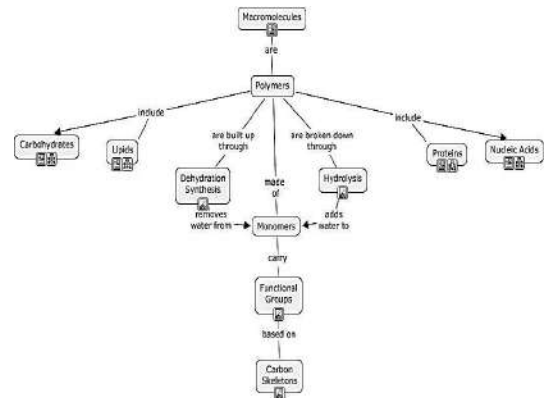




Unit 2 - Macromolecules

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Vocabulary / Key Terms/ Concepts	Unit 2: Macromolecules Notes
<ul style="list-style-type: none"> monomers polymers carbohydrates monosaccharide polysaccharides lipids nucleotides nucleic acids proteins amino acids enzymes 	<p>Expectations</p> <ul style="list-style-type: none"> Compare the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids. Analyze and evaluate the evidence regarding formation of simple organic molecules and their organization into long complex molecules having information such as the DNA molecule for self-replicating life. Investigate and explain cellular processes including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules. Identify and investigate the role of enzymes <p>Macromolecules</p> <p>Characteristics -</p> <ul style="list-style-type: none"> Large _____ molecules.  <pre> graph TD Macromolecules[Macromolecules] -- are --> Polymers[Polymers] Polymers -- include --> Carbohydrates[Carbohydrates] Polymers -- include --> Lipids[Lipids] Polymers -- include --> Proteins[Proteins] Polymers -- include --> NucleicAcids[Nucleic Acids] Polymers -- "are built up through" --> DehydrationSynthesis[Dehydration Synthesis] Polymers -- "are broken down through" --> Hydrolysis[Hydrolysis] DehydrationSynthesis -- "removes water from" --> Monomers[Monomers] Hydrolysis -- "adds water to" --> Monomers Monomers -- "are made of" --> Polymers Monomers -- "carry" --> FunctionalGroups[Functional Groups] FunctionalGroups -- "based on" --> CarbonSkeletons[Carbon Skeletons] </pre>

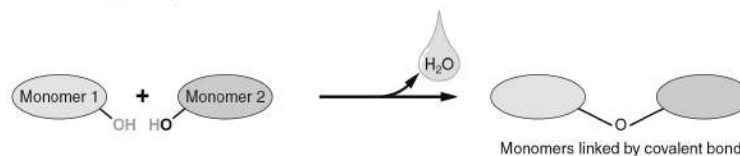
- *activation energy*
- *catalyst*
- *substrates*
- *Macromolecules*
- *Substrate*
- *Active site*
- *inhibition*

- Also called _____.
- Made up of smaller “building blocks” called _____.
- **Biological Macromolecules** are:
 1. _____
 2. _____
 3. _____
 4. _____

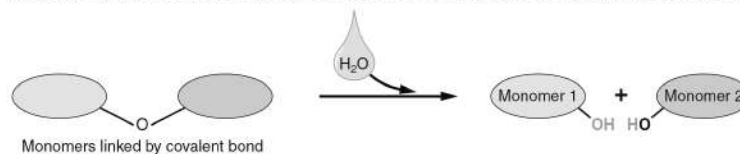
Dehydration Synthesis & Hydrolysis –

- Cells connect monomers to make macromolecules by a process called condensation or _____ (removing a molecule of water).
- Cells break down macromolecules into monomers by a process called _____ (adding a molecule of water)

(a) Dehydration synthesis
Monomers are joined by removal of OH from one monomer and removal of H from the other at the site of bond formation.



(b) Hydrolysis
Monomers are released by the addition of a water molecule, adding OH to one monomer and H to the other.



Carbohydrates

- _____ can range in size from small sugar molecules to large strands of sugar molecules bonded together. A biochemical test to indicate the presence of sugar

– _____ **solution** (indicator) – turns green, yellow, orange, or red when heated.

