SCH 4U

POLYMER EQUATIONS

Polymers are made of monomers

- Same kind of repeating unit
- 2 or more kinds of molecules combined
- 2 monomers together = dimer
- 3 monomers together = trimer

Eg. Plastics (synthetic)

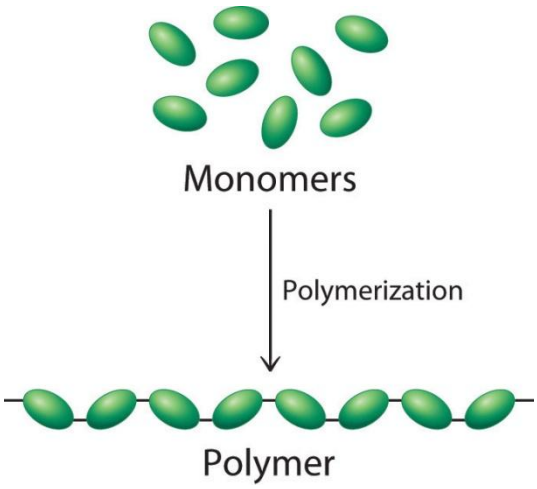
- Such as polyethene (or polyethylene) -- polymer
- Made of ethene -- $CH_2=CH_2$ (monomer)

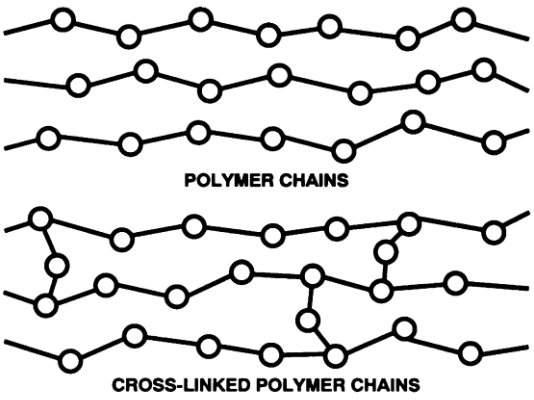
Eg. Starch (natural)

- Made of glucose

-- some polymers can be made into fibers.

Natural	Synthetic
cotton wool linen	rayon nylon polyester

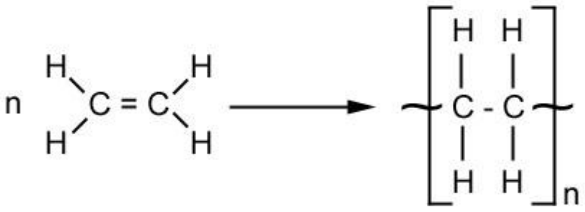




SYNTHETIC POLYMERS

① ADDITION -- double bonds are broken to form polymers with single bonds

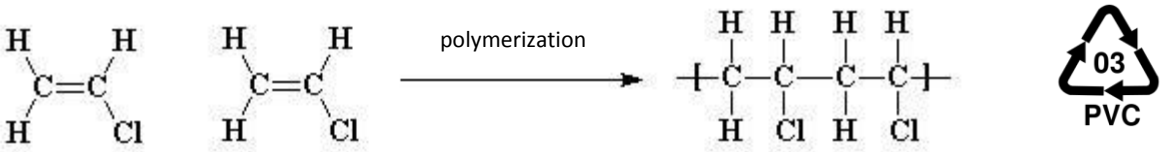
Eg. 2 monomers (molecules) of ethene ⟶ Dimer of ethene



Polymer of ethene

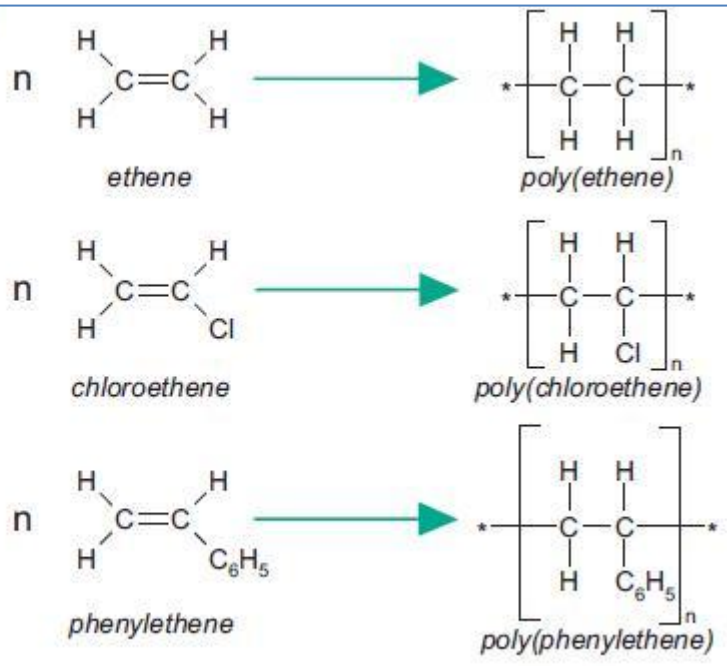
Many ethene molecules — polyethene (or polyethylene) (PE)

Eg.



