

# *Synthetic Polymers* *“Plastics”*

*<https://www.youtube.com/watch?v=PSxihhBzCjk>*

*The Graduate: Dustin Hoffman (1967)*

# *Polymers*



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# *Polymers*

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Macromolecules which are made from small molecules, monomers, or co-monomers which structurally repeat themselves.

## **Monomer**

Ethylene & Propylene

Styrene

Vinyl chloride

## **Co-monomers**

## **Polymer**

Polyethylene & Polypropylene

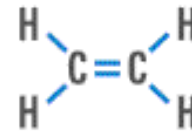
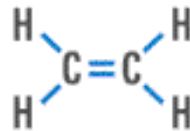
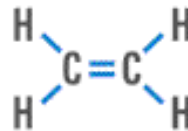
Polystyrene

PVC

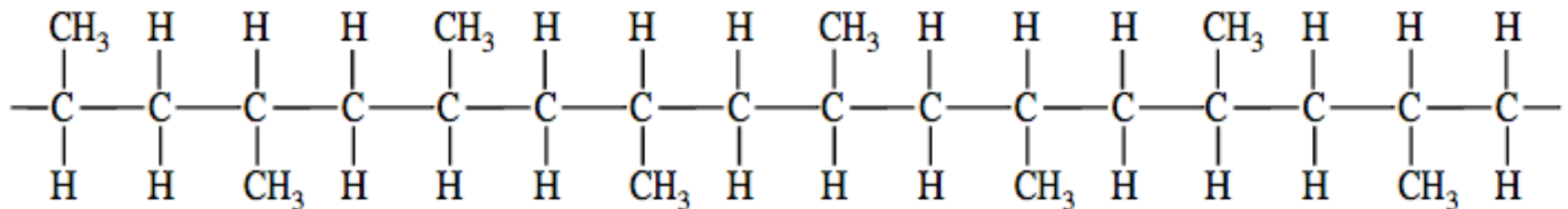
Nylon

(Proteins)

# *Polyethylene & Polypropylene Polymerization Mechanism*



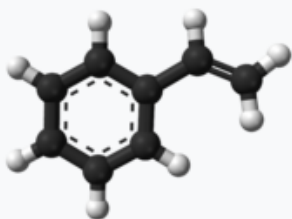
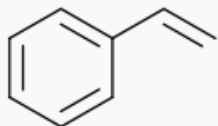
Initiation



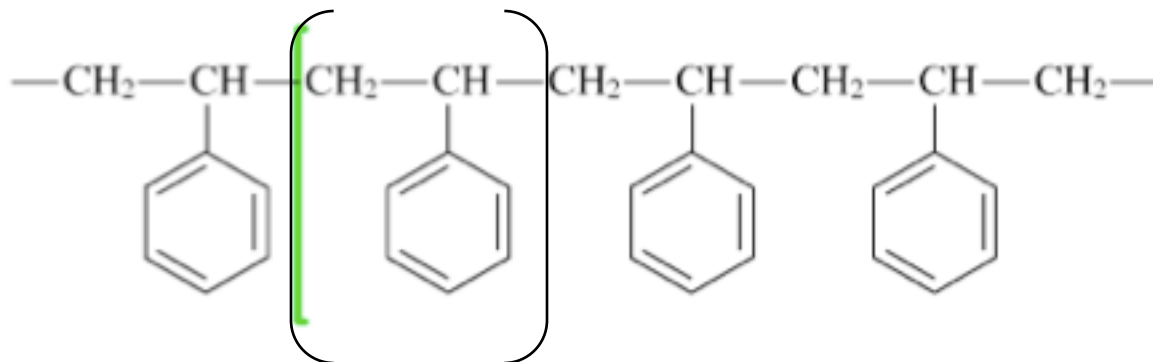


## *Polystyrene & Others*

Styrene



🎯 Addition polymers result from the rapid addition of one molecule at a time to a reactive cation, radical, or anion intermediate at the growing end of the chain. The monomers are usually alkenes. Click on the right-hand edge that defines a single repeat unit of the polymer.



