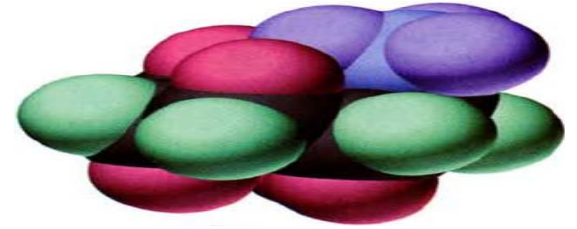


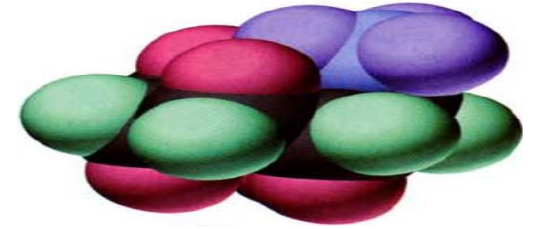
CELLULOSE



By
Kisar Bittar

CE 435
Dr. Alexandridis

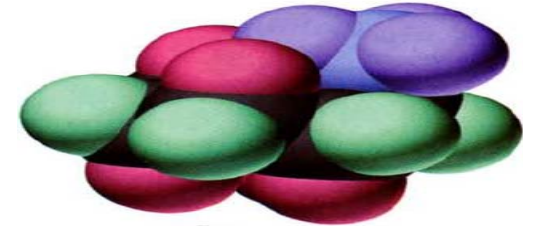
CELLULOSE



Outline:

- Introduction
- The Structure of Cellulose
- Polymerization
- Cellulose and Industries
- Summary

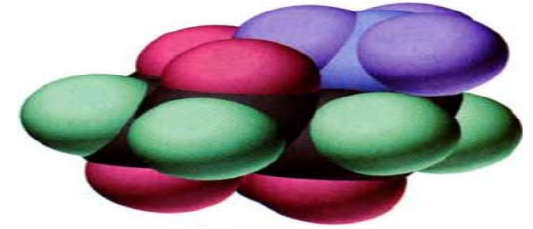
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■ Introduction:

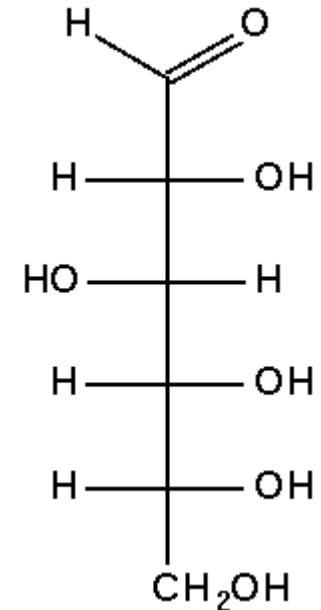
- Carbohydrates are chemical compounds that consist of carbons, hydrogen and oxygen atoms, giving the general formula $C_m(H_2O)_n$
- Carbohydrates are classified by the by the number of sugar units into monosaccharide, disaccharide, and polysaccharides
- Plants synthesize carbohydrates through photosynthesis
- $6CO_2 + H_2O \rightarrow 6O_2 + C_6H_{12}O_6$ (glucose) \rightarrow starch, cellulose + H_2O
- Animals can store energy by forming glycogen

CELLULOSE

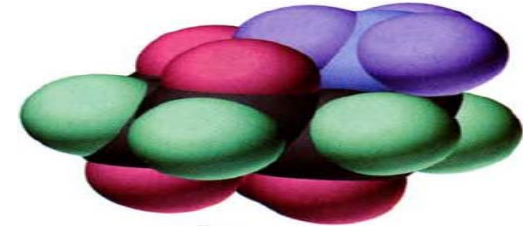


■ Introduction: (con't)

- Cellulose is a complex carbohydrate, or polysaccharide consisting of 3,000 or more glucose units
- Cellulose + H₃O⁺ + heat → over 1000 glucose molecules
- The most abundant organic compounds on earth
- The basic structural component of plants cell walls
 - 33% vegetable
 - 90% cotton
 - 50% wood

