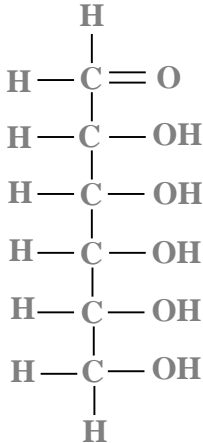


CARBOHYDRATE SUGARS

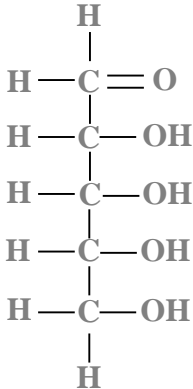
SUGAR EXAMPLES



GLUCOSE

C₆H₁₂O₆

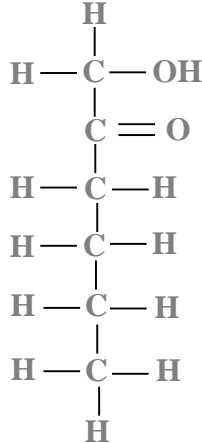
C₁H₂O₁



RIBOSE

C₅H₁₀O₅

C₁H₂O₁



FRUCTOSE

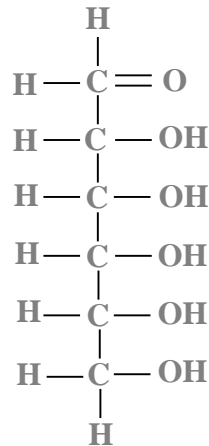
C₆H₁₂O₆

C₁H₂O₁

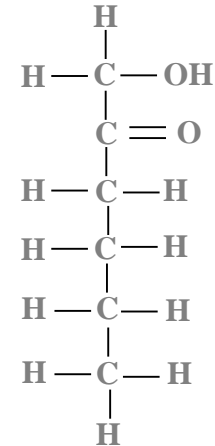
EMPIRICAL FORMULA

CARBOHYDRATE SUGARS

SUGAR EXAMPLES



GLUCOSE



FRUCTOSE

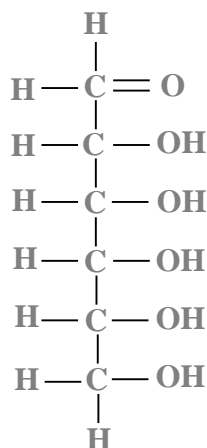


?

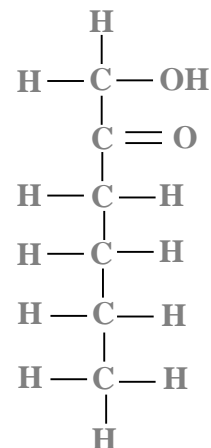
SAME MOLECULAR FORMULA / DIFFERENT MOLECULAR STRUCTURE

CARBOHYDRATE SUGARS

SUGAR EXAMPLES



GLUCOSE



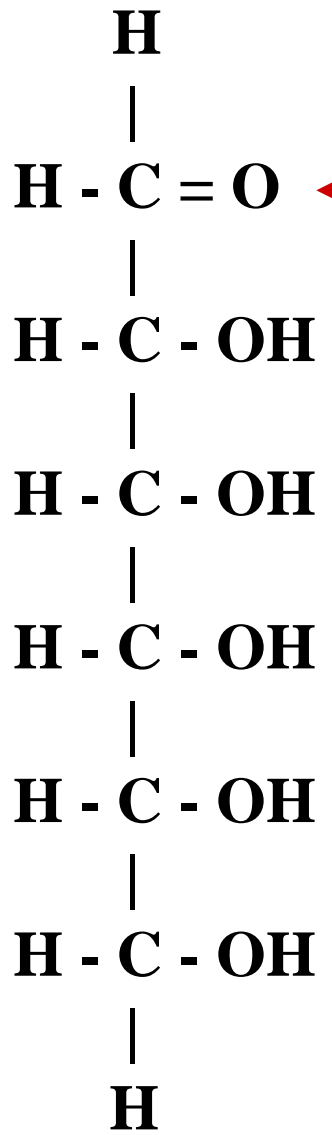
FRUCTOSE



ISOMERS

SAME MOLECULAR FORMULA / DIFFERENT MOLECULAR STRUCTURE

SUGAR



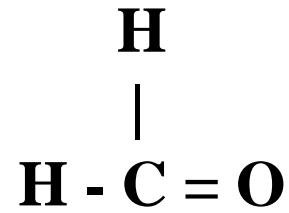
CARBONYL GROUP

HYDROCARBON

HYDROXYL GROUPS

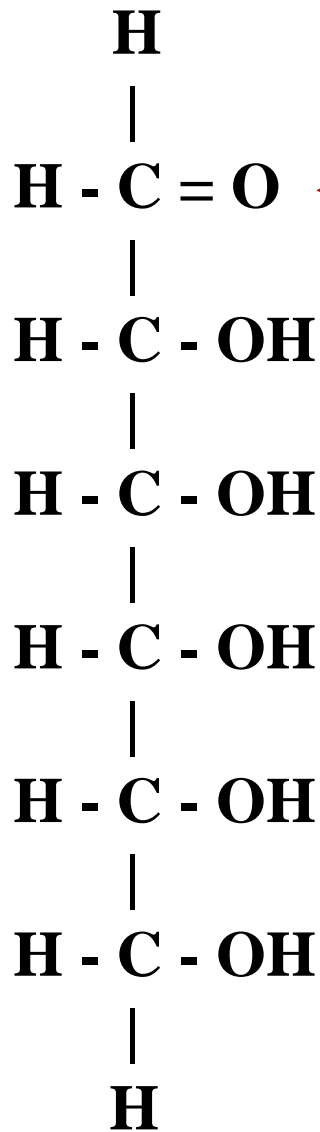
GLUCOSE

SUGAR HYDROXYL GROUPS

SUGAR**CARBONYL
GROUP****HYDROXYL
GROUPS****HYDROCARBON****GLUCOSE**

SUGAR

HYDROCARBON



GLUCOSE

CARBONYL GROUP

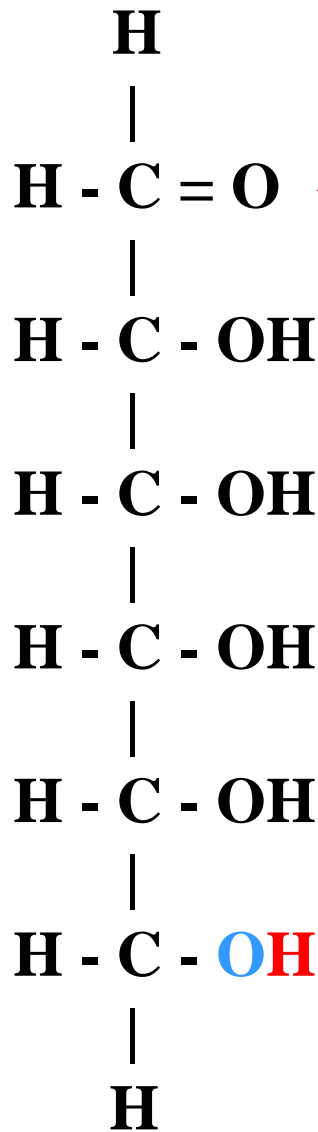
SEVERAL HYDROXYL GROUPS

OH

+

SUGAR

HYDROCARBON



GLUCOSE

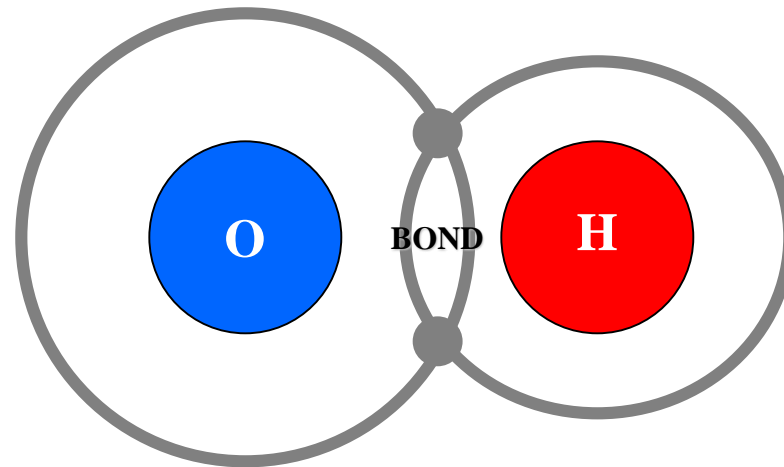
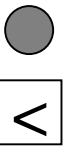
CARBONYL GROUP

SEVERAL HYDROXYL GROUPS

OH

+

SUGAR HYDROXYL GROUP




OXYGEN

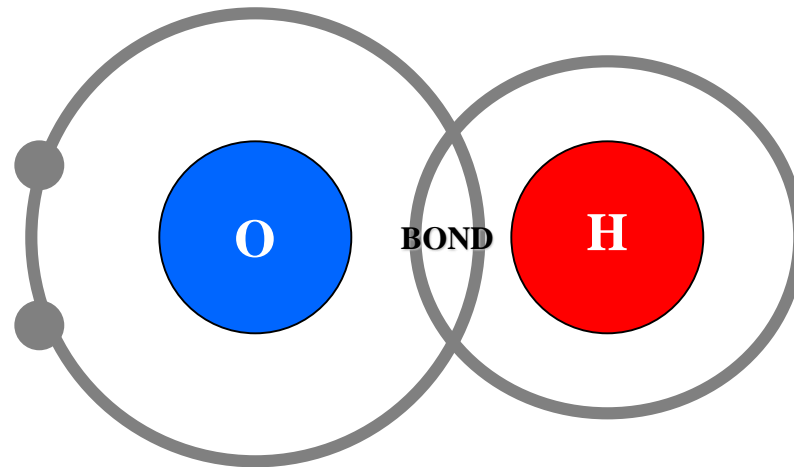
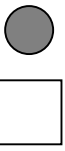
HYDROGEN

E- NEG = 3.5

E- NEG = 2.1

 = E-

SUGAR HYDROXYL GROUP



OXYGEN

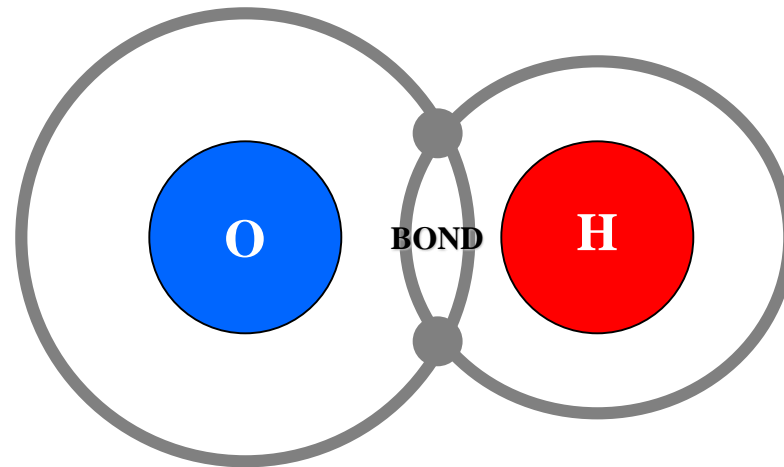
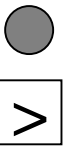
HYDROGEN

E- NEG = 3.5

E- NEG = 2.1

● = E-

SUGAR HYDROXYL GROUP



OXYGEN

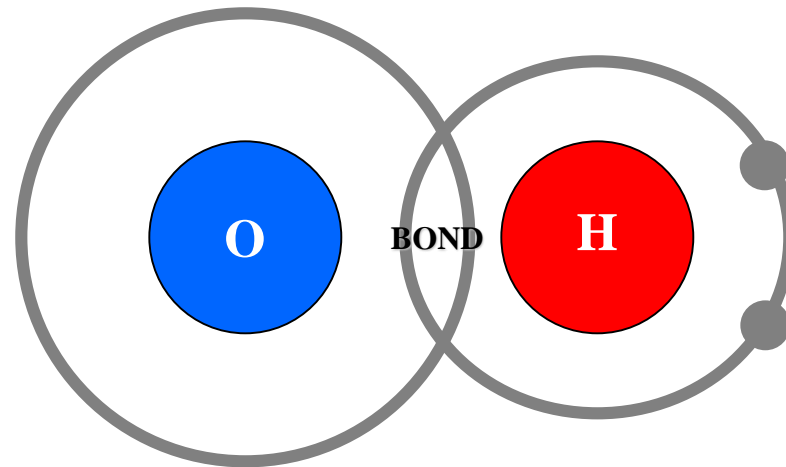
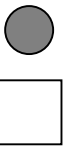
HYDROGEN

E- NEG = 3.5

E- NEG = 2.1

● = E-

SUGAR HYDROXYL GROUP



OXYGEN

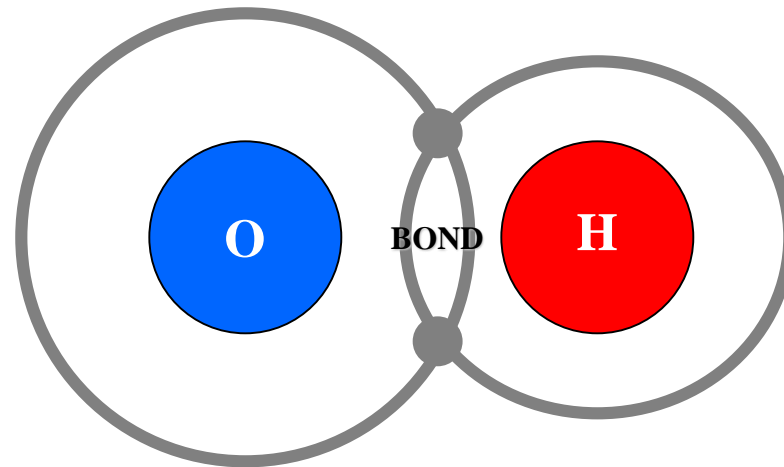
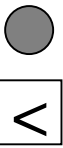
HYDROGEN