Many chloroethene molecules (or vinyl chloride) — polyvinylchloride (PVC)

- Notice that the principle is the same for each addition polymerisation.
- Each of the polymer structures shows the *repeat unit* in brackets. This is repeated thousands of times in each polymer molecule.
- It is important to show the repeat unit with 'side-links' to indicate that both sides are attached also to other repeat units.

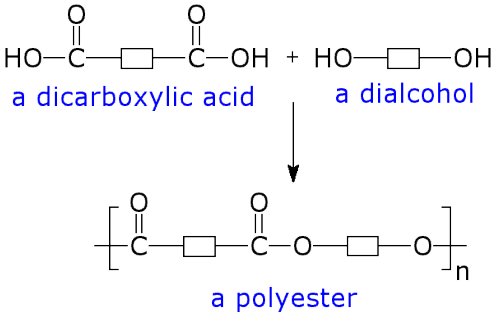


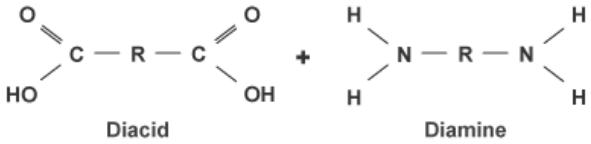
② **CONDENSATION** -- monomers join together to form ester or amide bond

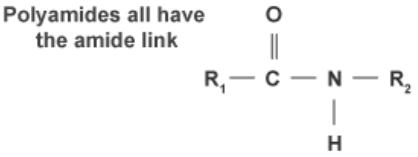
Eg. nylon, dacron (in carpetting)

Condensation polymers...

- with amide bonds -- nylons, polyamides
- with ester bonds -- polyesters -- diacids with dialcohols.