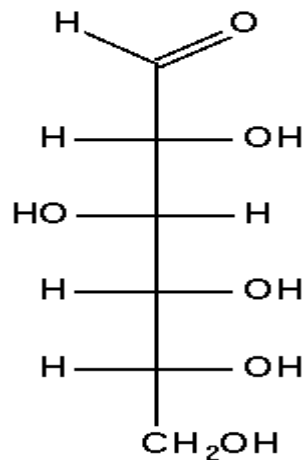


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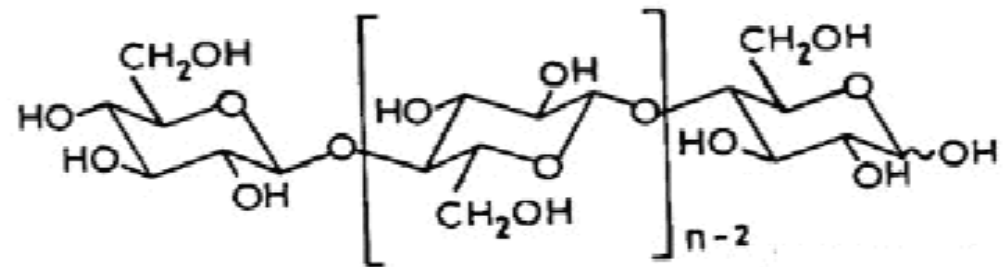
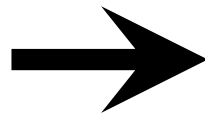


■ Structure of Cellulose:

- The Cellulose is composed D-glucose unite linked by β -1, 4 glycoside bonds
- Cellulose is poly(1,4- β -D-glucopyranoside)

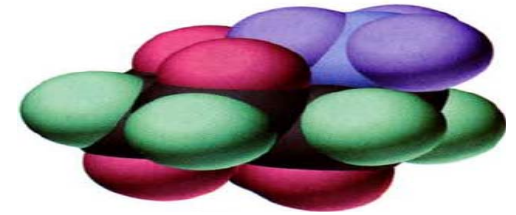


D- glucose



Cellulose

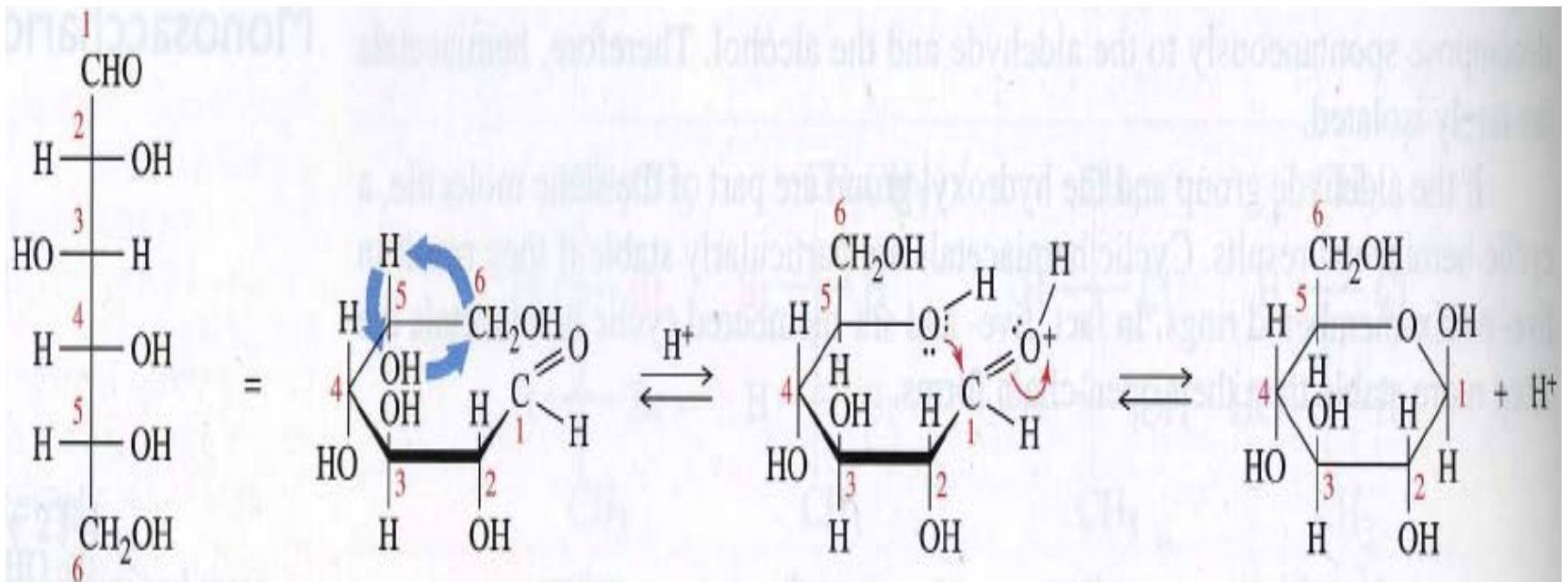
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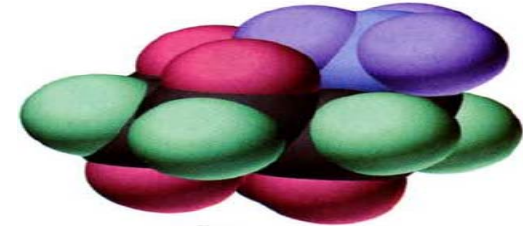
■ Polymerization:

