

Hayfield Secondary AP Summer Assignment Cover Sheet

Hayfield Secondary

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Course	AP Biology
Teacher Names & Email Addresses	Jefferson – MAJefferson@fcps.edu
Assignment Title	Summer Assignment
Date Assigned	Summer 2019-20 school year
Date Due	Please see the grid and directions in your packet
Objective/Purpose of Assignment	To review biochemistry/biology
Description of how Assignment will be Assessed	Test on week of September 16 th , Assignment completion grade on 1 st quarter
Grade Value of Assignment	Unit Test grade included in 1 st quarter grading period
Tools/Resources Needed to Complete Assignment	AP Biology, Campbell and Reese 11 th edition
Estimated Time Needed to Complete Assignment	10 hours



Introduction:

Welcome to AP biology! My class is highly intensive, with a lot of material that needs to be covered in a very short amount of time. This means we will occasionally have to get together after school as a group. Please be aware that part of taking this class is commitment to being on time, on task, and hard working. Although AP Biology is a huge commitment, **we will have a lot of fun**. I look forward to working with each one of you next year! Here are a few items of interest before you get started on the summer assignment.

I know the words "summer assignment" tends to send chills down any high school student's spine, but I think that you will find that this assignment will be very beneficial to you as we start the school year in the fall and even a little fun! The reasons I am giving you a summer assignment are:

- To keep your mind sharp and thinking, so you are ready to hit the ground running in September

Summer Assignment Overview

Task #	Due Date	Task Description	Objective
1	Week of Sept 16th	Complete MUST KNOWS questions, study for test	Review Biochemistry and build a foundation for Biology
2 Purchase	First day of class	large 3 ring binder	This will be where you keep your class notes and activities
3	Week of Sept 16th	View videos from youtube as needed to help you with concepts. I recommend Bozeman Science but there are many awesome tutorials out there.	The videos will help you create mental pictures of the concepts we will be using this year.

1. **Review Chapters 2 (Chemistry), 3 (Water), 4 (Carbon), 5 (Biological Molecules), and 6 (Organelles).** Chapter 7, as well as all previous chapters, will be covered when we return to school. You can do it early, but it is not required until the unit test. These chapters cover material that you learned in freshman biology and in chemistry.

- Read** the 5 assigned chapters carefully. You should be able to answer all the questions in the **Must Know** Packet. Pay attention to graphs, tables, diagrams. You learned some of this material in Chemistry and Biology but this is a college level text so you will have to work with the vocabulary.
- You will receive a **Must Know** packet like your summer assignment at the beginning of every unit. This packet will help you guide your reading/learning. I will collect and grade the packet. **This grade is a portion of your homework grade for the quarter (10%).** It is an important study tool to help you check your understanding. I strongly encourage you to complete the sections labeled **Must Do**. These are skill-based activities that need to be done by hand.
- Pacing Guide: Everyone works at a different pace. Know your pace and work within the time restraints of your summer. Try to finish one chapter per week with MUST KNOWS**

allowing extra time for topics you find more difficult. Please complete this package by yourself! We build upon this information and it is important that you truly understand it!

d. **Schedule upon return:**

Class 1: Ch 2/3 Biological Molecules

Class 2: Ch 4/5

Class 3: Ch 6 Organelles (any questions from the review?)

Class 4: Ch 7 Membrane Structure and Function

Class 5: Lab 1 – Osmosis and Diffusion

Class 6: Lab 1 – Osmosis ad Diffusion

Class 7: Cell Transport Applications

Class 8: Unit Test (Chapters 2, 3, 4, 5, 6, 7, Lab1)

- e. **Glossaries** or **shortcuts** are worthless in this class. Understanding is essential. Throughout the year I will help you develop these skills – if you need to.

2. Biological Molecules: Nature's Cookbook (I strongly encourage you do it while you review chapter 5 this summer.) It is at the end of this packet.

- Follow directions and complete this interactive guide to biological molecules. You will need glue and scissors.

3. Check Bozemanbiology: <http://www.bozemanscience.com/ap-biology/>

Mr. Paul Andersen has made 10-15 minute podcasts of everything that we will cover in AP Biology this year. **These is a great resource to preview before class and review after class.**

If you have problems/questions:

majefferson@fcps.edu

Please do not get stressed out **but do not procrastinate.** Enjoy the summer!

Your grade in AP Bio is based mostly on test, lab and quiz grades – no fluff, no busy work.

**Your homework after every class will be the same: Read and do MUST KNOWs.
All the information should be in your brain.**

Please fill out the **last page** of this packet and submit it to me before the last day of school.

Ch 2 – Chemical Context of Life - Must Know

Summer

Concept 2.1 Matter consists of chemical elements in pure form and in combinations called compounds

1. What four elements make up 96% of all living matter?

Concept 2.2 an element's properties depend on the structure of its atoms

2. Explain.
neutron

proton

electron

isotope

3. These are the most common isotopes used in Biology. Find out their half life and think about what it means.

Isotope	Half Life
^3H	
^{18}O	
^{14}C	
^{32}P	
^{35}S	
^{60}Co	

4. Can you use C14 to date fossils/rocks that are 250 million years old? Explain

5. Consider this entry in the periodic table for carbon.

What is the atomic mass? _____ Atomic number? _____

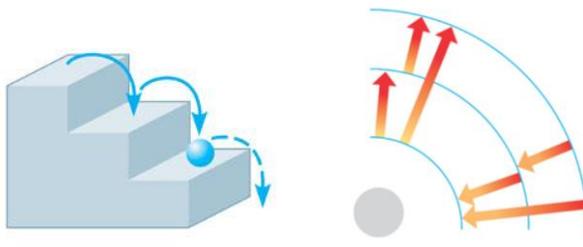
How many electrons does carbon have? _____ Neutrons? _____ Protons? _____

6
C
12

6. What is **potential energy**?

7. Explain how the **movement of electrons** relates to the concept of **potential energy** – use the diagram below to help answer the question.

(a)



8. Which has **more potential energy** in each pair?

- boy at the top of a slide/boy at the bottom
- electron in the first energy shell/electron in the third energy shell
- water/glucose

9. What determines the **chemical behavior** of an atom?

Concept 2.3 the formation and function of molecules depend on chemical bonding between atoms

10. What is meant by **electronegativity**? VERY IMPORTANT!!

11. Explain the difference between a **nonpolar covalent bond** and a **polar covalent bond**.

12. In a molecule of water, VERY IMPORTANT!!

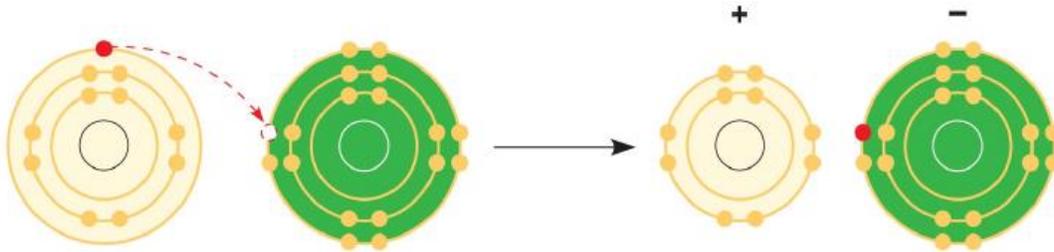
a. Which element is most **electronegative**?

b. Why is water considered a **polar molecule**?

c. In this figure, label the regions that are more positive or more negative.