# *Nylon*

A macromolecule which is a poly-amide.

Synthesis of Nylon 610



[https://www.youtube.com/watch?v=\\_6xINyWPpB8](https://www.youtube.com/watch?v=_6xINyWPpB8)

## *Plastic Waste / Recycling*

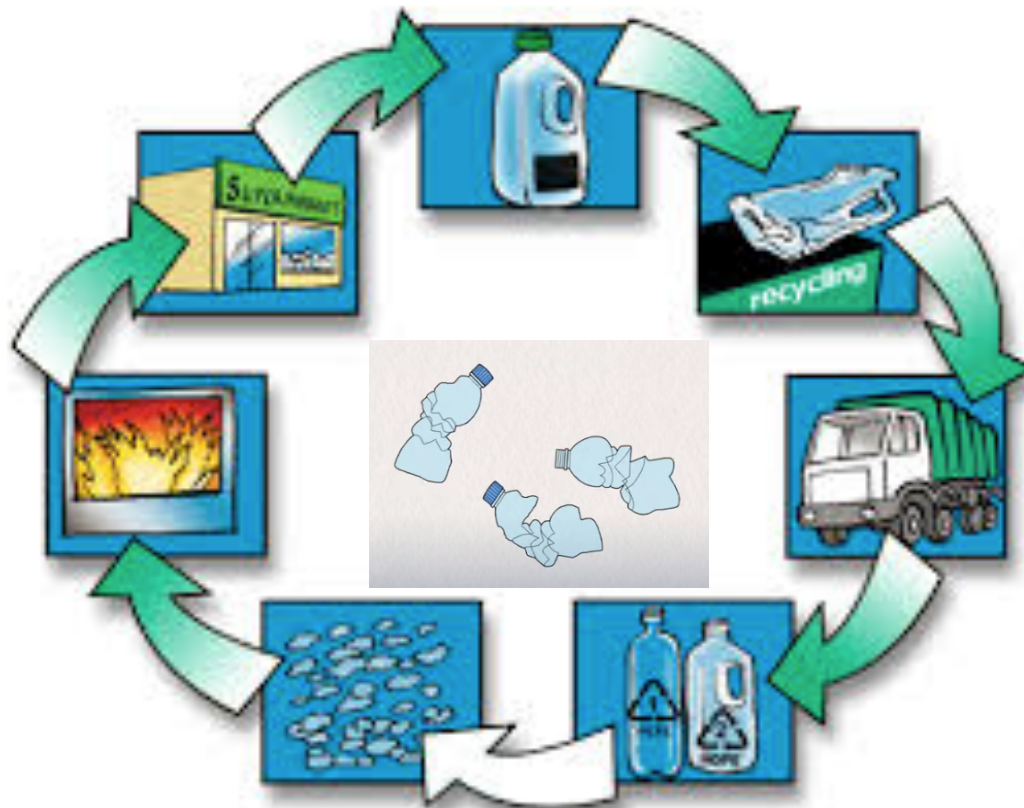


~300 billion pounds produced annually,  
Worldwide ~ 5% is recycled

# Northern California

<https://www.norcalcompactors.net/processes-stages-benefits-plastic-recycling/>

## Stages in Plastic Recycling



1. Sorting
2. Shredding
3. Identification and Classification
4. Extruding

[https://www.youtube.com/watch?v=\\_6xINyWPpB8](https://www.youtube.com/watch?v=_6xINyWPpB8)

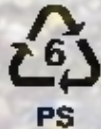
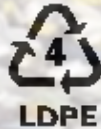
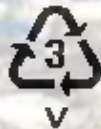