1. Drawing Cyclic Monosaccharides:

The repeating unit in cellulose is actually made up of two glucose units with each glucose unit in the linear chain being “turned over”.

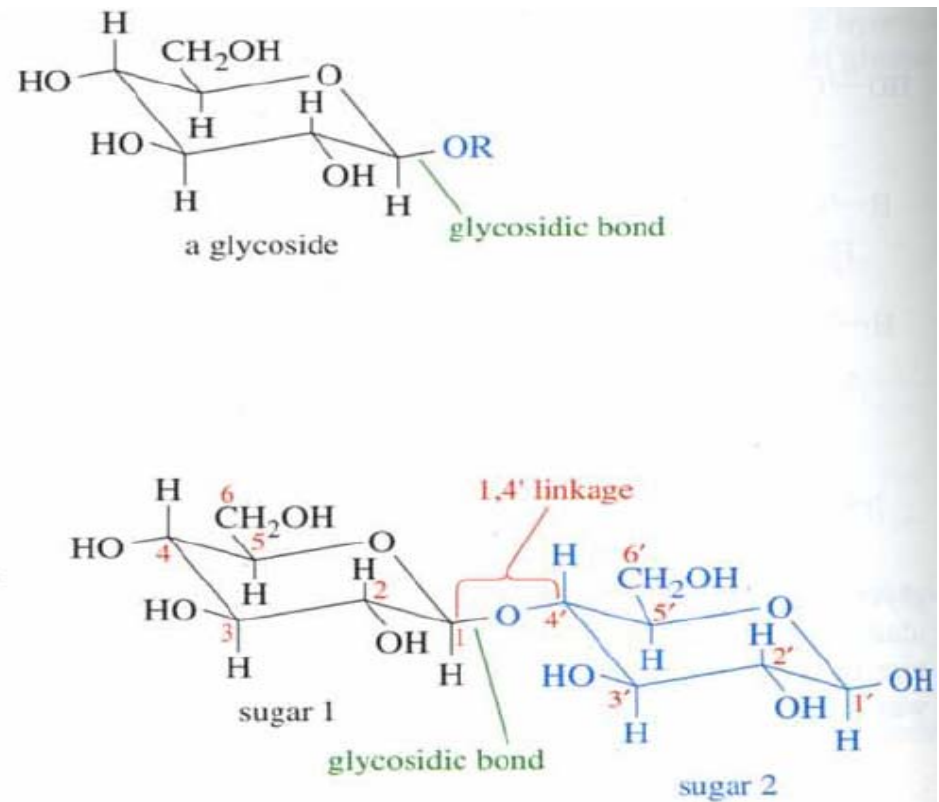
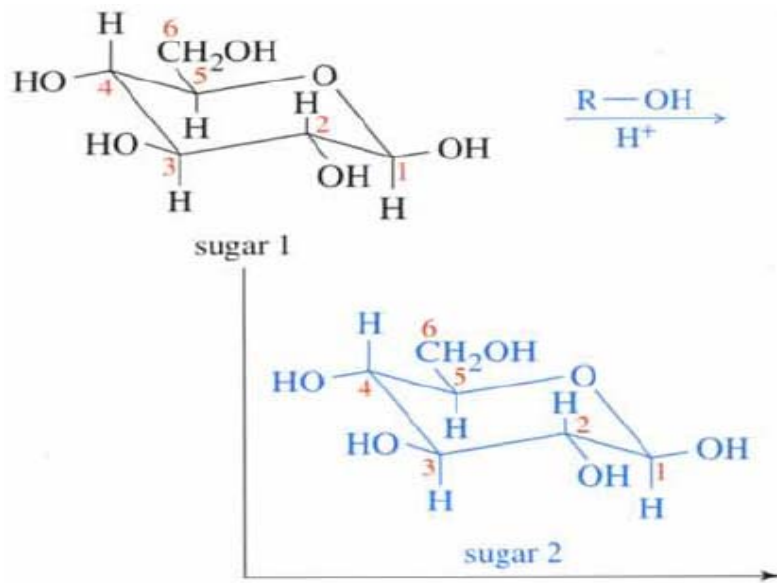


