



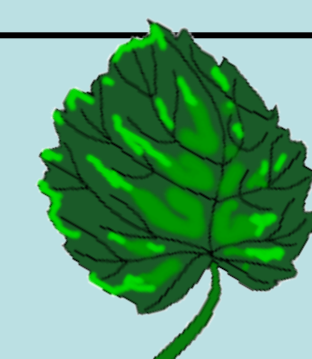
Green Chemistry: Catalysis

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Organic Chemistry 236
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What is Green Chemistry?

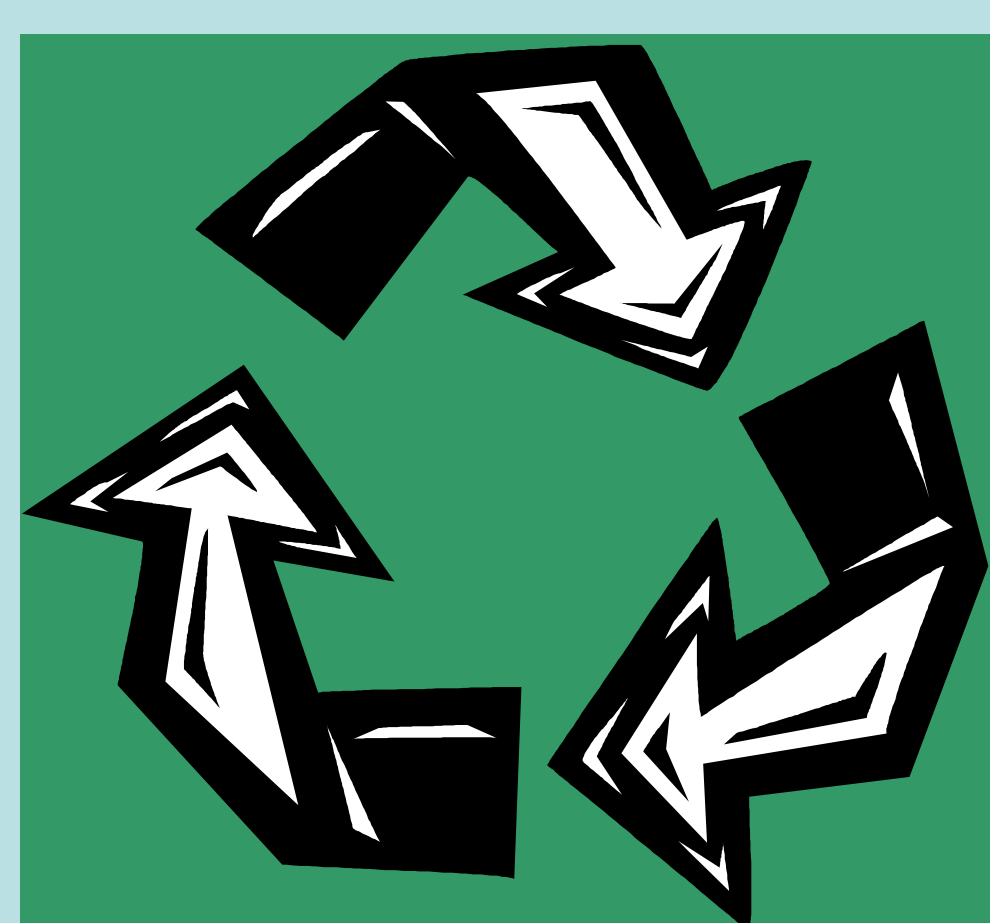


Green chemistry, also known as sustainable chemistry, is the use of chemistry for pollution prevention. More specifically, green chemistry is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances.

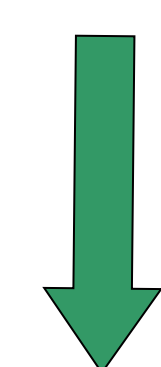
Green Chemistry can be applied to almost every aspect of our lives. Products which have benefited from Green Chemistry research include but are not limited to medications, diapers, food processing and packaging, plastics, printing, textiles, photography, electronics, pesticides, paints, paper recycling, furniture and automobiles.