- Elements Used to Form:

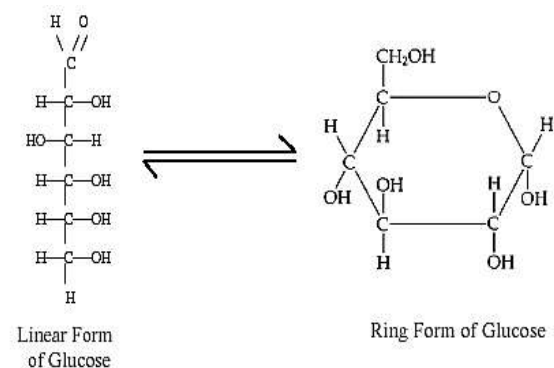
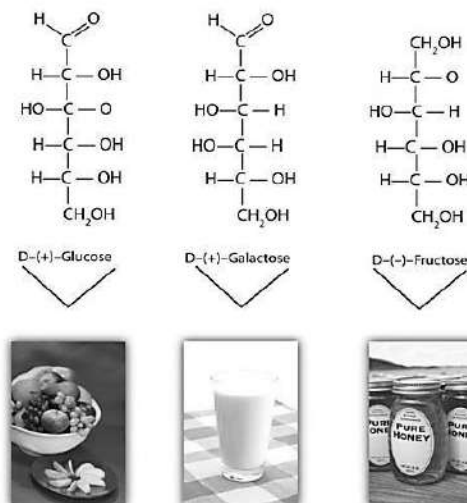
- _____
- _____
- _____

- Examples:

- _____

- Called **Simple Sugars** (*monomer*).
- Include: Glucose, Fructose & Galactose.

- They have the same chemical formula, $C_6H_{12}O_6$, but have different structures.
- These three sugars are structural isomers:

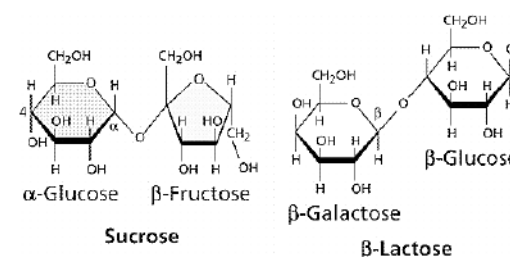


- _____ is found in sports drinks.
- _____ is called “milk sugar”
- _____ is found in fruits.

- If the compound name ends in – **ose** means it is a sugar.
- In aqueous (watery) solutions, Monosaccharides **form** _____
- They are the main fuel that cells use for work.

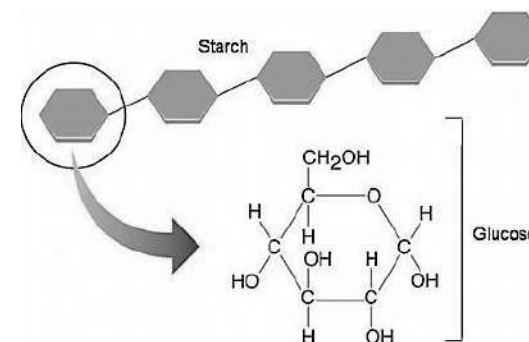
2. Disaccharide

- A _____ is made of two sugar molecules joined together.
- They are joined in the dehydration *process*.
- There is a glycosidic bond between the two sugars.



3. Polysaccharide

- _____ carbohydrates
- Composed of many sugar monomers linked together.
- _____ of monosaccharide chains.



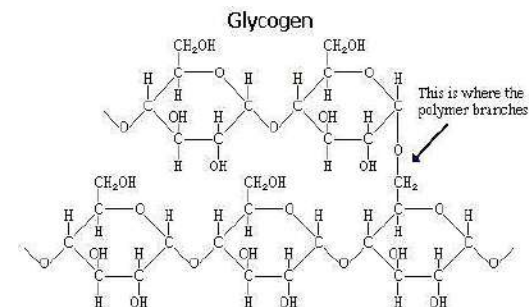
- o Three types of polysaccharides are: starch, glycogen, and cellulose.

- _____ – in **iodine** (indicator) turns dark blue or black

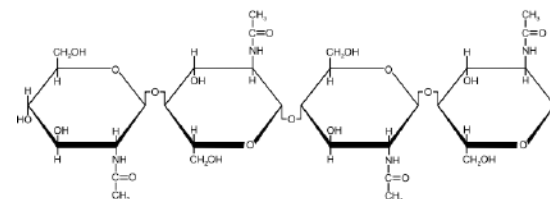
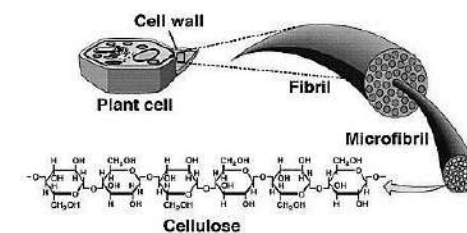
- Starch is an example of a polysaccharide in plants.
- Plant cells store starch for energy.
- Potatoes and grains are major sources of starch in the human diet.