E- NEG = 3.5

E- NEG = 2.1

● = E-

SUGAR HYDROXYL GROUP




OXYGEN

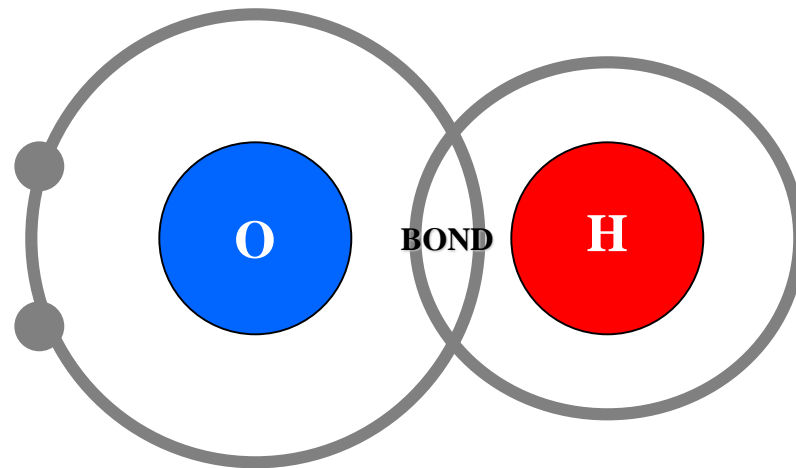
HYDROGEN

E- NEG = 3.5

E- NEG = 2.1

 = E-

SUGAR HYDROXYL GROUP



OXYGEN

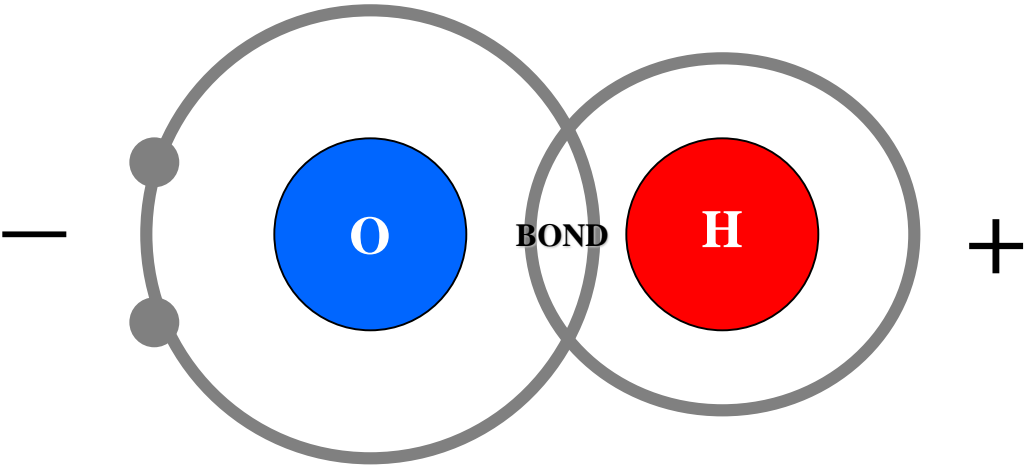
HYDROGEN

E- NEG = 3.5

E- NEG = 2.1

● = E-

SUGAR HYDROXYL GROUP



OXYGEN

HYDROGEN

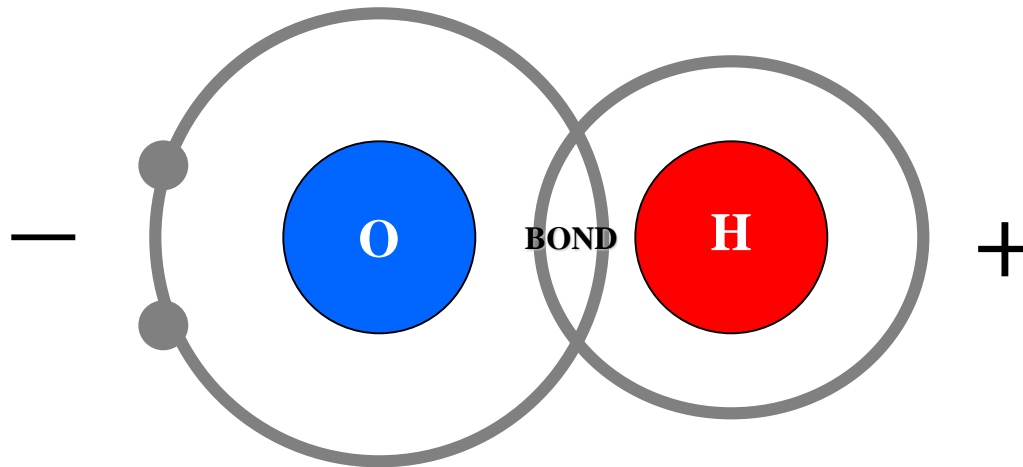
E- NEG = 3.5

E- NEG = 2.1

● = E-

SUGAR HYDROXYL GROUP

COVALENT BOND



OXYGEN **HYDROGEN**

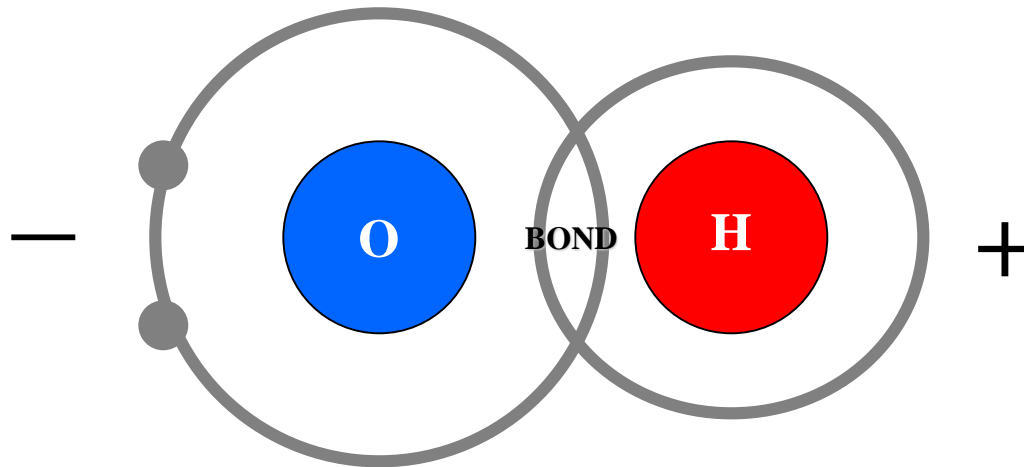
E- NEG = 3.5

E- NEG = 2.1

● = E-

SUGAR HYDROXYL GROUP

POLAR COVALENT BOND



OXYGEN

HYDROGEN

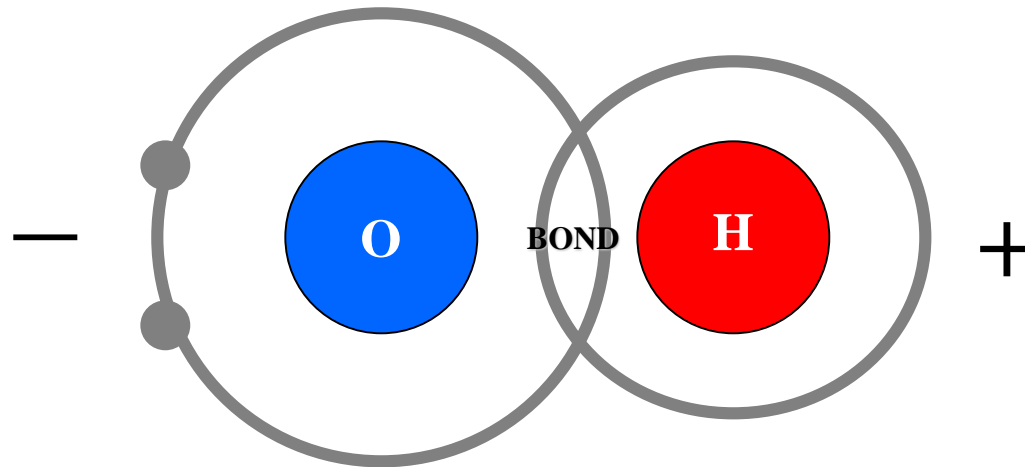
E- NEG = 3.5

E- NEG = 2.1

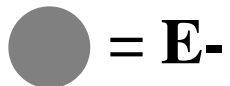
● = E-

SUGAR HYDROXYL GROUP

POLAR COVALENT BOND

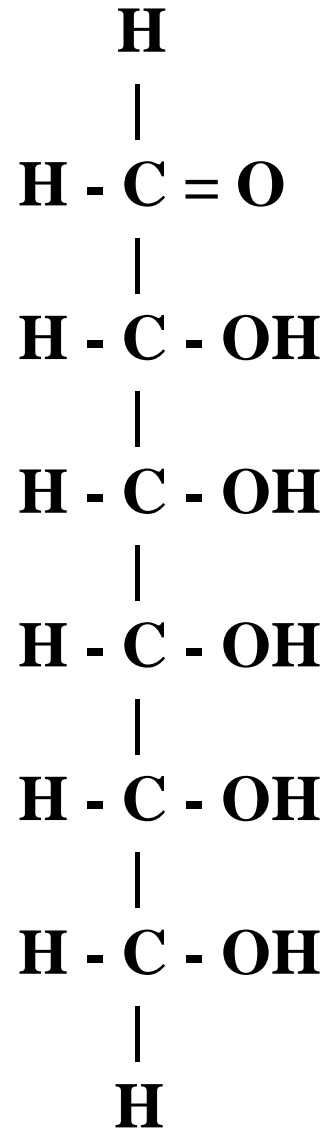


HIGHLY POLAR



SUGAR

HYDROCARBON



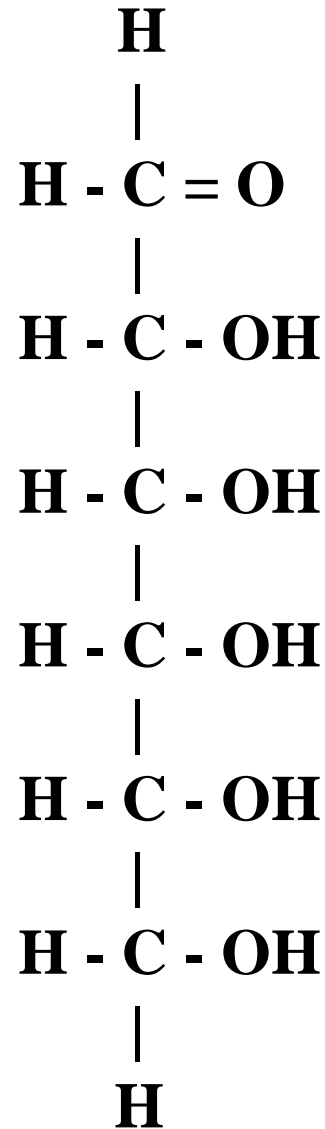
POLAR
HYDROXYL
GROUPS

GLUCOSE

SUGAR

HIGHLY POLAR

HYDROCARBON



**POLAR
HYDROXYL
GROUPS**

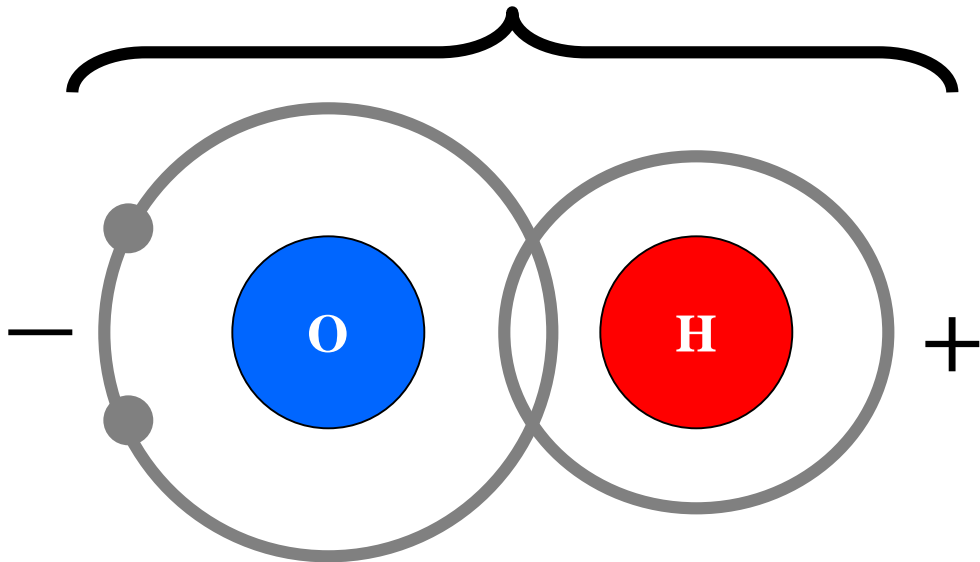
GLUCOSE

HIGHLY POLAR

SUGARS & WATER



POLAR HYDROXYL GROUP



AQUEOUS SOLUTION

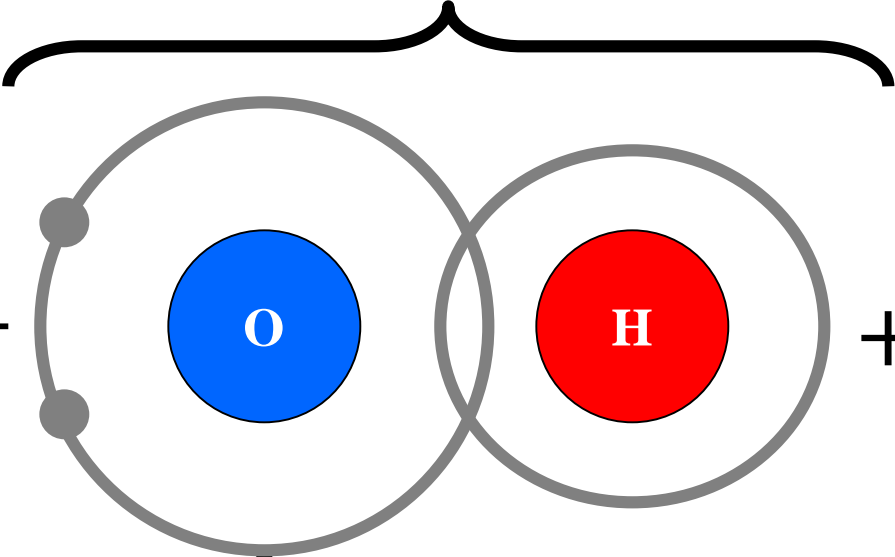
SUGAR

POLAR

● = E-

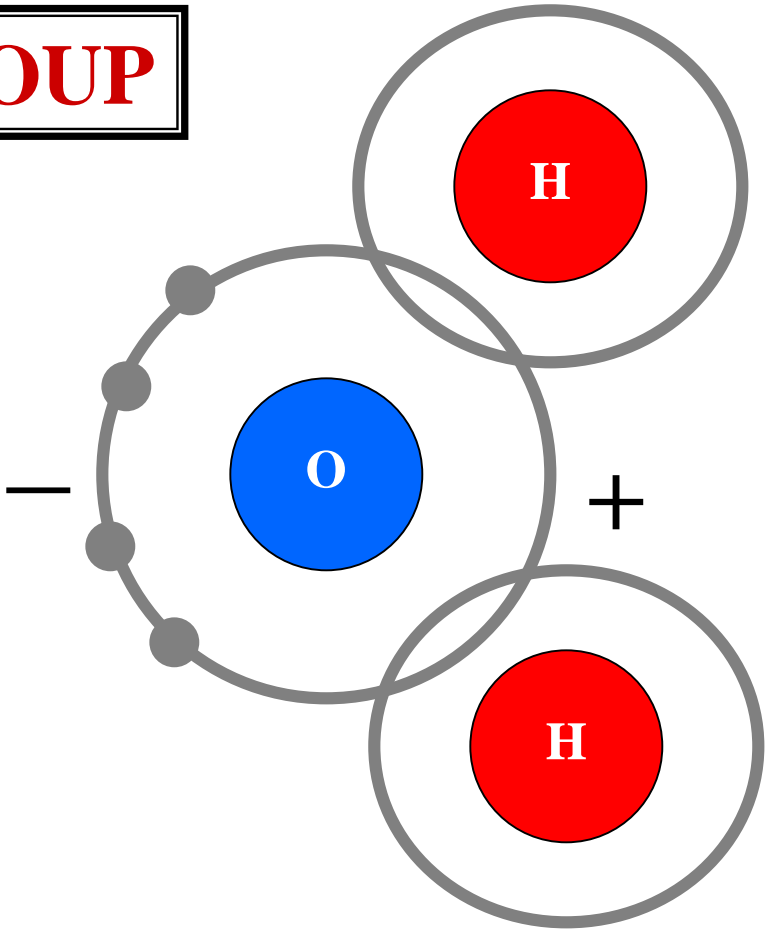
SUGARS & WATER

POLAR HYDROXYL GROUP



SUGAR

POLAR



POLAR

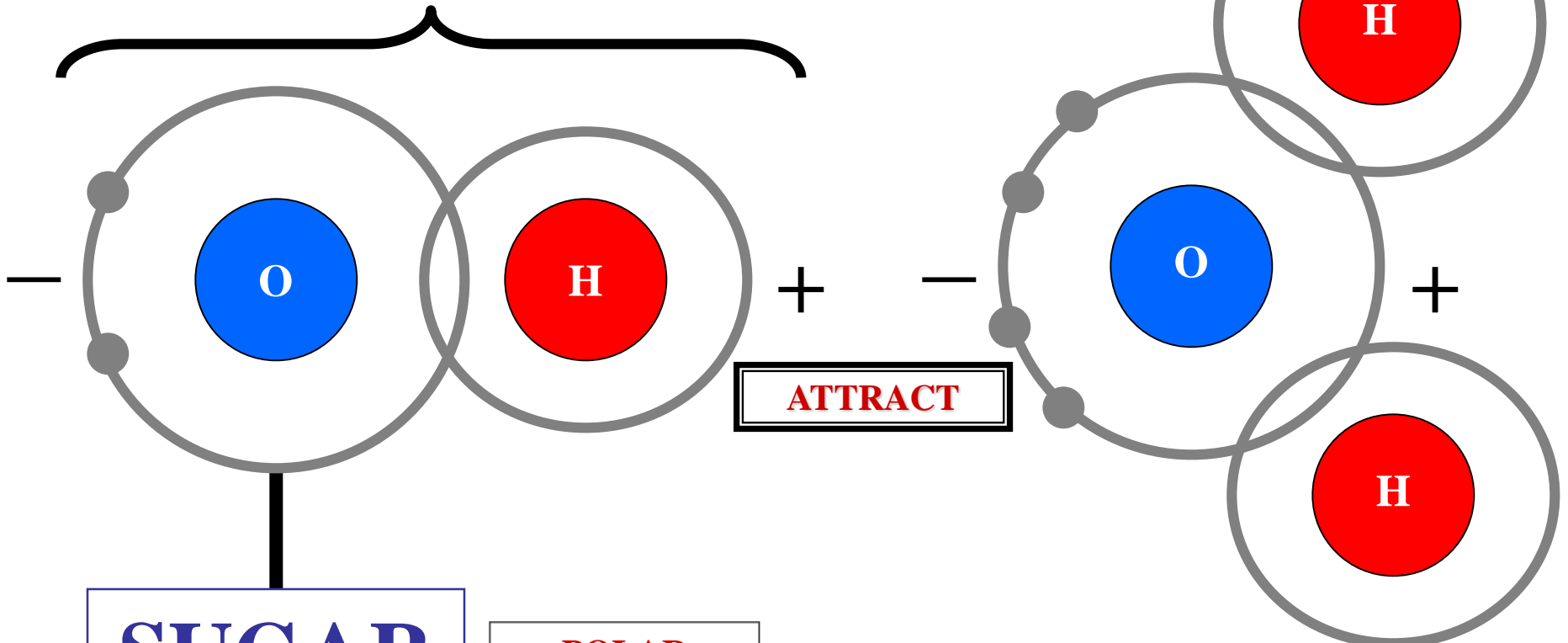
WATER

● = E-

AQUEOUS SOLUTION

SUGARS & WATER

POLAR HYDROXYL GROUP



SUGAR

POLAR

POLAR

WATER

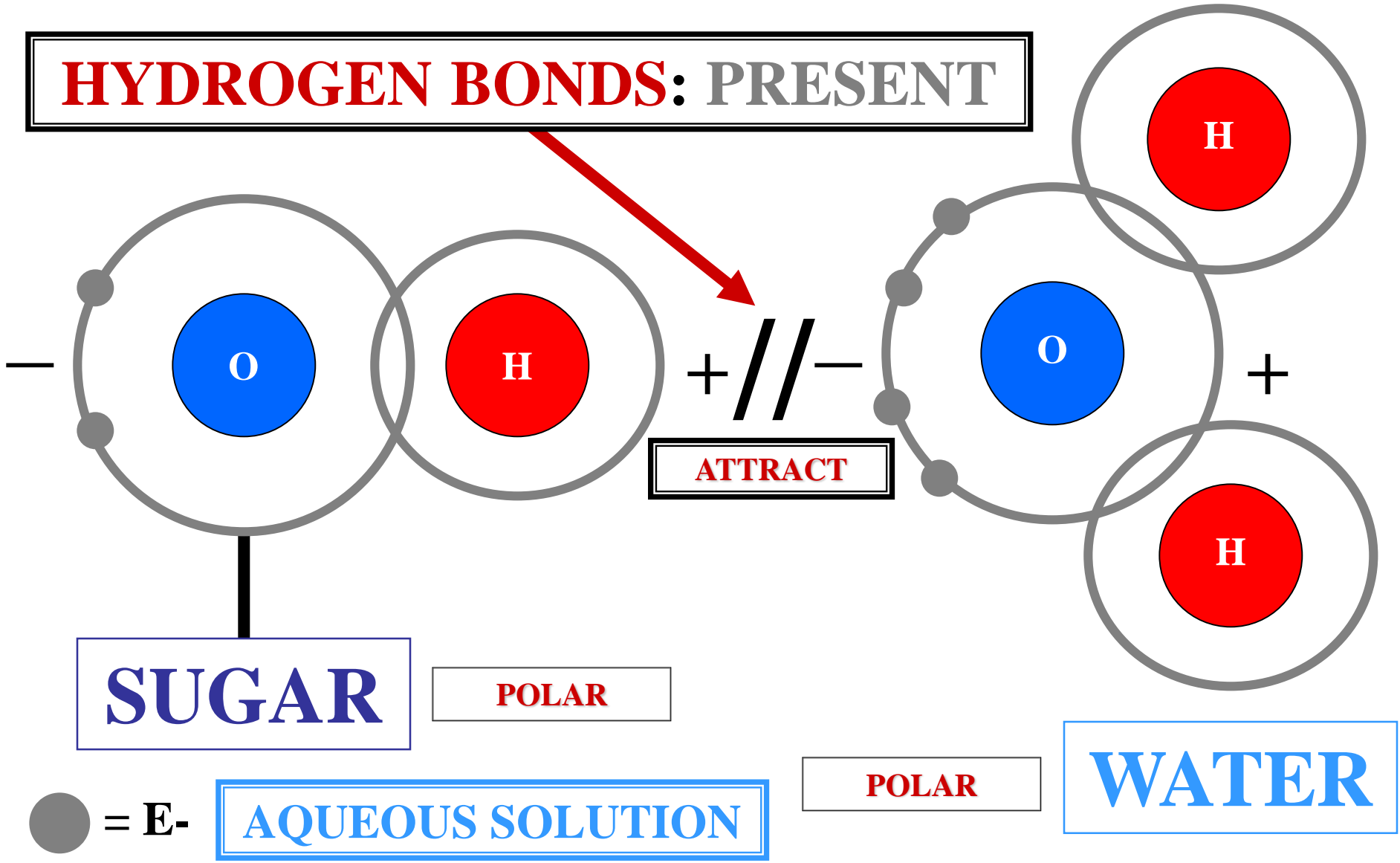