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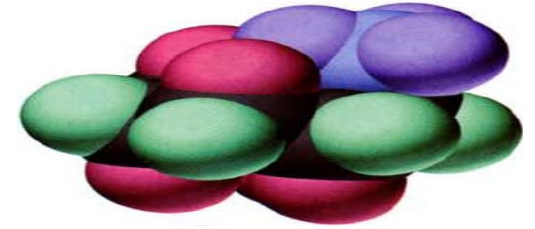


■ Polymerization: (con't)

2. Anionic Polymerization:

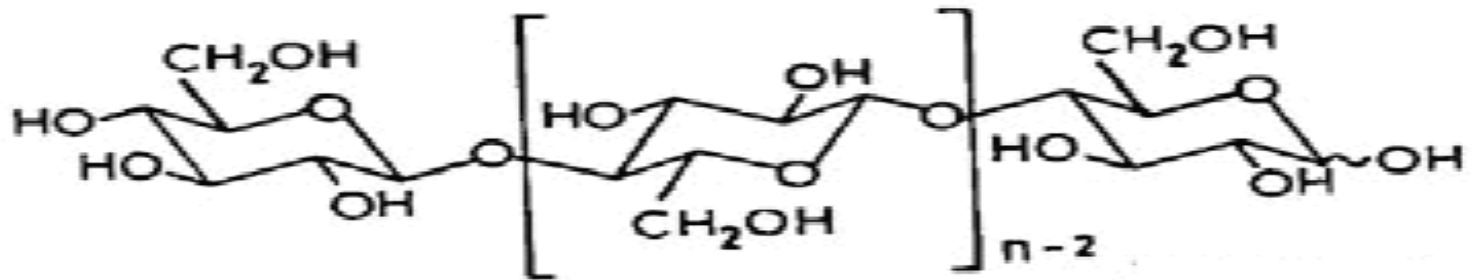


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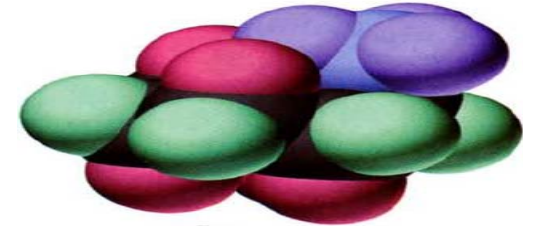


■ Polymerization: (con't)

2. Anionic Polymerization:
1,4- β -D-glucopyranoside



CELLULOSE



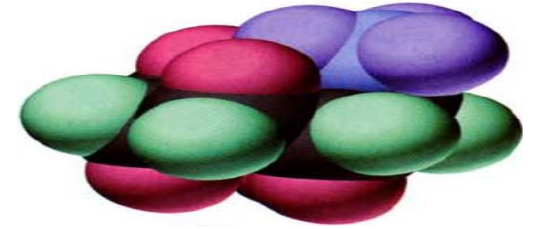
Cellulose and Industries:

1. Cotton:

- Cotton is composed of 87 -90% cellulose with the cotton fibers containing polymer chains in both amorphous and crystalline forms
- It is stiff and has a high tensile strength
- Absorbs water without feeling wet
- Absorbs heat
- Clothes, dyes, building materials, and papers