- _____
- Animals store excess sugar in the form of glycogen.
- Glycogen is similar in structure to starch because both are made of glucose monomers.

- _____
- Cellulose is the most abundant organic compound on Earth.
- It is the structural component of plants.
- It forms cable-like fibrils in the tough walls that enclose plants.
- Many animals cannot digest cellulose.
- It is also known as dietary fiber.



Arrangement of Fibrils, Microfibrils, and Cellulose in Cell Walls



- _____
- Chitin is made of _____ linked together in a chain.
- Partly derived from non-sugars (nitrogen).
- Composes _____ of insects, lobsters, and shrimp.
- The cell walls of _____ are also made from chitin.
- Chitin fibers are also used for _____.

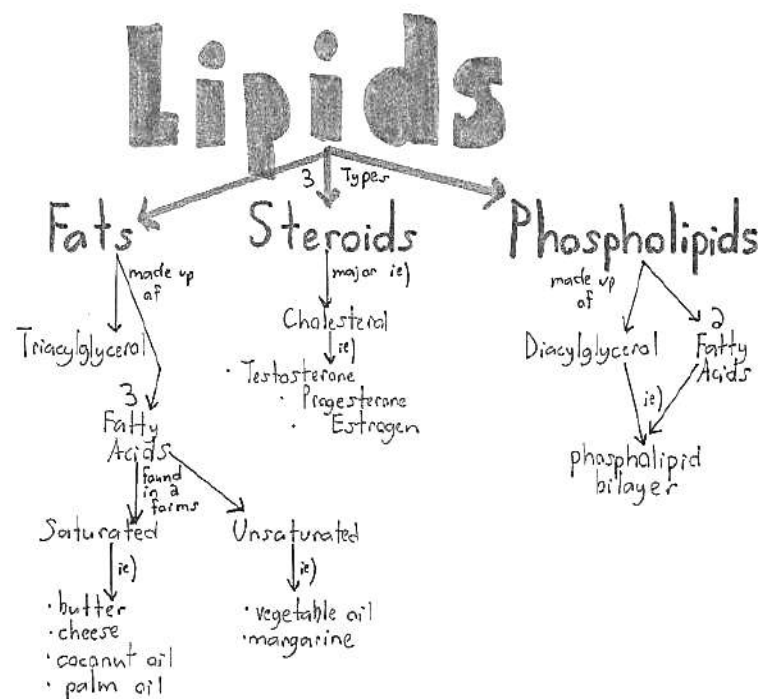
Lipids

Characteristics

- Lipids are _____ – “water fearing”.
- Do not mix with water.
- Includes fats, waxes, steroids, oils & _____.
- Stores the most energy.
- Composed of: _____

Six functions of lipids:

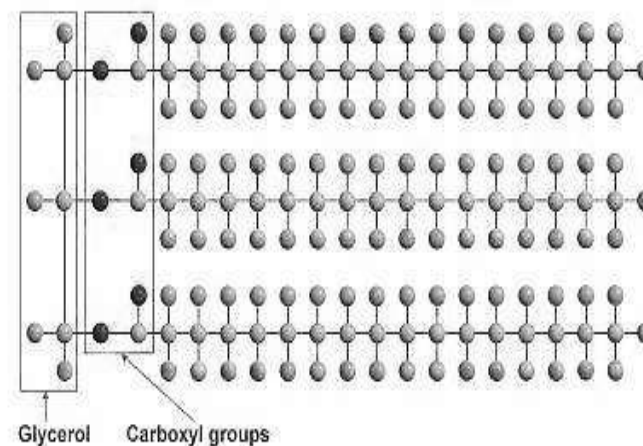
1. Long term _____



2. Protection against _____ loss (insulation)
3. Protection against _____ loss
4. Protection against physical _____
5. Chemical messengers (_____)
6. Major component of membranes (_____)

Fatty Acids –

- _____: a long chain of Hydrogen and Carbon make up lipids. The exception to the monomer/polymer rule is lipids. Lipid base units are not considered monomers. One type of lipid glycerol molecules in a 3:1 ratio. The bonding of three fatty acids to one glycerol molecule creates a triglyceride



Types of Fatty Acids

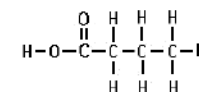
1. _____: if each Carbon is bonded by single bonds to other Carbons inside the fatty acid, the fatty acid is said to be saturated.
2. **Mono or _____ Acid:** If a double bond is present, then it is said to be mono-saturated or unsaturated.