● = E-

AQUEOUS SOLUTION

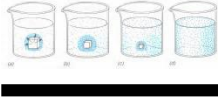
SUGARS & WATER



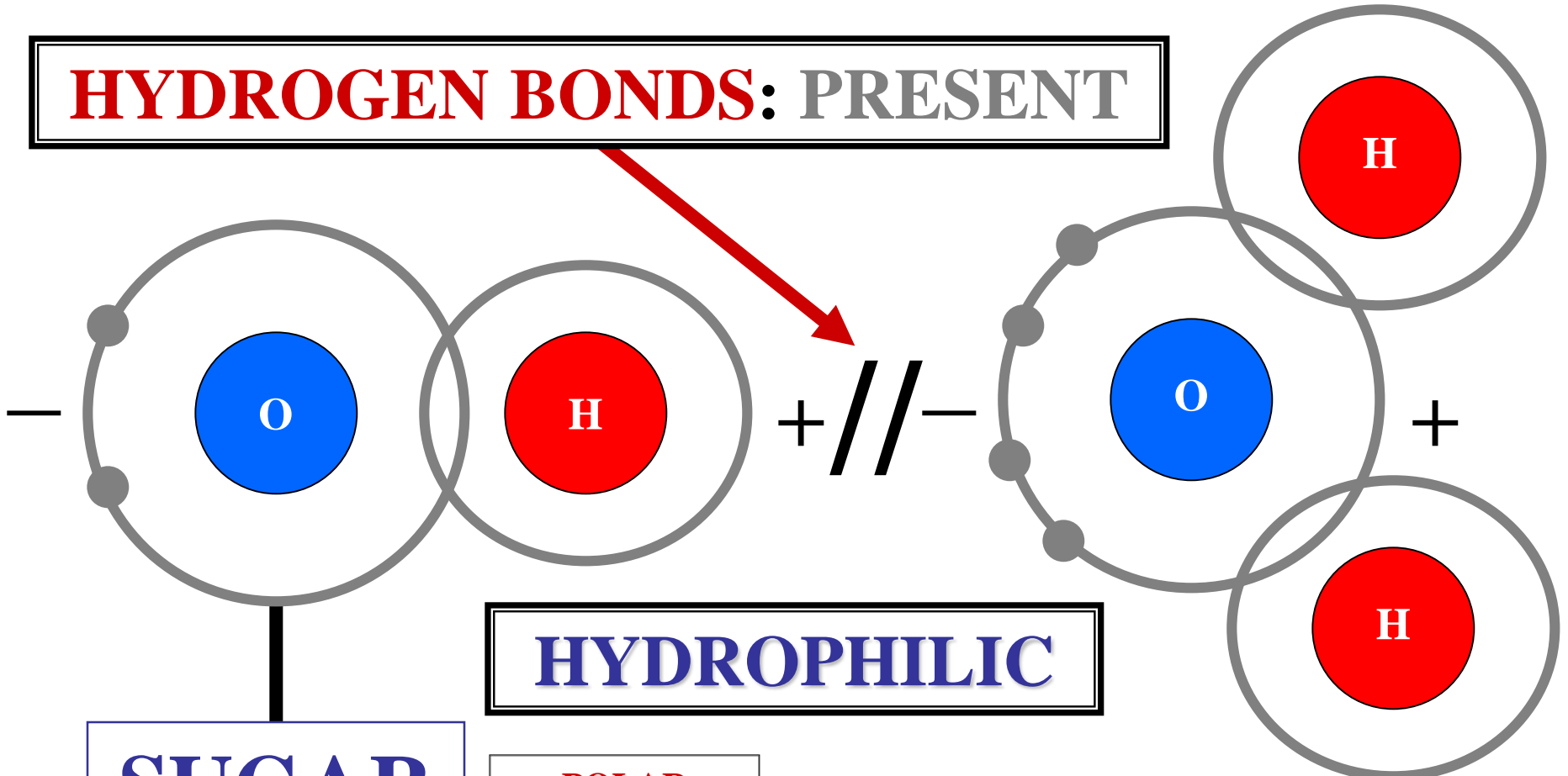
HYDROGEN BONDS: PRESENT



SUGARS & WATER



HYDROGEN BONDS: PRESENT



HYDROPHILIC

SUGAR

POLAR

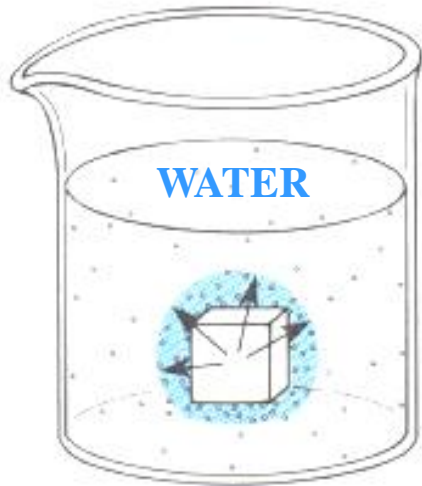
POLAR

WATER

● = E-

AQUEOUS SOLUTION

SUGARS HYDROPHILIC

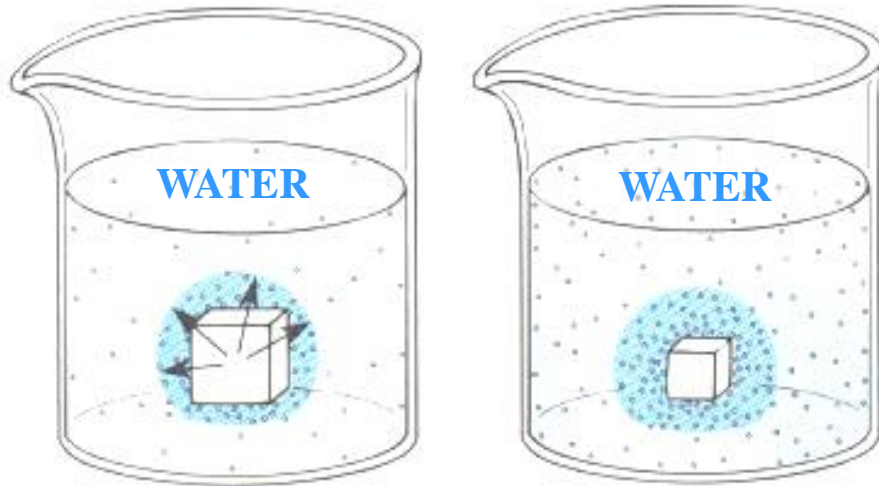


SUGAR CUBE

SUGAR SOLUTION



SUGARS HYDROPHILIC



A



B

SUGAR CUBE

SUGAR CUBE

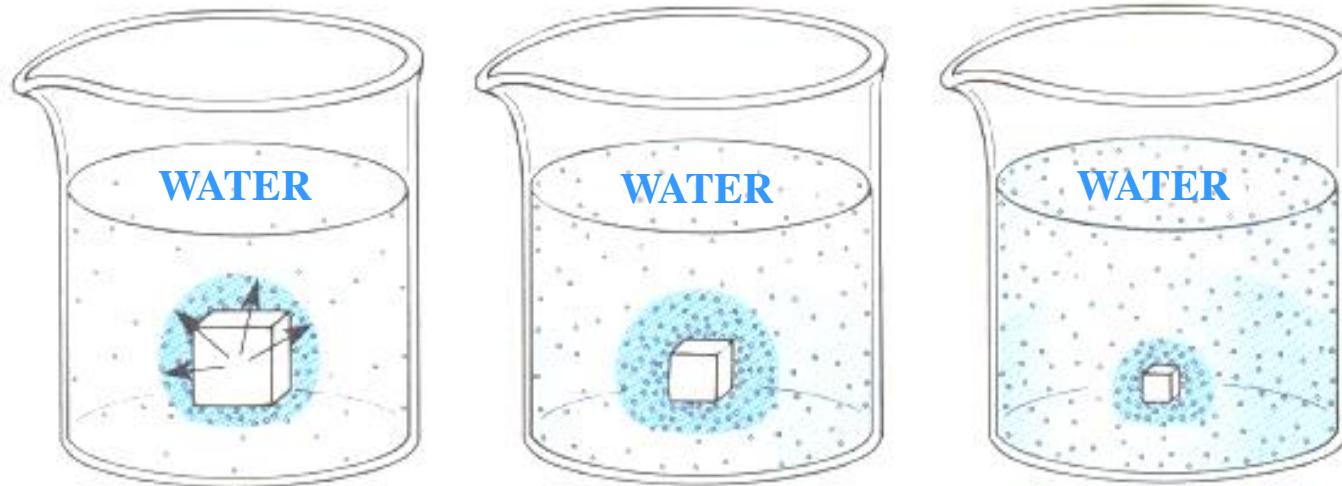
SUGAR CUBE DISSOLVES IN WATER

→ = TIME

SUGAR SOLUTION



SUGARS HYDROPHILIC



A



B



C

SUGAR CUBE

SUGAR CUBE

SUGAR CUBE

SUGAR CUBE DISSOLVES IN WATER

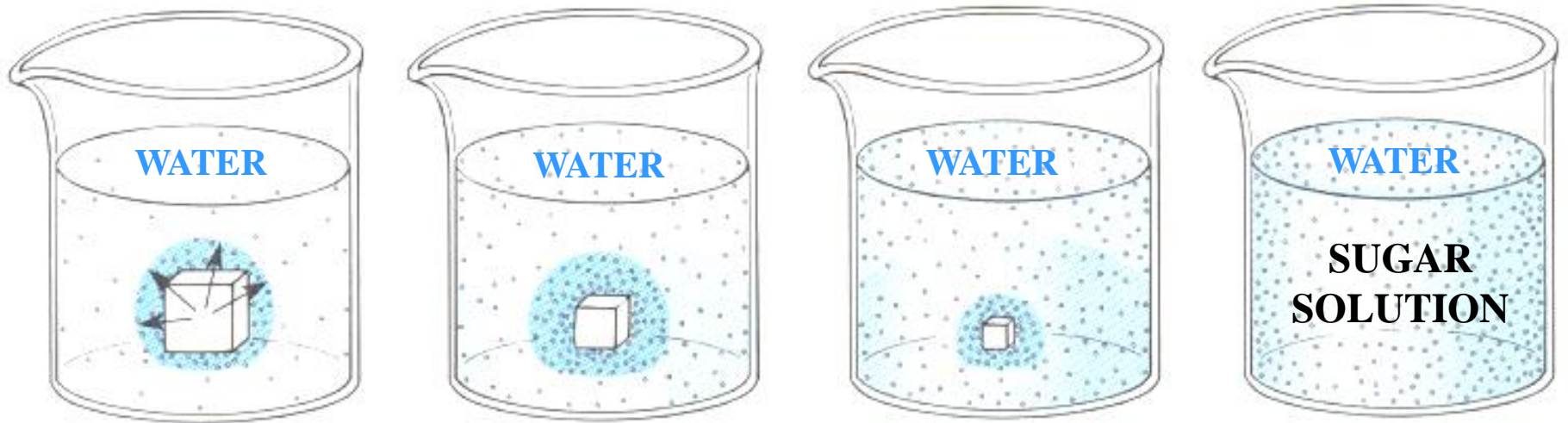
→ = TIME

SUGAR SOLUTION

SUGARS HYDROPHILIC

HB

//



A



B



C



D

SUGAR CUBE

SUGAR CUBE

SUGAR CUBE

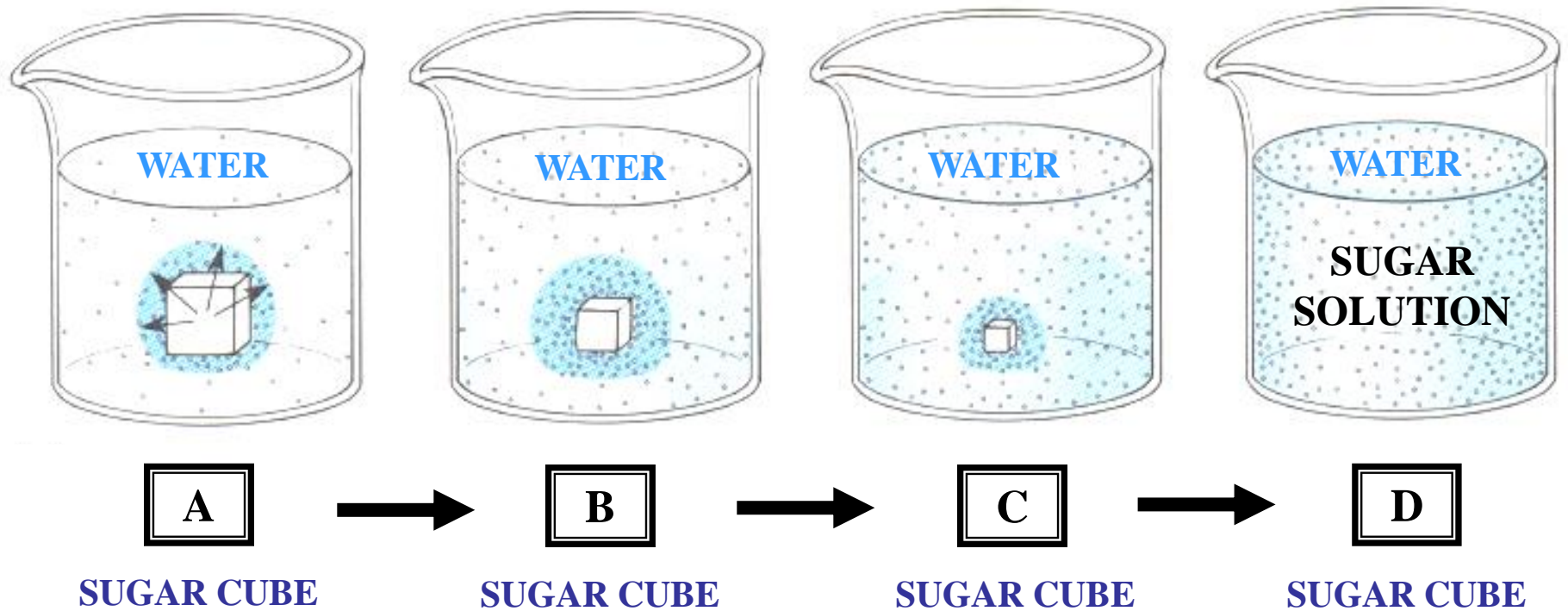
SUGAR CUBE

SUGAR CUBE DISSOLVES IN WATER

→ = TIME

SUGAR SOLUTION

SUGARS HYDROPHILIC



SUGAR & WATER FORM: HYDROGEN BONDS

→ = TIME

SUGAR SOLUTION



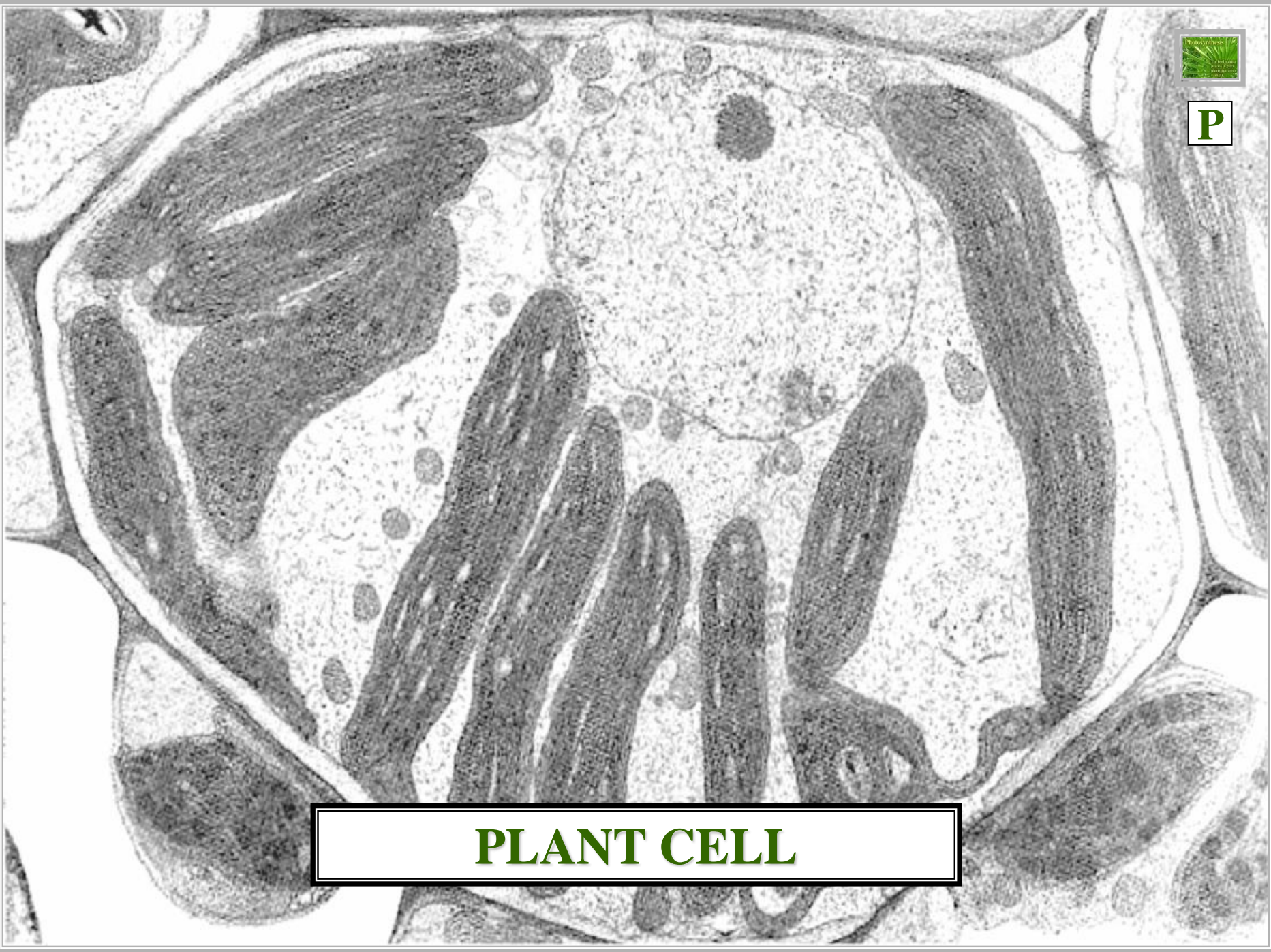
SUGAR FUNCTION

**SUGAR
FUNCTION**



**ENERGY
STORAGE**

**SUGAR
FUNCTION**



PLANT CELL

Photosynthesis



**CONVERSION
LIGHT ENERGY
TO
CHEMICAL ENERGY**

PHOTOSYNTHESIS



?

+

WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

THYLAKOID

CHEMICAL ENERGY

DK RXT

STROMA

SYNTHESIS

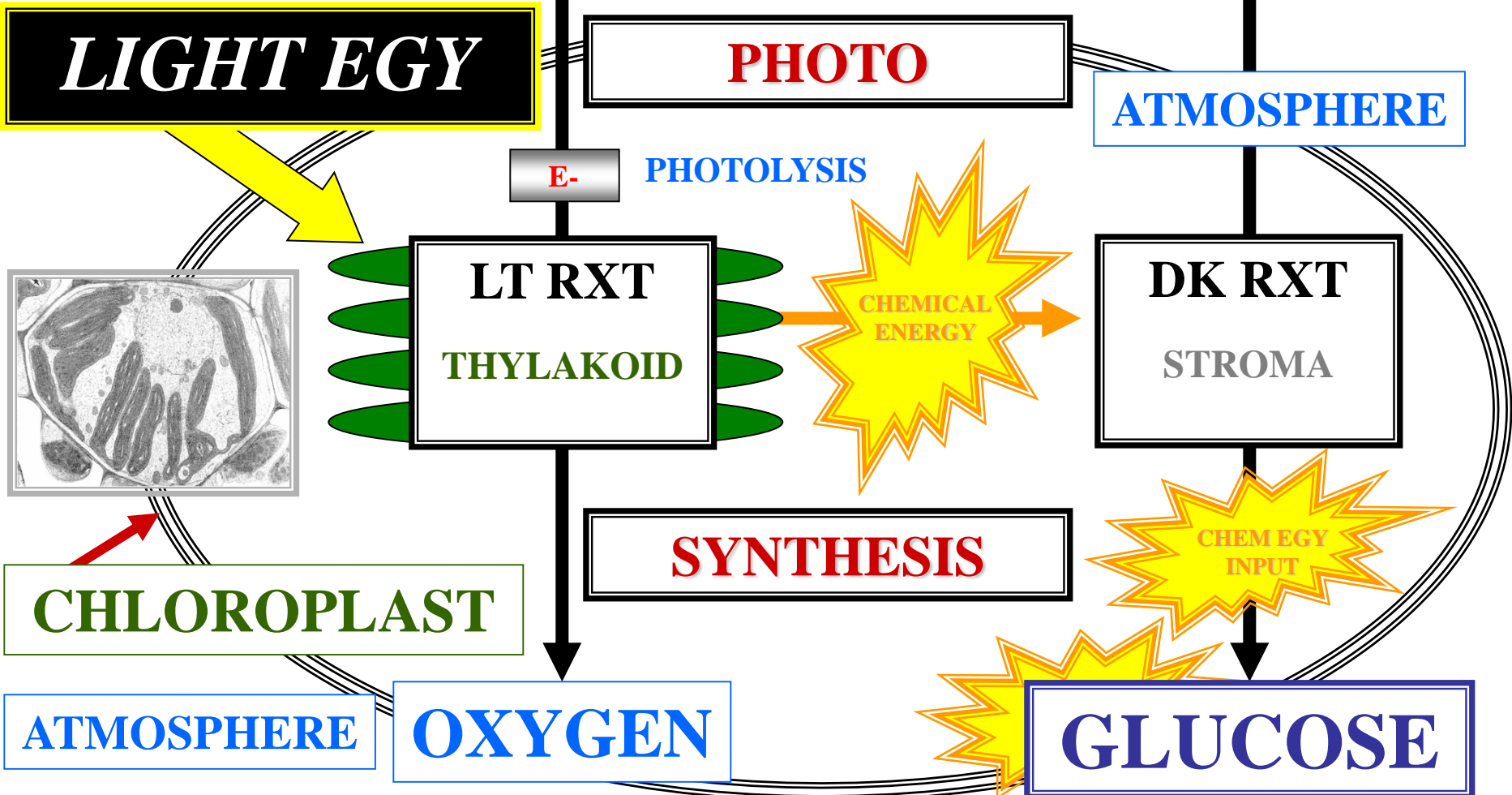
CHEMICAL ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE



PHOTOSYNTHESIS

S



WATER

CO₂

LIGHT ENERGY

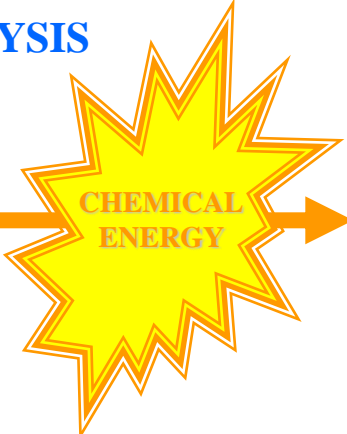
PHOTO

ATMOSPHERE

E- PHOTOLYSIS



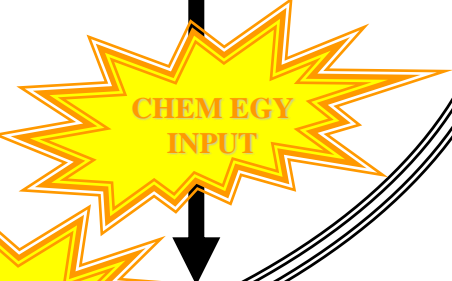
LT RXT
THYLAKOID



DK RXT
STROMA

CHLOROPLAST

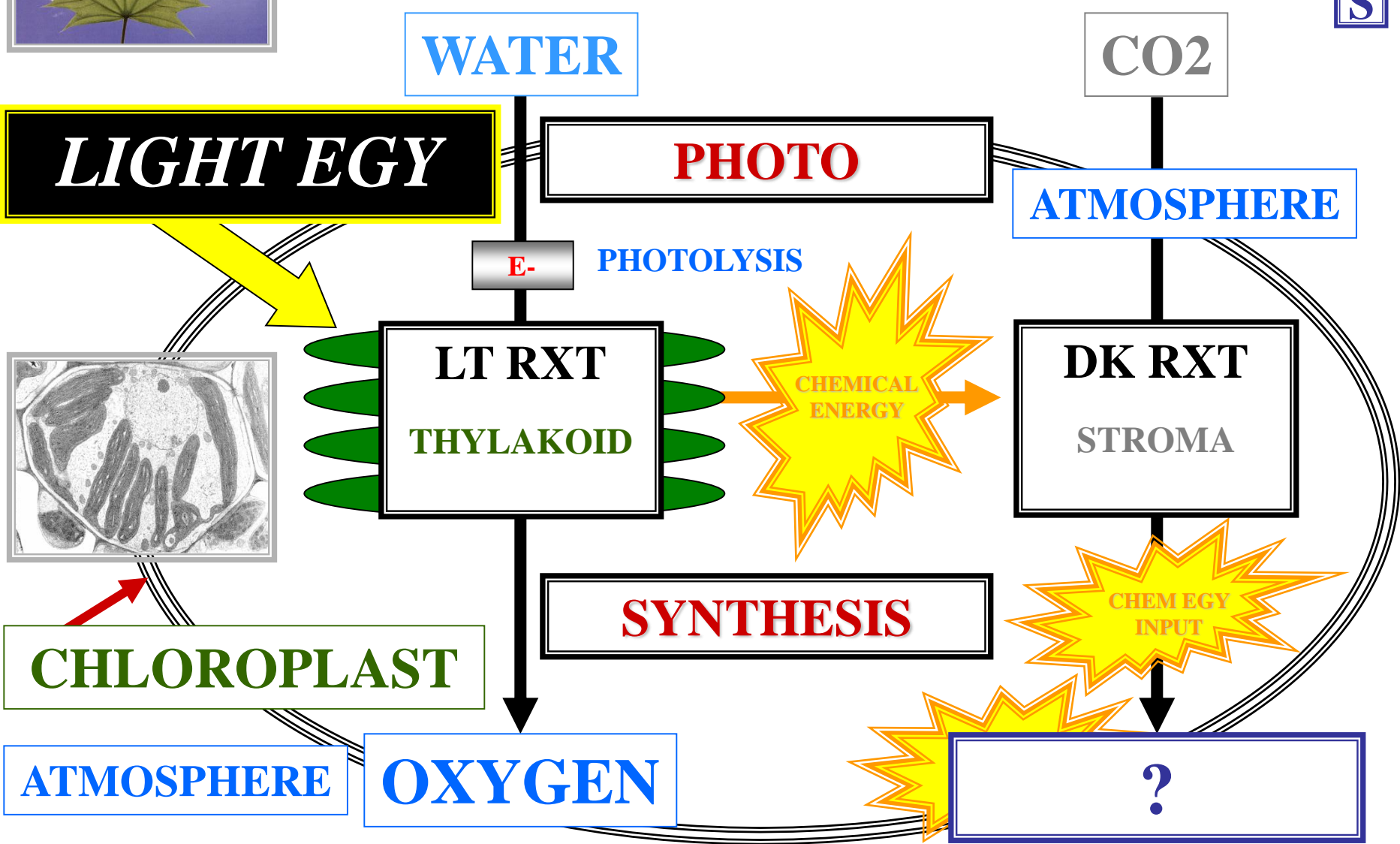
SYNTHESIS



ATMOSPHERE

OXYGEN

?



PHOTOSYNTHESIS



WATER

CO₂

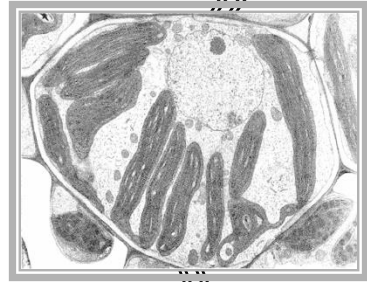


LIGHT ENERGY

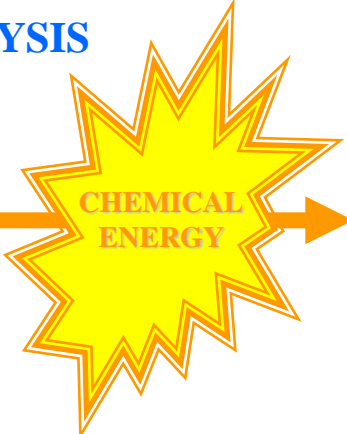
PHOTO

ATMOSPHERE

E- PHOTOLYSIS



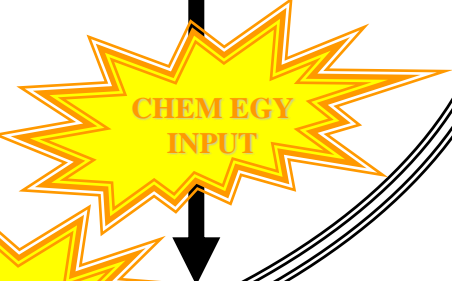
LT RXT
THYLAKOID



DK RXT
STROMA

CHLOROPLAST

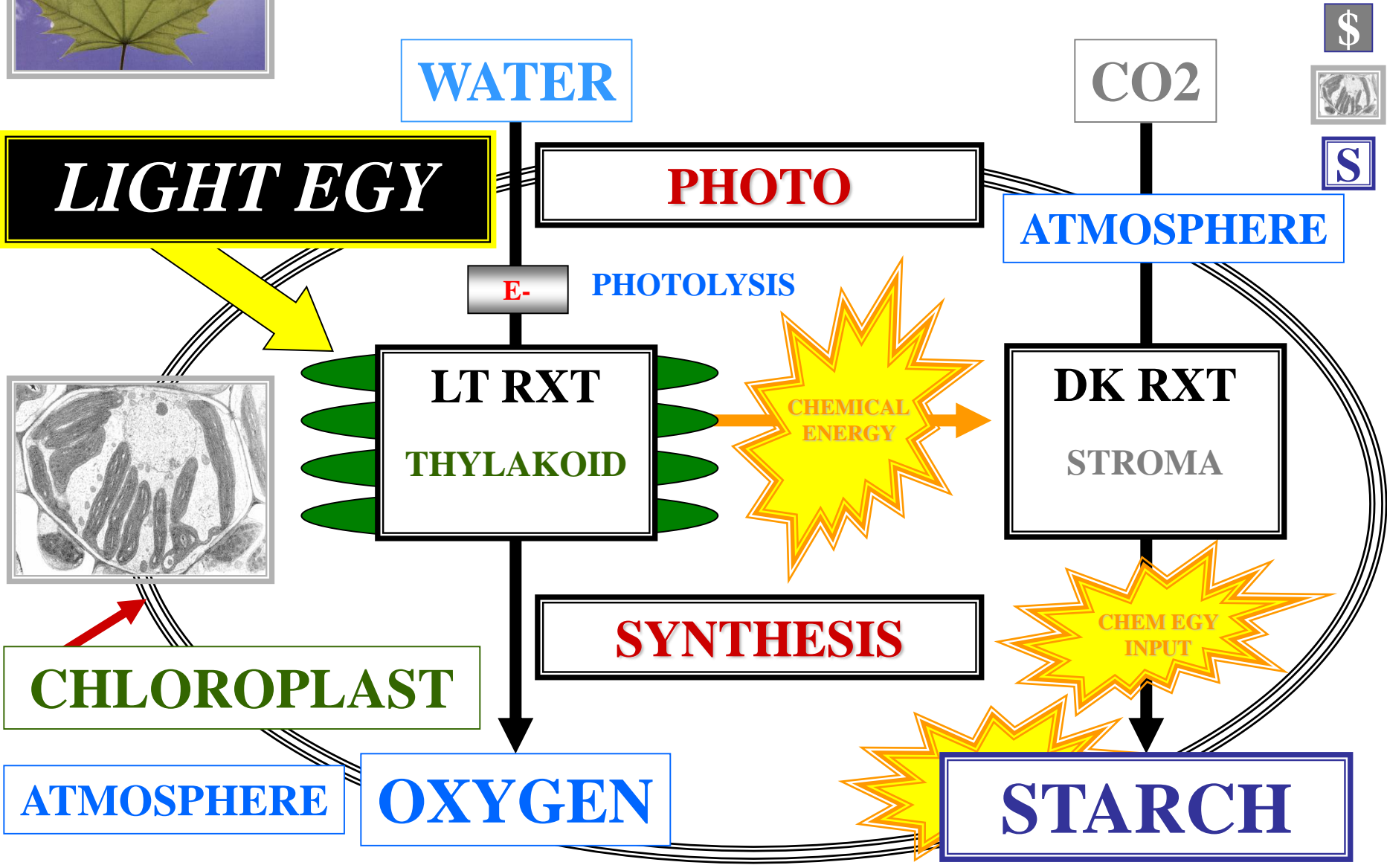
SYNTHESIS



ATMOSPHERE

OXYGEN

STARCH



**STARCH
ENERGY STORAGE
SUGAR**

STARCH = AMYLOSE

**STARCH
ENERGY STORAGE
SUGAR**

PLANT CELL

SUGAR FUNCTION

**SUGAR
FUNCTION**

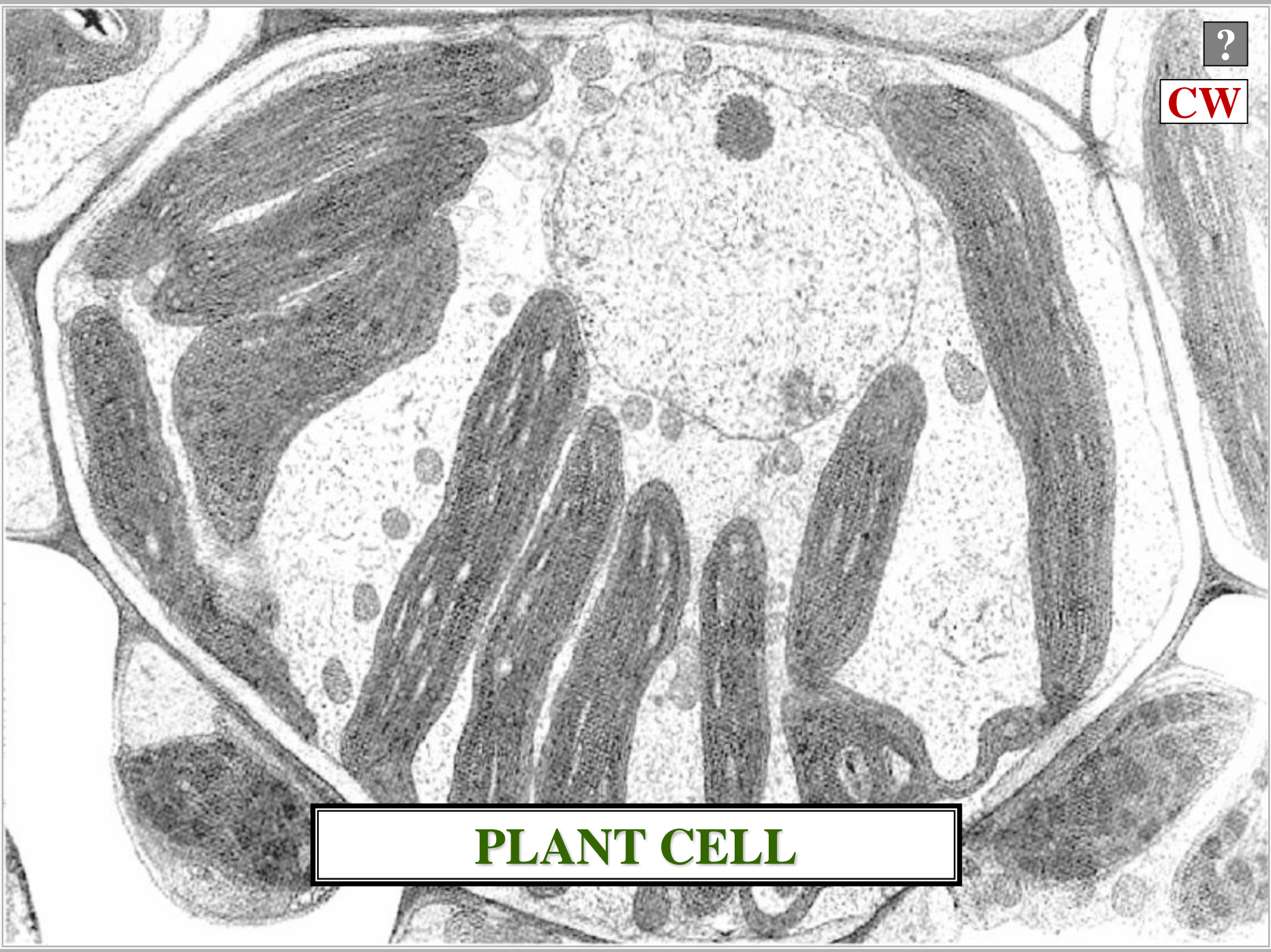


STRUCTURAL SUPPORT

**SUGAR
FUNCTION**

?

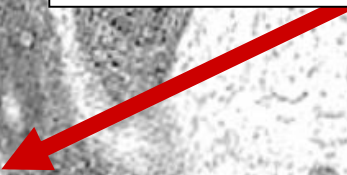
CW



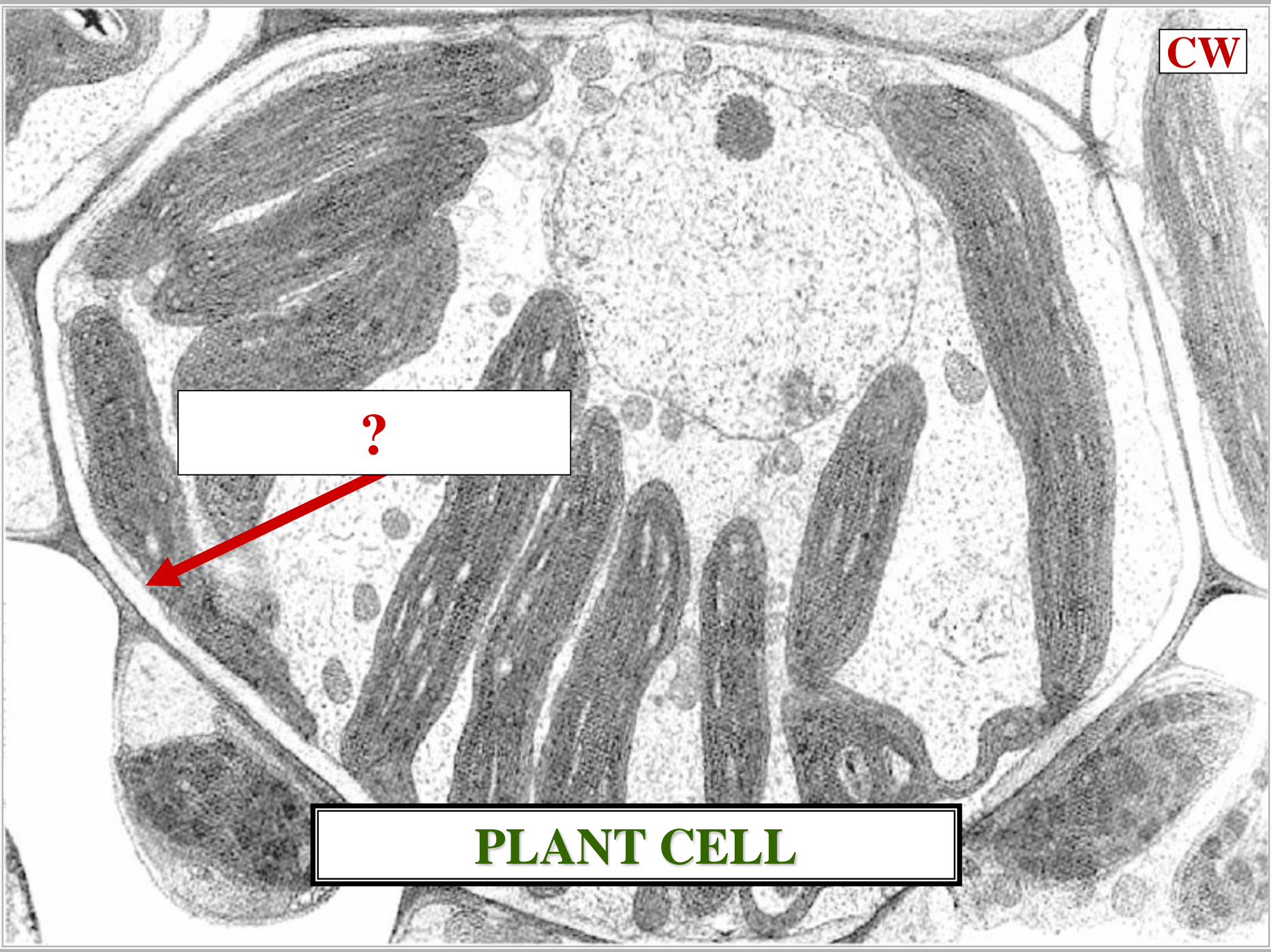
PLANT CELL

CW

?



PLANT CELL



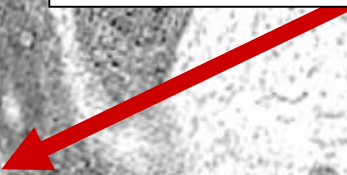
C

CELL WALL

?

