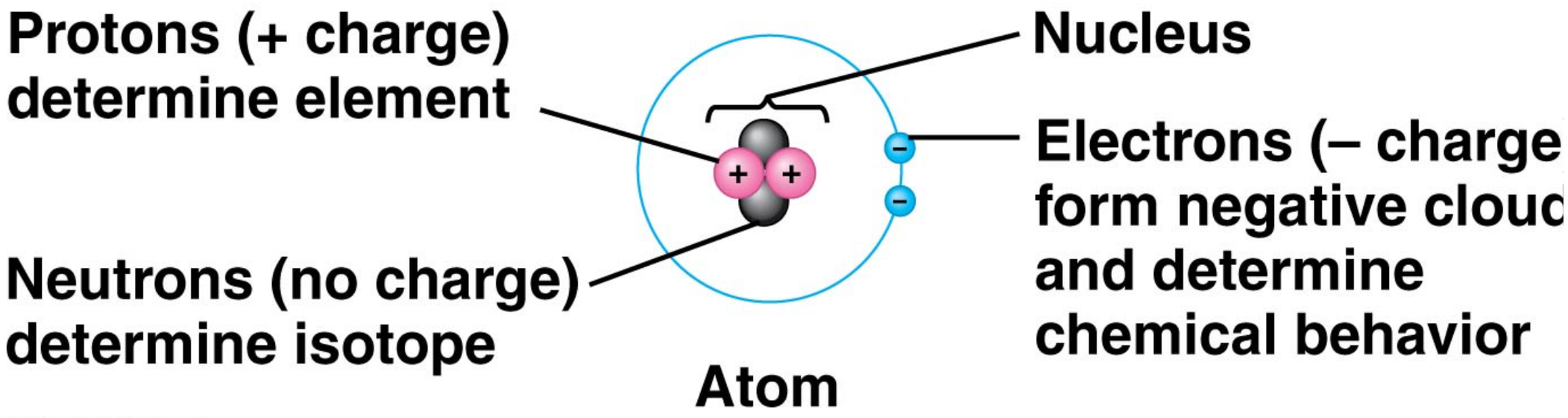
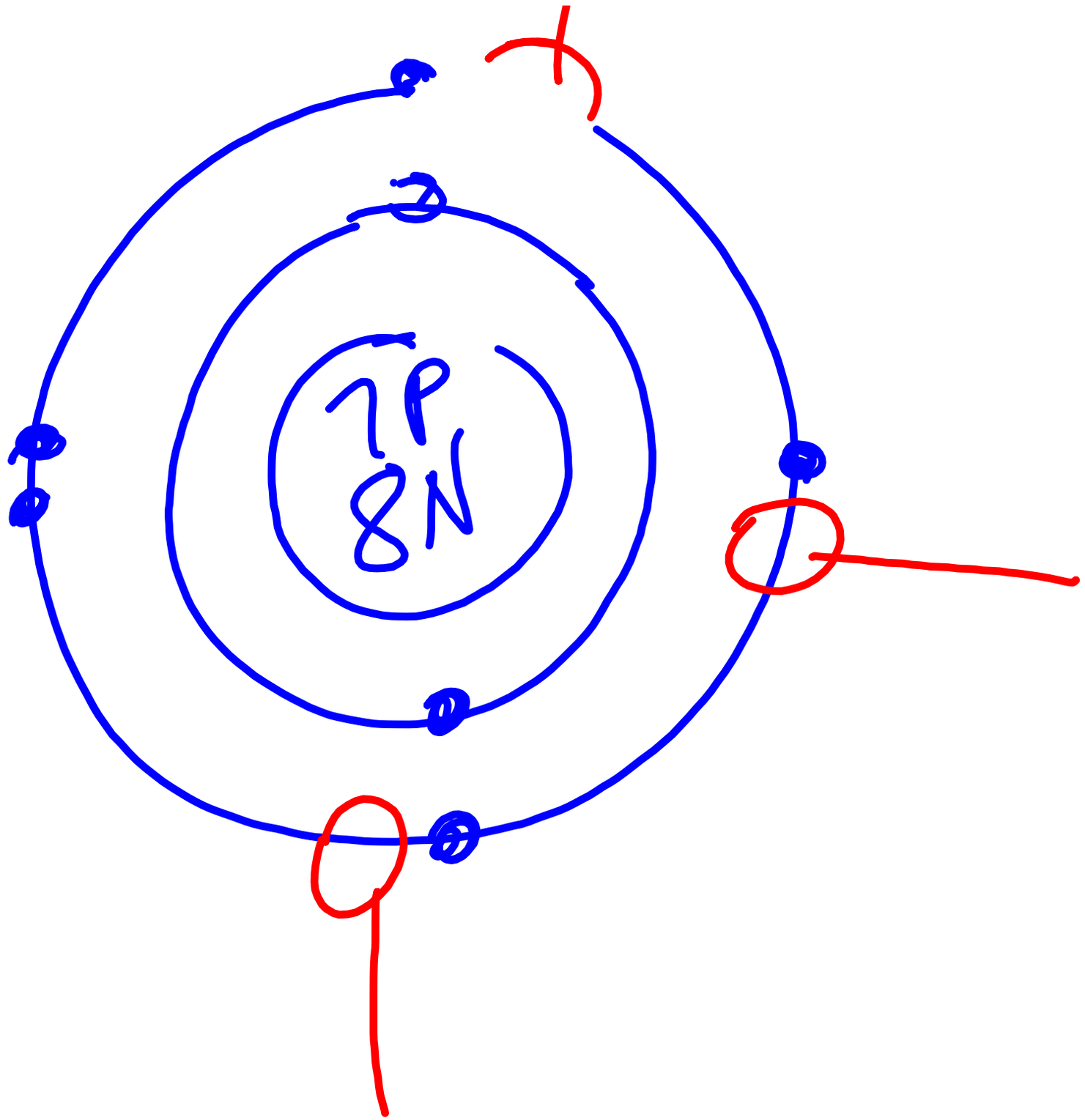
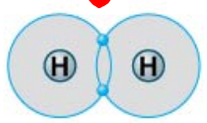
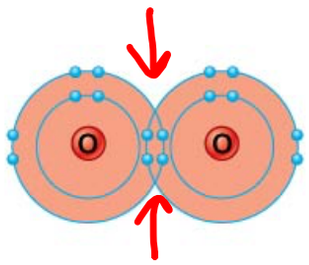
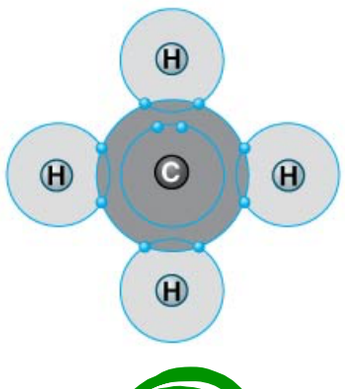
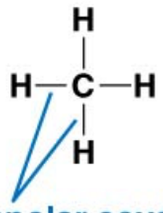
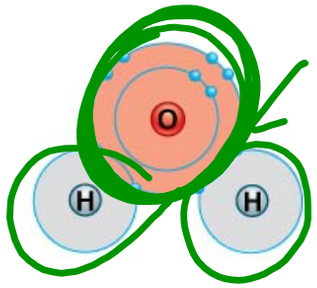
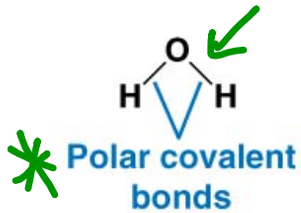
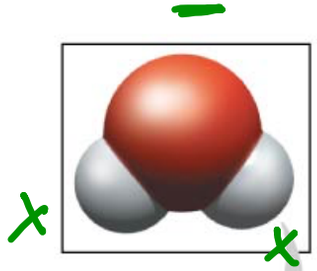
How is chemistry related to biology?