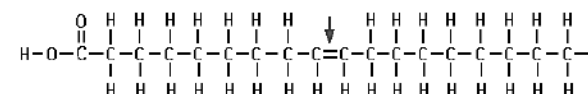
3. Acid -

More than one double bond

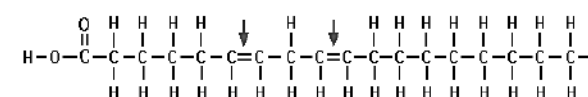
- Most animal fats have a high proportion of saturated fatty acids & exist as solids at room temperature (butter, margarine, shortening).
- _____ (indicator) can turn a variety of colors in the presence of lipids.
- Most plant oils tend to be low in saturated fatty acids & exist as liquids at room temperature (oils).



Butyric Acid-Saturated Fatty Acid



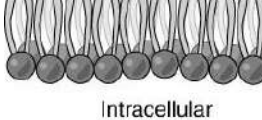
Oleic Acid- Monounsaturated Fatty Acid

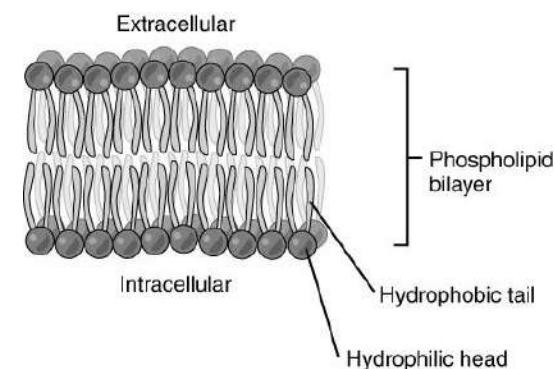


Linoleic Acid- Polyunsaturated Fatty Acid

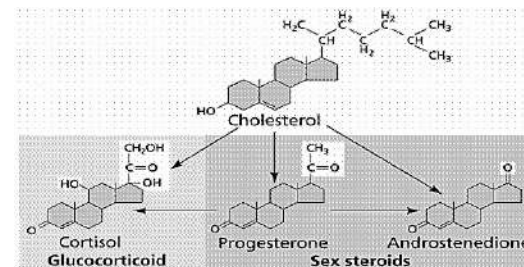
4. - Cell

membranes are made of lipids called phospholipids.

- Phospholipids have a head that is polar & attract water (_____).
 - Phospholipids also have 2 tails that are nonpolar and do not attract water (_____).
 - _____ —
 - The carbon skeleton of steroids is bent to form 4 fused rings.
- 



- _____ is the “base steroid” from which your body produces other steroids.



Proteins

- **Characteristics**

1. Composed of

- _____

2. Monomer

- _____

- 20 different (1 mod)
- Most structural variation

- **Functions**

1. Essential to Life –

_____ (indicator) turns purple/lavender with protein, pink with amino

2. Build _____

3. _____:

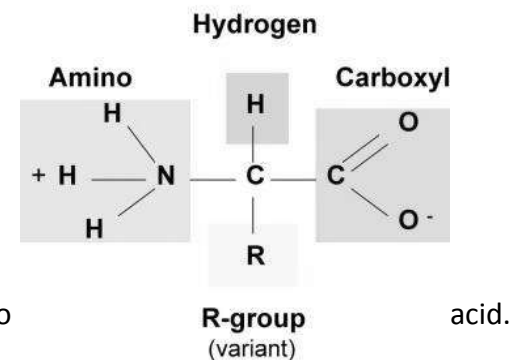
- Makes up _____ tissue

4. _____:

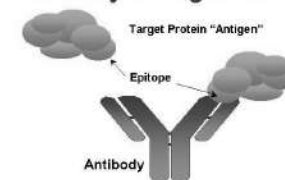
- Carries oxygen in an organism (hemoglobin).