STRUCTURAL SUPPORT

PLANT CELL





CELL WALL

This electron micrograph shows a cross-section of a plant cell. The cell wall is visible as a thin, dark layer on the left. Inside the cell, numerous dark, elongated structures represent cellulose microfibrils. A red arrow points from the 'CELL WALL' label to the cell wall. The 'CELLULOSE' label points to the microfibrils. The 'STRUCTURAL SUPPORT' label is positioned below the microfibrils, and the 'PLANT CELL' label is at the bottom center.

CELLULOSE

STRUCTURAL SUPPORT

PLANT CELL



**CELLULOSE
STRUCTURAL SUPPORT
SUGAR**

CELLULOSE

**CELLULOSE
STRUCTURAL SUPPORT
SUGAR**

PLANT CELL

CARBOHYDRATE SUGAR CLASSES

CARBOHYDRATE SUGAR CLASSES

MONO-SACCHARIDES

CARBOHYDRATE SUGAR CLASSES

CARBOHYDRATE SUGAR CLASSES

MONO-SACCHARIDES
DI-SACCHARIDES

**CARBOHYDRATE
SUGAR CLASSES**

CARBOHYDRATE SUGAR CLASSES



MONO-SACCHARIDES

DI-SACCHARIDES

POLY-SACCHARIDES

CARBOHYDRATE
SUGAR CLASSES

MONO-SACCHARIDES

MONO-SACCHARIDE

MONO-SACCHARIDE

**SINGLE SUGAR
MOLECULE**

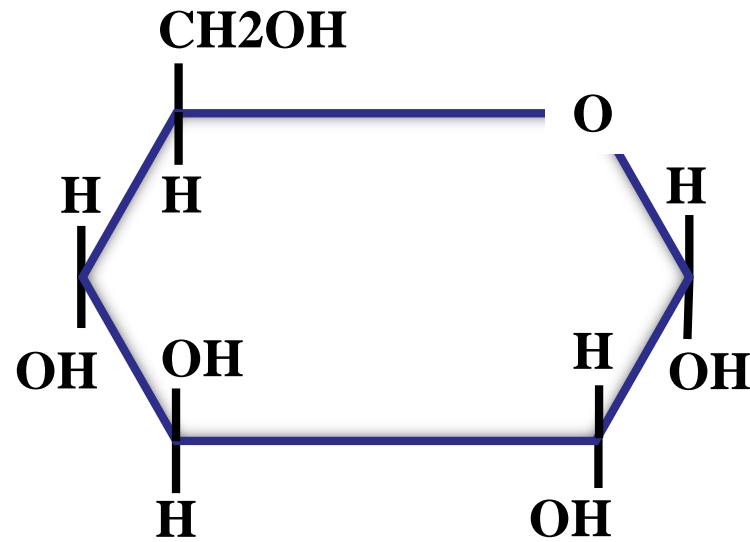
MONO-SACCHARIDE

MONO-SACCHARIDE

EXAMPLE



MONO-SACCHARIDE



GLUCOSE

MONO-SACCHARIDE

DI-SACCHARIDES

DI-SACCHARIDE



DI-SACCHARIDE

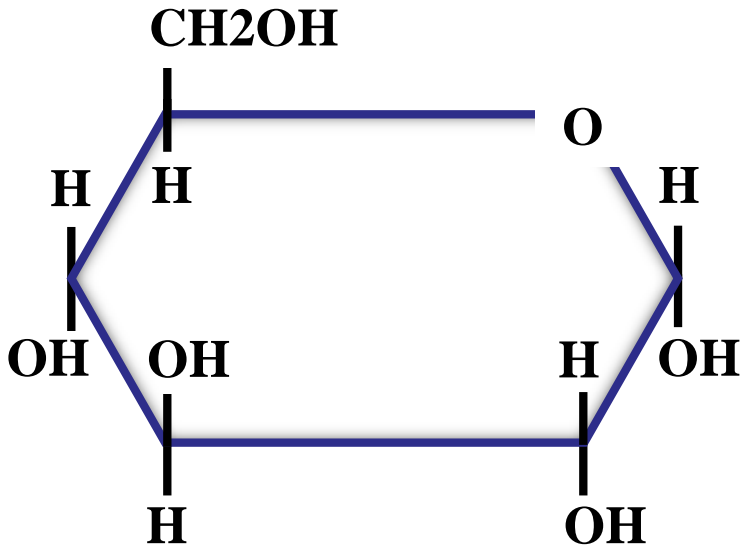
2 BONDED

MONO-SACCHARIDES

DI-SACCHARIDE

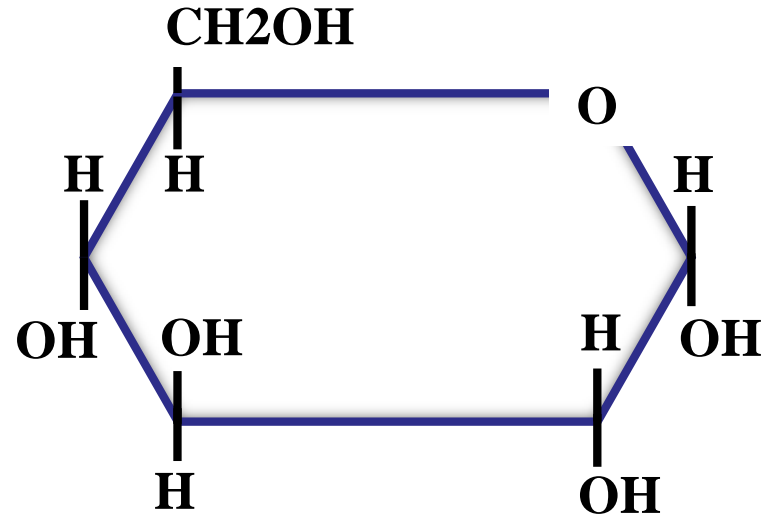


DI-SACCHARIDE



GLUCOSE

MONOSACCHARIDE

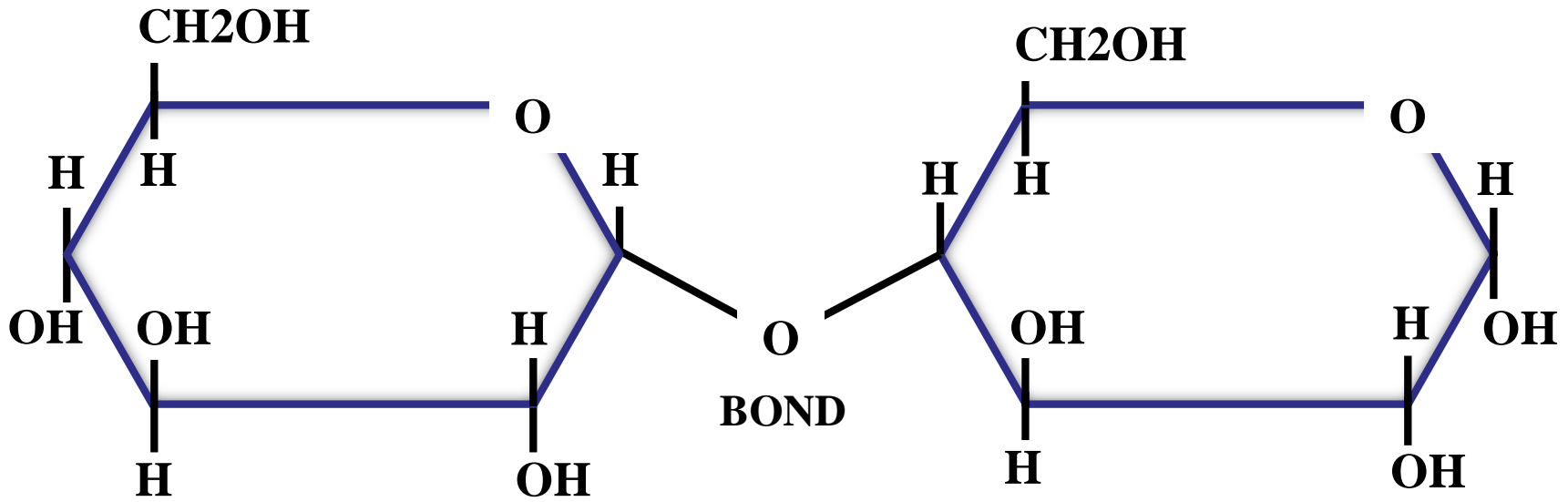


GLUCOSE

MONOSACCHARIDE

DI-SACCHARIDE

DI-SACCHARIDE



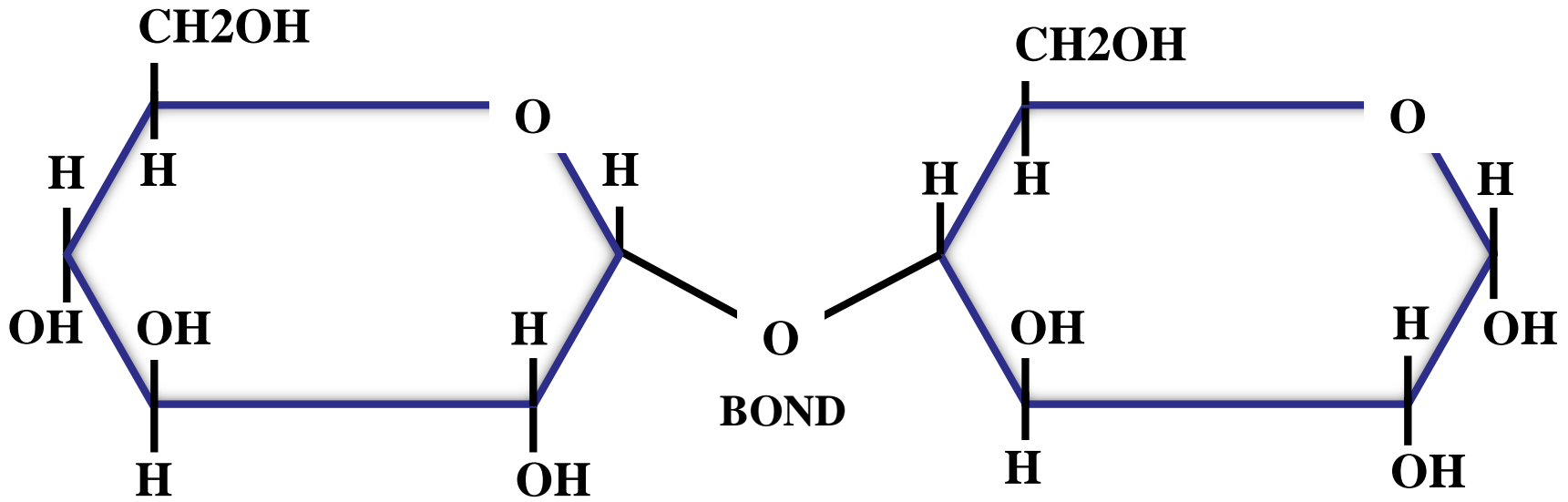
GLUCOSE

GLUCOSE

?

