



Summer Assignment 2022 – 2023

Course: AP Biology

Assignment title	Biochemistry Video Notes & Biochemistry Questions
Date due	Part 1 – Video Notes – due August 23, 2022 Part 2 – Biochemistry Worksheets – due August 25, 2022
Estimated time for completion	4 – 5 hours
Resources needed to complete assignment	<input checked="" type="checkbox"/> Textbook - OpenStax Biology for AP Courses <input checked="" type="checkbox"/> Notes – PowerPoint presentation, in this document <input checked="" type="checkbox"/> Biomolecules Interactive Tutorial <input checked="" type="checkbox"/> Other supplies: device(s) with internet capabilities.
How the assignment will be assessed	The Biochemistry Video Notes and the Biochemistry Questions will be scored using the accompanying rubric and guidelines. Both assignments will be averaged together and will be counted as a project grade (15%) for the 1 st quarter (Q1).
Purpose of assignment	<input checked="" type="checkbox"/> Review of foundational material/concepts/skills. <input checked="" type="checkbox"/> Expose students to required material/concepts/skills/texts that will not be covered during the academic year. <input checked="" type="checkbox"/> Have students read material that will be discussed or used in class at the beginning of the year.

AP Biology Summer Assignment

Welcome to AP Biology! This course is designed to be the equivalent of a two-semester introductory biology course usually taken in the first year of college. In other words, it is a little like drinking from a fire hose. It will be a rewarding experience, but as with most things that are, it will also be challenging. Throughout the course, you will become familiar with major recurring ideas that persist throughout all topics and material.

The 4 Big Ideas of AP Biology
Big Idea 1: The process of evolution drives the diversity and unity of life.
Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
Big Idea 3: Living systems store, retrieve, transmit and respond to information essential to life processes.
Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

On the pages that follow, you will find instructions for the two assignments that comprise your summer work for AP Biology. Both assignments will review biological chemistry concepts that you learned in freshman biology as well as foundational chemistry concepts you learned your sophomore year in chemistry. The first part of the assignment involves watching several assigned videos and taking video notes. The second part of your summer assignment consists of completing several sets of questions focusing on biological chemistry.

A hardcopy of your Biochemistry video notes will be due August 23, 2022, and your Biochemistry Questions will be due (submitted through Schoology) August 25, 2022. Both will be averaged together and counted as a project grade for 1st quarter. No late summer assignments will be accepted!

Included in this packet are the following resources:

Document	Page(s)
Assignment #1 – Video Notes	
• Instructions and Content Video List	3
Assignment #2 – Biochemistry Questions	
• Notes to use as a resource:	
○ Organic Chemistry Basics – functional groups	4
○ Water	5 – 8
○ Carbohydrates	9 – 10
○ Lipids	11 – 13
○ Proteins	14 – 17
• Links to an Online textbook, gSlides notes, Biomolecules Tutorial, and Biochemistry Questions in a gSlides presentation	18

Assignment #1 – Video Notes – due August 23, 2022

Watch the videos listed below and take **hand-written** notes on each of them. The notes should be your **original work**. EACH note sheet will be scored 0 to 5 based on completeness and thoroughness as shown in the rubric below.

Note pages will not be accepted late nor will they be accepted in a typed format.

#	Video Content	Links
005	Essential Characteristics of Life	https://bit.ly/2HUpsES
010	Abiogenesis	https://bit.ly/2U6a7Yg
	Molecules of Life	https://bit.ly/2lwqLXK
	Carbohydrates	https://bit.ly/2L7RADv
	Lipids	https://bit.ly/2lqVDJh
	Proteins	https://bit.ly/2IJHWIS
	Water – A Polar Molecule	https://bit.ly/2TUfnQ

0 No Credit	2 Below Expectations	3 – 4 Complete	5 Meets Expectations
No notes OR copied from a peer	Several criteria are missing from entry	All criteria are met, but there is room for improvement within criteria OR one criterion is missing from entry	All criteria listed below are met OR have been exceeded for each entry.

What does work that “meets expectations” have?