7. _____:

Amino Acid Structure



Antibody-Antigen Binding



- Helps fight off foreign invaders

- antibodies

8. _____: (more below)

- Speed up chemical reactions
- amylase and pepsin

9. _____ source

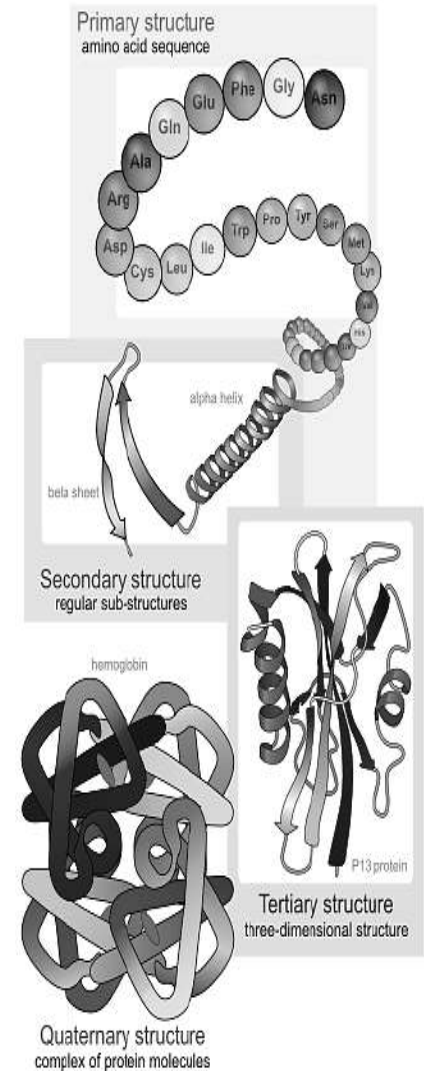
- 1 gram = 4 kcal of energy

- **Polymer: Polypeptide**

- _____ bonding links
- _____ Bond

- _____ **Shapes**

- The _____ **structure** is the specific sequence of amino acids in a protein. Called a _____.
- _____ **protein structures** occur when protein chains coil(helix) or fold(pleated)
- When protein chains called polypeptides join together, the _____ **structure** forms because R groups interact with each other.



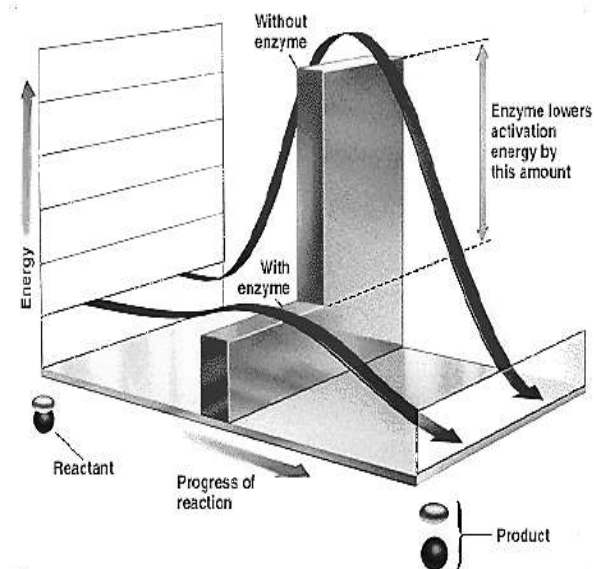
- Secondary structures bent and folded into a more complex 3-D arrangement of linked polypeptides
- Bonds: H-bonds, ionic, disulfide bridges (S-S)
- _____ **Structure:** Composed of 2 or more “subunits”.

Activity

- Many proteins act as biological catalysts or enzymes.

