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GOVERNOR'S SCHOOL
for Government and International Studies

Summer Assignment 2021-22	
Course: AP Biology	
Assignment title	Video Notes & Biochemistry Worksheets
Date due	Part 1 – Video Notes – due 1st day/block of class Part 2 – Biochemistry Worksheets – due 2nd day/block of class
Estimated time for completion	6 – 7 hours
Resources needed to complete assignment	☒ Textbook - *OpenStax Biology for AP Courses* ☒ Notes in packet ☒ Other supplies: device(s) with internet capabilities.
How the assignment will be assessed	The **Video Notes** will be scored using the accompanying rubric and guidelines. The **Biochemistry Questions** will be scored for correctness. Both assignments will be averaged together and will be counted as a **project grade** for the 1st quarter (Q1).
Purpose of assignment	☒ Review of foundational material/concepts/skills. ☒ Expose students to required material/concepts/skills/texts that will not be covered during the academic year. ☒ 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 on your own paper or electronic document. The second part of your summer assignment consists of completing several sets of questions focusing on biological chemistry in a Google Slides Presentation.

Your video notes are due on the 1st day of AP Biology and your biochemistry worksheets will be due on the 2nd day. Both will be averaged together and counted as a project grade for the 1st quarter. ***No late summer assignments will be accepted!***

Included in this document is the following information :

Assignment #1 – Video Notes – due 1st day of AP Biology

Watch the videos listed below and take notes on each of them (either hand-written or computer generated). 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.

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

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?

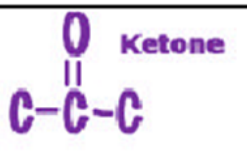
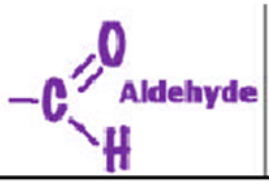
- ★ Each video's notes are on a different page of a handwritten or electronic document.
- ★ The video's title is written as it appears in the video on the top line of the page.
- ★ The notes are legibly written or typed.
- ★ Highlighting, colors, and/or a variety or fonts are used to emphasize key points, new vocabulary, and/or important concepts.
- ★ Examples are documented in your notes 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 pledged for authenticity and indication of MLWGS Honor Code.***

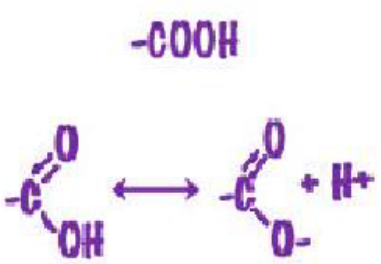
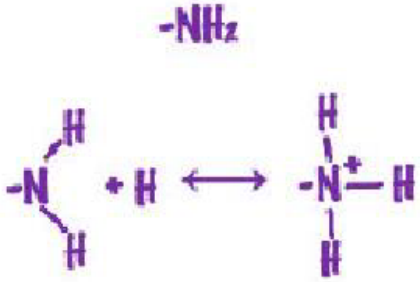
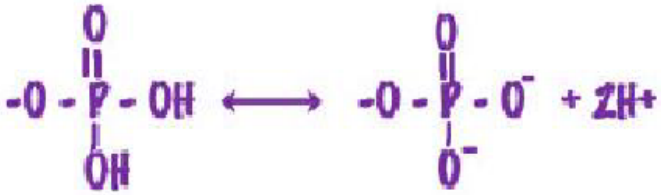
Notes are to be ***original work*** and are not to be copied from a peer – these serve as a log of what you have learned from the video. Copying them from a peer and not watching the video does you no good. You will receive zero credit if you are found submitting work that is too closely aligned with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

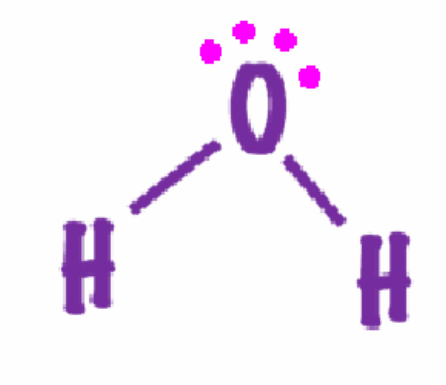
FUNCTIONAL GROUP	DRAWING/ FORMULA	PROPERTIES
Hydroxyl	-OH	• Polar • Water soluble • Alcohols
Carbonyl	 	• Polar • Water soluble