13. Another bond type is **the ionic bond**. Explain what is happening in the figure below:



14. What two elements are involved in this reaction?

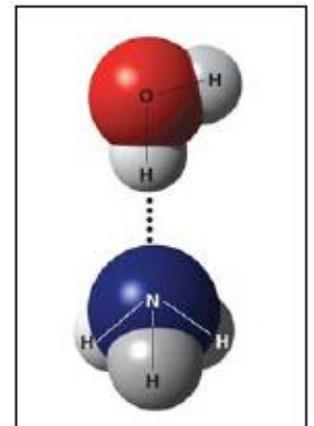
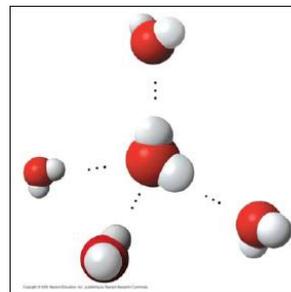
15. What is a **hydrogen bond**? IMPORTANT!!!!

16. Between which types of atoms do H-bonds form? IMPORTANT!!!!

17. How can you break a H-Bond? IMPORTANT!!!!

18. Indicate where the **hydrogen bond** occurs in these figures.

Name each molecule in these figures. IMPORTANT!!



Notice that a Hydrogen bond is formed between H and N in one figure and between H and O in the other.

19. This is a list of the types of bonds discussed in this section. Place them in order from the strongest to the weakest: **hydrogen bonds, covalent bonds, ionic bonds.**

Very STRONG



Very WEAK

UNDERSTAND DRUGS!!

20. Use **morphine** and **endorphins** as examples to explain why the **shape of a molecule** is so important for life!.

Concept 2.4 Chemical reactions make and break chemical bonds

21. Write the chemical equation for photosynthesis. Label the **reactants** and the **products**.

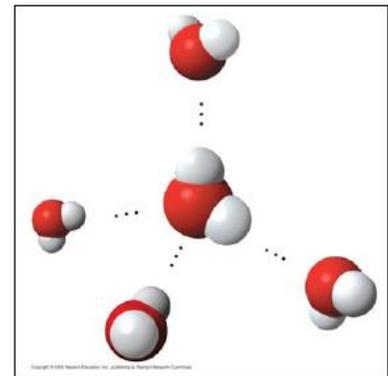
22. For the equation you just wrote, how many molecules of carbon dioxide are there? _____
 How many molecules of glucose? _____ How many elements in glucose? _____

Properties of Water

Concept 3.1 Polar covalent bonds in water molecules result in hydrogen bonding.

23. **MUST DO.** Study these water molecules.

- a. On the central molecule, **label** oxygen (O) and hydrogen (H).
- b. Add + and – signs to show the **charged regions** of *each* molecule.
- c. Label the **hydrogen bonds**.



24. What is a **polar molecule**?

25. Why is **water** a polar molecule?

26. What is a **Hydrogen Bond**?

27. How many hydrogen bonds can a single water molecule form?

Concept 3.2 Four emergent properties of water..

28. Distinguish between **cohesion** and **adhesion**.

	<i>Explanation</i>	<i>Examples (use your resources)</i>
Cohesion		
Adhesion		

29. Which property of water explains the ability of a water strider to walk on water? Or beads of water on a mirror or glass? Or paper soaking up water?

Moderation of Temperature

30. Water has high **specific heat**. What does this mean?

31. Explain how hydrogen bonding contributes to water's high specific heat. What role do H-bonds play in this property?

32. Summarize how water's high specific heat contributes to the moderation of temperature. How is this property important to life? **Understand the Application and significance.**

33. What causes water molecules to separate from each other and evaporate?

34. What is **heat of vaporization**?

35. Explain **Evaporative Cooling**. **IMPORTANT!**

36. What do H-bonds have to do with evaporative cooling?

Floating of Ice on Liquid Water

37. Explain *why* ice floats. Why is 4°C the critical temperature in this story?

38. Consider what would happen if ponds and other bodies of water accumulated ice at the bottom. Describe why this property of water is important.

Water: Solvent of Life

39. Explain these terms:

solvent

solution

solute

40. Explain **hydrophobic** and **hydrophilic**. **IMPORTANT!!**

MUST DO!! Preparing solutions.

- 41. What is a **mole**?
- 42. What is **molarity**?
- 43. What is the mass of a mole of glucose (C₆H₁₂O₆)? How do you calculate this using a periodic table?
- 44. What is the mass of a mole of sucrose (C₁₂H₂₂O₁₁)?

45. Solutions:

- a. What is a 1M solution?
- b. How do you make a **one molar (1M) solution of glucose** (C₆H₁₂O₆)
- c. How do you make a **0.2M solution of glucose** (C₆H₁₂O₆)
- d. How do you make 500 ml of a **0.2M solution of glucose** (C₆H₁₂O₆)
- e. How do you make a **one molar (1M) solution of sucrose** (C₁₂H₂₂O₁₁)?

Acids and Bases

When water dissociates, it forms "**hydronium (H₃O⁺) and hydroxide ions (OH⁻)**"
However, by convention, we represent the hydronium ion as **H⁺**.

- 46. What is the **concentration of each ion** (H⁺ and OH⁻) in pure water at 25°C?
- 47. What is an **acid** and a **base**? Explain in terms of the concentration of **H⁺ ions - [H⁺]**
acid

base (alkaline)

MUST DO!

48. Complete the following chart about pH and the concentration of H⁺ Understand what pH REALLY means

pH	Concentration of H ⁺ ions (scientific notation)	Concentration of H ⁺ ions (decimals)
0		
1		
2	10 ⁻² M	0.01 M
3	10 ⁻³ M	0.001 M
4	10 ⁻⁴ M	0.0001 M
5		0.00001 M
6		
7		
8		
9	10 ⁻⁹ M	
10		
11		0.00000000001 M
12		
13		
14	10 ⁻¹⁴ M	

49. Because the pH scale is **logarithmic**, each numerical change represents a **10X change in ion concentration**.

- a. How many times more acidic is a pH of 3 compared to a pH of 5?
- b. How many times more basic is a pH of 12 compared to a pH of 8?
- c. Explain difference between a pH of 8 and a pH of 12 in terms of H⁺ concentration.

50. Even a slight change in pH can be harmful! How do **buffers** moderate pH change?

Ch 4 – Carbon and the Molecular Diversity of Life - Must Know

Summer

Concept: Carbon atoms can form diverse molecules by bonding to four other atoms

1. Read the section “The Chemical Groups Most Important to Life”(concept 4.3).
2. Analyze/understand the table about “*Biologically important chemical groups*”.(fig4.9)
Draw and memorize the following groups:

- Hydroxyl
- Carboxyl
- Amino
- Sulfhydryl
- Phosphate
- Methyl

3. Read and Understand “ATP: An Important Source of Energy for Cellular Processes”

Concept 5.1 Macromolecules are polymers, built from monomers

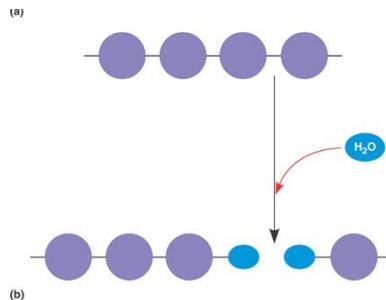
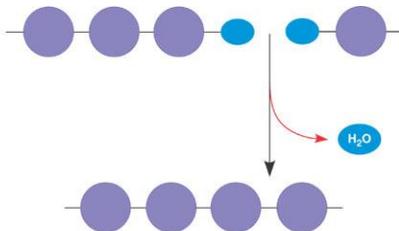
4. What is a **Polymer**:

Monomer:

5. **Monomers** molecules are joined together through a **dehydration** (or **condensation**) reaction to form **polymers**. What occurs in this reaction?

6. Large molecules (polymers) are **converted into monomers** in what type of reaction?

7. Label the 2 diagrams below – identify a **monomer**, **polymer**, **condensation reaction**, and **hydrolysis**.



8. Consider the following reaction:



- The equation is not balanced; it is *missing a molecule of water*. Write it in on the correct side of the equation.
- What kind of reaction is this? **Condensation** or **hydrolysis**
- Is $C_6H_{12}O_6$ (glucose) a monomer, or a polymer?
- When two monomers are joined, a molecule of _____ is always removed.