Catalytic agents. Use catalytic agents (small amounts required, reusable) rather than stoichiometric reagents (larger amounts required, non-reusable). **Catalysis** Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

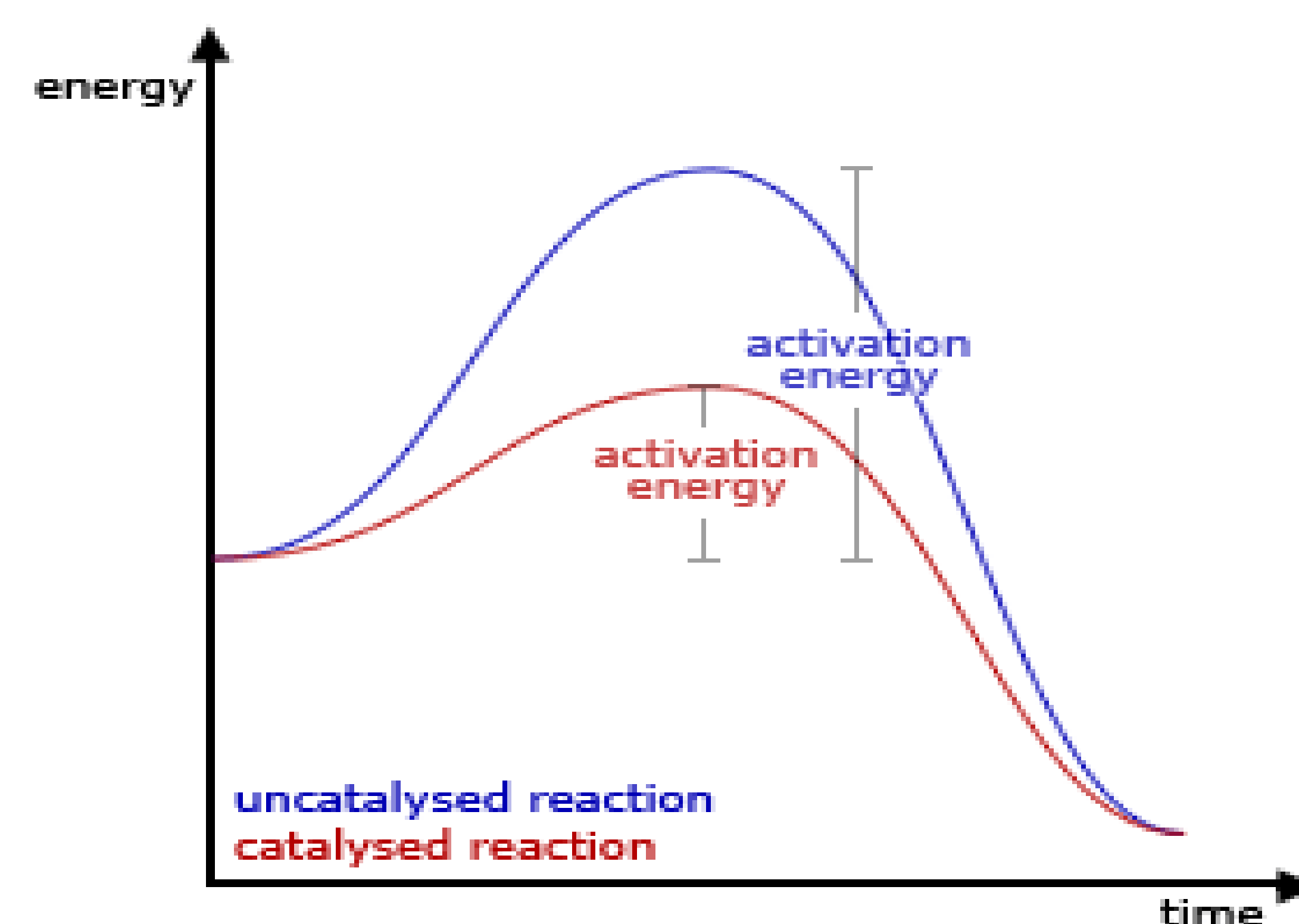
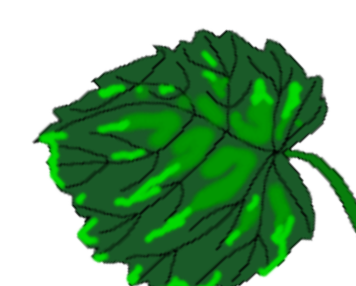
Scientists are currently working to come up with synthesizing pathways similar to those that the body uses in order to keep toxins out of the environment. Enzyme like catalysis play an important role in green chemistry