REACTION

DI-SACCHARIDE



GLUCOSE

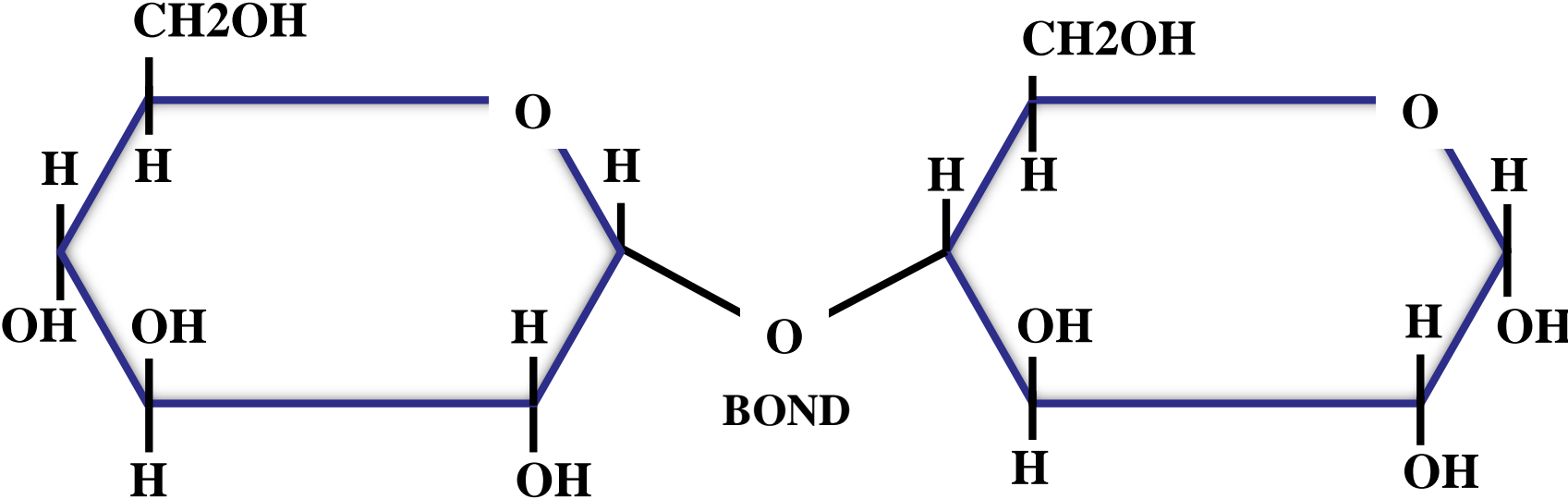
GLUCOSE

**CONDENSATION
REACTION**

DI-SACCHARIDE EXAMPLE



DI-SACCHARIDE



GLUCOSE

GLUCOSE

MALTOSE

DI-SACCHARIDE

POLY-SACCHARIDES

POLY-SACCHARIDE

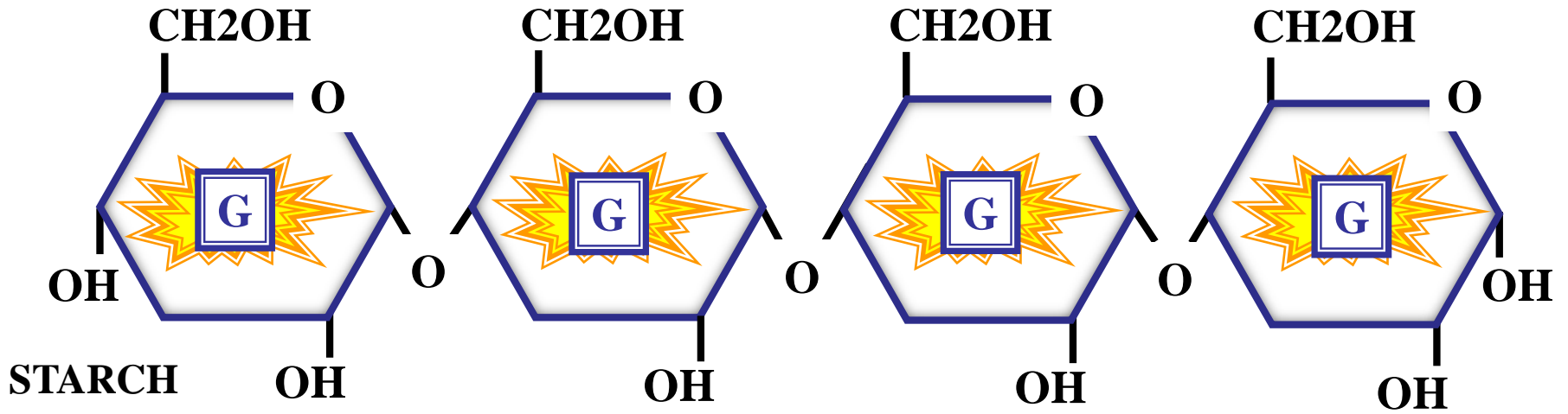
POLY-SACCHARIDE

**3 OR MORE BONDED
MONO-SACCHARIDES**

POLY-SACCHARIDE

POLY-SACCHARIDE

EXAMPLES

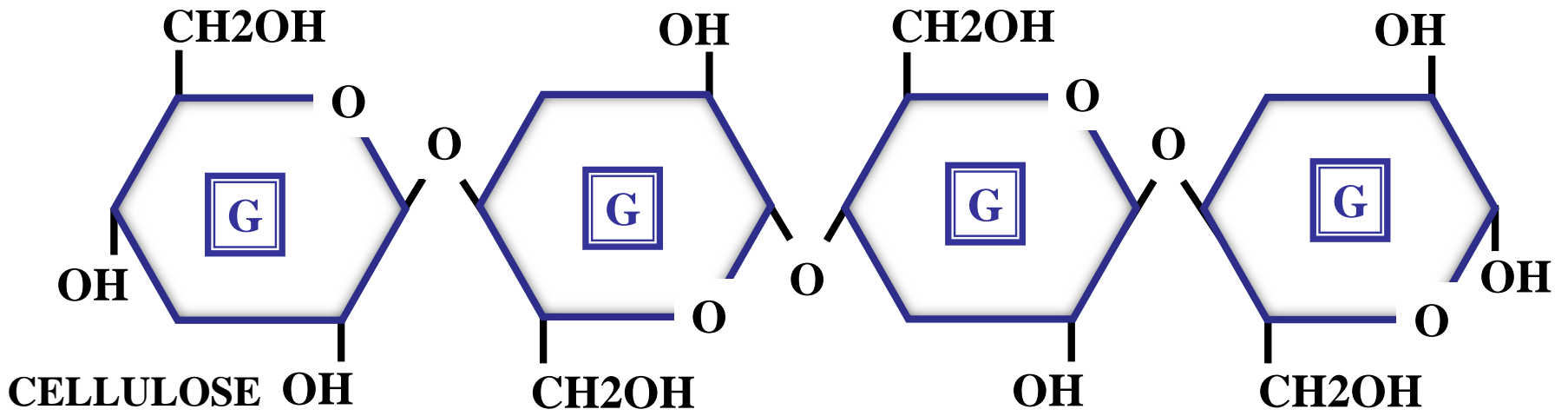


STARCH = AMYLOSE

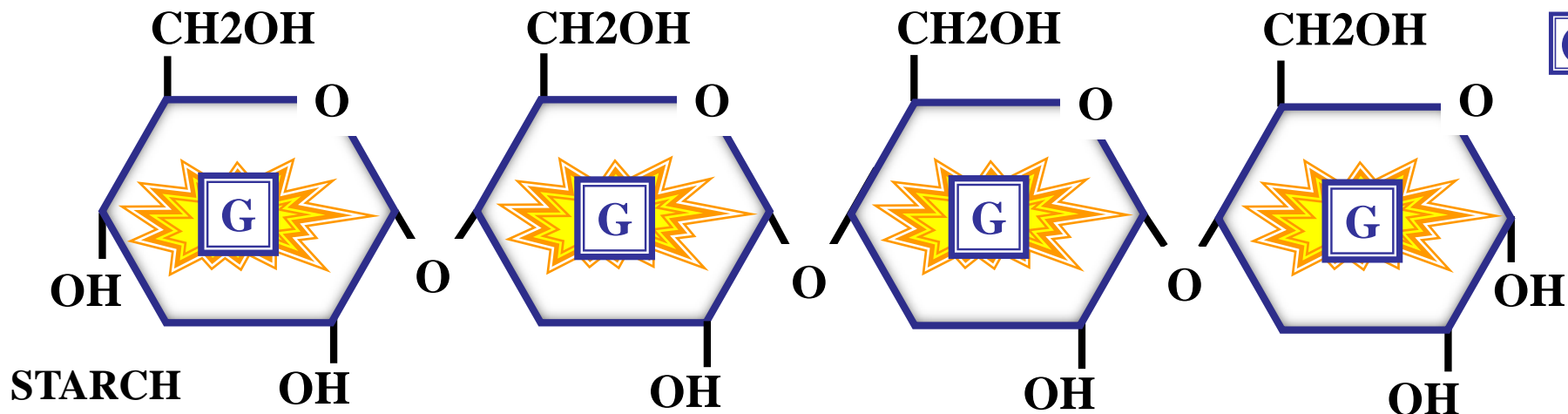
 = GLUCOSE MONOSACCHARIDE

 = ENERGY

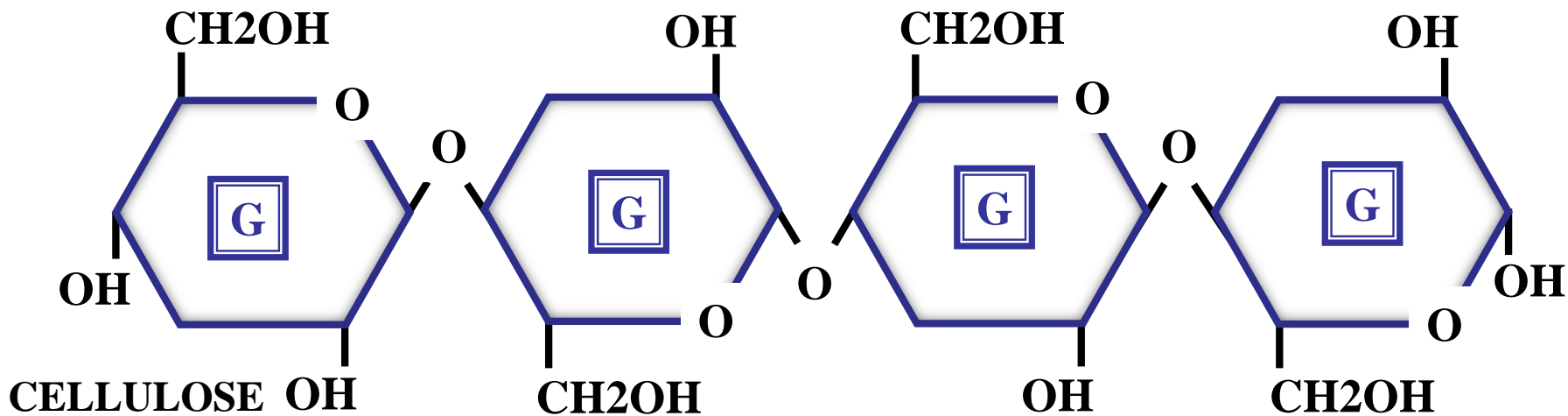
G = GLUCOSE MONOSACCHARIDE



CELLULOSE



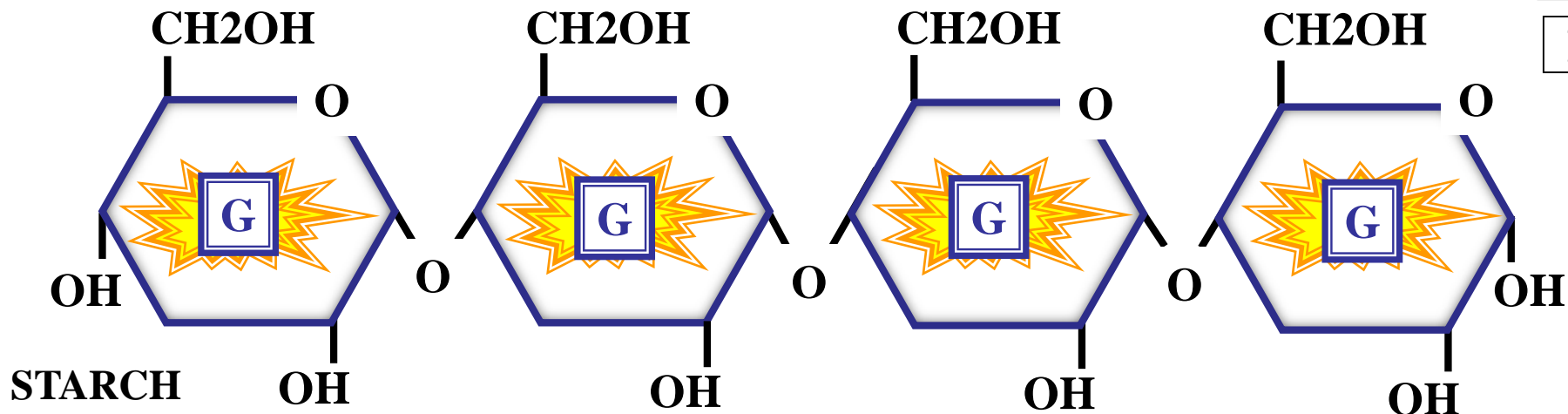
STARCH = POLY-SACCHARIDE



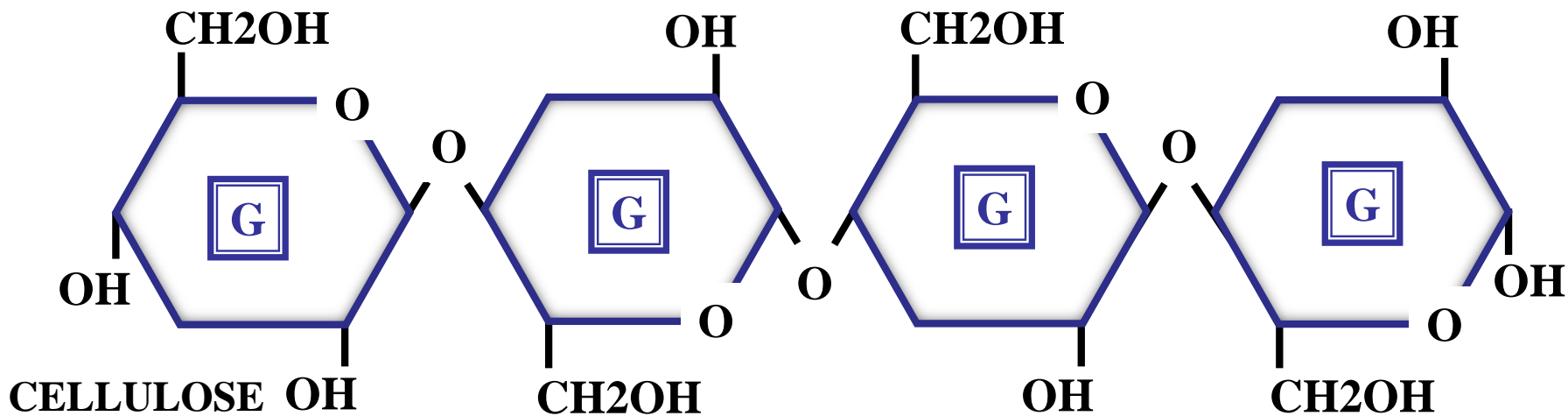
CELLULOSE = POLY-SACCHARIDE

*/-

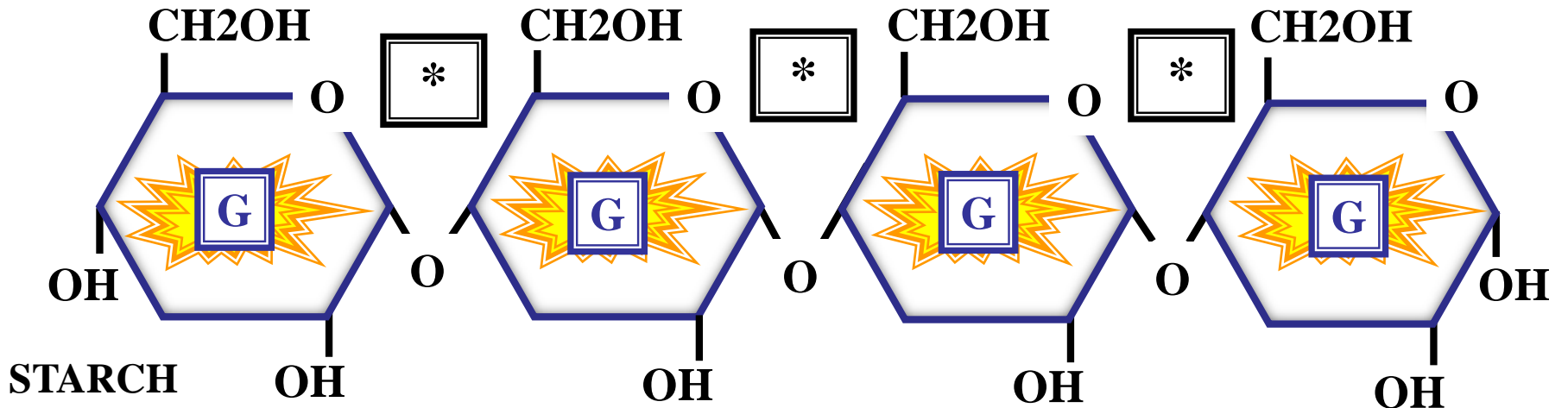
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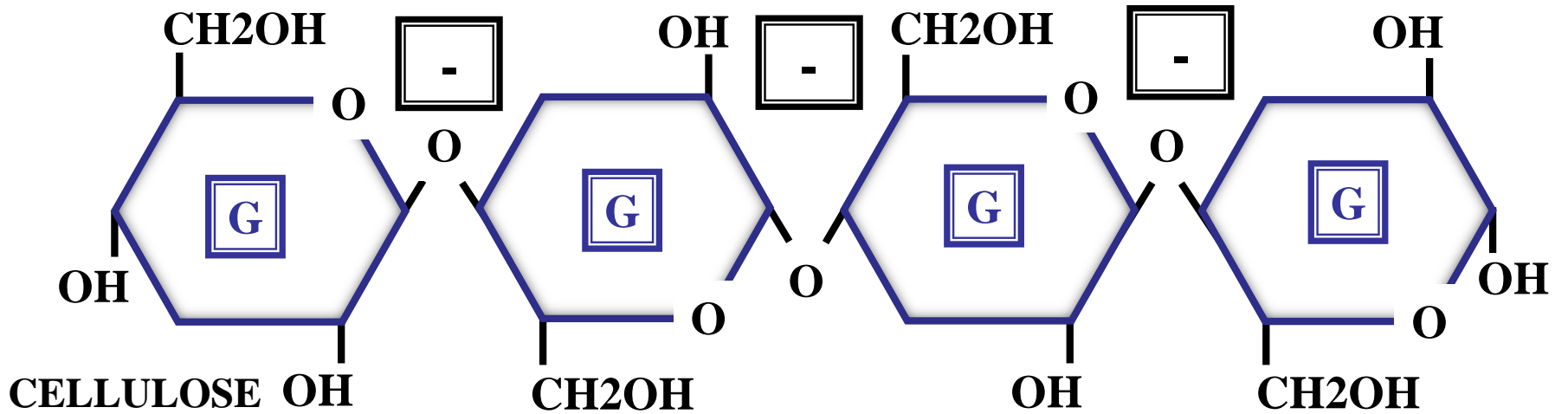
GLUCOSE MONO-SACCHARIDES