Functional Group	Drawing/ Formula	Properties
Carboxyl		• Polar • Water soluble • Acid
Amino		• Polar • Water soluble • Weak base
Sulfhydral		• Form disulfide bridges • Stabilize protein shape
Phosphate		• Polar • Water soluble • Acid • Important in energy transfer
Methyl		• Nonpolar • Not water soluble

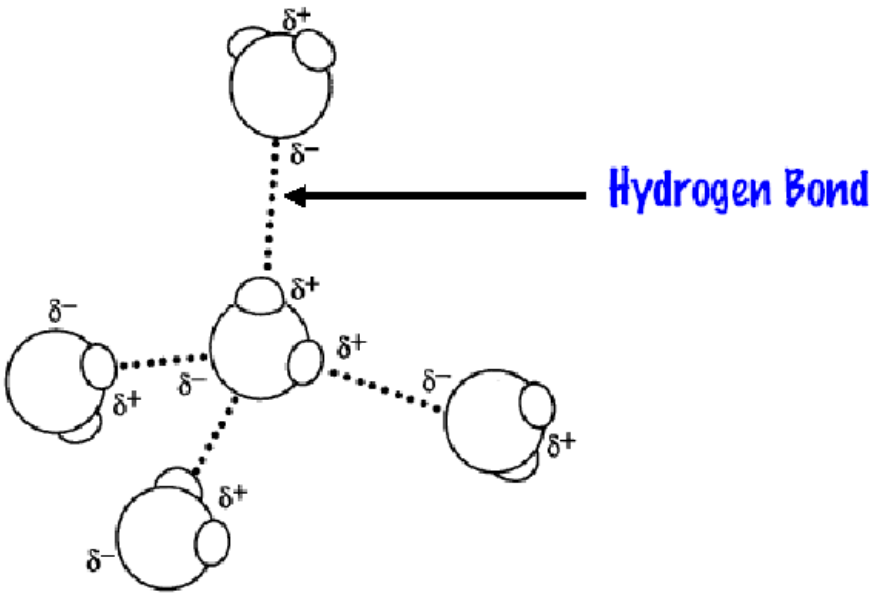
NOTES - WATER, ACIDS, BASES, BUFFERS

STRUCTURE & GEOMETER 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:

$$H_2O + H_2O \leftrightarrow \boxed{H_3O^+} + \boxed{OH^-}$$

$$H_2O \leftrightarrow \boxed{H^+} + \boxed{OH^-}$$

Hydronium ion Hydroxide ion

1 out of 554,000,000 water molecules dissociates
At equilibrium in pure water at 25°C
$[H^+] = [OH^-] = 1.0 \times 10^{-7}$ M

If add $[H^+]$ to pure water
- Removes OH^-
- Equilibrium shifts left
- $[H^+] > [OH^-]$

If add $[OH^-]$ to pure water
- Removes H^+
- Equilibrium shifts left
- $[OH^-] > [H^+]$
- reduces H^+ indirectly

If add NH_3
- $NH_3 + H^+ \rightarrow NH_4^+$
- Reduces H^+ directly

pH Scale:

$pH = -\log_{10}[H^+]$
if $[H^+] = 10^{-7}$
then pH = 7

$[H^+] \times [OH^-] = 10^{-14}$
If $[H^+] = 10^{-9}$
Then $[OH^-] = 10^{-5}$
pOH = 5
pH = 9

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

BICARBONATE BUFFER SYSTEM:

$$H_2O + CO_2 \leftrightarrow H_2CO_3 \leftrightarrow HCO_3^- + H^+$$

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

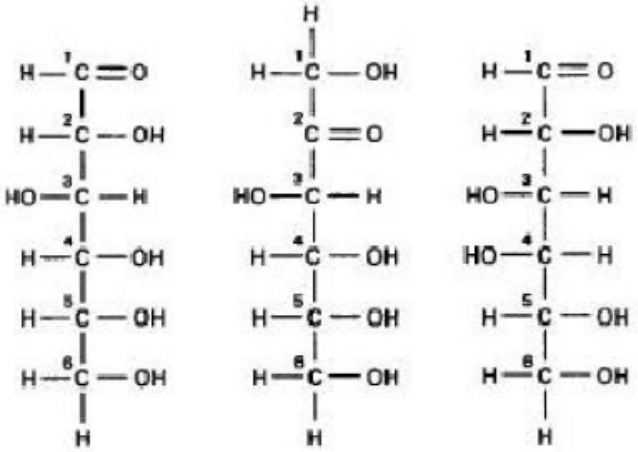
Action:	**Effect:**
Increase $[H^+]$ How? Fat metabolism OD on acidic drug	Increase [H+] Equilibrium shifts left $H+ + HCO_3- \rightarrow H_2CO_3 \rightarrow CO_2 + H_2O$ Increase $[CO_2]$ Increase rate and depth of respiration
Increase Rate & Depth of Respiration Hyperventilate	Decrease $[CO_2]$ Equilibrium shifts left $H+ + HCO_3- \rightarrow H_2CO_3 \rightarrow CO_2 + H_2O$ 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

Aldehyde | Ketone | Aldehyde



Glucose | Fructose | Galactose

$C_6H_{12}O_6$

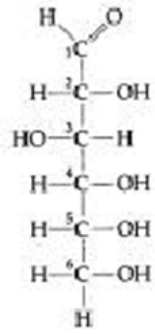
MONOSACCHARIDES:

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

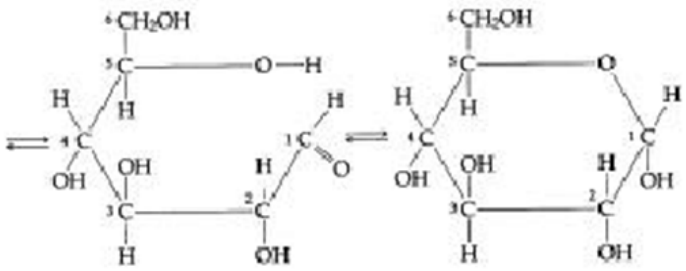
Trioses
- 3 carbon sugar
- glyceraldehyde

Pentose
- 5 carbon sugar
- Ribose
- Deoxyribose

Hexose
- 6 carbon sugar
- Glucose
- Galactose
- Fructose



Glucose
Linear form (dry)

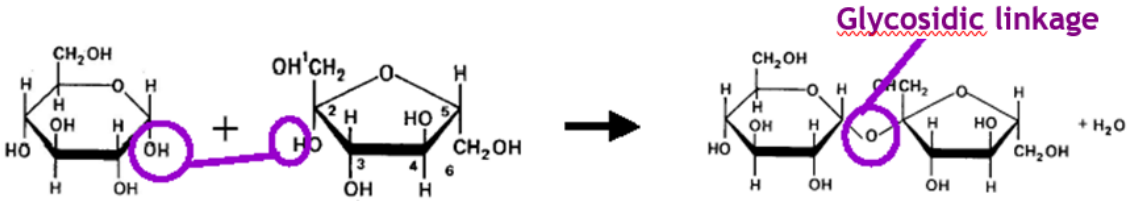


Glucose
ring form (in sol.)

DISACCHARIDES:

Double sugars

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



Glucose	+	Fructose	→	Sucrose	+	water
Glucose	+	Glucose	→	Maltose	+	water
Glucose	+	Galactose	→	Lactose	+	water

POLYSACCHARIDES:

Many monosaccharides covalently bonded together

FUNCTIONS:

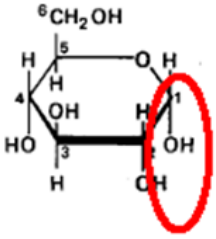
Storage	Structural
Starch: storage carbohydrate in plants Glycogen: storage carbohydrate in animals	Cellulose: plant cell wall component Chitin: polymer of amino sugar building block of exoskeletons