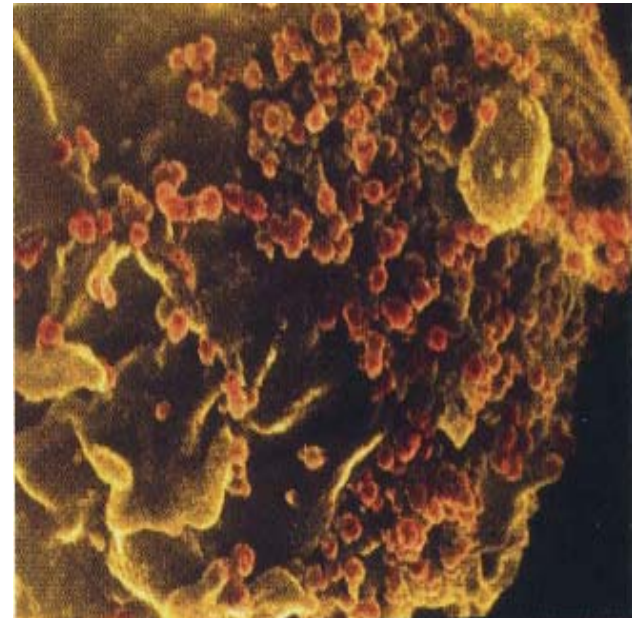
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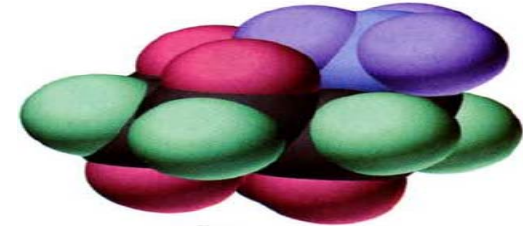
Cellulose and Industries: (con't)

2. Pharmaceuticals:

- Medicines are derived from plants and, many of those that are not, are chemicals synthesized to mimic active principles originally purified from plants and used medicinally (cellulose acetate phthalate)



CELLULOSE



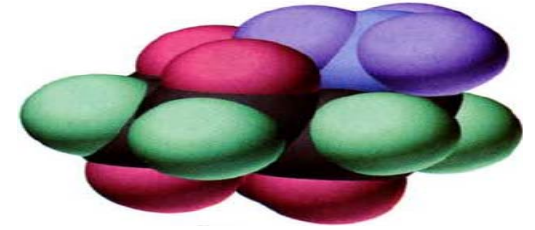
Cellulose and Industries: (con't)

3. Cellophane

- Can be obtained when a viscous cellulose reacts with acid (sulfuric acid) to produce cellophane, further treatment such as washing and bleaching
- Highly impermeable to dry gases and bacteria



CELLULOSE



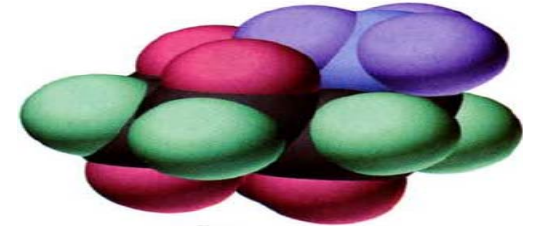
Cellulose and Industries: (con't)

4. Bombs

Cellulose trinitrate is used as a propellant for bullets due to the fact that nitrate $-OH$ group can be explosive



CELLULOSE



Cellulose and Industries: (con't)

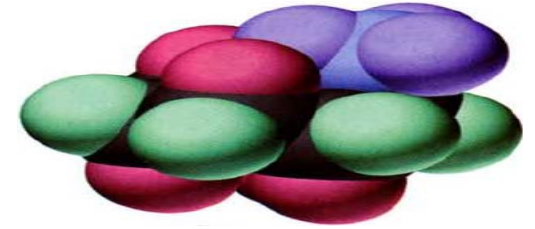
6. Energy Drinks:

Glucuronolacton, vitamins, and carbohydrates

Gives you wings



CELLULOSE

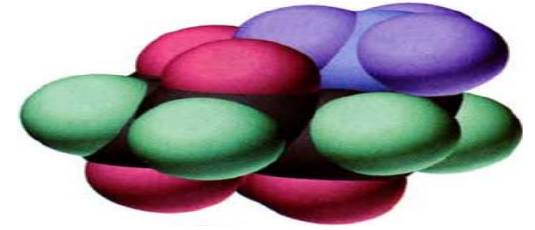


Cellulose and Industries: (con't)

7. Industrial Sugar



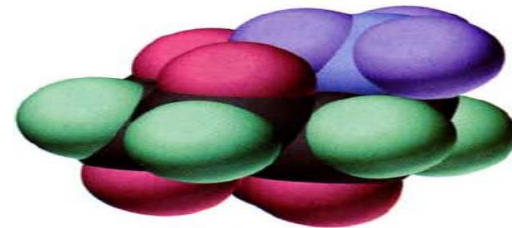
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Things to Remember:

- Cellulose is a complex carbohydrates
- Glucose is the monomer $C_6H_{12}O_6$
- The special properties of cellulose result from the association of the long chain
- Be careful with its isomers
- Cellulose is very insoluble in water
- Unlike the animals, the human cannot metabolized cellulose

CELLULOSE



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