GLUCOSE MONO-SACCHARIDES



DIFF GLUCOSE TO GLUCOSE BONDS



DIFF GLUCOSE TO GLUCOSE BONDS

STARCH
VS
CELLULOSE



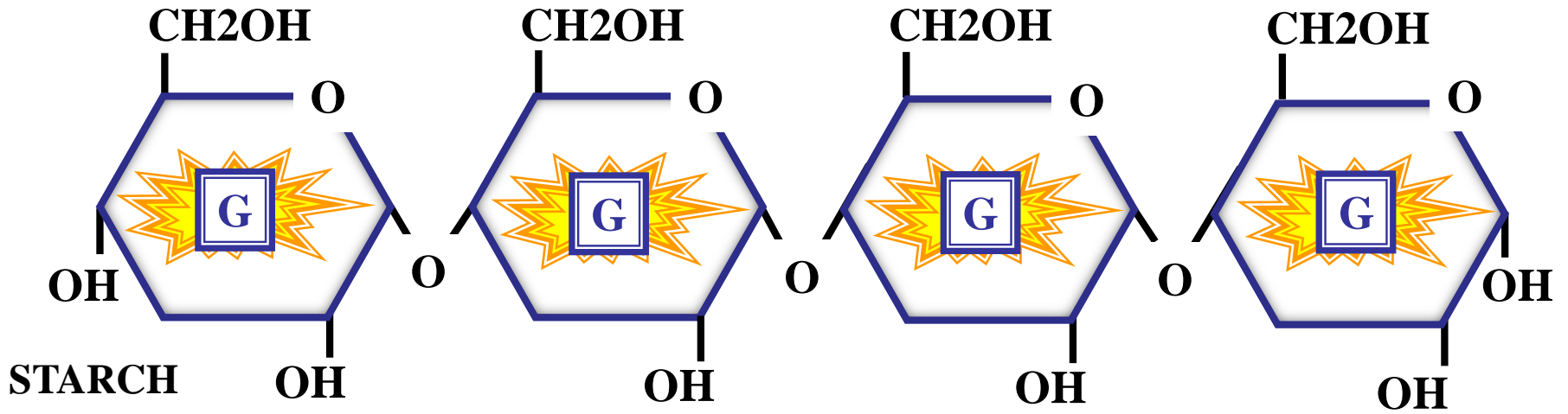
STARCH

STARCH FUNCTION

PLANT CELL

STARCH
ENERGY STORAGE
POLY-SACCHARIDE

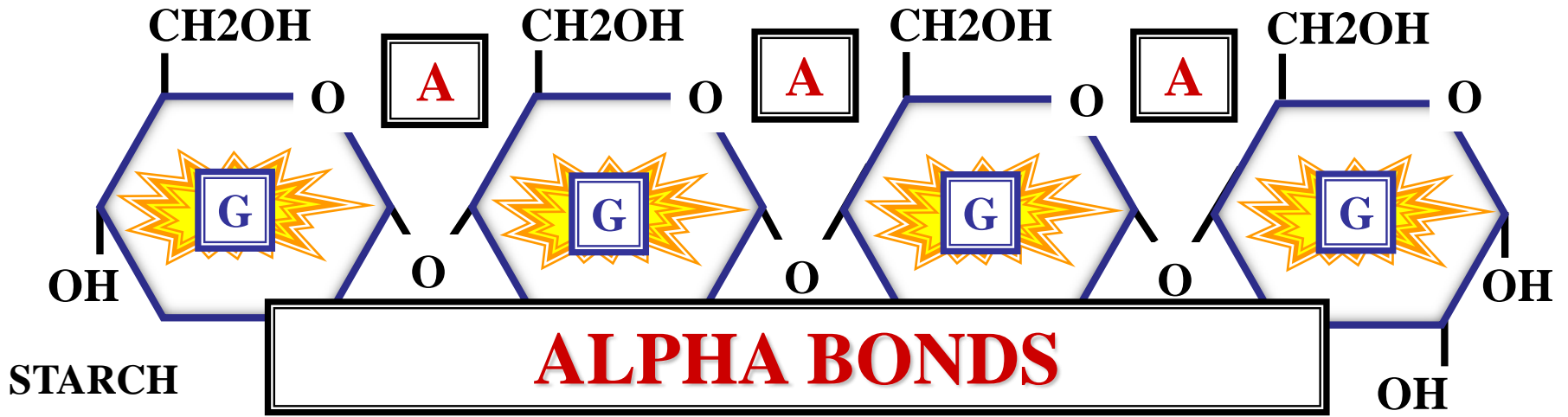
PLANT CELL



STARCH = AMYLOSE

 = GLUCOSE

 = ENERGY

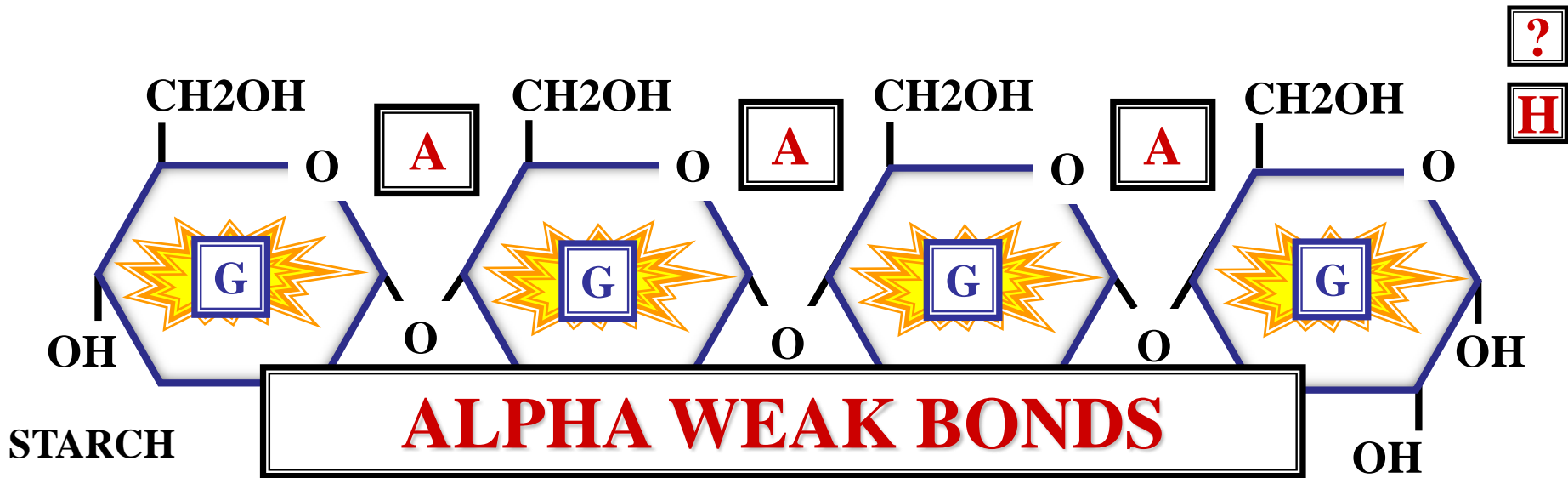


STARCH = AMYLOSE

 = ALPHA BOND

 = GLUCOSE

 = ENERGY

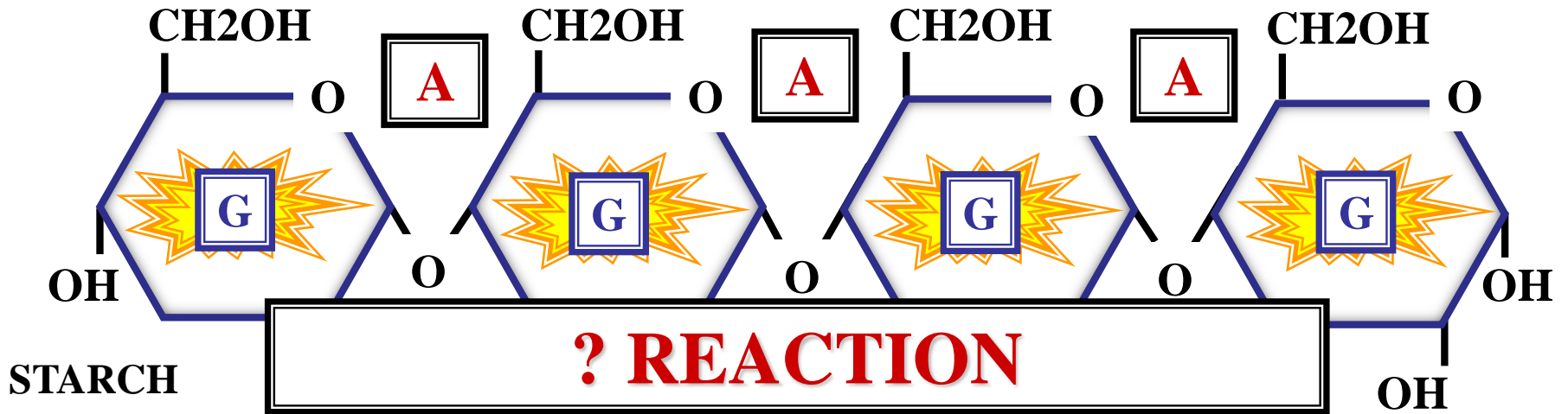


STARCH = AMYLOSE

A = ALPHA BOND

G = GLUCOSE

ENERGY

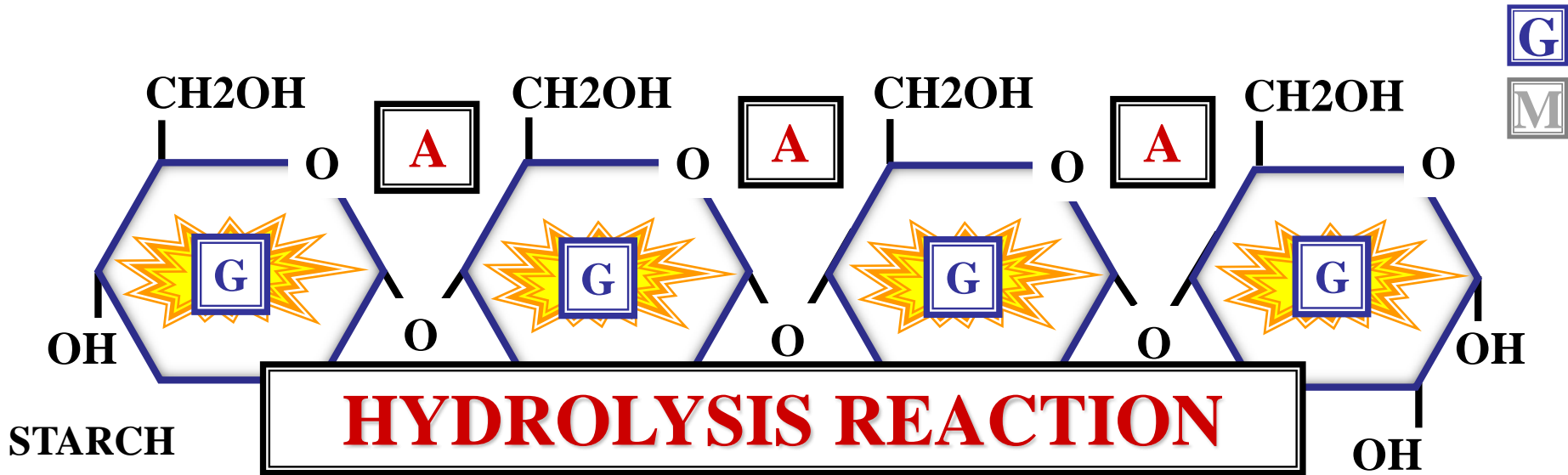


STARCH = AMYLOSE

 = ALPHA BOND

 = GLUCOSE

 = ENERGY



STARCH = AMYLOSE

 = ALPHA BOND

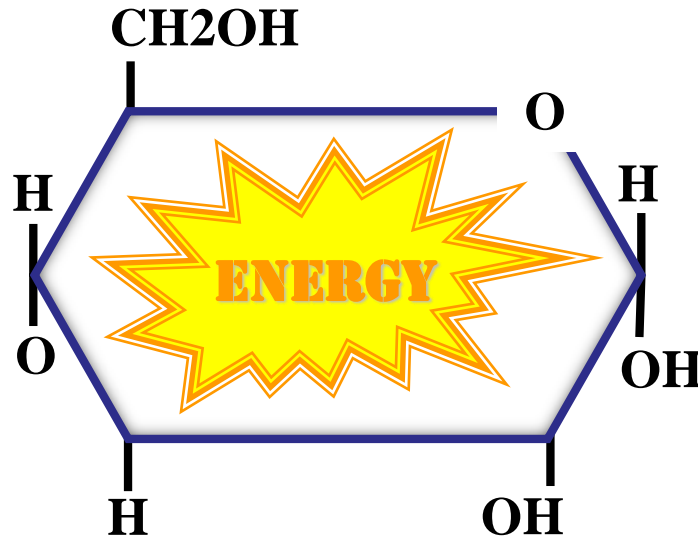
 = GLUCOSE

 = ENERGY

CELL METABOLISM

CELL METABOLISM

G



GLUCOSE

ENTERS CELL METABOLISM

CELL METABOLISM

CELL METABOLISM

GLUCOSE

HEXOKINASE

GLUCOSE-6-PHOSPHATE

PHOSPHOGLUCOISOMERASE

FRUCTOSE-6-PHOSPHATE

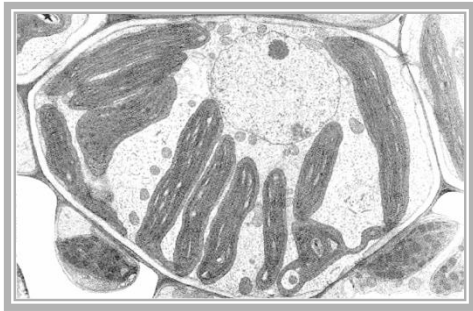
PHOSPHOFRUCTOKINASE

FRUCTOSE-1-6-PHOSPHATE



+

 = ENERGY



FRUCTOSE-1-6-PHOSPHATE



**ALDOLASE
ISOMERASE**



PHOSPHOGLYCERALDEHYDE - PGAL

PHOSPHOGLYCERALDEHYDE - PGAL

TRI-PHOSPHATE DEHYDROGENASE

TRI-PHOSPHATE DEHYDROGENASE

1-3-BISPHOSPHOGLYCERATE

1-3-BISPHOSPHOGLYCERATE

PHOSPHOGLYCEROKINASE

PHOSPHOGLYCEROKINASE



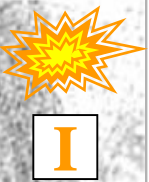
ENERGY RELEASED



3-PHOSPHOGLYCERATE - PGA

3-PHOSPHOGLYCERATE - PGA

CELL METABOLISM



ENERGY



**ENERGY DRIVES
BIOCHEMICAL REACTION**

CELL METABOLISM