What Is Catalysis?

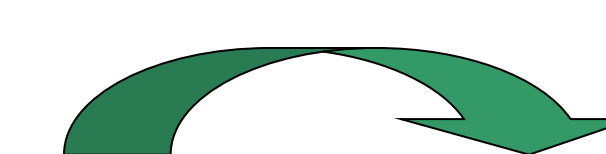


- In chemistry and biology, catalysis is the acceleration (increase in rate) of a chemical reaction by means of a substance, called a catalyst, that is itself not consumed by the overall reaction.
- A catalyst decreases the activation energy of a chemical reaction. Catalysts participate in reactions but are neither reactants nor products of the reaction they catalyze. More generally, one may at times call anything that accelerates a reaction, without itself being consumed or changed, a "catalyst"

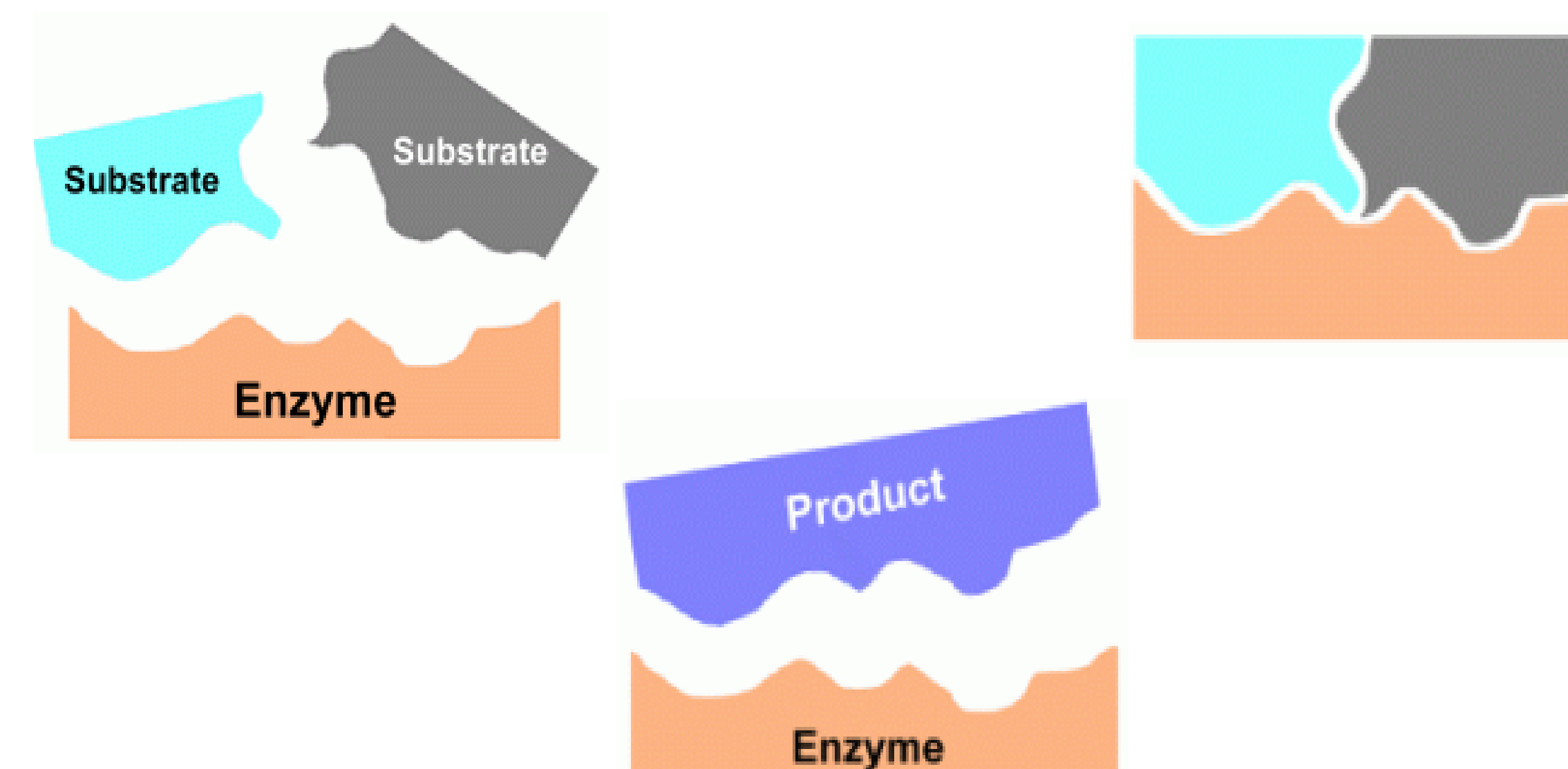


What Is An Example Of A Catalyst?