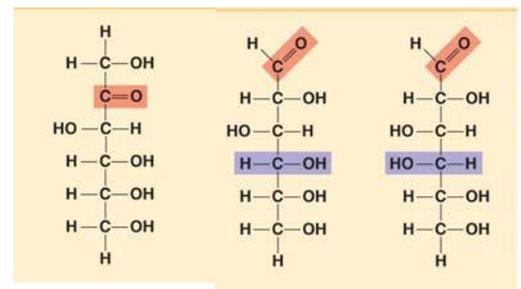
Concept 5.2 Carbohydrates serve as fuel and building material

9. These are three **monosaccharides** (simple sugars). **Name** them and notice how they are **different**.

MUST DO!

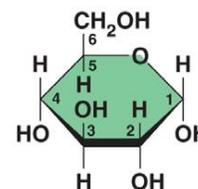
10. Count the number of C, H, and O in each monosaccharide molecule .

Write their formulas under the diagram



11. All these sugars have the same chemical formula: $C_6H_{12}O_6$. What do we call compounds that have the **same molecular formulas but different structural formulas**?

12. **MUST DO.** This is the abbreviated ring structure of glucose. Where are all the carbons? Pay attention to the numbering system. This will be important!
Circle the number 3 carbon. Put a square around the number 5 carbon.

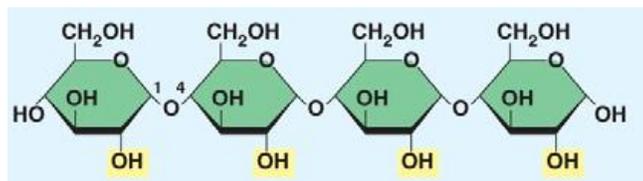


13. Complete this chart regarding 3 important disaccharides

Disaccharide	Formed from which monosaccharides	Found where?
Sucrose		
Lactose		
Fructose		

14. Here is a molecule of starch

Starch and **glycogen** are two **polysaccharides** used for storage. Plants store their extra glucose in the form of **starch**. Animals store some of their extra glucose in the form of **glycogen**.



15. What kind of reaction is used to make starch and glycogen? Dehydration or hydrolysis?

16. Complete the table

		Made from which monomers?	Function?
Storage Polysaccharides	Starch Glycogen		
Structural Polysaccharides	Cellulose		

17. **We cannot digest cellulose, the cell wall of plants. We actually call cellulose "fiber" or roughage.** Why can't we digest cellulose? What organisms can?

Concept 5.3 Lipids are a diverse group of hydrophobic molecules

18. **MUST UNDERSTAND!**

Lipids include **regular fats** (waxes, oils), **phospholipids**, and **steroids**. All lipids are **hydrophobic, non-polar molecules**.

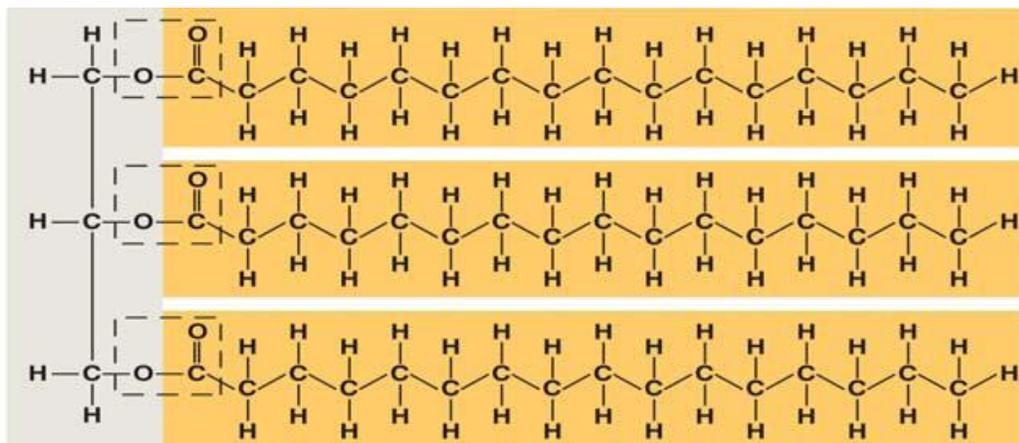
19. **MUST DO.**

- What are the **building blocks of fats**?

- Label the building blocks in this figure.

- Label the **ester linkages**.

- Write the chemical formula of this lipid! ☺



20. If a fat is composed of 3 **fatty acids** and 1 **glycerol** molecule, how many water molecules will be removed to form it?

Saturated and Unsaturated fats – MUST DO!

21. Draw a fatty acid chain that is 8 carbons long and is unsaturated.

22. Draw a fatty acid chain that is 8 carbons long and is saturated.

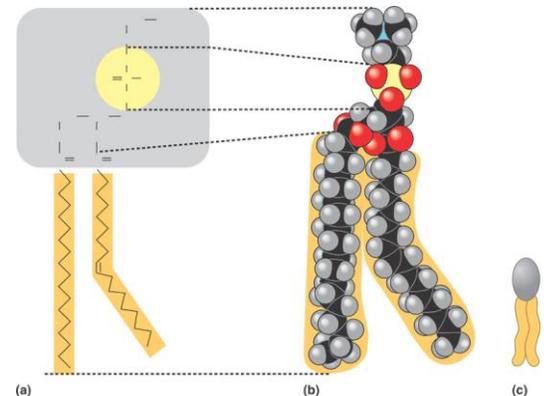
23. Name two **saturated** fats that we eat.

24. Name two **unsaturated** fats that we eat.

25. List four important **functions** of fats in our body.

26. Label this **phospholipid MUST DO!**

- *phosphate group*
- *glycerol*
- *fatty acid chains*
- *hydrophobic region*
- *hydrophilic region*



27. Which fatty acid chain in this figure is **unsaturated**? Label it. How do you know it is unsaturated?

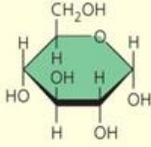
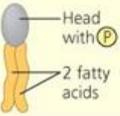
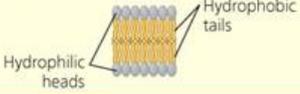
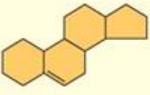
28. **MUST DO!** Label the **saturated** fatty acid chain. How do you know it is saturated?

29. **MUST DO!** Draw the phospholipid bilayer structure of a plasma membrane. Label the *hydrophilic heads*, *hydrophobic tails*

30. **MUST DO!** Draw a molecule of cholesterol, a basic **steroid** molecule.

31. What are other examples of **steroid fats**? Which **hormones** are made by your body using cholesterol as raw materials?

MUST UNDERSTAND! Nice Chart summarizing Carbohydrates and Lipids

Large Biological Molecules	Components	Examples	Functions
<p>Concept 5.2 Carbohydrates serve as fuel and building material</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Made of C, H, O</p> </div>	 <p>Monosaccharide monomer</p>	<p>Monosaccharides: glucose, fructose</p> <p>Disaccharides: lactose, sucrose</p>	<p>Fuel; carbon sources that can be converted to other molecules or combined into polymers</p>
	<p>Polysaccharides:</p> <ul style="list-style-type: none"> • Cellulose (plants) • Starch (plants) • Glycogen (animals) • Chitin (animals and fungi) 	<ul style="list-style-type: none"> • Strengthens plant cell walls • Stores glucose for energy • Stores glucose for energy • Strengthens exoskeletons and fungal cell walls 	
<p>Concept 5.3 Lipids are a diverse group of hydrophobic molecules and are not macromolecules</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Made of C, H, O (very little O)</p> </div>	<p>Glycerol</p>  <p>3 fatty acids</p>	<p>Triacylglycerols (fats or oils): glycerol + 3 fatty acids</p>	<p>Important energy source</p> 
	 <p>Head with (P) 2 fatty acids</p>	<p>Phospholipids: phosphate group + 2 fatty acids</p>	<p>Lipid bilayers of membranes</p>  <p>Hydrophilic heads Hydrophobic tails</p>
	 <p>Steroid backbone</p>	<p>Steroids: four fused rings with attached chemical groups</p>	<ul style="list-style-type: none"> • Component of cell membranes (cholesterol) • Signals that travel through the body (hormones)

Concept 5.4 Proteins include a diversity of structures, resulting in a wide range of functions

32. What are proteins made of? What are the monomers used to make proteins?

MUST DO!!