- ✓ Each video’s notes are on a different page.
- ✓ The video’s title is written as it appears in the video on the top line of the paper.
- ✓ The notes are legibly written.
- ✓ Highlighting or colors are used to emphasize key points, new vocabulary, and/or important concepts.
- ✓ Examples from the video are documented in some way when given in the video.
- ✓ Pictures, charts, or graphs are used to display details provided in the video.
- ✓ A summary of the video content is provided at the end of the notes. Please emphasize the summary in some way (title it, star it, highlight it, etc.)
- ✓ **Each set of notes is INDIVIDUALLY pledged with the FULL STATEMENT (see below) and signature for authenticity and an indication that the MLWGS Honor Code was followed.**


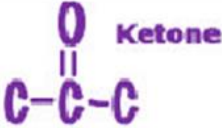

Honor Pledge – “I have neither given nor received, nor will I give or receive, unauthorized assistance on this assignment.”

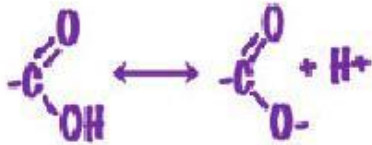
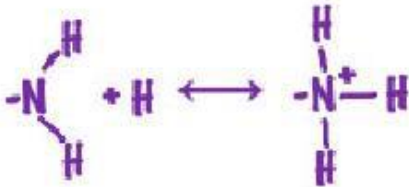
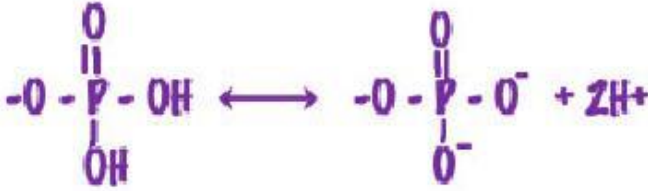
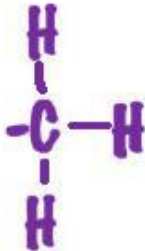
Notes are to be **original work** and are not to be copied from a peer – these serve as a log of what you have learned from the video. Copying them from a peer and not watching the video does you no good. You will receive zero credit if you are found submitting work that is too closely aligned with a classmate’s work.

NOTES - ORGANIC CHEMISTRY BASICS

PROPERTIES OF CARBON:

- Has 4 valence electrons
- Form 4 covalent bonds (single, double, triple)
- Carbon chain
 - Straight, branching, ring
 - Varies in length, number and location of double bonds, and presence of other elements
- Forms isomers
 $C_6H_{12}O_6$ chemical formula for glucose, fructose, & galactose

FUNCTIONAL GROUP	DRAWING/FORMULA	PROPERTIES
Hydroxyl		<ul style="list-style-type: none"> • Polar • Water soluble • Alcohols
Carbonyl	 	<ul style="list-style-type: none"> • Polar • Water soluble

FUNCTIONAL GROUP	DRAWING/ FORMULA	PROPERTIES
<p>Carboxyl</p>	<p style="text-align: center;">-COOH</p> 	<ul style="list-style-type: none"> • Polar • Water soluble • Acid
<p>Amino</p>	<p style="text-align: center;">-NH₂</p> 	<ul style="list-style-type: none"> • Polar • Water soluble • Weak base
<p>Sulphydal</p>	<p style="text-align: center;">-SH</p>	<ul style="list-style-type: none"> • Form disulfide bridges • Stabilize protein shape
<p>Phosphate</p>		<ul style="list-style-type: none"> • Polar • Water soluble • Acid • Important in energy transfer
<p>Methyl</p>	<p style="text-align: center;">-CH₃</p> 	<ul style="list-style-type: none"> • Nonpolar • Not water soluble

