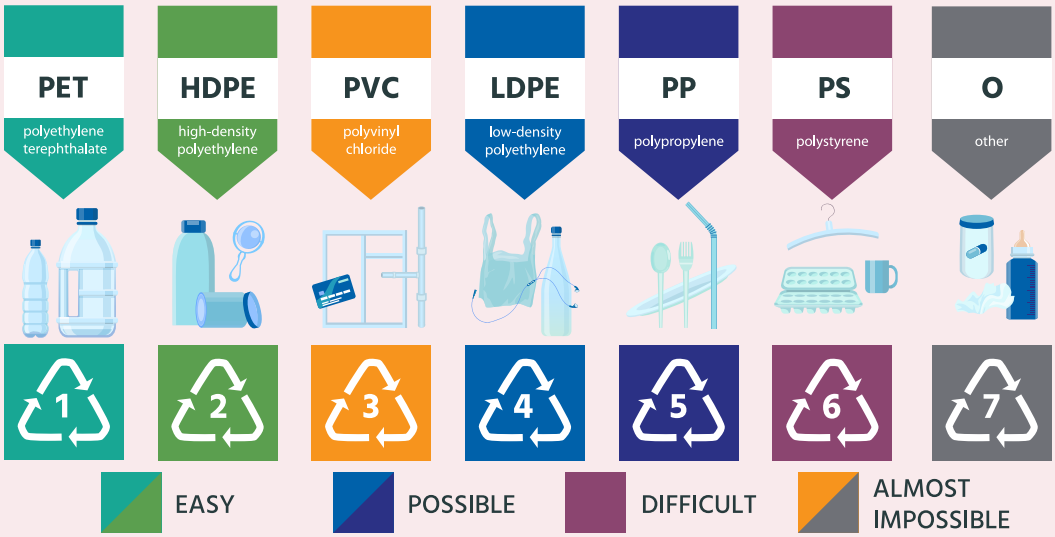
Make sure it measures up

PLASTICS CAN BE DIVIDED INTO TWO MAJOR CATEGORIES:

1. THERMOSET OR THERMOSETTING PLASTICS - once cooled and hardened, retain their shapes and cannot return to their original form. They are hard and durable. Thermosets can be used for auto parts, aircraft parts and tires. Examples include polyurethanes, polyesters, epoxy resins and phenolic resins.

2. THERMOPLASTICS - less rigid than thermosets, thermoplastics can soften upon heating and return to their original form. They are easily molded and extruded into films, fibers and packaging. Examples include polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC).

PLASTIC PROCESSING DIFFICULTIES



REAL WORLD CONNECTIONS

Today, plastic is used across almost every sector, including produce packaging, in building and construction, textiles, consumer products, transportation, electronics, and industrial machinery. It is an endlessly useful material, but because of its widespread use, plastics' durability makes it difficult to recycle or dispose of.

APPLICATION

POLYLACTIC ACID (PLA) - Different than most thermoplastic polymers in that it is derived from renewable resources like corn starch or sugar cane. Most plastics, by contrast, are derived from nonrenewable petroleum reserves. Plastics that are derived from biomass, such as PLA, are known as bioplastics.

POLYLACTIC ACID - Biodegradable and can be produced from already existing manufacturing equipment. This makes it relatively cost efficient to produce. Because of this, PLA has the second largest production volume of any bioplastic.

There are a vast array of applications for Polylactic Acid. Some of the most common uses include plastic films, bottles, and biodegradable medical devices such as screws, pins, rods, and plates that are expected to biodegrade within a year. PLA constricts under heat and is thereby suitable for use as a shrink wrap material. The ease with which Polylactic Acid melts allows for some interesting applications in 3D printing.