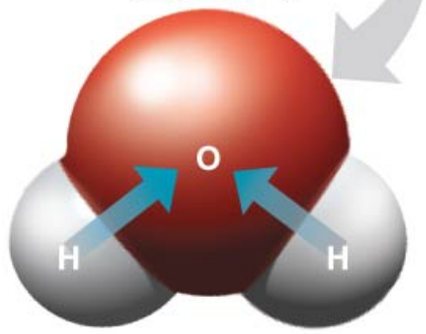
Draw an atom of nitrogen: Atomic number is 7 and mass is 15 (watch the PBS video review)

https://mass.pbslearningmedia.org/resource/nvhe.sci.chemistry.compounds/how-elements-form-compounds/


7P
8N

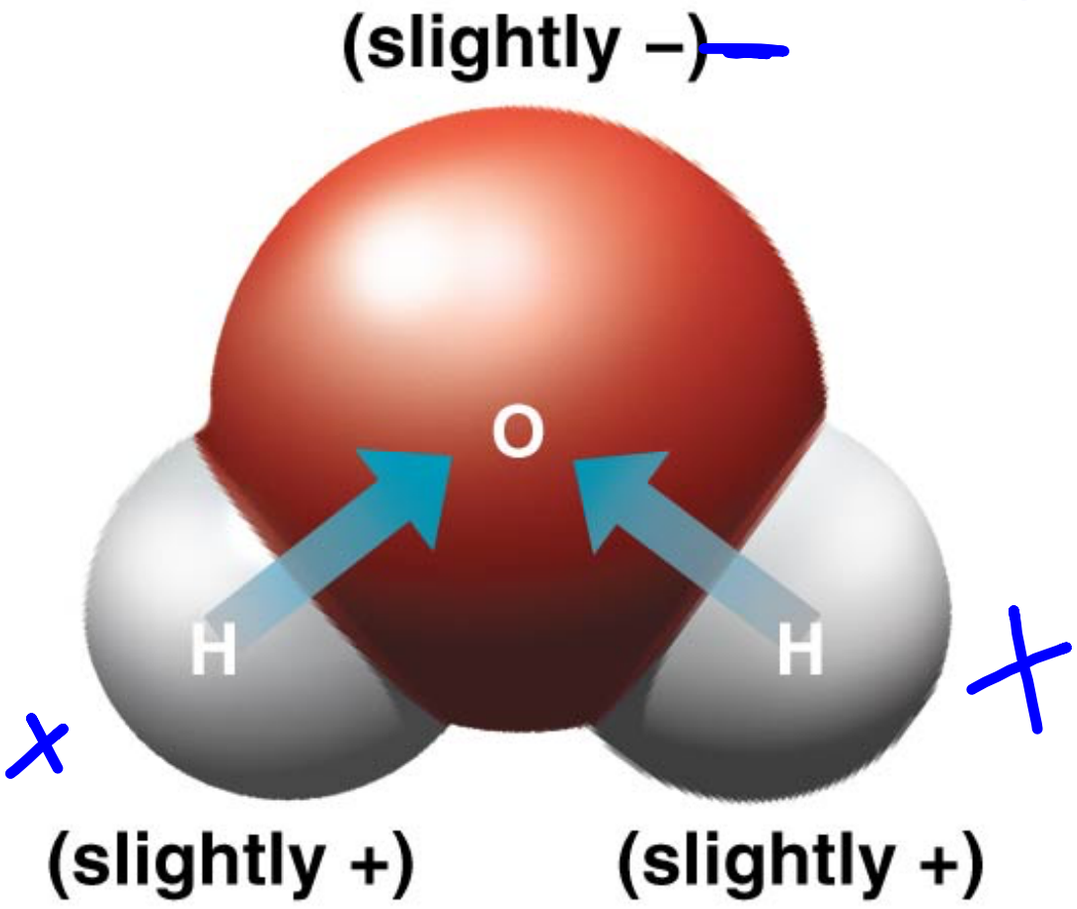
Molecular Formula	Electron Distribution Diagram	Structural Formula	Space-Filling Model
H_2 Hydrogen		H—H Single bond	
O_2 Oxygen		O=O Double bond	
CH_4 Methane		 Nonpolar covalent bonds	
H_2O Water		 Polar covalent bonds	 (slightly –)