NOTES - WATER, ACIDS, BASES, BUFFERS

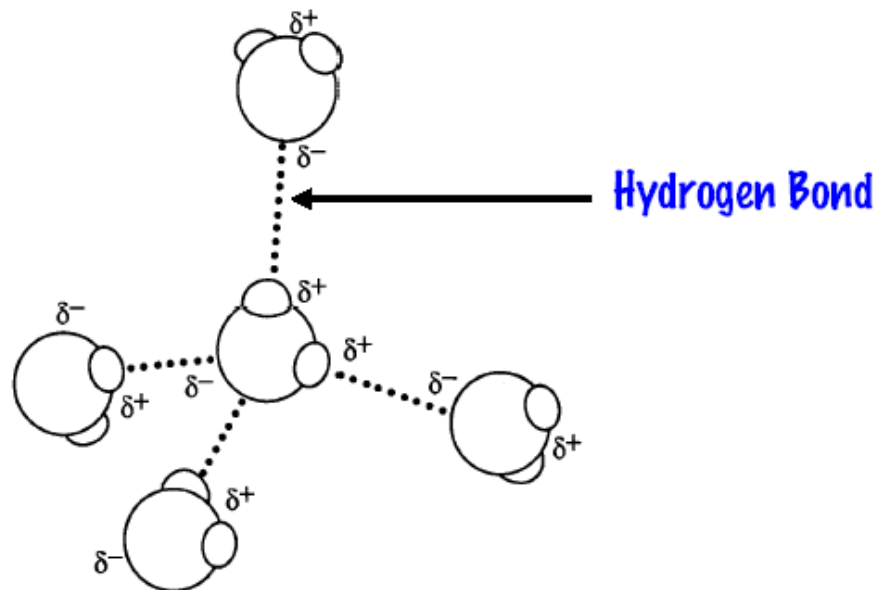
STRUCTURE & GEOMETRY OF WATER:

Water is polar



Maximum number of H bonds = 4

Each water molecule can form a max. of 4 hydrogen bonds with 4 other water molecules



PROPERTIES OF WATER:

Liquid water is cohesive

Cohesion = H bonds between water molecules; H_2O molecules tend to stick tog.
Importance = Transport H_2O against gravity in plants
Higher surface tension

Water has a high specific heat

Takes a lot of energy to raise 1 gram of H_2O 1 °C
Why? Must break H bonds
Liquid H_2O can absorb large amounts of heat with small changes in temperature

Water has a high heat of vaporization

Takes a lot of energy to convert liquid H_2O into vapor
Why? Must break H bonds
Keeps water in liquid state

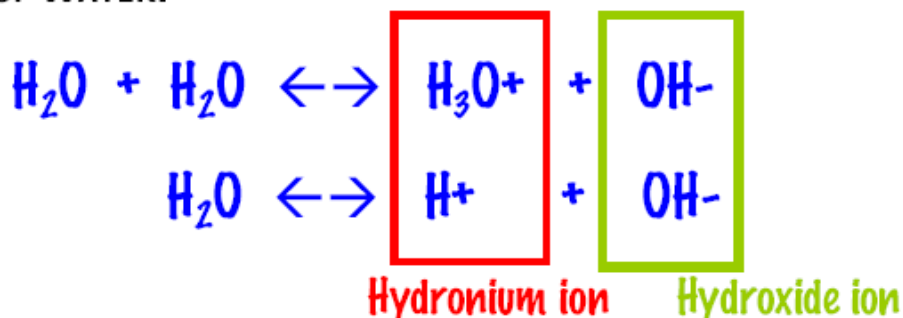
Water expands with it freezes

Solid H_2O is less dense than liquid H_2O
Why? In solid state H_2O locked into max. number of H bonds; takes up more space

Water is a versatile solvent

Will dissolve polar covalent and ionic compounds

DISSOCIATION OF WATER:



1 out of 554,000,000 water molecules dissociates

At equilibrium in pure water at 25°C

$$[\text{H}^+] = [\text{OH}^-] = 1.0 \times 10^{-7} \text{ M}$$

If add $[\text{H}^+]$ to pure water

Removes OH^-

Equilibrium shifts left

$$[\text{H}^+] > [\text{OH}^-]$$

If add $[\text{OH}^-]$ to pure water

Removes H^+

Equilibrium shifts left

$$[\text{OH}^-] > [\text{H}^+]$$

reduces H^+ indirectly

If add NH_3



Reduces H^+ directly

PH SCALE:

$$\text{pH} = -\log_{10}[\text{H}^+]$$

$$\text{if } [\text{H}^+] = 10^{-7}$$

$$\text{then pH} = 7$$

$$[\text{H}^+] \times [\text{OH}^-] = 10^{-14}$$

$$\text{If } [\text{H}^+] = 10^{-9}$$

$$\text{Then } [\text{OH}^-] = 10^{-5}$$

$$\text{pOH} = 5$$

$$\text{pH} = 9$$

BUFFERS:		
Description	Function	Importance
Weak acids or bases	Minimize changes in pH	Controls chemical reactions Maintains homeostasis

BICARBONATE BUFFER SYSTEM:



HCO_3^- = Bicarbonate (weak base)

H_2CO_3 = Carbonic acid (weak acid)