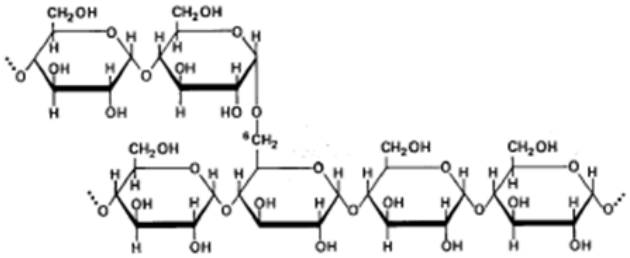
STARCH VS CELLULOSE

Starch

Polymer of α - glucose

Branched α 1-4 linkages





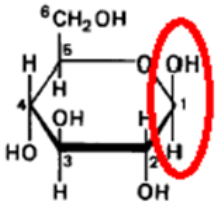
Cellulose

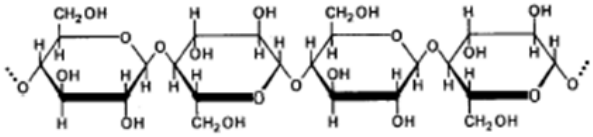
Polymer of β - glucose

Linear

Unbranched β 1-4 linkages

Most animals lack enzyme to break β 1-4 linkages





NOTES - LIPIDS

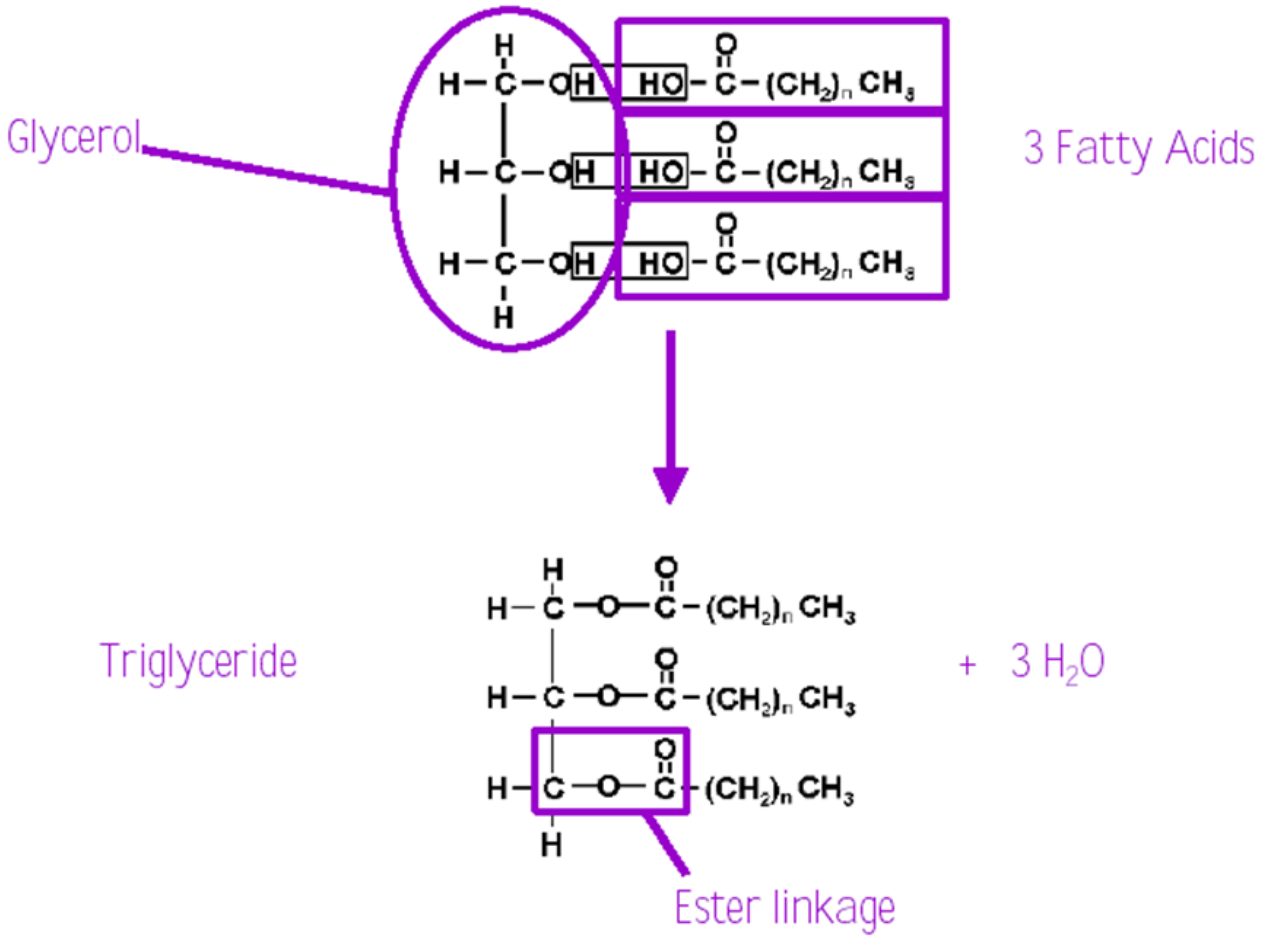
General Characteristics:

Not soluble in water

Mostly hydrocarbon chains

Fats, steroids, phospholipids

Building Blocks:



Fats:

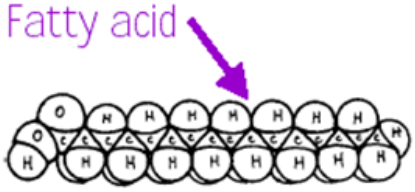
Glycerol + fatty acids
Triglycerides have 3 fatty acids
Fatty acids present may vary

Compact energy source
Cushions vital organs
Provides insulation

Saturated:

No double bonds between carbons
Straight chain

Fatty acid

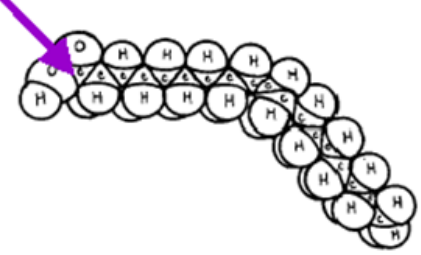


Usually solid at room temperature
Straight chains allow for tight packing
Most animal fats

Unsaturated:

At least 1 double bond between carbons
Hydrocarbon chain is bent

Fatty acid



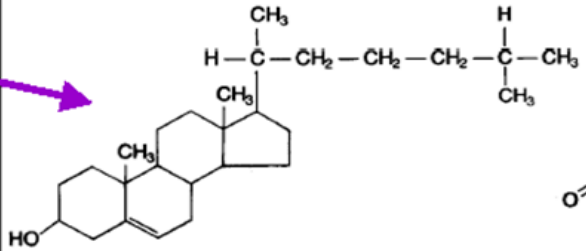
Usually liquid at room temperature
Bent chain prevents tight packing
Most plant fats

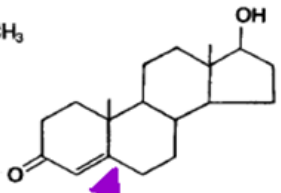
STEROIDS:

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

Cholesterol

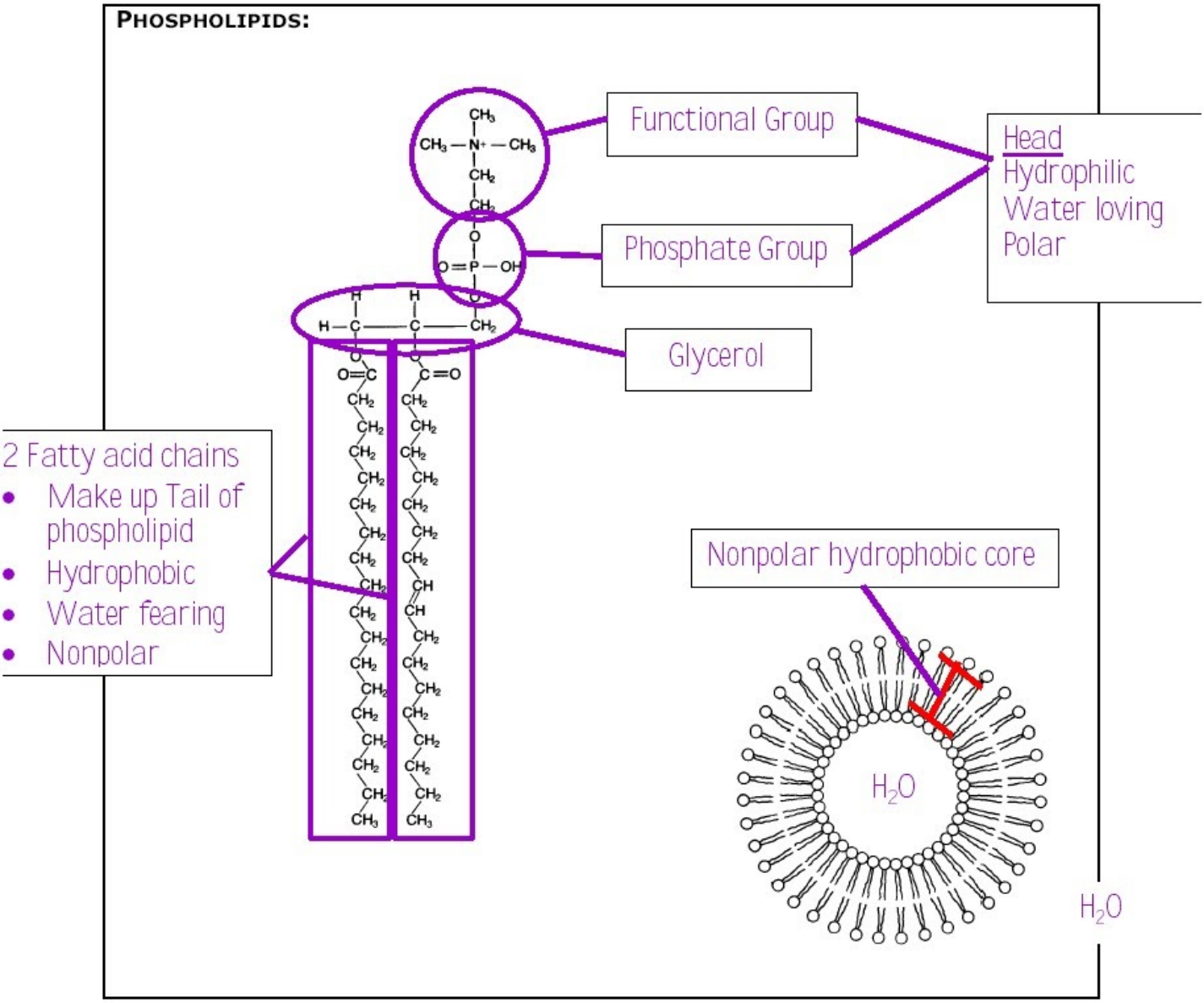
- Precursor of other steroids
- Component of animal cell membranes
- Contributes to artereosclerosis





Testosterone

PHOSPHOLIPIDS:



Notes - PROTEINS

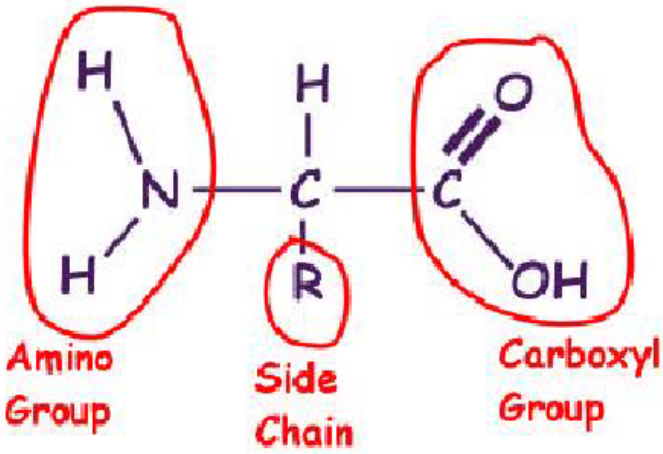
GENERAL CHARACTERISTICS AND IMPORTANCES:

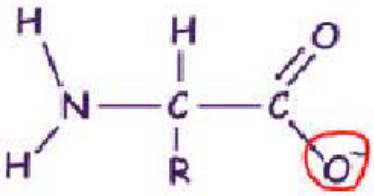
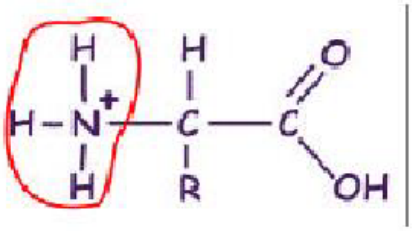
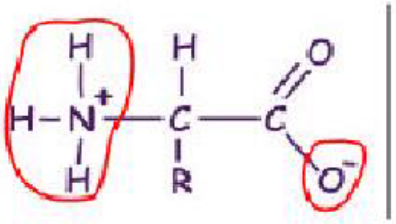
- Polymers of amino acids
- Each has unique 3-D shape
- Vary in sequence of amino acids
- Major component of cell parts
- Provide support
- Storage of amino acids
- Receptor proteins; contractile proteins; antibodies; enzymes