Polar covalent bonds in a water molecule



Water is Polar

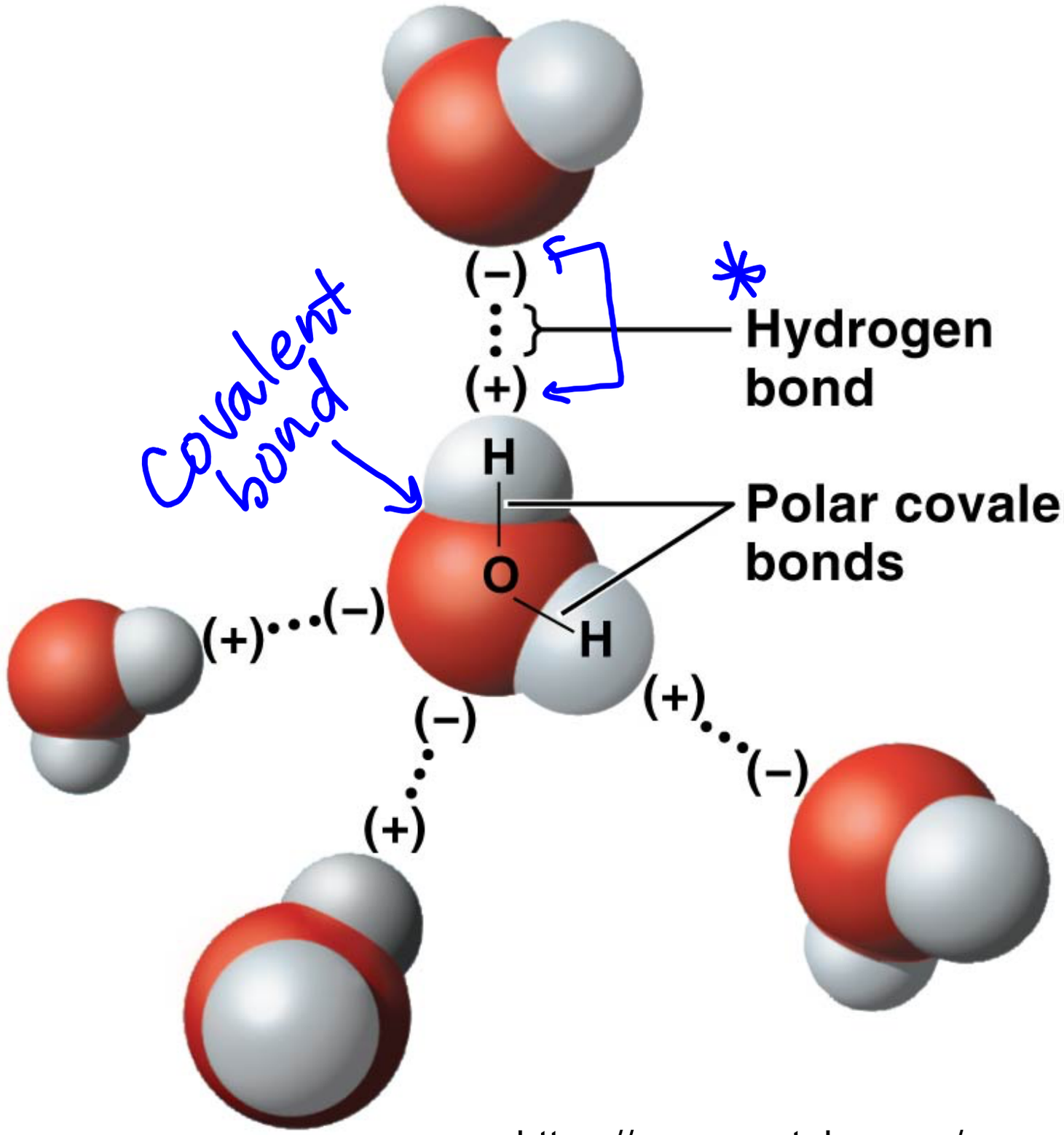
Importance of Water



Polar covalent bonds in a water molecule

"Like dissolves Like"

"opposites attract"