Major buffer system in blood

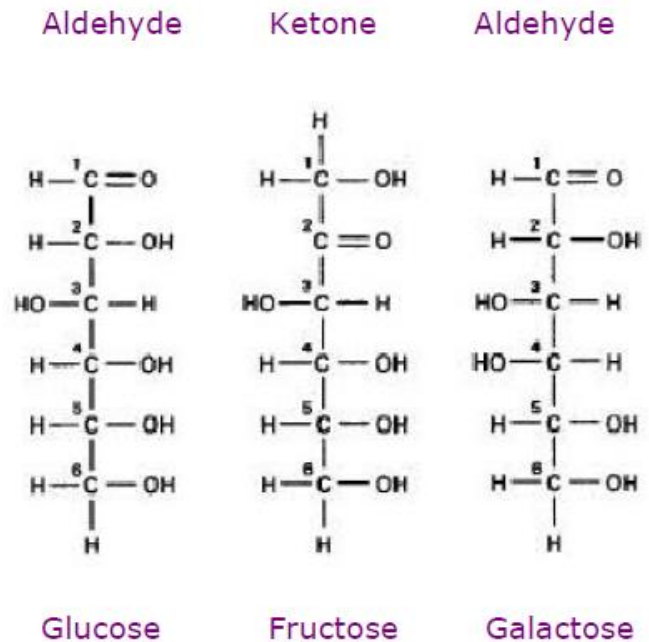
Maintains blood pH between 7.38 and 7.42

Action:	Effect:
Increase $[\text{H}^+]$ How? Fat metabolism OD on acidic drug	Increase $[\text{H}^+]$ Equilibrium shifts left $\text{H}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Increase $[\text{CO}_2]$ Increase rate and depth of respiration
Increase Rate & Depth of Respiration Hyperventilate	Decrease $[\text{CO}_2]$ Equilibrium shifts left $\text{H}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ Blood pH increases

NOTES - CARBOHYDRATES

GENERAL CHARACTERISTICS:

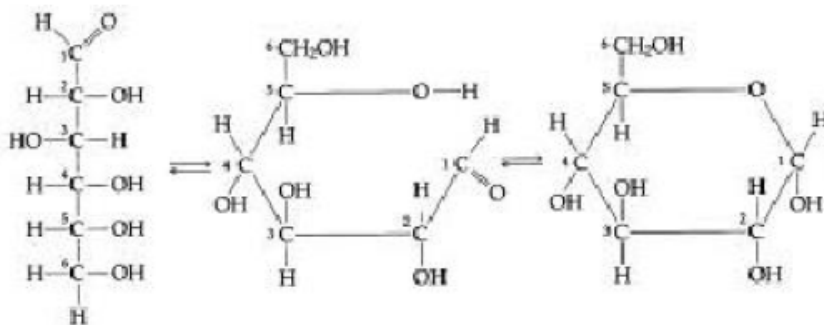
- ◆ Polymers of simple sugars
- ◆ Classified according to number of simple sugars
- ◆ Sugars
 - 3 to 7 carbons
 - -OH attached to each carbon except one
- ◆ Aldehydes or ketones



MONOSACCHARIDES:

- ◆ Simple sugars
- ◆ Monomers of di- and polysaccharides
- ◆ Store energy in chemical bonds

- Trioses
 - 3 carbon sugar
 - glyceraldehyde
- Pentose
 - 5 carbon sugar
 - Ribose
 - Deoxyribose
- Hexose
 - 6 carbon sugar
 - Glucose
 - Galactose
 - Fructose



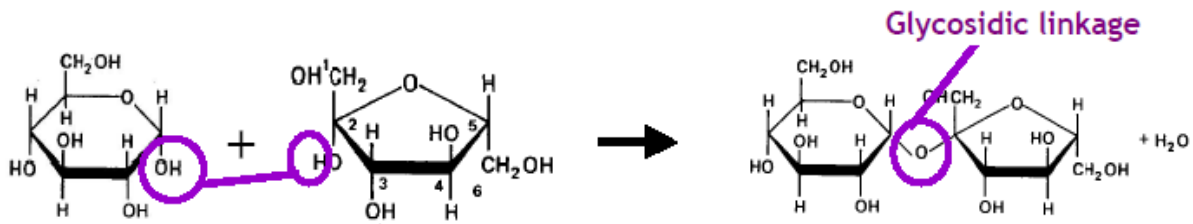
Glucose
Linear form (dry)

Glucose
ring form (in sol.)