<http://www.lotfi.net/recycle/plastic.html>

### Recycling categories for common plastics

Plastic recycling number	Acronym and name of polymer	Original uses	Recycle uses
1	PET Poly(ethylene terephthalate)	Beverage bottles, food and cleanser bottles	Carpet fibers, fiberfill insulation, nonfood containers
2	HDPE High-density polyethylene	Milk, juice, water bottles, grocery bags (crinkly)	Oil and soap bottles, trash cans, grocery bags, pipes
3	PVC (or V) Polyvinyl chloride	Food and water bottles, food wraps, blister packs, construction materials	Drainage pipes, flooring tile, traffic cones
4	LDPE Low-density polyethylene	Flexible bags for trash, bread, milk, groceries; flexible wraps and containers	Bags for trash, groceries; irrigation pipes; oil bottles
5	PP Polypropylene	Handles, bottle caps, lids, wraps, bottles	Auto parts, fibers, pails, refuse containers
6	PS Polystyrene	Foam cups, packaging; cutlery; furniture; appliances	Insulation, toys, trays, packaging "peanuts"
7	Other	Various	Plastic "timber," posts, fencing, pallets



Other

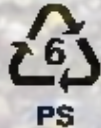
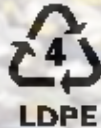
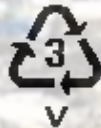


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2	HDPE		
3	V		
4	LDPE		
5	PP		
6	PS		
7	Other	Various	Plastic "timber," posts, fencing, pallets

*ONE MILLION plastic bottles are bought EVERY MINUTE around the world — and that number will top half a TRILLION by 2021. Less than half of those bottles end up getting recycled. 8 MILLION METRIC TONS of plastic winds up in our oceans each year.*



Other

02 / 2:57







<http://www.lotfi.net/recycle/plastic.html>

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Other

<https://www.youtube.com/watch?v=1qT-rOXB6NI>



<https://www.youtube.com/watch?v=1qT-rOXB6NI>





<https://www.youtube.com/watch?v=tG4AYagBz9Q>



*Micro-plastics  
Bellows Beach, Oahu, Hawaii*

<https://www.sciencemag.org/news/2019/03/dead-whale-found-40-kilograms-plastic-its-guts>



D'BONE COLLECTOR MUSEUM

## Dead whale found with 40 kilograms of plastic in its guts

By **Alex Fox** | Mar. 18, 2019 , 4:15 PM

Name: \_\_\_\_\_

### Organic Functional Group Sudoku Puzzle

adapted from

Crute, Thomas D.; Myers, Stephanie A., *J. Chem. Educ.* 2007, **84**, 612

The precursor of the sudoku puzzle was first published in the United States in 1979 by Howard Gams, a retired architect and freelance puzzle constructor. In April 1984, the puzzle was introduced in Japan and the name "sudoku" was assigned to the puzzle. "Suzi wa dokushin ni kagiri" may be translated as "the numbers must be single" or "the numbers must occur only once". Later the name was abbreviated to sudoku (pronounced SUE-dough-see) "su" means numbers, "doku" means single). In April 2005, *The New York Times* published sudoku puzzles as a regular feature and by July 2005, the puzzle surged in popularity all over the country (1, 2).

The following Sudoku puzzle deals with the names and generic structures of organic functional groups found in organic molecules. They do not deal directly with numbers as

	R-COOH					R-CONH <sub>2</sub>	R-NH <sub>2</sub>	R-CO-R'
R-NH <sub>2</sub>	R-Cl	R-CO-R'	R-OH			R-O-R'		
R-O-R'					R-COO-R'		R-Cl	R-OH
R-CO-R'								
R-COO-R'	R-OH		R-O-R'	R-NH <sub>2</sub>	R-CO-R'		R-COOH	R-CONH <sub>2</sub>
								R-O-R'
R-CONH <sub>2</sub>	R-CO-R'		R-COOH					R-Cl
		R-NH <sub>2</sub>			R-Cl	R-OH	R-CONH <sub>2</sub>	R-COO-R'
R-Cl	R-COO-R'	R-CHO					R-O-R'	

*Poly-*

*ester*

*urethane*

*ethylene*

*propylene*

*styrene*

*vinyl chloride*

*vinyl alcohol*

*amide (Kevlar)*

*terephthalate*

*acrylonitrile*

*imide*

*phenylene-*

*bisoxazole*