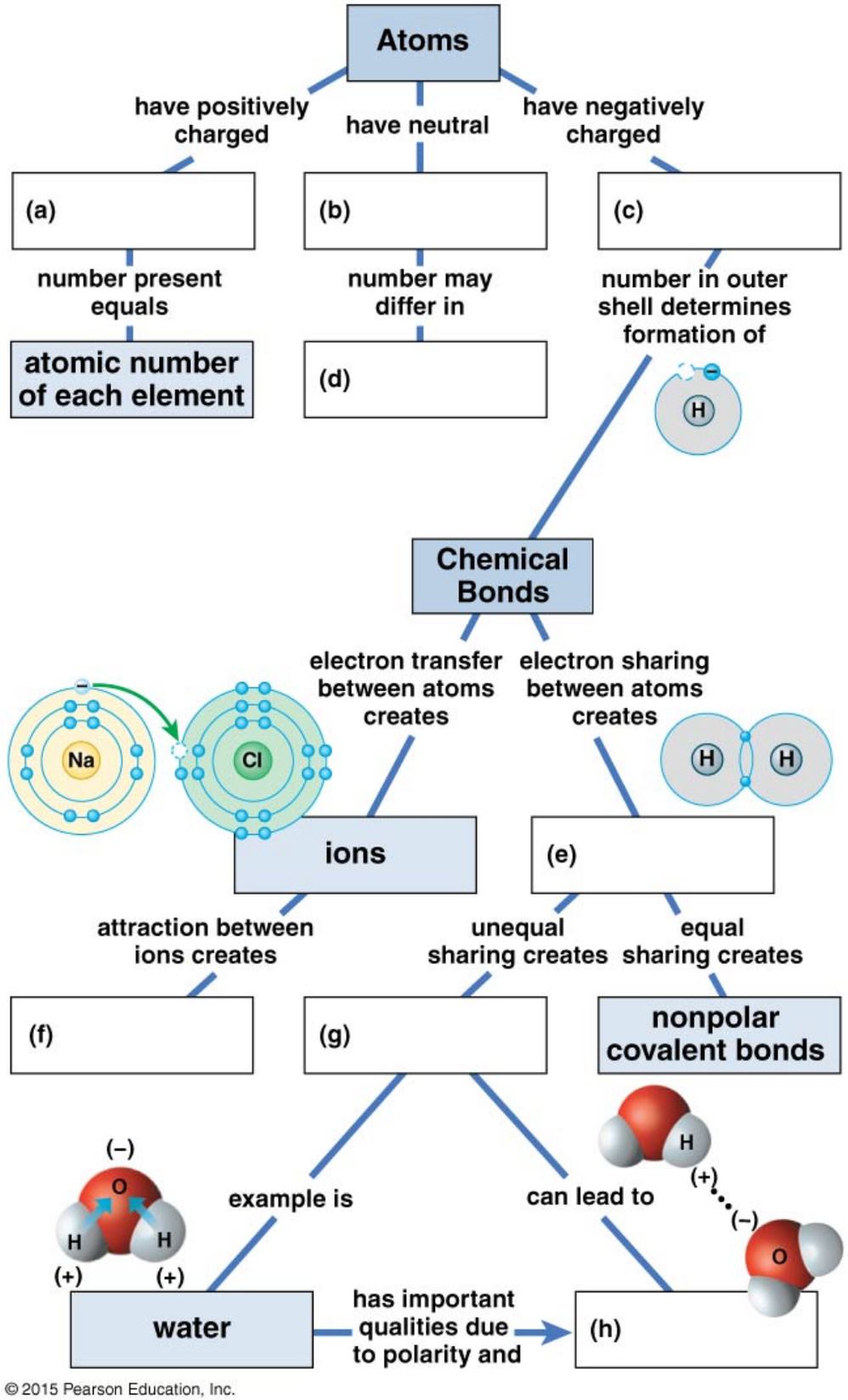


https://www.youtube.com/watch?v=0eNSnj4ZfZ8

Capillary Tube Demo!

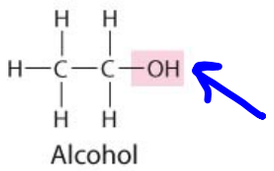
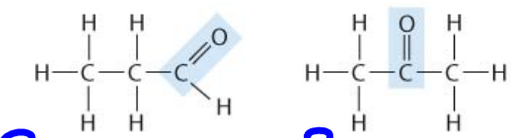
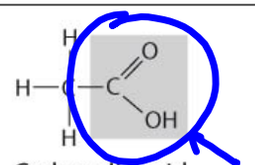
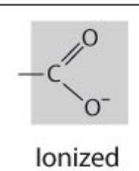
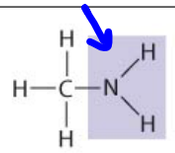
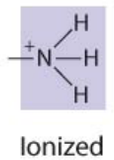
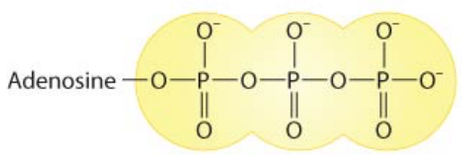
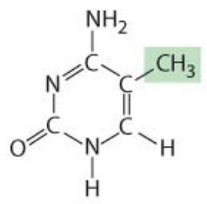
Adhesion – water molecules are attracted to other molecules
ex| water + glass

cohesion – water sticks to other water molecules



Introduction to Organic Chemistry and Biochemistry

TABLE 3.2 IMPORTANT CHEMICAL GROUPS OF ORGANIC COMPOUNDS

Chemical Group	Examples
Hydroxyl group —OH	 Alcohol
Carbonyl group C=O	 Aldehyde; Ketone
Carboxyl group —COOH	 Carboxylic acid;  Ionized
Amino group —NH_2	 Amine;  Ionized
Phosphate group —OPO_3^{2-}	 Organic phosphate
Methyl group —CH_3	 Methylated compound

Functional Groups:

Hydroxyl

Carboxyl

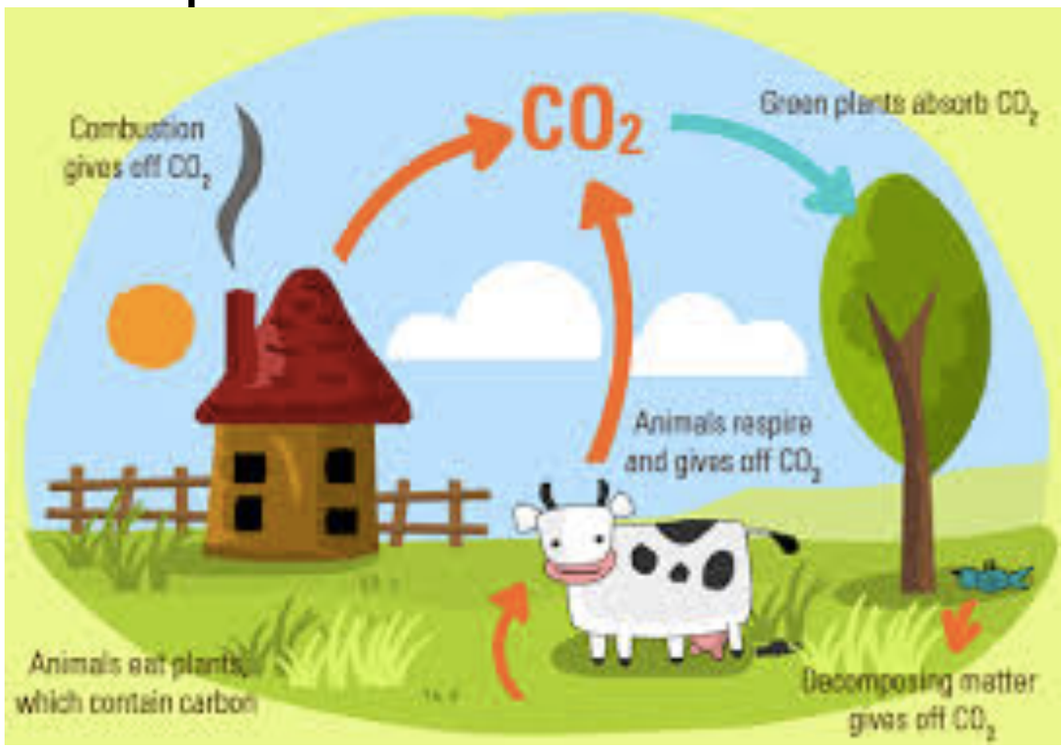
Aldehyde

Ketone

Amino

Phosphate

Organic Chemistry is the study of carbon-based compounds.