DISACCHARIDES:

Double sugars

Condensation Synthesis: removal of water molecule to form bond between monomers



POLYSACCHARIDES:

Many monosaccharides covalently bonded together

FUNCTIONS:

Storage

Starch: storage carbohydrate in plants

Glycogen: storage carbohydrate in animals

Structural

Cellulose: plant cell wall component

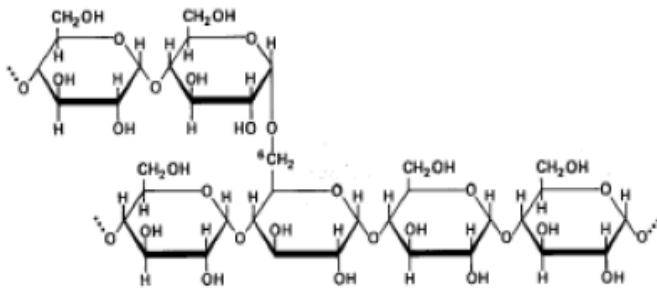
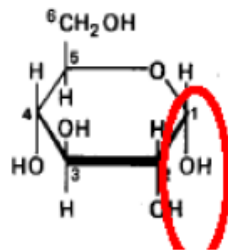
Chitin: polymer of amino sugar
building block of exoskeletons

STARCH VS CELLULOSE

Starch

Polymer of α - glucose

Branched α 1-4 linkages



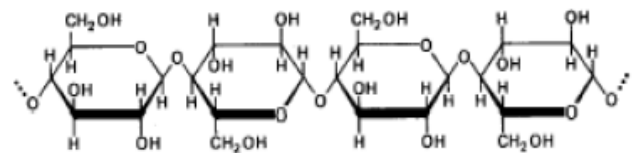
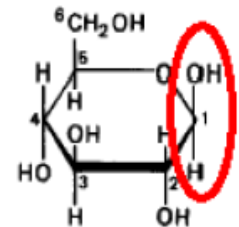
Cellulose