BUILDING BLOCKS:

Amino acids

20 different amino acids



ANION	CATION	DIPOLAR ION
		

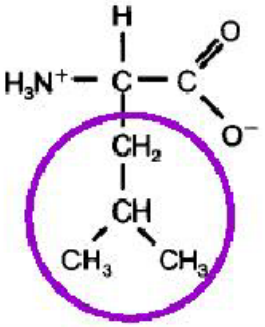
CLASSIFICATION:

Based on properties of side chain

NONPOLAR:

Hydrocarbon Chains

No oxygen

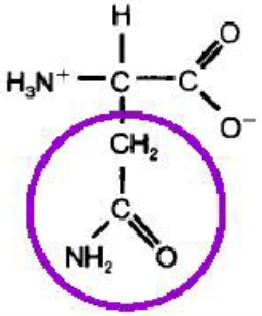


POLAR:

Oxygen present

Sometimes sulfur

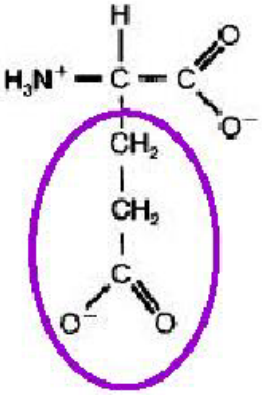
No charge



POLAR CHARGED ACIDIC:

Negative charge

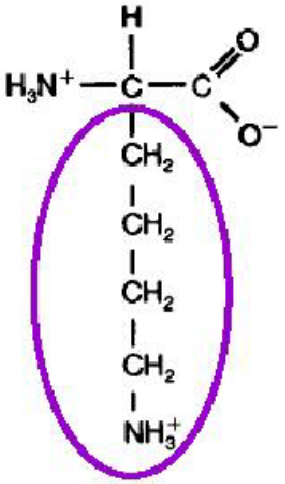
Donate H+ to solution



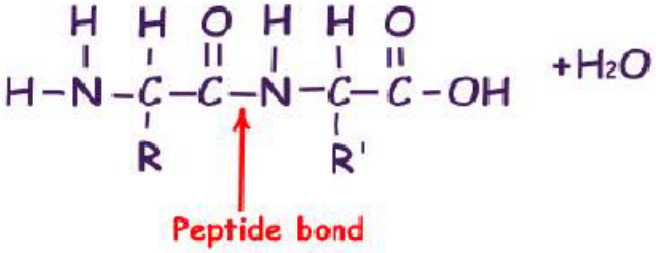
POLAR CHARGED BASIC:

Positive charge

Gain H+ from solution



PEPTIDE BONDS:



PROTEIN CONFORMATION:

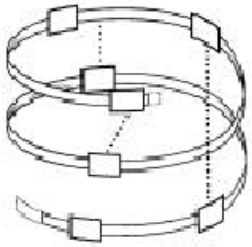
Unique 3-D shape

PRIMARY:

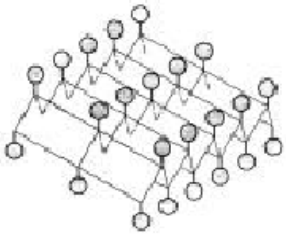
- Sequence of amino acids
- Determined by genes (sequence of bases in DNA)

SECONDARY:

α helix

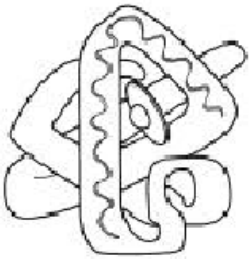


β pleated sheet



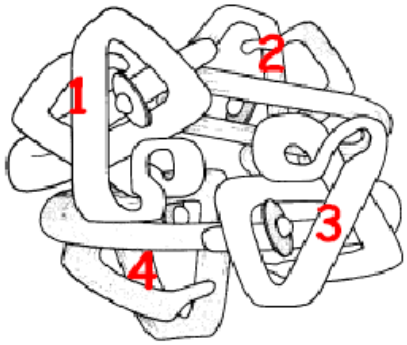
- Regular repeated folding of peptide chain
- Folding stabilized by hydrogen bonds

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 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