Can be simple: Methane: CH_4

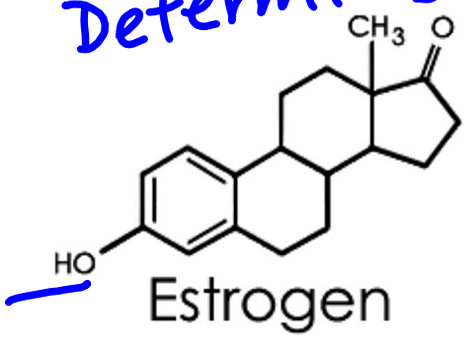
or Complex:
Hemoglobin: $C_{2952}H_{4664}O_{832}S_8Fe_4$

In Biology, the most important organic molecules are **proteins, nucleic acids, lipids and carbohydrates**.

Other <u>elements</u> in these molecules include: hydrogen, oxygen, nitrogen, sulfur and phosphorus.

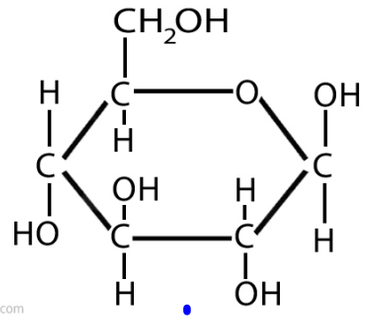
Structure and Function for Organic Molecules

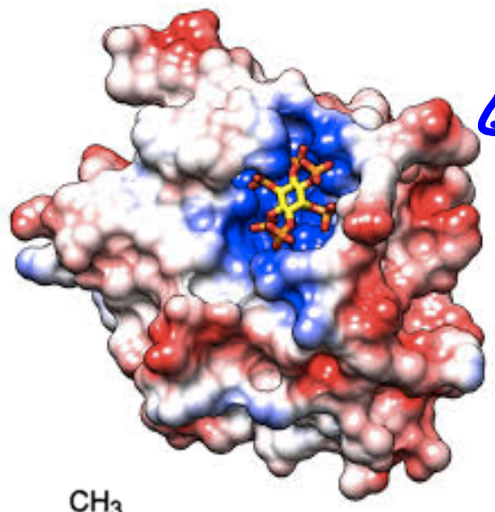
Determines



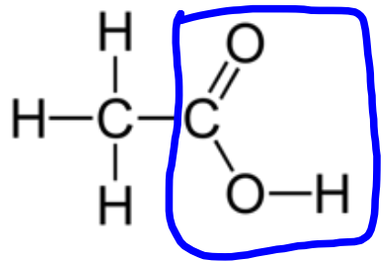
Estrogen

Glucose

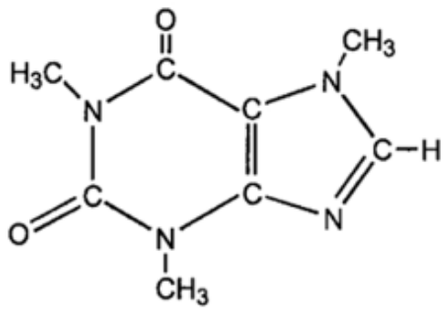




protein

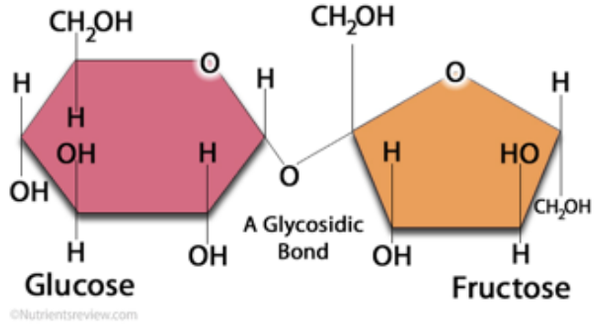


Acetic Acid (vinegar)



Caffeine

Sucrose

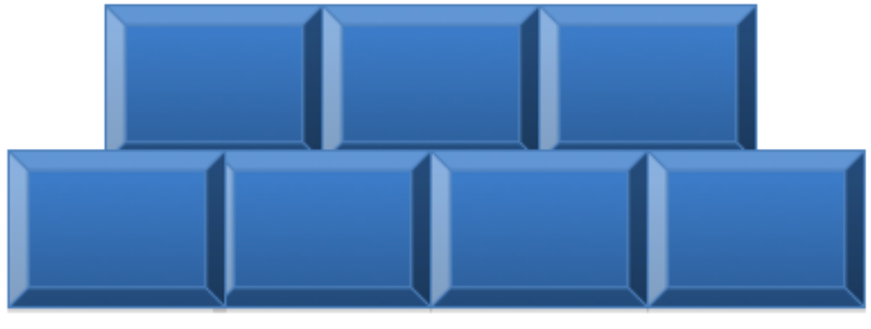


Can you find the **functional groups** in these molecules??

Many organic molecules are **polymers**, which are chains of **monomers** connected by covalent bonds.

