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https://www.youtube.com/watch?v=QMRU7PUNusA
Living matter is made up of many different elements, but 96% of all living matter is comprised of just a few. Which element below is part of this 96%?

A. iodine
B. phosphorus
C. iron
D. nitrogen

Which of the following statements best describes trace elements?

A. Trace elements are found in very small quantities in cells but still play a critical role in the functioning of living organisms.
B. Trace elements are only found in some living organisms, but not all of them.
C. Trace elements are present in living organisms in small amounts and have no special role in the function of cells.
D. Trace elements are elements that are found in small quantities in nature and living organisms uptake them to improve the condition of the environment.

https://www.youtube.com/watch?v=bzaVL4jYmGA
Water has unique properties that allow it to support life. Which of the following best describes this?

A. Water is a non-polar molecule because oxygen and hydrogen share electrons equally, which allows for hydrogen bonding.
B. Water is a polar molecule because oxygen and hydrogen form polar covalent bonds, which allows for hydrogen bonding.
C. Water covalently bonds with other water molecules, which is the strongest form of bonds.
D. Water forms ionic bonds with other water molecules, which allows it to break bonds easily.

Which statement best describes hydrogen bonding?

A. a covalent bond that occurs when an negatively charged oxygen donates an electron to a positively charged hydrogen
B. an ionic bond that occurs when a hydrogen shares its lone electron with an oxygen or nitrogen
C. an attractive force between the partial positive charge on a hydrogen and a partial negative charge on an oxygen or nitrogen
D. an attractive force between the partial negative charge on a hydrogen and a partial positive charge on an oxygen or nitrogen

https://www.youtube.com/watch?v=kGrYheDLiuk
CORRECTION TO CONTENT (at approximately 4:25 in video)
cis- meaning "on this side" - molecules in the *cis-* configuration have substitutions on the same side of the double bond. This gives them a **bent** structure.
trans- meaning "on the other side" - molecules in the *trans-* configuration have substitutions on opposite sides. This gives the hydrocarbon an almost **linear** structure.

Carbon can form up to four covalent bonds because --

A. it has four valence electrons.
B. it is a polar molecule.
C. it bonds to hydrogens, which are small.
D. it has a greater electronegativity than most other elements.

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Isomers have the ____ chemical formula, _____ chemical structures and _____ biological functions.

A. different, different, same
B. same, different, different
C. same, different, same
D. different, same, same

https://www.youtube.com/watch?v=ieToMWPAPt8

Which functional group is used in stabilizing three-dimensional structures of proteins by forming covalent bonds?

A. sulfhydryl
B. amino
C. carboxylic acid
D. carbonyl

Which of the following is the correct functional group for alcohols?

A. -COOH
B. -CH3
C. -OH
D. -SH

Major components of organic compounds such as fats, phospholipids and fossil fuels consist of hydrocarbons. Hydrocarbons are molecules that are made of

A. hydrogen and carbon atoms.
B. hydrogen, oxygen and carbon atoms.
C. water molecules and carbon atoms.
D. hydrogen, carbon and nitrogen atoms.

All living organisms have common organic compounds that perform many of life's functions. All organic compounds are made of atoms and elements. Which of the following is the most complete list of elements common to all organic life?

A. helium, calcium, carbon and potassium
B. hydrogen, carbon, oxygen, phosphorus and nitrogen
C. hydrogen and carbon
D. potassium, hydrogen, calcium and phosphorus

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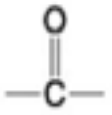
Use the following information for the next 2 questions.

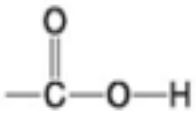
Functional groups are specific groups of atoms that retain their chemical behavior regardless of the size of the molecule to which they are attached. They play critical roles in the chemistry of the cell. Use the diagrams below to answer the questions that follow.

A. —OH

D. $—NH_2$

B. 

E. — SH

C. 

Which of the functional groups above would be found in an ethanol molecule?

A. A
B. B
C. C
D. D
E. E

Which group is a carboxyl functional group?

A. A
B. B
C. C
D. D
E. E

Enantiomers are possible because carbon can form 4 bonds. Which of the following best describes enantiomers?

A. compounds with the same covalent partnerships that differ in spatial arrangements of atoms
B. compounds that are mirror images of each other
C. compounds that have the same molecular formula but differ in the covalent arrangement of atoms
D. compounds that have a different formula but the same covalent arrangement

Lipids are considered _____ because they do not interact with water. Carbohydrates and salts are considered _____ because they do interact with water.

A. polar covalent, ionic
B. nonpolar, hydrophobic
C. hydrophobic, hydrophilic
D. polar, nonpolar

https://www.youtube.com/watch?v=HBmSYkHcdVs

How can certain animals extract energy and nutrients from cellulose?

A. cellulose is made from alpha glucose monomers and they have they enzyme to break it down
B. cellulose is made from beta glucose monomers and they have a symbiotic relationship with bacteria to break it down
C. cellulose is not digestible for an organism, it is only insoluble fiber
D. cellulose is a protein made up of amino acids which are used to make proteins for the cell

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Which of the following is a monosaccharide?