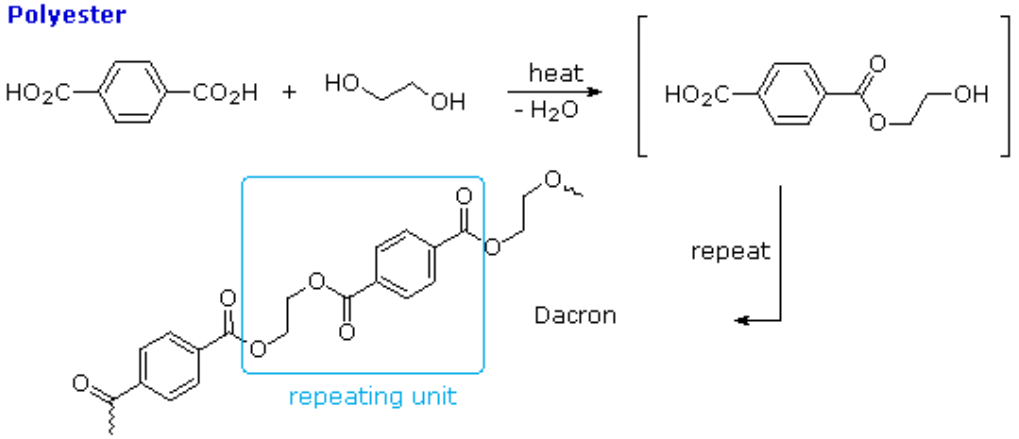




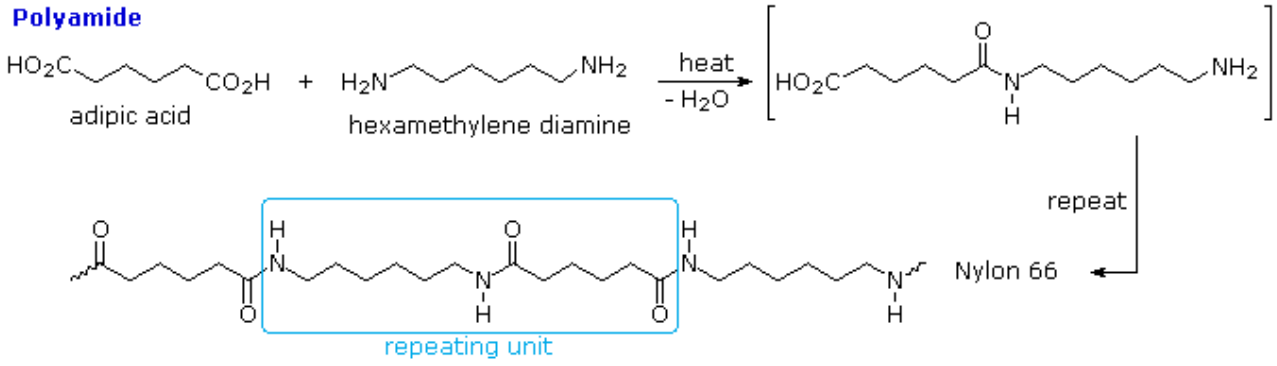


Examples of Condensation Polymers

Polyester



Polyamide



NATURAL POLYMERS

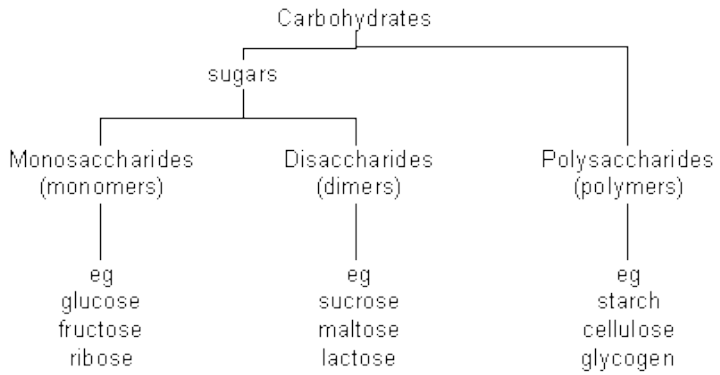
Basics of Biomolecules

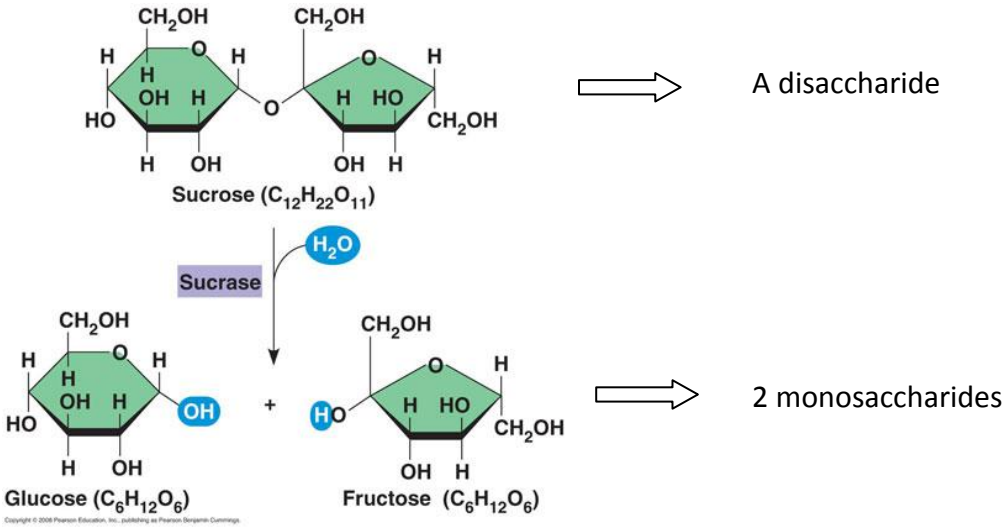
1. **Carbon is the central atom**
2. **Carbon will bond covalently because of 4 valence electrons**
3. **Carbon likes to share electrons with sulfur, phosphorous, oxygen, nitrogen, other carbons, and hydrogen**
4. **SPONCH**
5. **All four are macromolecules (BIG molecules)**
6. **Polymers- large unit of the macromolecule (made of many monomers)**
   Monomers- small pieces of the polymer (building blocks)