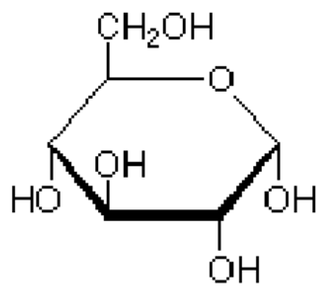
- **Monomer** – smallest biomolecule – the building block

- **Polymer** – many monomers covalently bonded



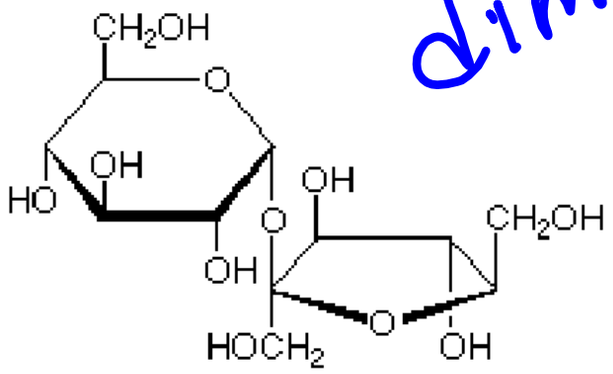
Many organic molecules are **polymers**, which are chains of **monomers** connected by covalent bonds. (for example: Carbohydrates - the monomer is **glucose**, the dimer is **sucrose** and the polymer is starch (**amylose**)

monomer



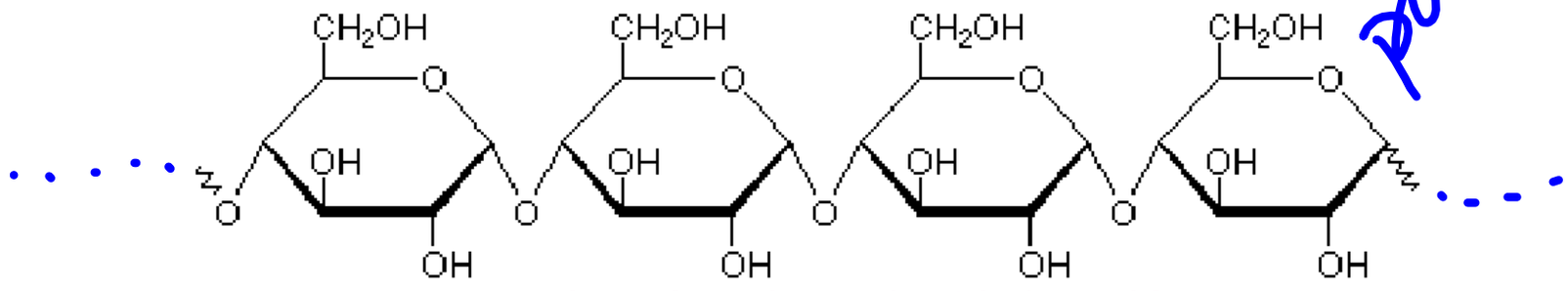
glucose (a monosaccharide)

dimer



sucrose (a disaccharide)

polymer

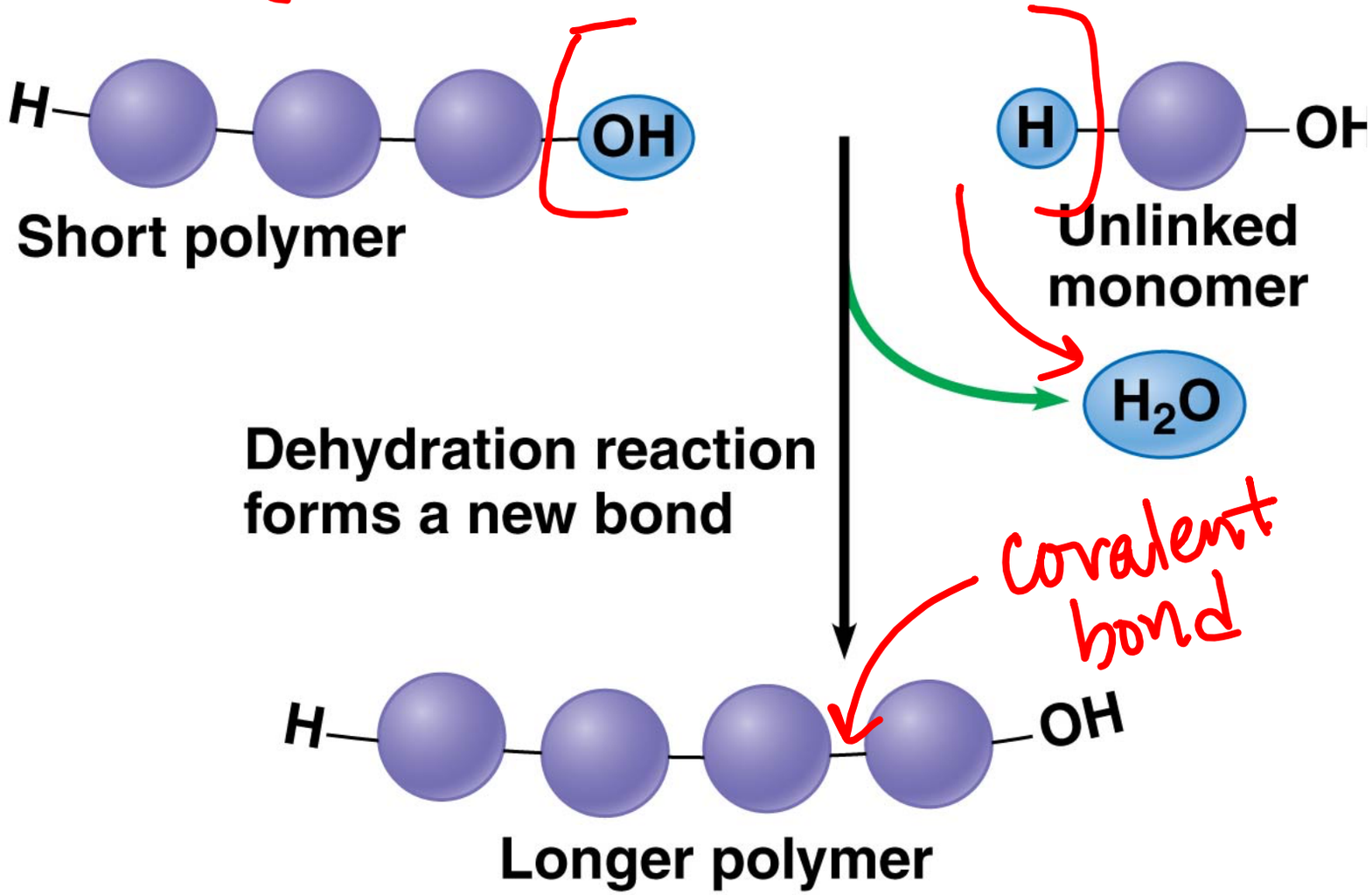


amylose (a polysaccharide/starch)