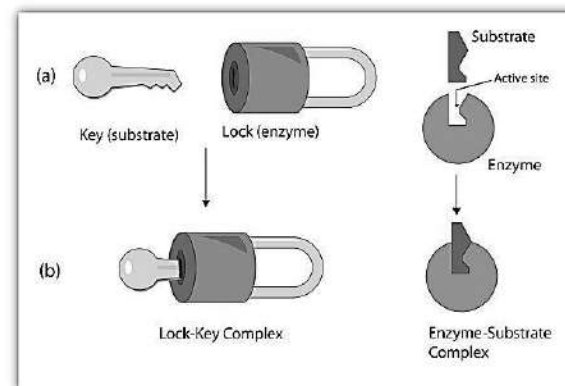
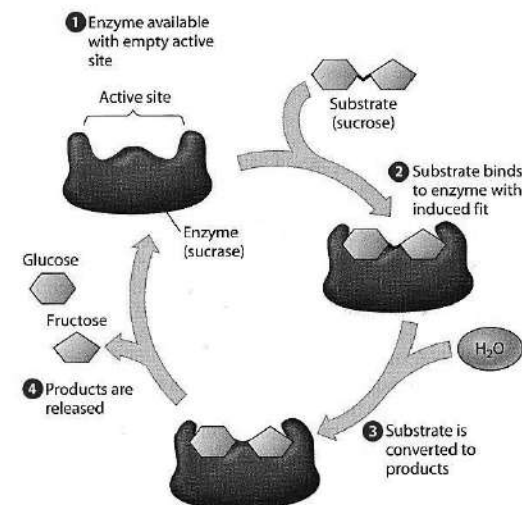
1. Thousands of different enzymes exist in the body.
2. Enzymes control the rate of chemical reactions by weakening bonds, thus _____ the amount of _____ energy needed for the reaction.
3. This is accomplished by binding to the reactants.
4. They will then twist or bend the material, lowering the energy needed to split it.

- The enzyme contains an opening called its _____ (active) site.
 1. This site is specific for the object it will hold, called the _____.
 2. There are just as many enzymes as there are substrates.



3. The enzyme system is the enzyme and substrate combined.

- Most are _____.
- They _____ the activation energy of a reaction.
- They _____ the reaction...
- They are _____ to the substrate.
 - They allow the substrate to fit into the active site like a ball into a glove, holding it tight.
(_____ **Model**)
 - They can be reused – _____.
 - Some Common Enzymes:



Active Site	Enzyme	Effect on Food
mouth	salivary amylase	breaks down starches into disaccharides



	stomach	<i>pepsin</i>	breaks down proteins into peptides
	small intestine (from pancreas)	<i>amylase</i>	continues starch breakdown
	small intestine (from pancreas)	<i>trypsin</i>	continues breakdown of protein
	small intestine (from pancreas)	<i>lipase</i>	breaks down fat
	small intestine	<i>maltase, sucrase, lactase</i>	breaks down remaining disaccharide into monosaccharide
	small intestine	<i>peptidase</i>	breaks down di-peptides into amino acids
<div> <div> <ul style="list-style-type: none"> Two types: <ol style="list-style-type: none"> _____ acid (_____ -double helix) _____ acid (_____ -single strand) Nucleic acids are composed of long chains of _____ (monomer) linked by dehydration synthesis. Composed of the Elements: _____ </div> <div> <p>The diagram illustrates the structural and chemical differences between RNA and DNA. On the left, the RNA structure is shown as a single helix of sugar-phosphates, with its chemical components listed: Cytosine (C), Guanine (G), Adenine (A), and Uracil (U), collectively labeled as 'Nucleobases of RNA'. On the right, the DNA structure is shown as a double helix of sugar-phosphates, with its chemical components listed: Cytosine (C), Guanine (G), Adenine (A), and Thymine (T), collectively labeled as 'Nucleobases of DNA'. A 'Base pair' is specifically labeled in the DNA structure.</p> </div> </div>			



	<p>● Nucleotides include:</p> <ul style="list-style-type: none"> - A _____ group - A _____ sugar (5-carbon) - A _____ bases: - _____ (A) - _____ (T) - <i>DNA only</i> - _____ (U) - <i>RNA only</i> - _____ (C) - _____ (G) <div data-bbox="1444 313 1864 621"> <p>The diagram illustrates the structure of a nucleotide. On the left is a phosphate group consisting of a phosphorus atom (P) double-bonded to one oxygen (O) and single-bonded to three others (one OH and two O atoms). One of the single-bonded oxygen atoms is connected via an ester bond to a sugar molecule. The sugar is a five-membered ring with an oxygen atom at the top vertex. The base of the sugar ring is labeled sugar. Attached to the right side of the sugar ring is a base, which is a six-membered heterocyclic ring with two nitrogen atoms (N) and four carbon atoms (C). One carbon atom is double-bonded to an amino group (NH₂). The base is labeled base.</p> </div>
<p>Notes Summary</p>	<div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div>