33. Draw the chemical structure of the amino acids Glycine and Cysteine - next to each other. Find them in the amino acid chart)

Label

- **amino group**

- **carboxyl group**

- **alpha carbon**

- circle the **water molecule** that would be removed if Gly and Cys were joined together.

Note the **peptide bond** formed when the two are joined.

Glycine	Cysteine

MUST DO!!

34. Examine the amino acid chart carefully. Understand why some R groups are **nonpolar**, some **polar**, and others **electrically charged (acidic or basic)**. If you were given an R group, could you place it in the correct group?

HINT:

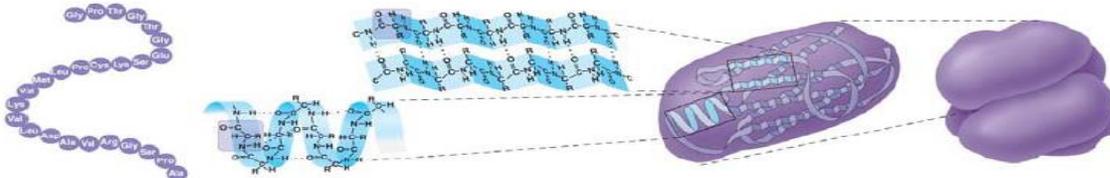
- **Non-polar (C and H)**
- **Polar (O-electronegative like water)**

- acidic (donate H⁺)
- Basic (accept/remove H⁺)

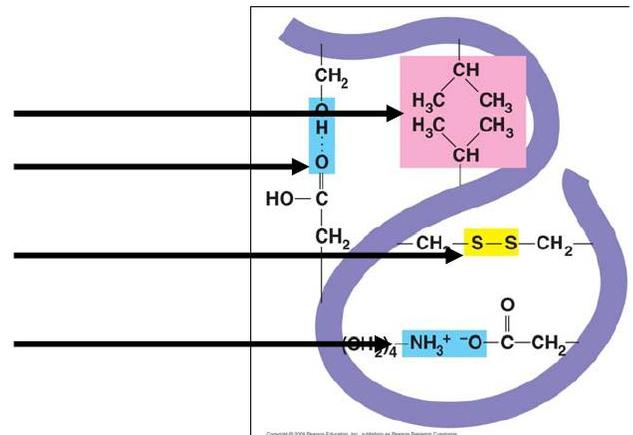
35. Explain the four levels of protein structure –

Level of Protein Structure	Explanation	Type of Bonds	Example
Primary			
Secondary - Alpha helix - Beta pleats			
Tertiary			
Quaternary			

36. Label each of the levels of protein structure on this figure.
Protein Structure is VERY IMPORTANT. I'll ask you about it all year long.



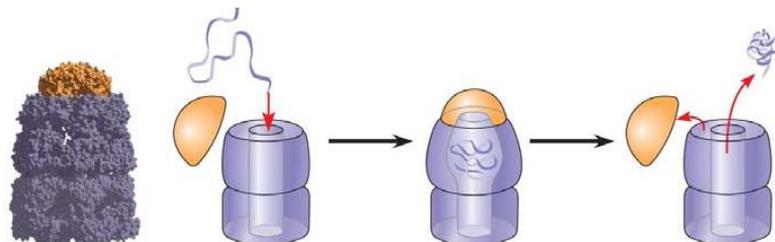
37. **MUST DO!**
Enzymes are **globular proteins** that exhibit at least tertiary structure.
 In this figure, identify and explain each interaction that contributes to the **folding of the protein**



38. **Mutations** change the primary structure of a protein. Protein structure can also be changed by **denaturation**. What is **denaturation**?

39. Give at least three ways a protein may become denatured.

40. *Chaperone proteins* or **chaperonins** assist in the proper **folding of proteins**. Annotate this figure to explain the process.

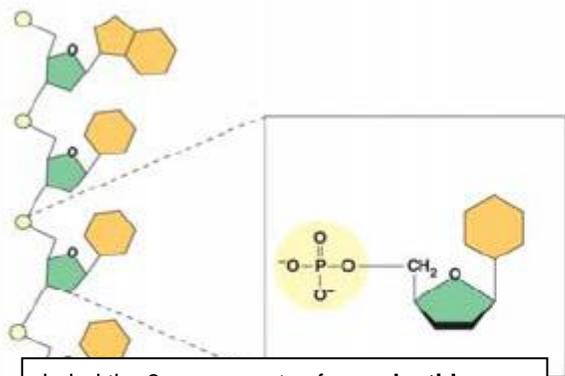


Concept 5.5 Nucleic acids store and transmit hereditary information

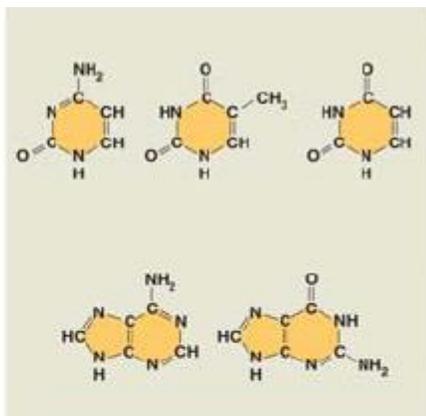
41. What do the following nucleic acids do?

- DNA
- mRNA
- tRNA
- rRNA

42. **MUST DO!** The components of a nucleic acid are a **sugar**, a **nitrogenous base**, and a **phosphate group**. Label them on the figure below.

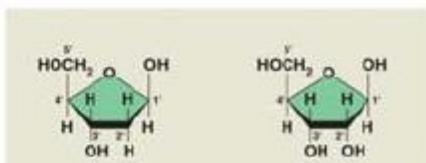


Label the 3 components of a **nucleotide**:
Sugar
N-base
Phosphate group



43. Name these 5 nitrogen bases.

What makes them different from each other?



44. Name these 2 pentose sugars. What makes them different?

45. Notice that there are five **nitrogen bases**.

- Which four are found in DNA?
- Which four are found in RNA?

46. How do **ribose** and **deoxyribose** sugars differ? Look at the molecules!

47. What two molecules make up the “uprights” or sides of the DNA ladder?

48. What molecules make up the rungs or steps of the DNA molecule?

MUST UNDERSTAND! Nice Chart summarizing Proteins and Nucleic Acids

6.1 Biologists use microscopes and the tools of biochemistry to study cells

1. What is considered a major disadvantage of the **electron microscopes**?
2. Study the electron micrographs in your text. Describe the different types of images obtained from: **scanning electron microscopy (SEM)**

transmission electron microscopy (TEM)

3. In **cell fractionation**, whole cells are broken up in a blender, and this slurry is centrifuged several times. Each time, smaller and smaller cell parts are isolated. This will isolate different organelles and will allow us to study of their biochemical activities. Which **organelles are the smallest** ones isolated in this procedure?