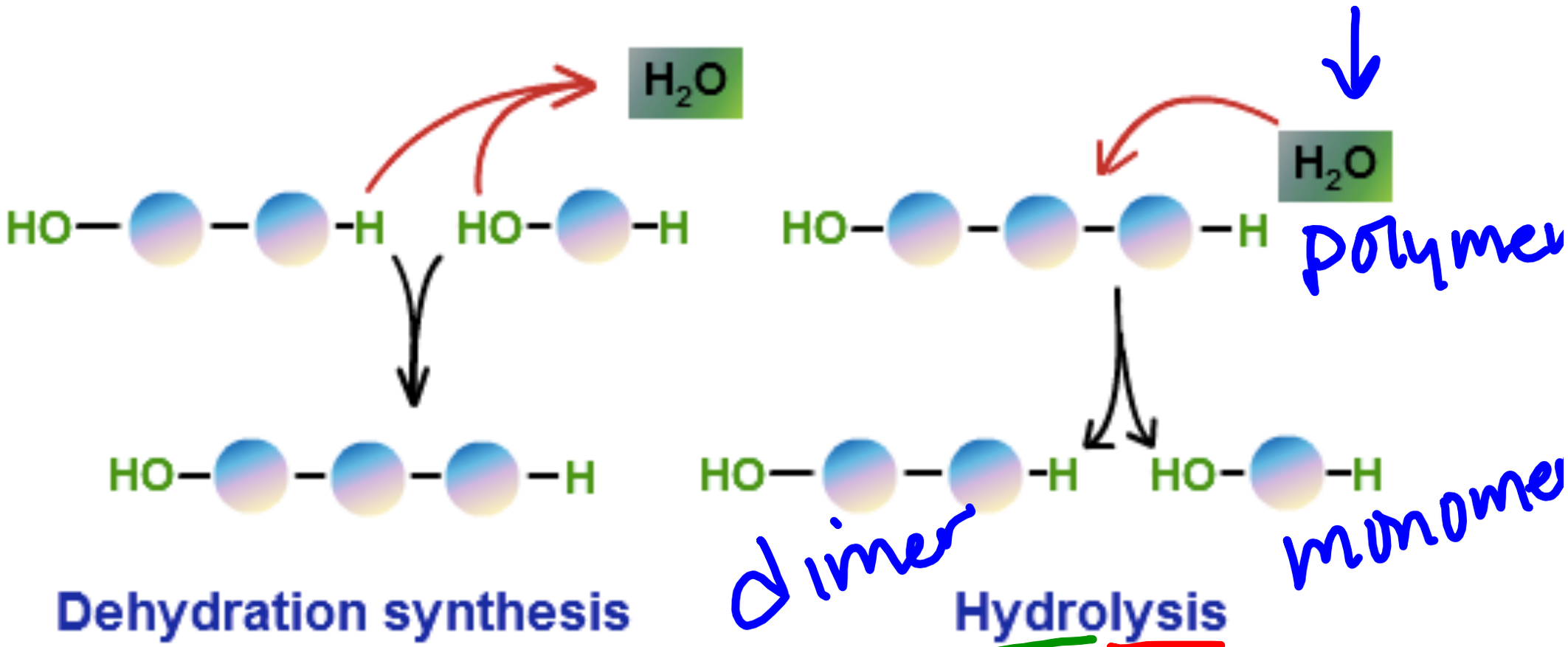
Dehydration Synthesis is a process by which monomers become linked by covalent bonds.

Why is it called dehydration?

Condensation reaction



The opposite process is called **hydrolysis**.



Carbohydrates!

Zoomers: Go find something with carbohydrates in it and bring it back to show us!

Schoolers: List some foods you know to contain carbohydrates!

Carbohydrates are sugars that serve as a fuel and main carbon source.

same as water

Elements C, H and O with a H:O ratio of 2:1

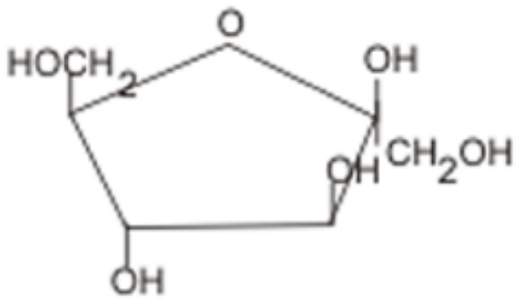
monosaccharides

disaccharide

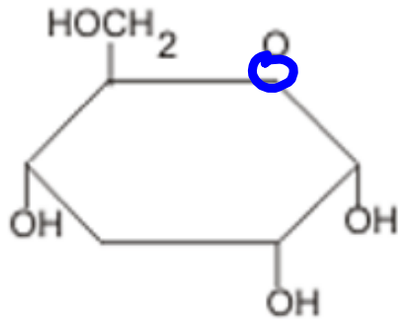
Examples:

Glucose	Fructose	Sucrose
$C_6H_{12}O_6$	$C_6H_{12}O_6$	$C_{12}H_{22}O_{11}$

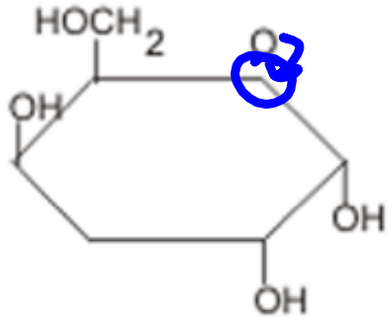
Monosaccharides: The simplest sugars



Fructose



Glucose

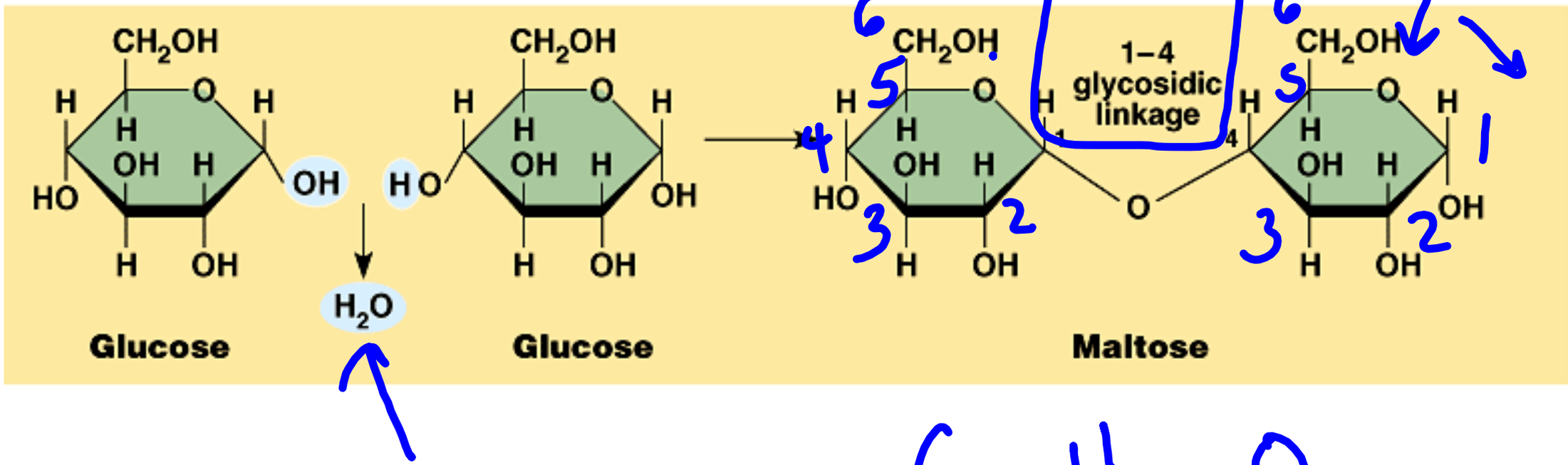


Galactose

Disaccharides: Two monosaccharides joined by a condensation reaction (dehydration synthesis)

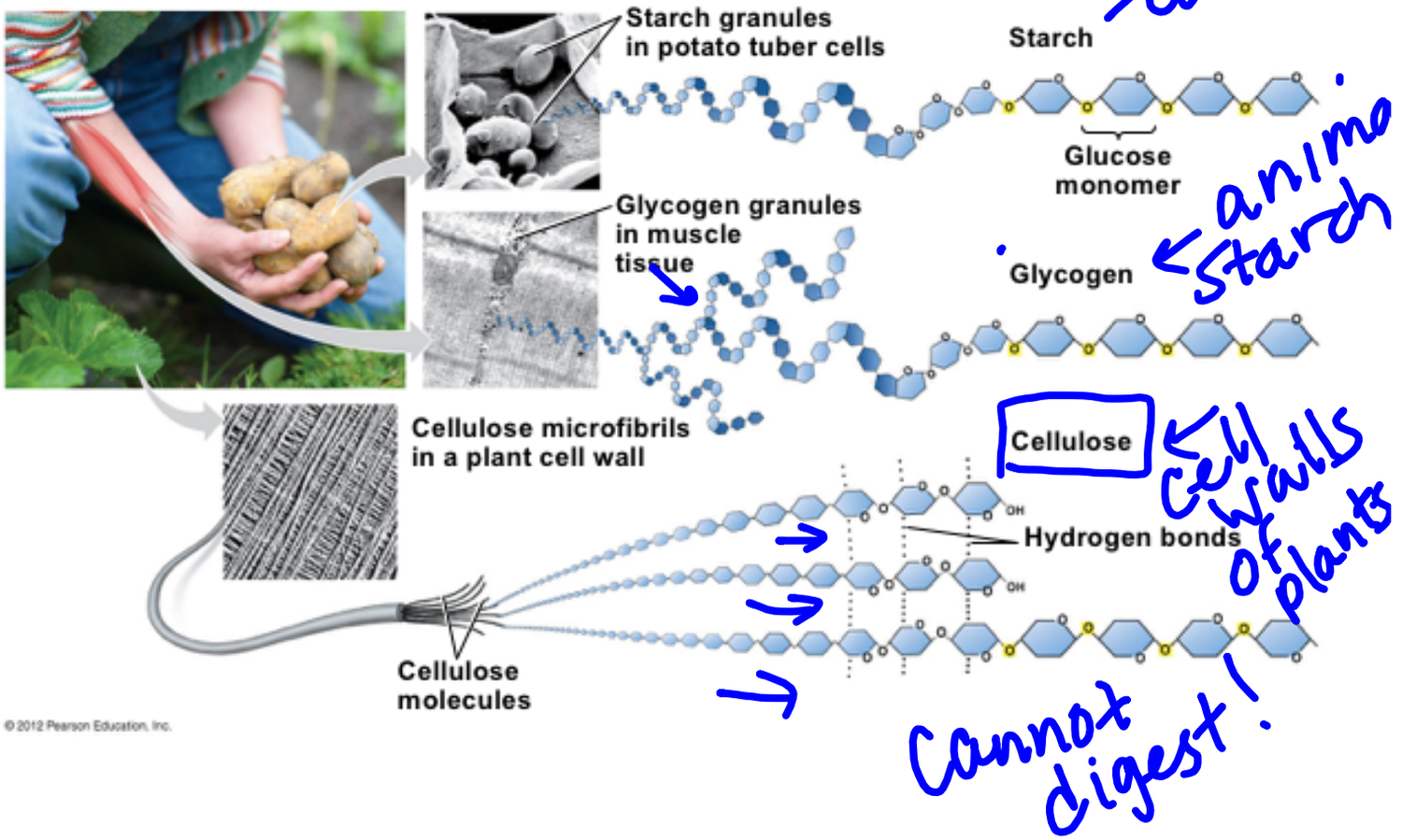
Polysaccharides: Longer chains of monosaccharides

Dehydration Reaction for Carbohydrates



$C_{12}H_{22}O_{11}$

Important Examples of Polysaccharides:



- amylose

← animal starch

← cell walls of plants

Cannot digest!

Carbohydrate Review:

1. What are the monomers of carbohydrates called?

The dimers? The polymers?

2. Explain the role of carbohydrates

3. If I gave you a list of chemical names, how would you be able to identify the carbohydrates?

4. What type of bonds hold polymers of carbohydrates together?