Polymer of β - glucose

Linear

Unbranched β 1-4 linkages

Most animals lack enzyme to break β 1-4 linkages

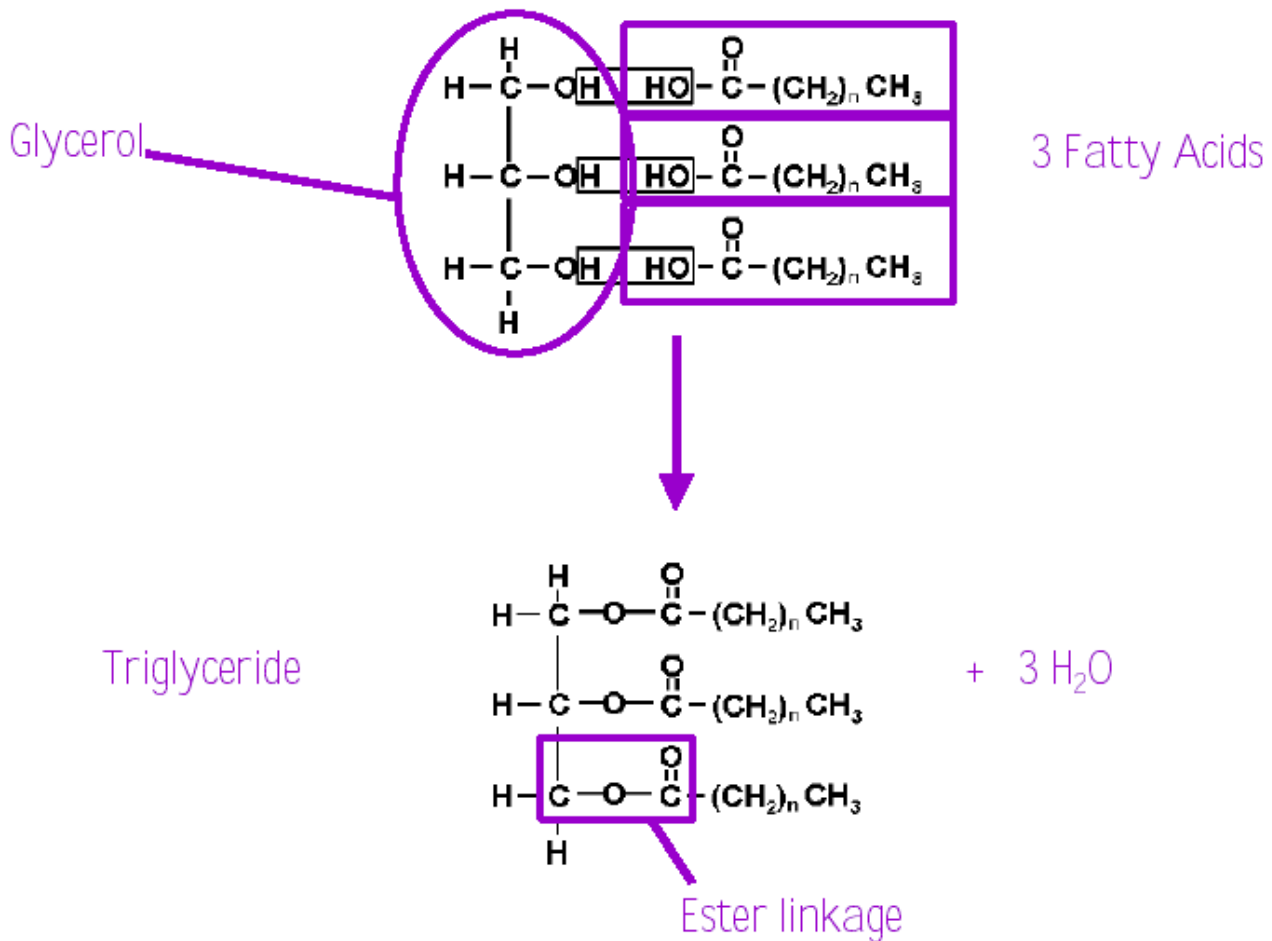


NOTES - LIPIDS

General Characteristics:

Not soluble in water
Mostly hydrocarbon chains
Fats, steroids, phospholipids

Building Blocks:



Fats:

Glycerol + fatty acids
 Triglycerides have 3 fatty acids
 Fatty acids present may vary

Compact energy source
 Cushions vital organs
 Provides insulation

Saturated:

No double bonds between carbons
 Straight chain

Fatty acid

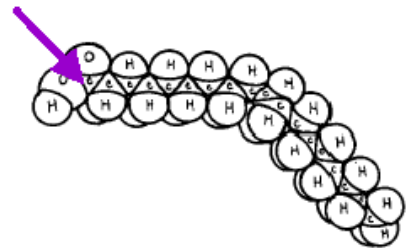


Usually solid at room temperature
 Straight chains allow for tight packing
 Most animal fats

Unsaturated:

At least 1 double bond between carbons
 Hydrocarbon chain is bent

Fatty acid



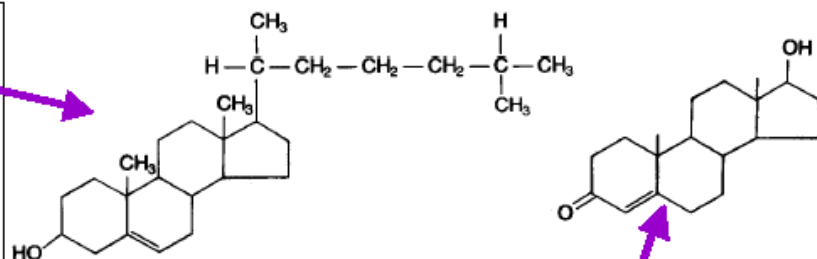
Usually liquid at room temperature
 Bent chain prevents tight packing
 Most plant fats

STEROIDS:

Consist of 4 fused carbon rings
 Three are 6-sided
 One is 5-sided
 Attached functional groups vary