Biomolecule	Elements/Chemical Formula	Function	Monomer/Polymer	Examples	Other
Carbohydrates	Carbon, Hydrogen, Oxygen $C_6H_{12}O_6$ = glucose 1:2:1 Ratio	*main source of energy	Monomer = sugar or monosaccharide Polymer = polysaccharide Starch in plants; Glycogen in animals	Glucose, fructose, Ex. of foods: Sugar, starch (potatoes, pasta, etc.)	Sugars end in –ose
Proteins	Carbon, Hydrogen, Oxygen and <u>*Nitrogen*</u> Has a –COOH and $-NH_2$ and R group	*control rate of chemical reactions *regulate cell processes (enzymes and hormones) *Bones and muscles *transport things in and out of cells	Monomer = amino acids Polymer = protein/polypeptide chain	Ex. of foods: Meat, poultry, eggs, beans, soy, nuts, peanut butter, enzymes	*one of the most important biomolecules *enzymes usually end in ***-ase***
Nucleic Acids	Carbon, Hydrogen, Oxygen, Nitrogen and <u>*Phosphorus*</u>	*stores and transmits genetic information	Monomer = nucleotide (sugar, phosphate group and nitrogenous base Polymer = nucleic acid	DNA = deoxyribonucleic acid RNA = ribonucleic acid	
Lipids	Contains primarily Carbon and Hydrogen Has a –COOH group	*stores energy and *make up biological membranes *waterproof coverings	<u>*No True Monomer or Polymer*</u> Usually contains glycerol and fatty acid chains	Fats, oils, waxes, and biological membranes Ex. Cholesterol	. *DOES NOT DISSOLVE IN WATER

① CARBOHYDRATES

- 2 or more <u>aldehyde</u> or <u>ketone</u> groups
- Polysaccharides made of monosaccharides and disaccharides.
- Cellular respiration -- carbohydrates combine with inhaled oxygen to produce carbon dioxide, water and energy.



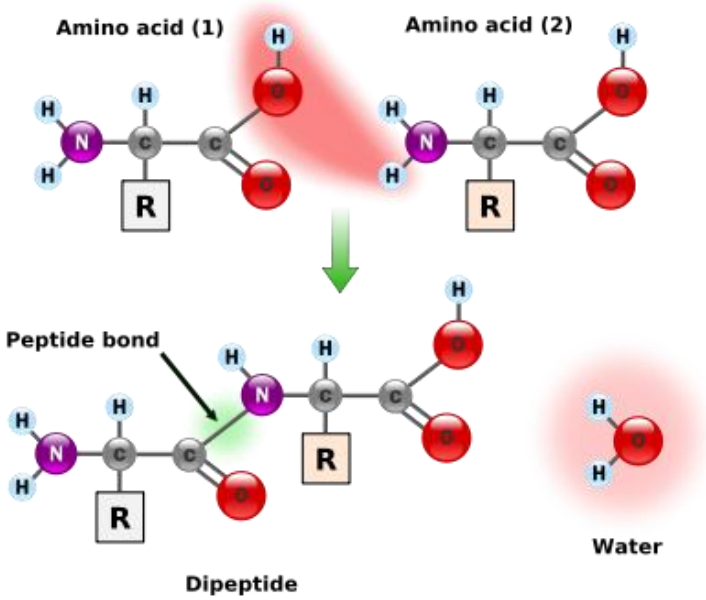


A disaccharide

2 monosaccharides

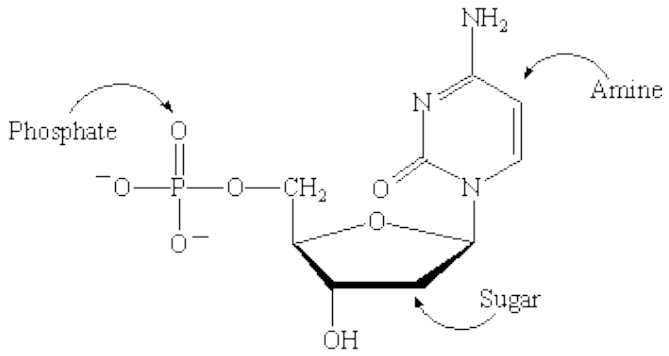
② PROTEINS

- Polymers made of amino acids (20)
- Sequence of amino acids determine the shape and biological function of the protein.



③ NUCLEIC ACIDS

- Made of nucleotide monomers
- Form polymers of DNA (determine shape and structure of organisms in nuclei of cells) and RNA (works with DNA to produce proteins in body).



④ LIPIDS

- oily substances, not soluble in water, soluble in hydrocarbon solvents.
- Triglycerides -- fats, oils
- Long-term storage of energy -- converts carbs to fat if storage is too long.
- 3-carbon glycerol + 3 fatty acid chains
- Form macromolecules, not polymers
- Waxes = esters of long chain alcohols and long chain carboxylic acids.