Make sure you understand the process of **Cell Fractionation** (Fig. 6.4)

6.2 Eukaryotic cells have internal membranes that compartmentalize their functions

4. Complete the table about prokaryotic and eukaryotic cells.

Characteristic	Prokaryotic	Eukaryotic
DNA		
Membrane-bound organelles		
Ribosomes (rRNA)		
Nucleus		
Size		
Examples		

5. This is a prokaryotic cell. **Label** each of these features and give its **function** or description.

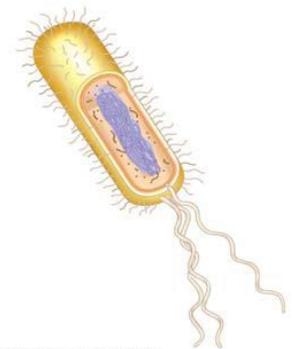
cell wall

plasma membrane

bacterial chromosome

cytoplasm

flagella



6. Why are cells so small? Explain the relationship of **surface area to volume**. **VERY IMPORTANT!**

6.3 The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes

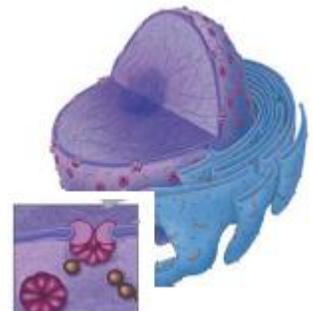
7. In the figure, label the **nuclear envelope**, **nuclear pores**, and **pore complex**.

8. Found within the nucleus are the **chromosomes**. They are made of **chromatin**. What are the two components of chromatin?

9. When do the **thin chromatin fibers condense** to become distinct **chromosomes**?

10. What is the job of the nucleolus?

11. What is the function of **ribosomes**? What are their **two components**?

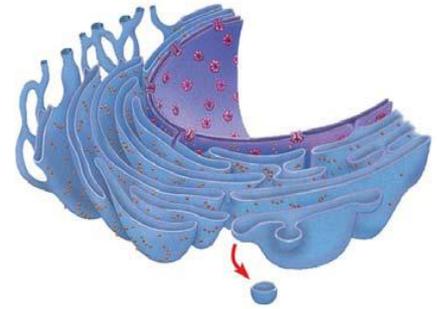


12. Ribosomes are the same in all organisms, but we distinguish between two types of ribosomes based on where they are found, and the destination of the protein product made. Complete this chart to demonstrate this concept.

Type of Ribosome	Location	Product
Free		
Bound		

6.4 The endomembrane system regulates protein traffic and performs metabolic functions in the cell

13. The **endoplasmic reticulum (ER)** makes up more than half the total membrane system in eukaryotic cells. Use this sketch to explain the **lumen**, **transport vesicles**, and the difference between **smooth** and **rough ER**.



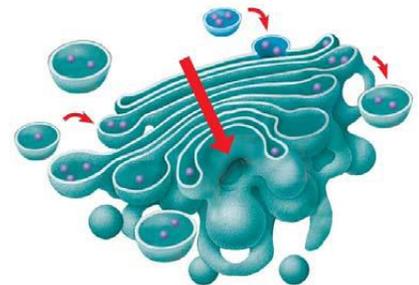
14. Describe three major **functions** of the **smooth ER**.

15. Why does alcohol abuse increase tolerance to other drugs such as barbiturates?

16. The **rough ER** is studded with ribosomes. As proteins are synthesized, they are threaded into the lumen of the rough ER. Some of these proteins have carbohydrates attached to them in the ER to form **glycoproteins**. What does the ER then do with these **secretory proteins**?

17. Besides **packaging secretory proteins** into **transport vesicles**, what is another major function of the rough ER?

18. The transport vesicles formed from the rough ER fuse with the Golgi apparatus. Use this sketch to label the **cisterna** of the Golgi apparatus, and its **cis** and **trans** faces. Describe what happens to a transport vesicle and its contents when it arrives at the Golgi.



19. What is a **lysosome**? What do they contain? What is their pH?

20. One function of lysosomes is intracellular digestion of particles engulfed by **phagocytosis**. Explain this process of digestion.

21. What human cells carry out phagocytosis?

22. A second function of lysosomes is to recycle cellular components in a process called **autophagy**. Describe this process.

23. There are many types of **vacuoles**. Complete the chart.

Type of Vacuole	Function
Food Vacuole	
Contractile Vacuole	
Central Vacuole in Plants	

6.5 Mitochondria and chloroplasts change energy from one form to another

24. Draw a mitochondrion here and label the **outer membrane**, **inner membrane**, **inner membrane space**, **cristae**, **matrix**, and **mitochondrial ribosomes**.

25. What is the function of the **mitochondria**?

26. What is the function of the **chloroplasts**?

27. Recall the relationship of structure to function. Why is the inner membrane of the mitochondria **highly folded**? What role do all the individual thylakoid membranes serve? (Same answer for both questions.)

28. Explain the **Endosymbiotic Theory** about the origin of mitochondria and chloroplast. **VERY IMPORTANT!**

29. Explain the important role played by **peroxisomes**.

6.6 The cytoskeleton is a network of fibers that organizes structures and activities in the cell

30. What is the **cytoskeleton**?

31. There are three main types of fibers that make up the cytoskeleton. Name them.

32. **Microtubules** are hollow rods made of a globular protein called **tubulin**. What are 4 functions of microtubules?

33. Animal cells have a **centrosome** that contains a pair of **centrioles**. Plant cells do not have centrioles. What is another name for **centrosomes**?

What is believed to be the role of centrioles?

34. **Microfilaments** are solid, and they are built from a double chain of the protein **actin**. What are four functions of microfilaments?

35. **Intermediate filaments** are bigger than microfilaments but smaller than microtubules. They are more permanent fixtures of cells. Give two functions of intermediate filaments

Extracellular components and connections between cells help coordinate cellular activities

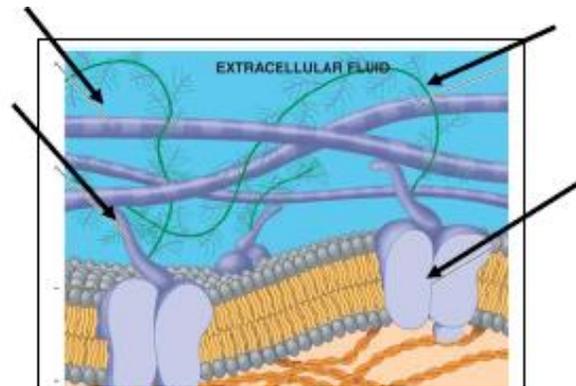
36. What are three functions of the **cell wall**?

37. What is the cell wall of plants made off?

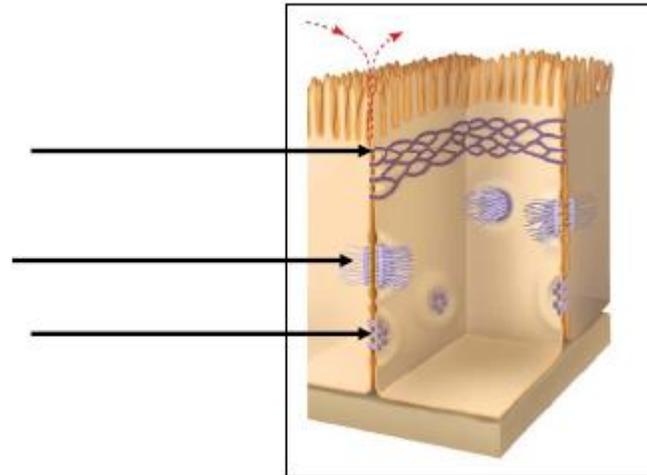
38. What are **plasmodesmata**? What can **pass through** them?

MUST DO!

39. Animal cells do not have cell walls, but they do have an **extracellular matrix (ECM)**. Label the elements indicated, and give the role of each. **IMPORTANT!!!**



40. Animals cells do not have *plasmodesmata*. This figure shows the three types of **intercellular junctions** seen in animal cells. Label each type and summarize its role. **IMPORTANT!!!**



Intercellular Junction	Role
Tight Junction	
Desmosomes	
Gap Junction	

MUST DO! Cell Size Issues

Why can't organisms be one big giant cell? **Diffusion** limits cell size! **The larger the distance, the slower the diffusion rate.** A cell 20 cm would require months for nutrients to get to the center.