ENERGY
INPUT

CMP-A + CMP-B \longrightarrow **CMP-C**

**ENERGY DRIVES
BIOCHEMICAL REACTION
TO PRODUCT**

***EFFICIENT
CELL
METABOLISM***

HOMEOSTASIS





CELLULOSE

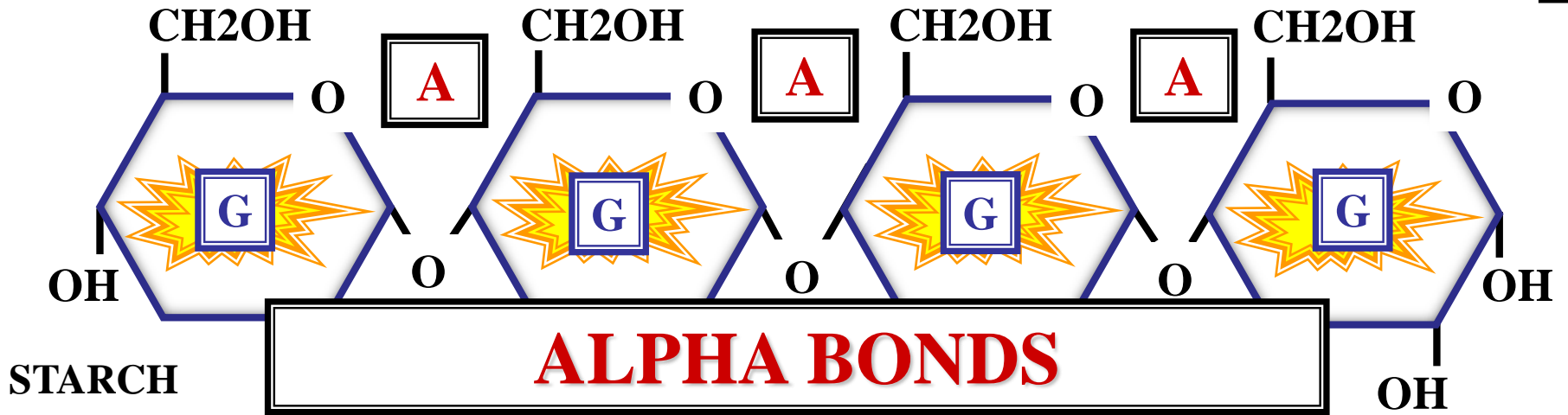
CELLULOSE FUNCTION

PLANT CELL

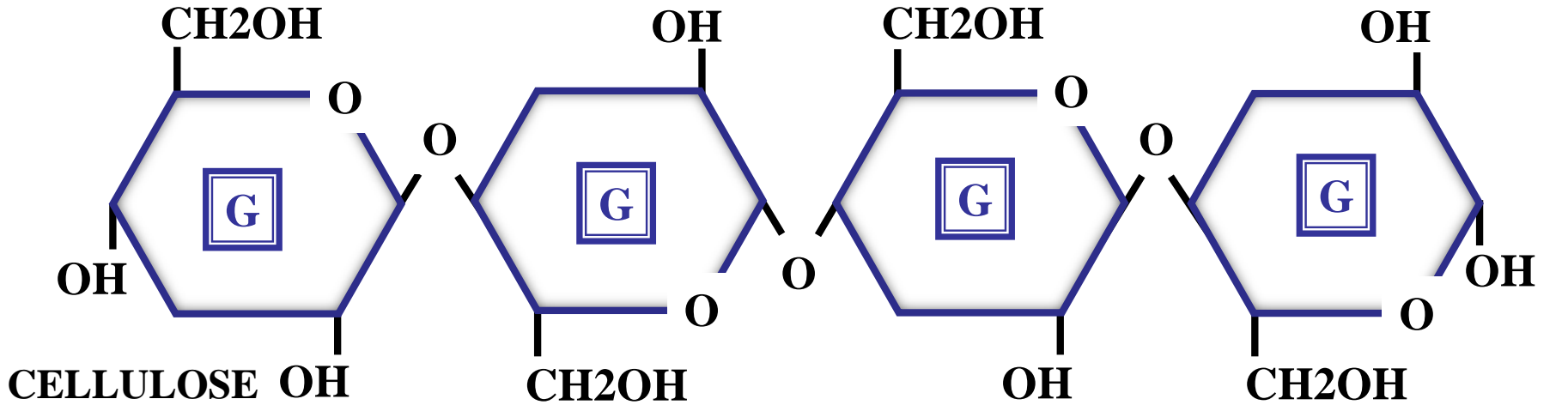


**CELLULOSE
STRUCTURAL
SUPPORT
POLY-SACCHARIDE**

PLANT CELL

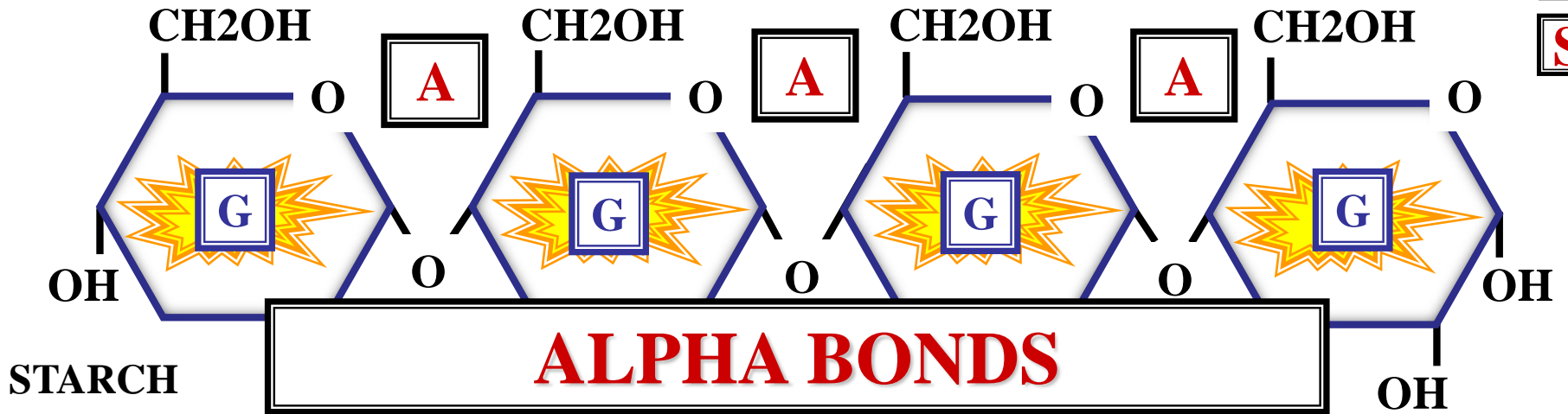


STARCH = AMYLOSE

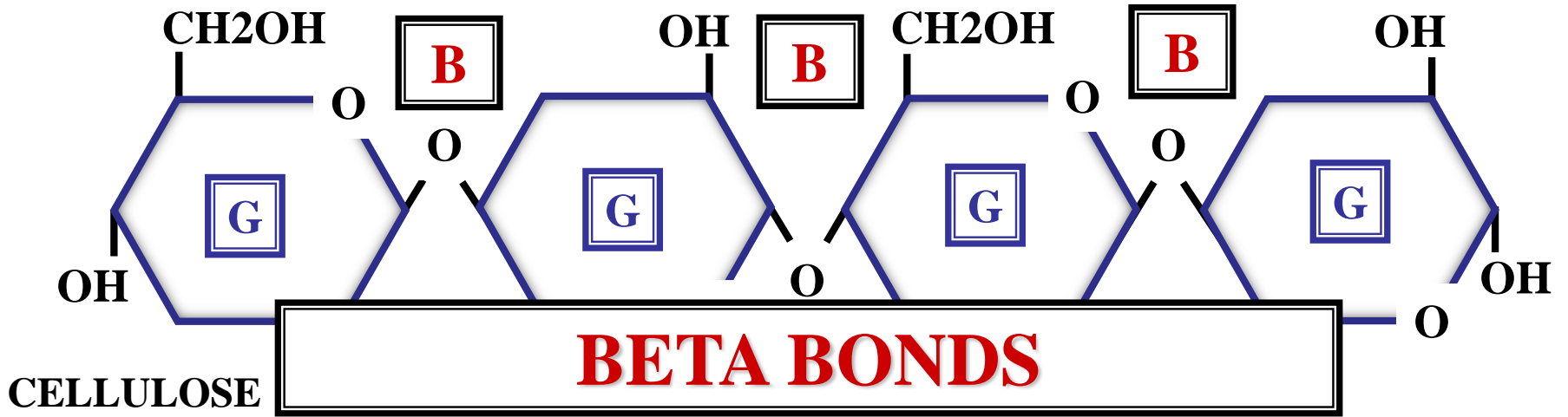


CELLULOSE

G = GLUCOSE



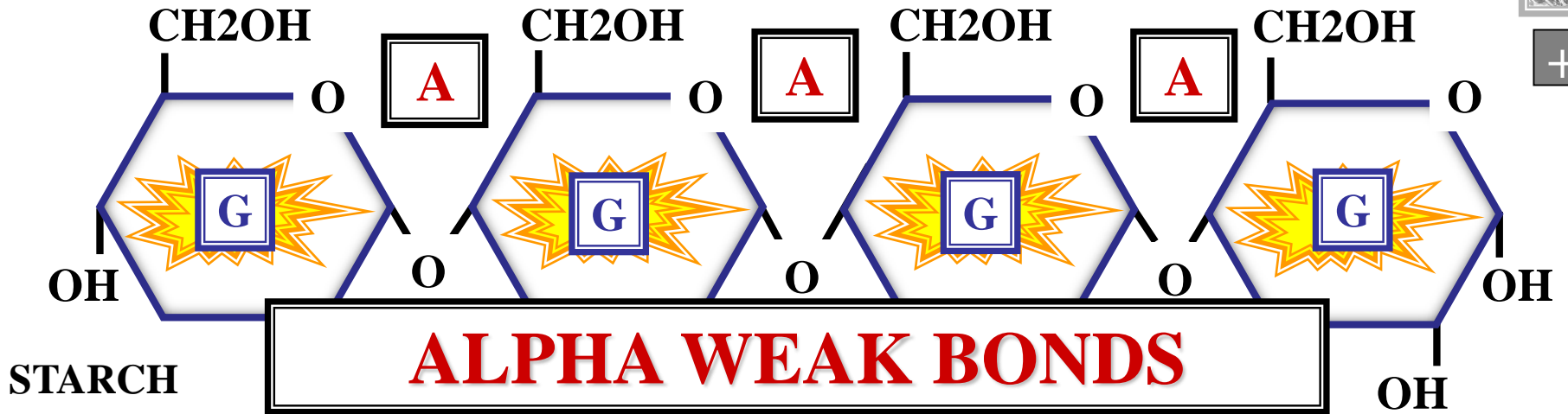
STARCH = AMYLOSE



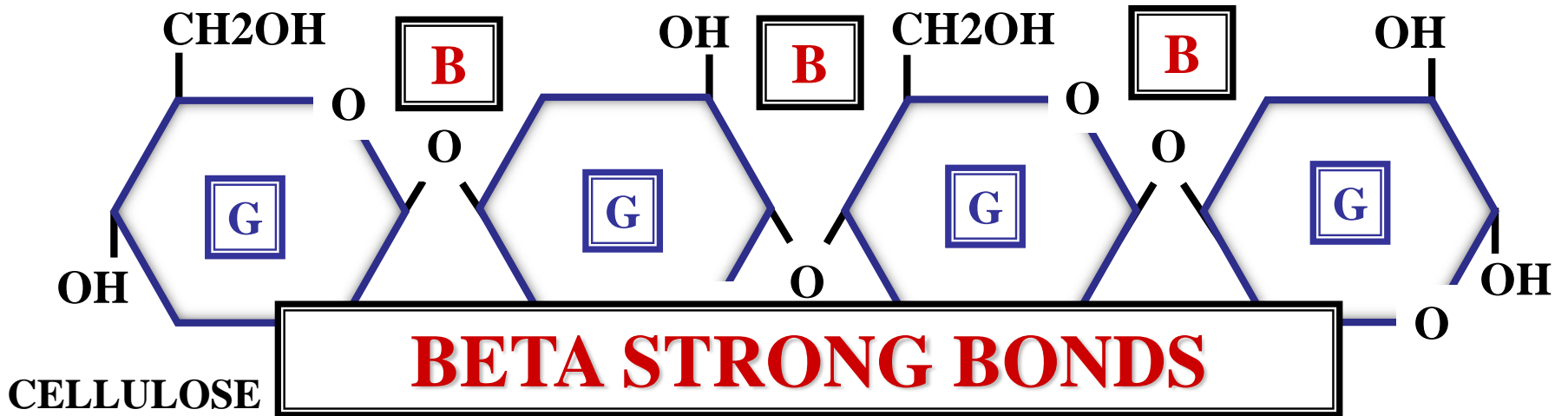
B = BETA BOND

CELLULOSE

G = GLUCOSE



STARCH = AMYLOSE



B = BETA BOND

CELLULOSE

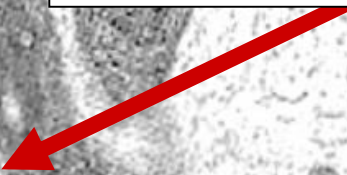
G = GLUCOSE



**CELLULOSE STRUCTURAL SUPPORT
POLYSACCHARIDE**

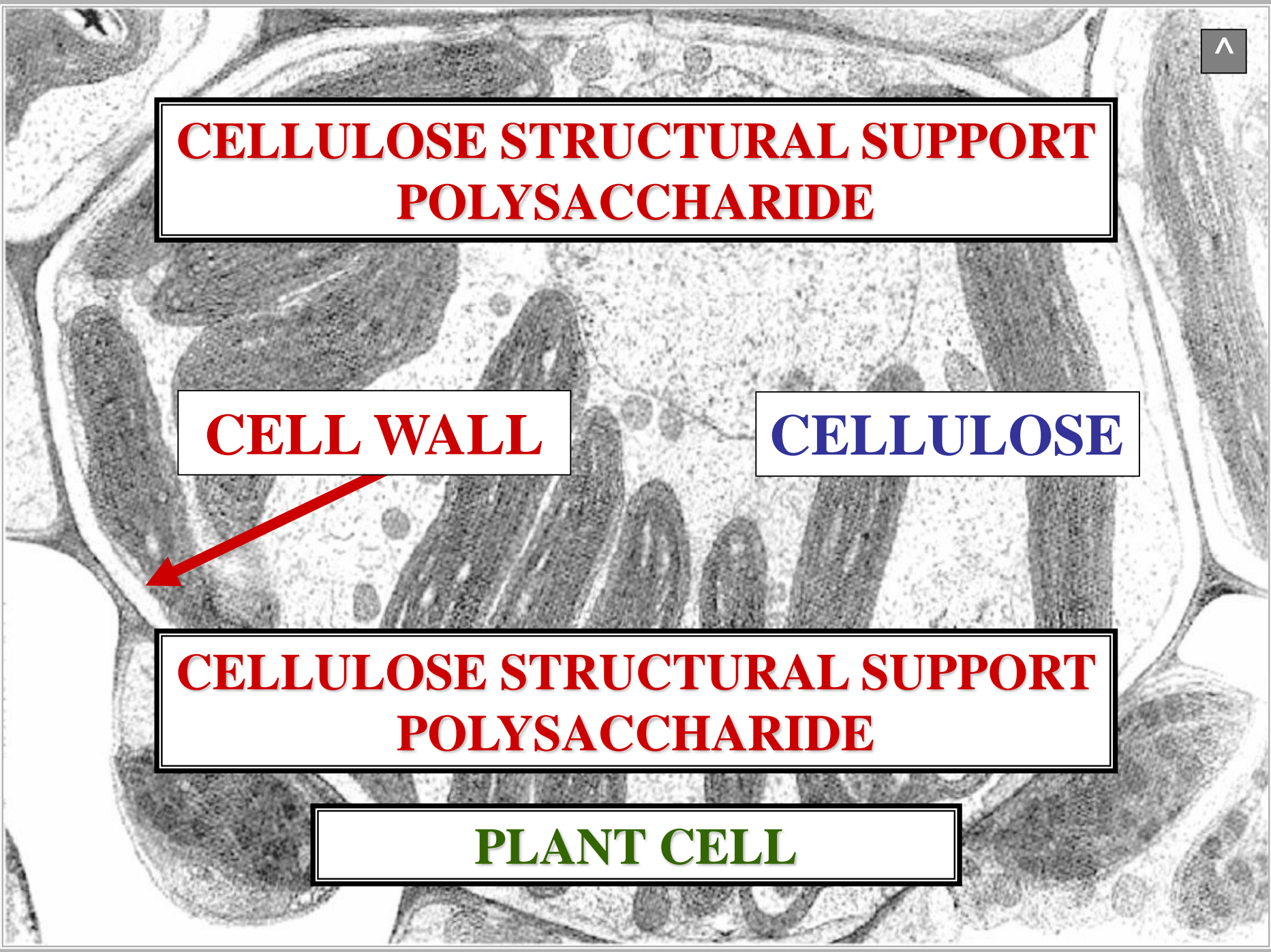
CELL WALL

CELLULOSE



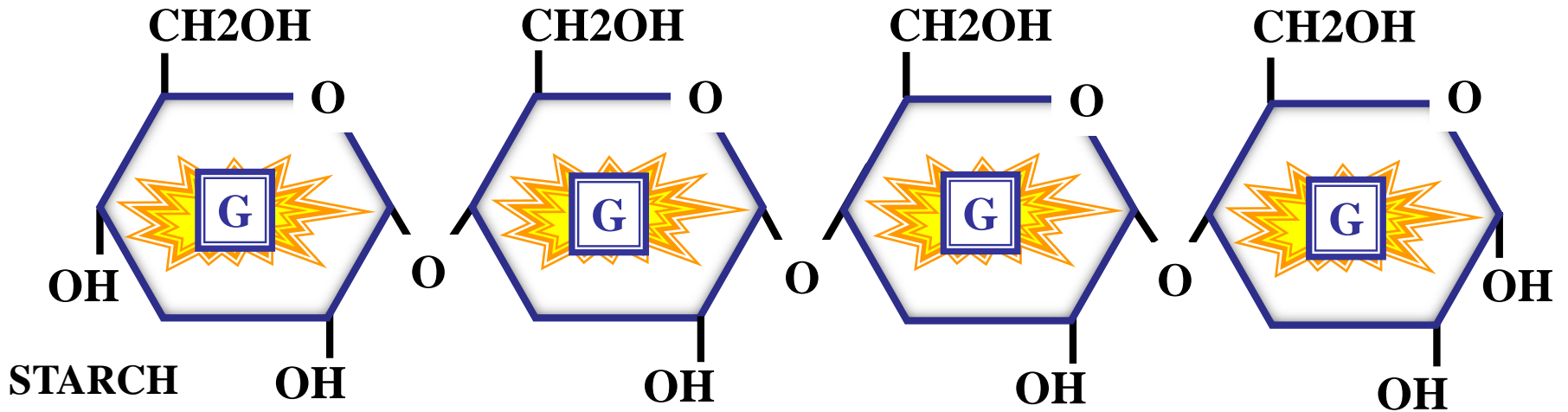
**CELLULOSE STRUCTURAL SUPPORT
POLYSACCHARIDE**

PLANT CELL

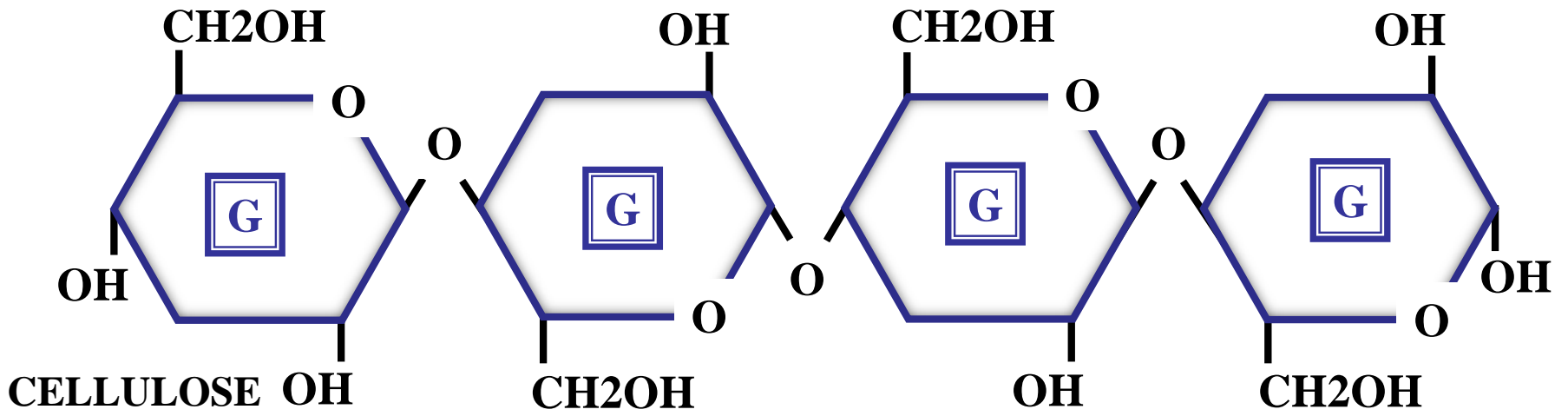




STARCH
VS
CELLULOSE
SUMMARY



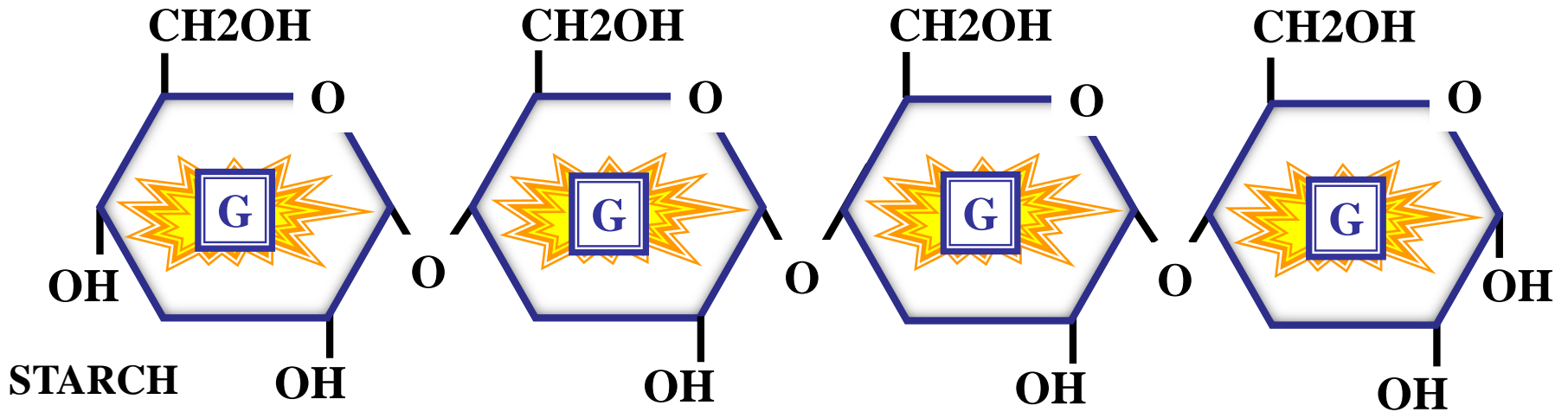
STARCH = AMYLOSE



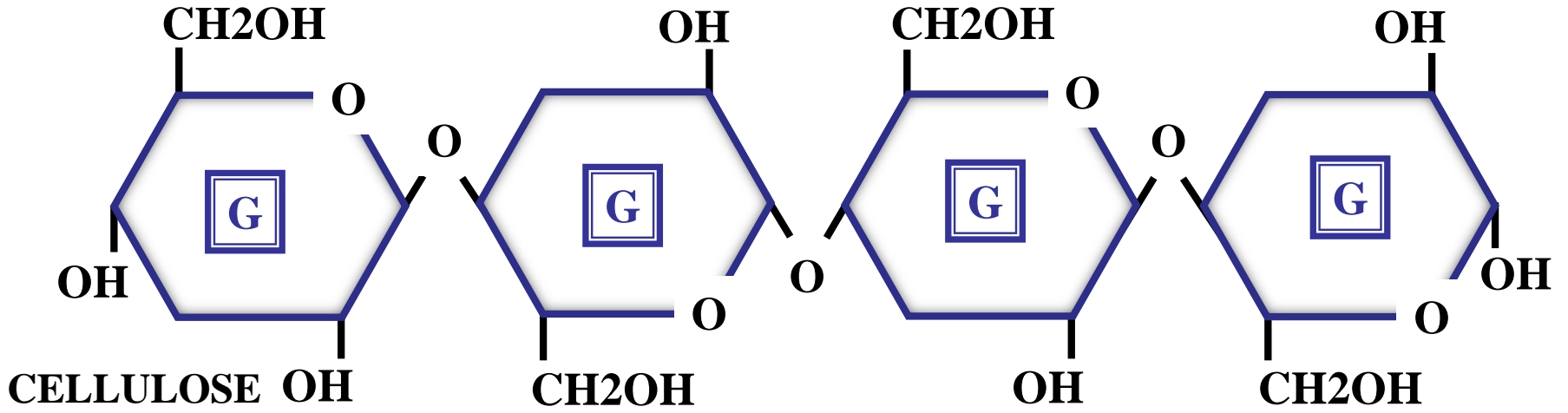
 = ENERGY

CELLULOSE

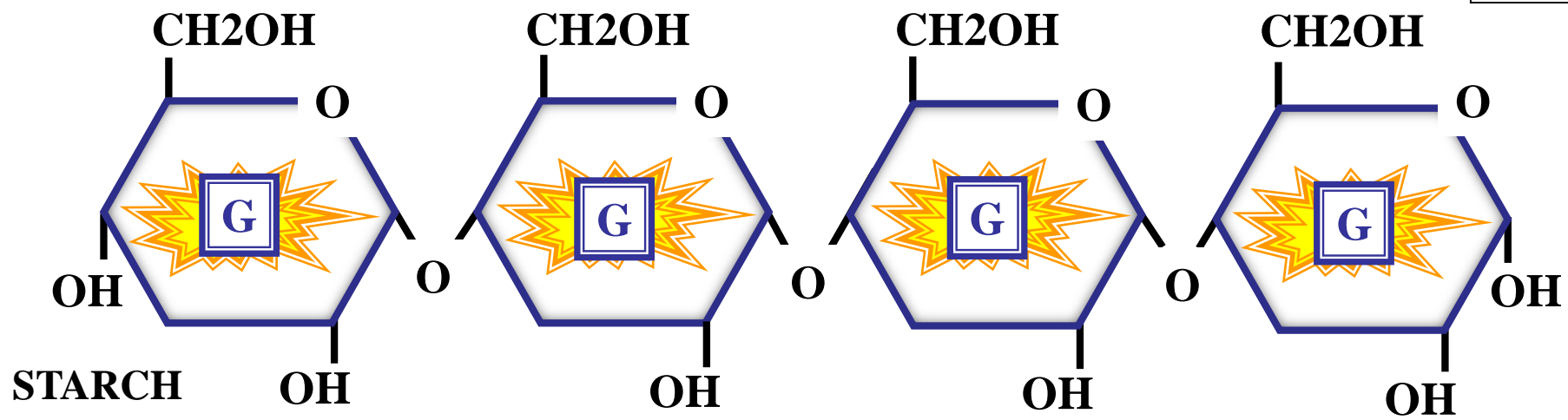
 = GLUCOSE



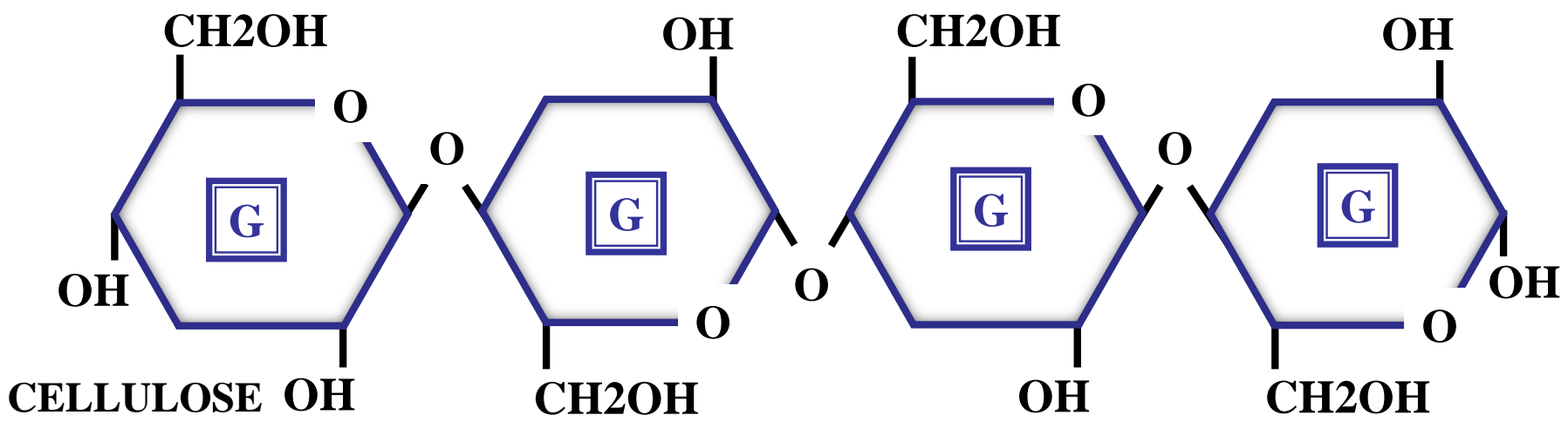
STARCH = POLY-SACCHARIDE



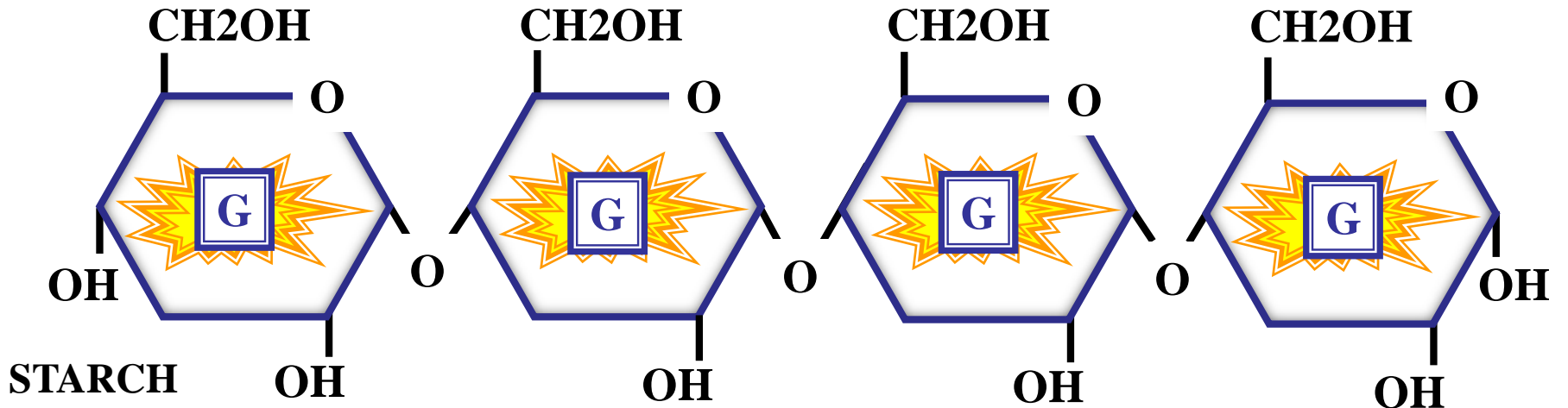
CELLULOSE = POLY-SACCHARIDE



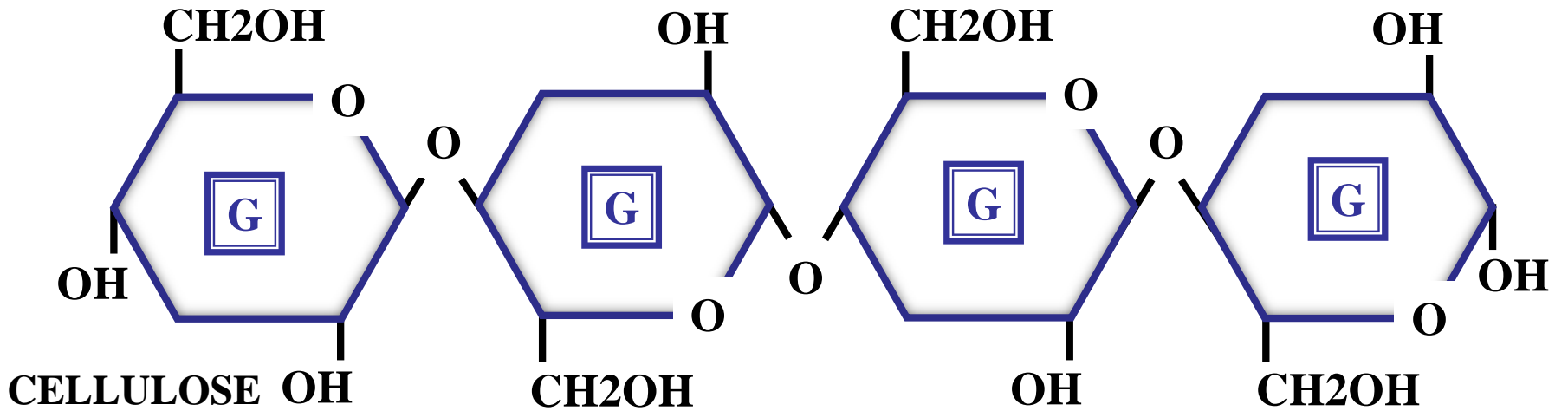
GLUCOSE MONO-SACCHARIDES



GLUCOSE MONO-SACCHARIDES



DIFF GLUCOSE TO GLUCOSE BONDS



DIFF GLUCOSE TO GLUCOSE BONDS