Enzymes

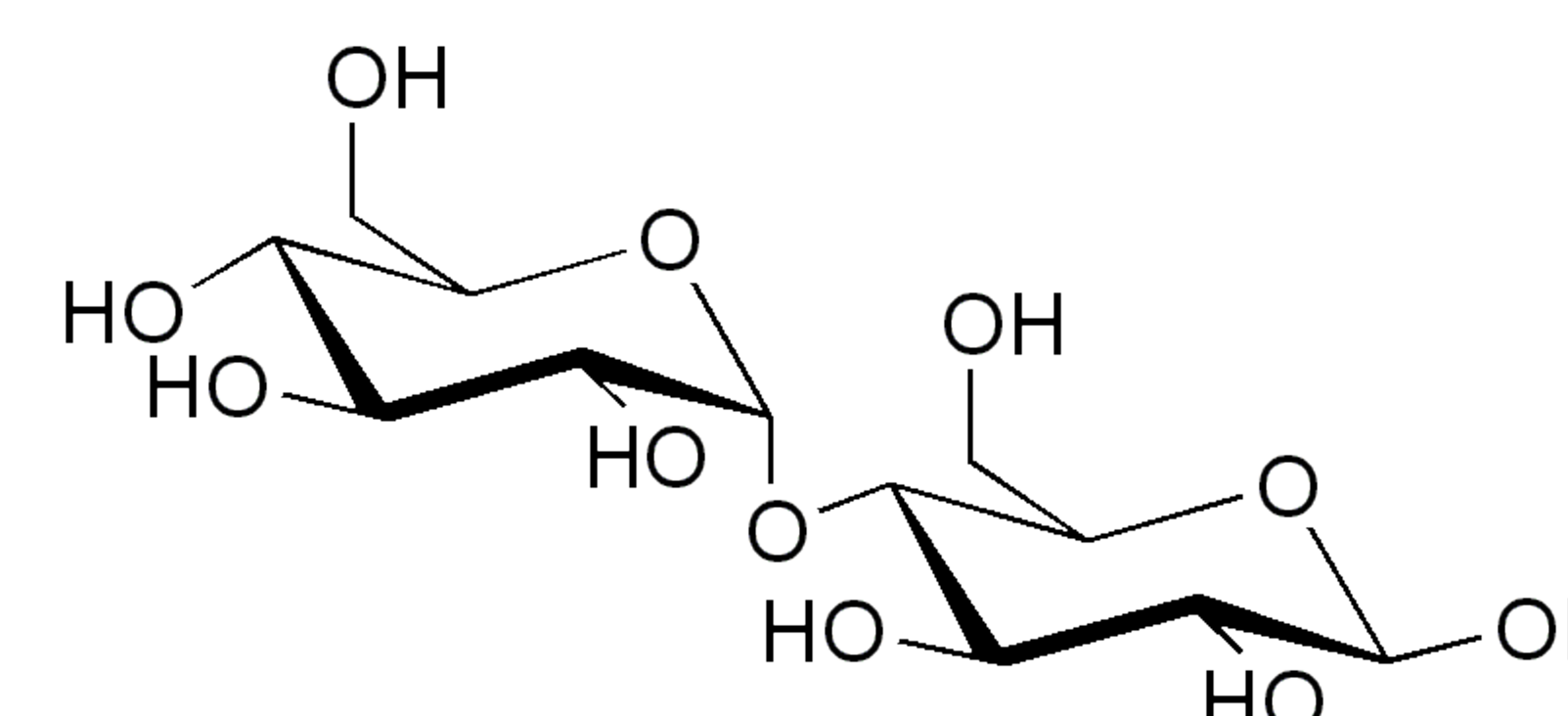


- Enzymes are proteins that act as a catalyst for chemical reactions. Almost all processes in a cell need enzymes in order to occur at significant rates. Since enzymes are extremely selective for their substrates and speed up only a few reactions from among many possibilities, the set of enzymes made in a cell determines which metabolic pathways occur in that cell.
- Like all catalysts, enzymes work by lowering the activation energy for a reaction, thus significantly accelerating the rate of the reaction. Most enzyme reaction rates are millions of times faster than those of comparable uncatalyzed reactions. As with all catalysts, enzymes are not consumed by the reactions they catalyze, nor do they alter the equilibrium of these reactions. However, enzymes do differ from most other catalysts by being much more specific. Enzymes are known to catalyze about 4,000 biochemical reactions.
- Ideal Catalysts are those that act as enzymes, so they are non-toxic, safe, selective, regenerated, and basically do their job without producing waste byproducts.



Example: Salivary Amylase

Amylase is found in saliva and breaks starch down into maltose and dextrin, which can be used by your body for energy



What Does Catalysis Do For The Environment?



Example: Professor Galen Suppes, recipient of a 2006 Presidential Green Chemistry Challenge award, has developed a new method for converting glycerin, a co-product of biodiesel production, to propylene glycol, a nontoxic chemical which can be used in antifreeze. The new system uses a catalyst which reduces the temperature and pressure required for the reaction and produces fewer byproducts than alternative methods.

Green Peroxide Catalyst: could help clean up the world!

- An innovative, environmentally friendly catalyst has the potential to clean up water polluted at textile, pulp and paper mills, remove sulfur from petroleum, more effectively kill anthrax, break down toxic agricultural pesticides.
- It's called Fe-TAML, for Iron-Tetra Amido Macrocyclic Ligand. Fe-TAML is a chemical catalyst that causes hydrogen peroxide, a potent bleach, to work faster and more safely.
- Catalysts are substances that alter the rate of chemical reactions. Chemist Terry Collins set out to create a chemical catalyst that could do all the things today's industrial catalysts do, but in a non-toxic way. "This is a pretty big deal if this can come in at a cost that's competitive," says Dennis Hjeresen, director of the American Chemical Society's Green Chemistry Institute.