As a cell gets larger, the volume of the cell increases more rapidly than the surface. For optimum diffusion rates, cells need to maintain a large **surface area to volume ratio**. However, as the cell size increases, the ratio gets smaller – too much volume for so little surface – and diffusion becomes very inefficient as a way of moving molecules inside the cell.

1. Calculate the surface and volume of a cube cell of increasing size. Fill in the chart.

	1-mm side cube	3-mm side cube	5-mm side cube	7-mm side cube	9-mm side cube
Surface Area					
Volume					
Divide Surface area by Volume (SA / V) Surface Area to Volume Ratio					

What happens to the surface area to volume ratio as the cells get bigger?

What happens to the surface area to volume ratio as the cells get bigger?

Everything that the cell needs or has to eliminate has to go through the **cell membrane**. Therefore, the cell's ability to either get substances from the outside or eliminate waste is related to the **surface area**. In addition, how much food and other material from the outside is needed and how much waste the cell has to eliminate, is related to the **volume**.

As a cell gets bigger there will come a time when its surface area is insufficient to meet the demands of the cell's volume - and the cell stops growing.

A way to solve the problem of surface area is to make the cell **long and thin**. This technique is used by many protists as well as certain cells in your body such as nerve cells and muscle cells, both of which are long and skinny.

Calculate the surface and volume for a rectangular cell that is 16 mm x 4 mm x 0.125 mm.

Surface: Volume: Surface Area/Volume:

Important Facts about Cell Size - Think!

1. A cell is a **metabolic** compartment where a multitude of chemical reactions occur.
2. The **number of reactions** increases as the volume of a cell increases. (The larger the volume the larger the number of reactions)
3. All **raw materials** necessary for metabolism can enter the cell **only** through its cell membrane.
4. The greater the **surface area** the larger the amount of raw materials that can enter at only one time.
5. Each unit of volume requires a specific amount of surface area to supply its metabolism with raw materials. The amount of surface area available to each unit of volume varies with the size of a cell.

6. As a cell grows its SA/V decreases.
7. At some point in its growth its SA/V becomes so small that its surface area is too small to supply its raw materials to its volume. At this point the cell cannot get larger and must divide.

Questions for your brain! Easy... Please answer them.

1. What surrounds a cell and controls what enters or leaves?
2. Materials move into and out of a cell by what process?
3. Is diffusion more efficient over short or long distances?
4. Which increases faster --- surface area or volume of a cell?

Why?

5. When a cell's volume becomes too large for its surface area, what do the cells do?
7. Which of the following is correct concerning an spherical cell?
 - a. As the diameter decreases, the surface area remains the same
 - b. As the diameter decreases, the surface area increases
 - c. As the diameter decreases, the surface area to volume ratio increases
 - d. As the diameter increases, the volume decreases
 - e. the surface area to volume ratio is independent of the diameter
8. The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that
 - a. plant cells are capable of having a much higher surface-to-volume ratio than animal cells.
 - b. plant cells have a much more highly convoluted (folded) plasma membrane than animal cells.
 - c. plant cells contain a large vacuole that reduces the volume of the cytoplasm.
 - d. animal cells are more spherical, while plant cells are elongated.
 - e. the basic functions of plant cells are very different from those of animal cells.
9. One strategy that allows larger cells to have an effective surface area to volume ratio is:
 - a. having a completely spherical shape.
 - b. being short and fat.
 - c. having thin, finger-like projections.
 - d. having a thinner plasma membrane.
 - e. locomotion.

End of Summer Review

Ch 7 – Membrane Structure – Must Know (due on test day)

7.1 Cellular membranes are fluid mosaics of lipids and proteins

1. What does **selective permeability** mean and why is that important to cells?

2. What is an **amphipathic** molecule?

3. Which molecule in the cell membrane is **amphipathic**? Draw it!! **MUST DO!**

4. How is the **fluidity** of cell membrane's maintained? **IMPORTANT!!!**

5. What is the role of **cholesterol** in membrane **fluidity**?

6. In a hot environment, which type of fatty acids should increase in the phospholipid bilayers - Saturated or unsaturated?

7. In a cold environment, which type of fatty acids should increase in the phospholipid bilayers - Saturated or unsaturated?

8. Describe how each of the following affect membrane fluidity: **VERY IMPORTANT!**

a. **decreasing temperature**

b. **phospholipids with unsaturated hydrocarbon chains**

c. **phospholipids with saturated hydrocarbon chains**

d. **cholesterol**

MUST DO!

9. Label the following structures:

glycolipid

glycoprotein

integral protein

peripheral protein

cholesterol

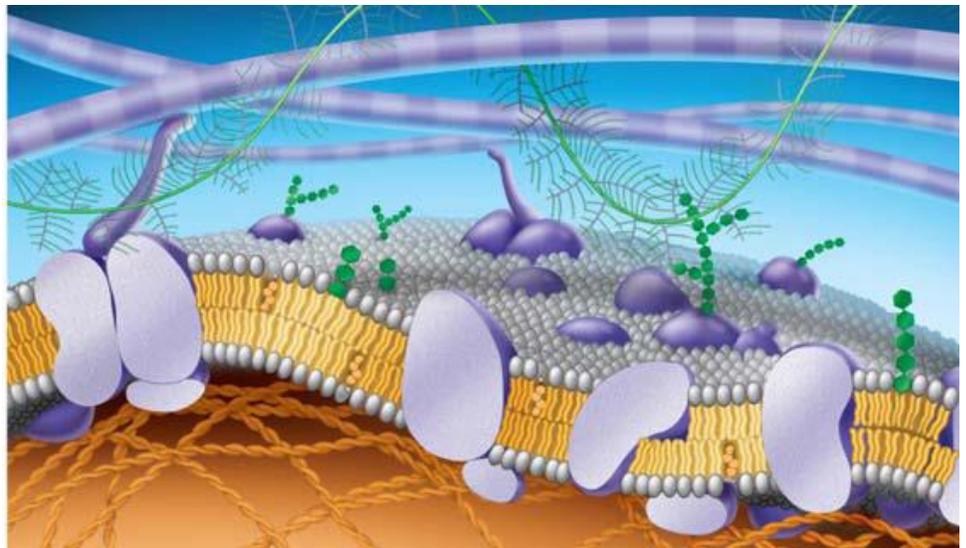
phospholipid

Extra Cellular Matrix (ECM)

fibers

cytoskeleton microfilaments

integrins



10. Membrane **proteins** are the

mosaic part of the model. What is the difference between **integral and peripheral proteins**?

integral proteins

peripheral proteins

11. Use Figure 7.9 to briefly describe **major functions of membrane proteins**.

Function	Description
Transport	
Enzymatic activity	
Signal Transduction	
Cell-cell recognition	
Intercellular Joining	
Attachment to Cytoskeleton and ECM	

12. How do **glycolipids** and **glycoproteins** help in **cell to cell recognition**?

13. What is the difference between **glycolipids** and **glycoproteins**?

7.2 Membrane structure results in selective permeability

14. What is the difference between **channel proteins** and **carrier proteins**?

15. Peter Agre received the Nobel Prize in 2003 for the discovery of **aquaporins**. What are **aquaporins**?

16. The following materials must cross the membrane. For each, tell how it is accomplished. **IMPORTANT!!**

Material	Method
CO ₂	
Glucose	
H ⁺	
O ₂	
H ₂ O	

7.3 Passive transport is diffusion of a substance across a membrane with no energy investment

17. Explain the following DO NOT use the glossary!!
diffusion

concentration gradient

passive transport

osmosis

isotonic

hypertonic

hypotonic

turgid

flaccid

plasmolysis

18. Use as many words from the list above to describe why a carrot left on the counter overnight would become limp. Underline each word you use. **DO IT!**