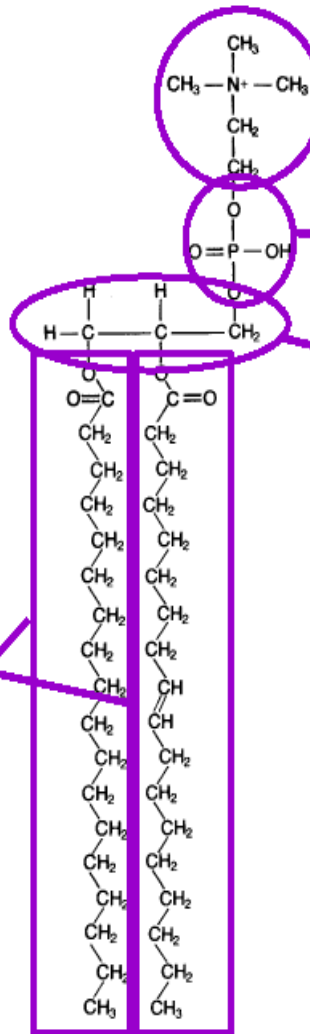
Cholesterol

- Precursor of other steroids
- Component of animal cell membranes
- Contributes to arteriosclerosis



Testosterone

PHOSPHOLIPIDS:



Functional Group

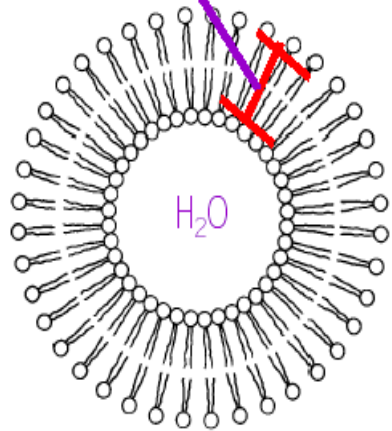
Phosphate Group

Glycerol

Head
Hydrophilic
Water loving
Polar

- 2 Fatty acid chains
- Make up Tail of phospholipid
 - Hydrophobic
 - Water fearing
 - Nonpolar

Nonpolar hydrophobic core



H₂O

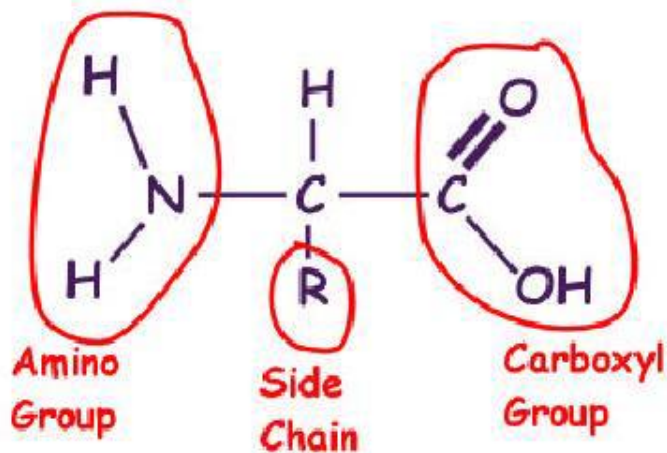
NOTES - PROTEINS

GENERAL CHARACTERISTICS AND IMPORTANCES:

- Polymers of amino acids
- Each has unique 3-D shape
- Vary in sequence of amino acids
- Major component of cell parts
- Provide support
- Storage of amino acids
- Receptor proteins; contractile proteins; antibodies; enzymes

BUILDING BLOCKS:

Amino acids
20 different
amino acids



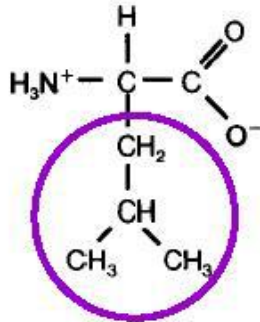
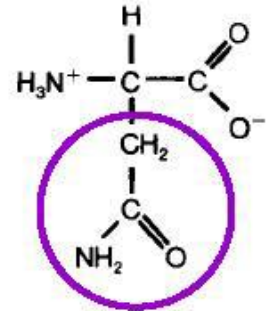
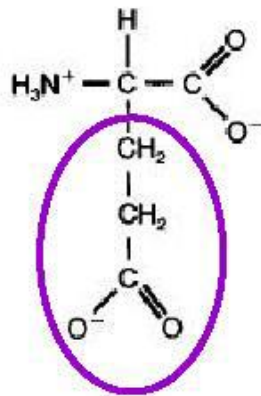
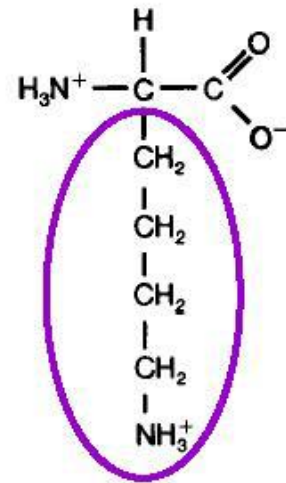
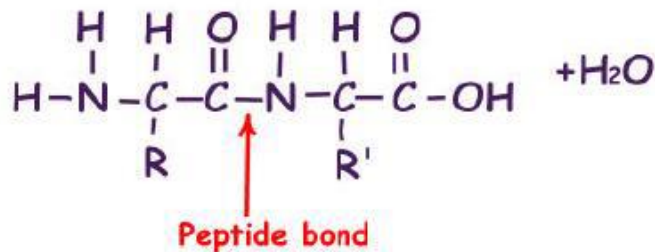
ANION	CATION	DIPOLAR ION
<p>Chemical structure of an amino acid anion: $\text{H}_2\text{N}-\text{CH}(\text{R})-\text{COO}^-$. A red circle highlights the negatively charged oxygen atom (O^-).</p>	<p>Chemical structure of an amino acid cation: $\text{H}_3\text{N}^+-\text{CH}(\text{R})-\text{COOH}$. A red circle highlights the positively charged nitrogen atom (H_3N^+).</p>	<p>Chemical structure of an amino acid dipolar ion: $\text{H}_3\text{N}^+-\text{CH}(\text{R})-\text{COO}^-$. Red circles highlight both the positively charged nitrogen atom (H_3N^+) and the negatively charged oxygen atom (O^-).</p>

CLASSIFICATION:

Based on properties of side chain

NONPOLAR:Hydrocarbon
Chains

No oxygen

**POLAR:**Oxygen present
Sometimes sulfur
No charge**POLAR CHARGED ACIDIC:**Negative
chargeDonate H+
to solution**POLAR CHARGED BASIC:**Positive
chargeGain H+ from
solution**PEPTIDE BONDS:**

PROTEIN CONFORMATION:
Unique 3-D shape

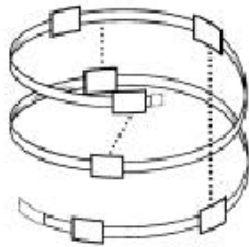
PRIMARY :



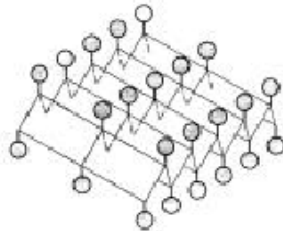
- Sequence of amino acids
- Determined by genes (sequence of bases in DNA)

SECONDARY :

α helix

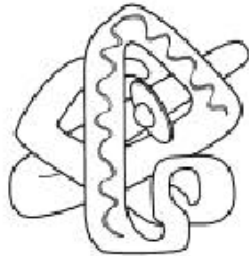


β pleated sheet



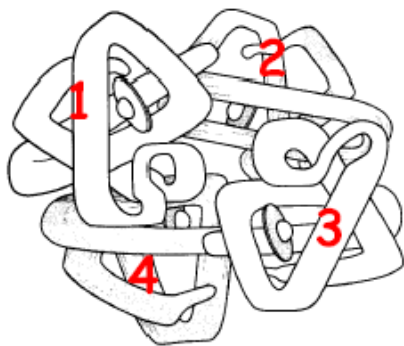
- Regular repeated folding of peptide chain
- Folding stabilized by hydrogen bonds

TERTIARY :



- Globular proteins
- Irregular contortion
- Shape stabilized by H bonds, ionic bonds, hydrophobic interactions, disulfide bridges
- Enzymes

QUATERNARY :



- Interaction of several polypeptides
- Hemoglobin
- Collagen

Hemoglobin
 4 polypeptide chains

DENATURATION:

Changing protein's native conformation

Change shape = change in activity

How?

1. High temperature
2. Chemical agent (acid or base) change in pH
3. Organic solvent

Link to online Textbook – [OpenStax Biology for AP Courses](#)

Link to gSlides notes presentation for [Unit 1 - Biochemistry](#)

Link to Interactive Tutorial – [Biomolecules Tutorial \(Gateway Page\)](#)

Link to [Biochemistry Questions](#) in a Google Slides Presentation

- open the presentation, [make a copy](#) to your google drive and THEN answer the questions.
- you will submit the assignment through Schoology at the beginning of the school year