19. What is **facilitated diffusion**? Is it **active** or **passive**? Give two examples.

20. Label the **hypotonic solution**, **isotonic solution**, and **hypertonic solution**.

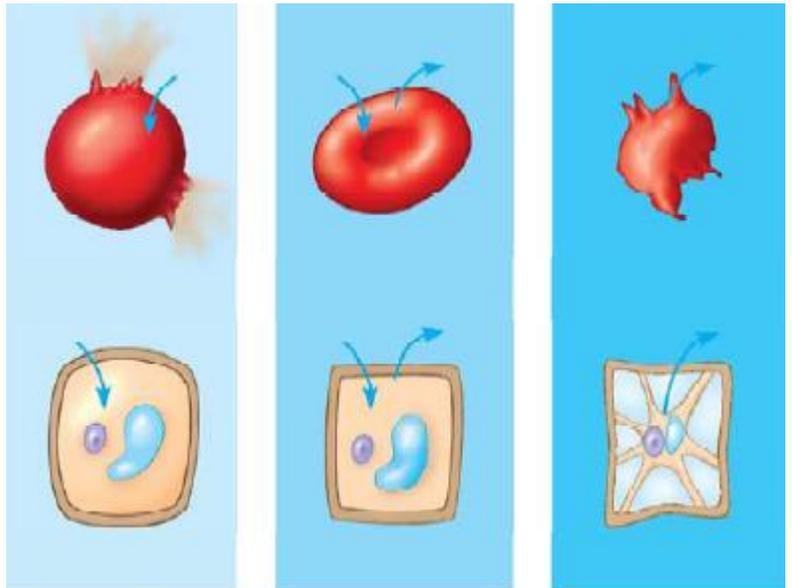
What is indicated by the *blue arrows*?

21. Which cell is **Lysed**?

Turgid?

Flaccid?

Plasmolyzed?



22. **Animal or Protista cells burst when placed in a hypotonic solution. Plant cells do not burst!! Why not?**

Concept 7.4 Active transport uses energy to move solutes against their gradients

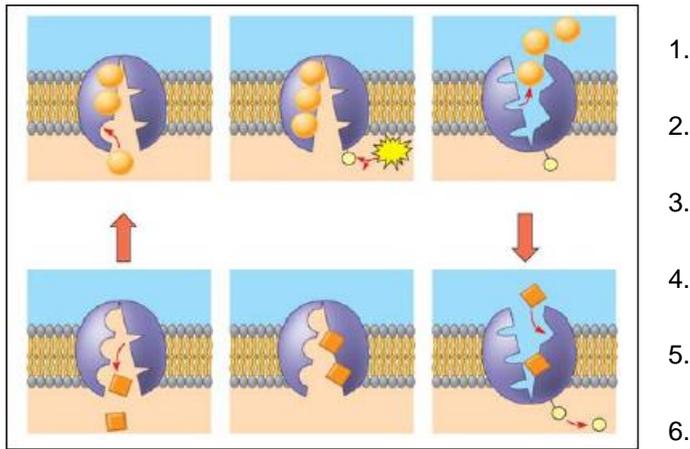
23. Describe **active transport**.

24. What type of proteins are involved in active transport?

25. How is ATP used in active transport?

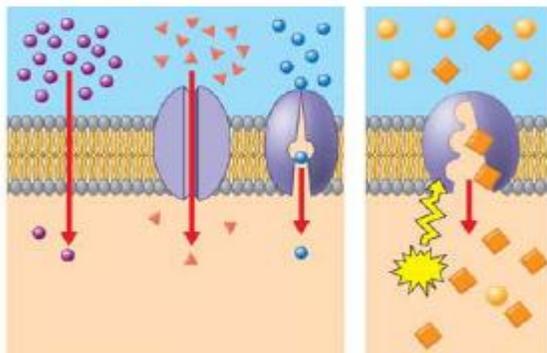
26. The **sodium-potassium pump** is an important system – **MUST KNOW!**

Use the diagram to understand how it works. Use the following terms to label these figures: **extracellular fluid**, **cytoplasm**, **Na⁺**, **K⁺**, **ATP**, **ADP**, **P**, **transport protein**. Summarize what is occurring in each figure.



- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

27. On the diagram below, add these labels: **facilitated diffusion with a carrier protein**, **facilitated diffusion with a channel protein**, **active transport with a carrier protein**, **simple diffusion**. For each type of transport, give an example of a material that is moved in this manner.



- 1.
- 2.
- 3.
- 4.

28. What is **membrane potential**?

29. Which side of the membrane is **positive**?

30. What are the two forces that drive the diffusion of ions across the membrane? What is the combination of these forces called?

31. What does the **proton pump** do?.

32. What is **cotransport**?

33. How is **co-transport** in the intestine used for the treatment of diarrhea?

7.5 Bulk transport across the plasma membrane occurs by exocytosis and endocytosis

34. Define each of the following and give a specific cellular example.

endocytosis

exocytosis

35. Are these processes **active** or **passive transport**? Explain your response.

Nature's Cookbook

Synthesizing macromolecules through the process of condensation (= dehydration reaction)

Polymers are made by joining together many **monomers**. **Macromolecules** are polymers.

ALL living organisms are made of 4 types of macromolecules

- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids

WORD BANK

Photosynthesis
Energy
Covalent
Cell membrane
Polysaccharide
Condensation
Water

1. Carbohydrates C, H, O

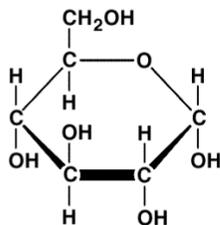
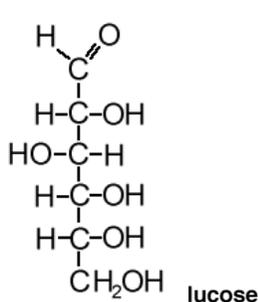
To make an energy-loaded carbohydrate mix together:
Carbon, Hydrogen and Oxygen

Bake in the full sun inside chloroplasts. These elements will be linked together with _____ bonds to make a sweet molecule called **GLUCOSE**. This process is called _____ and makes enough glucose to supply _____ for all producers; the **leftover glucose can be stored as starch** or **eaten by other organisms**.

Glucose is a **monosaccharide**. Glucose is a **monomer**

This is the linear and folded structure of glucose. Glucose is often represented by a simple hexagon.

Mono = one
Saccharide =
sugar



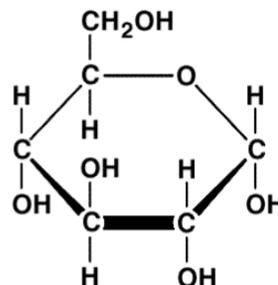
Count the atoms of C, H, and O and write the chemical formula of glucose in the box.

Chemical Formula of
Glucose

In this glucose molecule

Draw one glucose molecule here:

- circle the H on the left side
- circle the OH on the right side



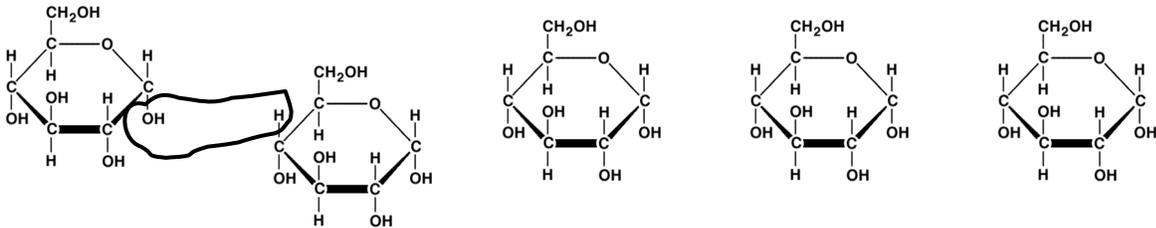
Making Polysaccharides or Complex Carbohydrates

1. Draw 4 glucose molecules
2. On 2 glucose molecules, cut off (and save) the H end on the left and the OH end on the right
3. On the third glucose molecule, cut off and save the H end on the left only
4. On the fourth glucose molecule, cut off and save the OH end on the right only
5. Fit all the glucose molecules like a puzzle and draw them here.

6. Draw the little **H** and **OH** pieces together to make 3 molecules of _____

By taking out molecules of water in a process called dehydration synthesis or _____ you have combined molecules of glucose to make a _____ like starch, cellulose, or glycogen.

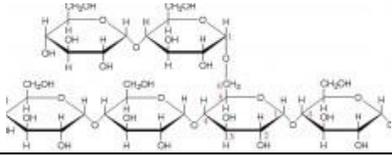
Circle the **H** and **OH** that would be removed from the following glucose molecules to make a polysaccharide
The first one has been done for you.



Complete this chart

Polysaccharide	Found in ...	Main function
<p>Starch</p>		
<p>Cellulose</p>		

Glycogen



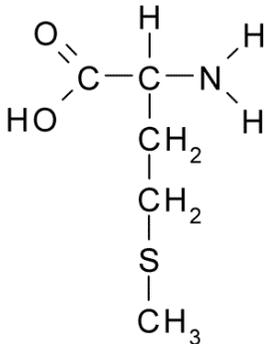
2. Proteins C, H, O, N, S

To make an amino acid mix together : **Carbon, Hydrogen, Oxygen**, some **Nitrogen** and sometimes some **Sulfur**.

Mix these elements well using **covalent bonds** to make individual **amino acids**, the monomers of **proteins**. Then get ready for some **dehydration synthesis** as you connect the amino acids to make proteins.

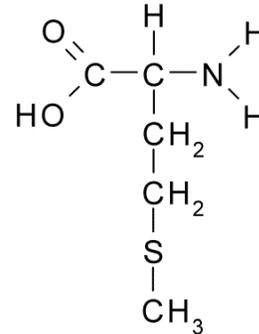
Amino acids have an **amino end (NH₂)** and a **carboxyl end (COOH)**

- Circle the **Amino end (NH₂)**
- Draw a rectangle around the **Carboxyl end (COOH)**



Methionine, one of the 20 amino acids

- Circle the **OH** in the **carboxyl end**
 - Circle the **H** in the **amino end**
- These are the groups that will be removed during a dehydration reaction to form H₂O

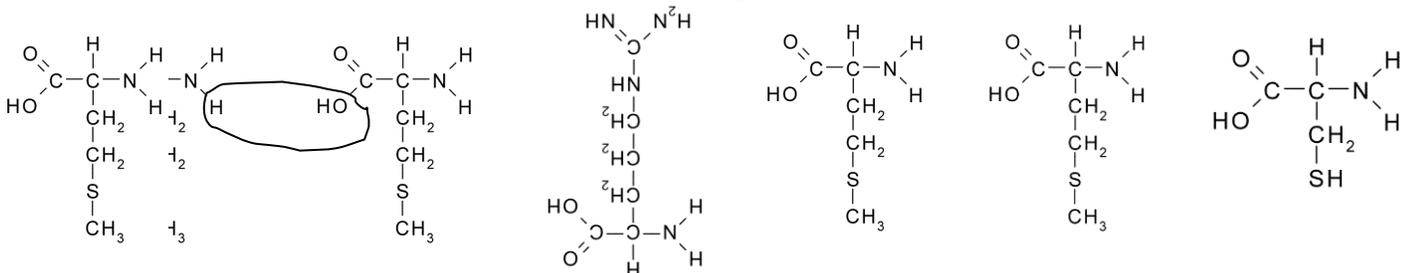


Methionine, one of the 20 amino acids

1. Draw the 4 amino acids
2. Draw the H and OH groups from the ends as needed so you can fit the amino acids together like a puzzle. Save the H and OH! Draw the amino acids together here.

3. Draw the Hs and OHs together to make 3 molecules of _____

Circle the H and OH that would be removed from the following amino acids to make a protein. See example



3. Lipids C, H, O_{little}

To make lipids mix the following:

One part _____

Two parts _____

A dash of _____ (very little)

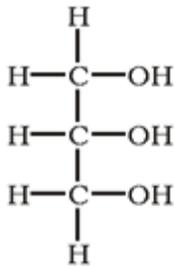
These elements will be joined by _____ bonds to make **glycerol** and **fatty acids**, the building blocks of lipids.

Lipids are important as part of all _____ in the cell. Lipids are also use for long term storage of _____

Lipids are not considered polymers because the individuals units do not repeat. Lipids are formed by joining two types of molecules: **glycerol** and **fatty acids**.

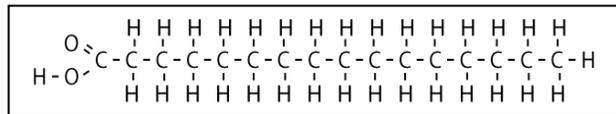
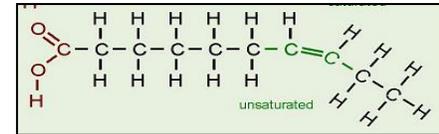
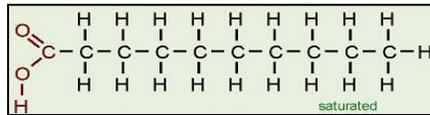
Glycerol

- Write the chemical formula of Glycerol



Fatty Acids

-Write the chemical formula of each of these fatty acids – count the atoms!



Build a lipid:

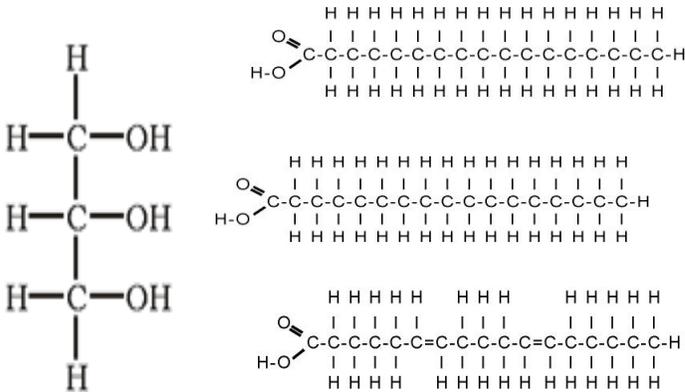
1. Draw the glycerol and the 3 fatty acid molecules.
2. Draw the OH groups off the glycerol molecule. Save them.
3. Draw the H from each fatty acid. Save them.
4. Draw the lipid (triglyceride) molecule here.

6. Draw the 3 water molecules here.

By taking out molecules of water in a process called _____ (or condensation), you have combined 3 fatty acid molecules with a molecule of glycerol to make a lipid called a **triglyceride**.

Butter, olive oil, and chocolate (cocoa butter) are examples of triglycerides.

Circle the H and OH that would be removed from the following glycerol and fatty acids to make a triglyceride



4. Nucleic Acids C,H,O,N,P

Nucleic acids are harder to make and require 2 steps.

First you need to make a **nucleotide** by combining the following:

- a **phosphate** (PO₄)
- a **five carbon sugar** (ribose or deoxyribose)
- a **nitrogen base** (A,T,C,G, or U).

All the atoms in these molecules are joined together by _____ bonds.

The chart below has all the basic molecules that you will join together to make a **NUCLEOTIDE**.

Look at the Nitrogen Bases. With a **red pencil** trace the part of the molecule that it is the **same** in all nitrogen bases. Look at the Sugars. With a **red pencil** **circle** the part that is **different** between ribose and deoxyribose.

Name: _____

Grade: _____

Email: _____

*if you don't get this summer assignment in June, please email me this information majefferson@fcps.edu.

1. Why did you sign up to take AP Biology?
2. What are your personal strengths when it comes to learning new material?
3. What causes you to struggle in a course?
4. What is the most effective way for you to prepare for a test?
5. How many AP classes are you taking (please list)?
6. Have you or will you be taking anatomy and physiology?