A. glutamic acid
B. tyrosine
C. glucose
D. adenosine

https://www.youtube.com/watch?v=RBpl3UlyXas
One unifying property of lipids is

A. they have double bonds between carbon.
B. they are steroids and are used for communication.
C. they are hydrophobic and nonpolar.
D. they are hydrophilic and polar.

Nucleotides are joined together in a phosphodiester bond by

A. hydrolysis.
B. oxidation-reduction.
C. combustion.
D. dehydration synthesis.

https://www.youtube.com/watch?v=X0pPNdXpIO4
The primary structure of a protein is

A. the hydrogen bonds formed between amino and carboxyl groups.
B. the sequence of amino acids as dictated by the gene.
C. the association of several polypeptide chains forming and active protein.
D. the R-group interactions giving the polypeptide a specific 3D structure.

What is the quaternary structure of a protein?

A. the sequence of amino acids
B. the initial folding into alpha helices or beta sheets
C. the folding of one amino acid chain into a functional protein
D. the interaction between multiple subunits to form one functional protein

Inside cells, small organic molecules are joined together to form larger molecules. Which of these correctly pairs a monomer to the polymer it can form?

A. glucose - starch
B. amino acid - nucleic acid
C. phospholipid - fatty acid
D. ribosome - protein

Lactose, a sugar in milk, is composed of one glucose molecule and is linked to one galactose molecule. how is lactose classified?

A. as a pentose
B. as an enzyme
C. as a monosaccharide
D. as a disaccharide

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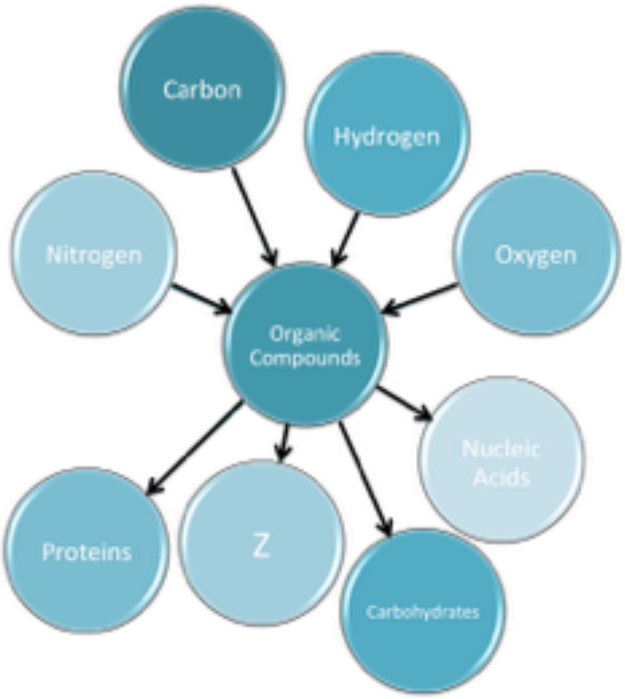
Check the boxes next to all of the TRUE statements about enzymes.

A. Enzymes are proteins.
B. Enzymes are made of polypeptide chains.
C. Enzymes have generic shapes to allow for the use with many different substrates.
D. Enzymes are not reusable, they are destroyed after they bind to the substrate.
E. Enzymes lower the amount of energy that is needed in order for a reaction to occur.



What substance could be represented by the letter Z in the diagram above?

A. water
B. nucleotide
C. lipid
D. amino acid

Proteins consist of polypeptides folded in a specific formation. Amino acids are the monomers of proteins. The organic molecules of amino acids have both carboxyl and amino groups. The center carbon is known as the alpha carbon. Four different components attach to the alpha carbon including the R group. The different R groups make up the 20 different amino acids. The physical and chemical properties of each different R group give the unique characteristics of the particular protein. All of the following molecules below contain amino acids except...

A. enzymes.
B. antibodies.
C. keratin.
D. steroids.

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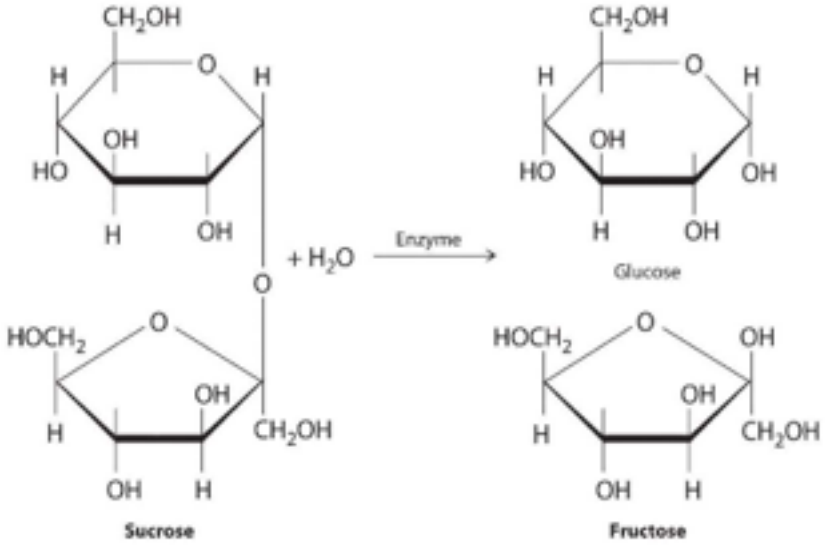
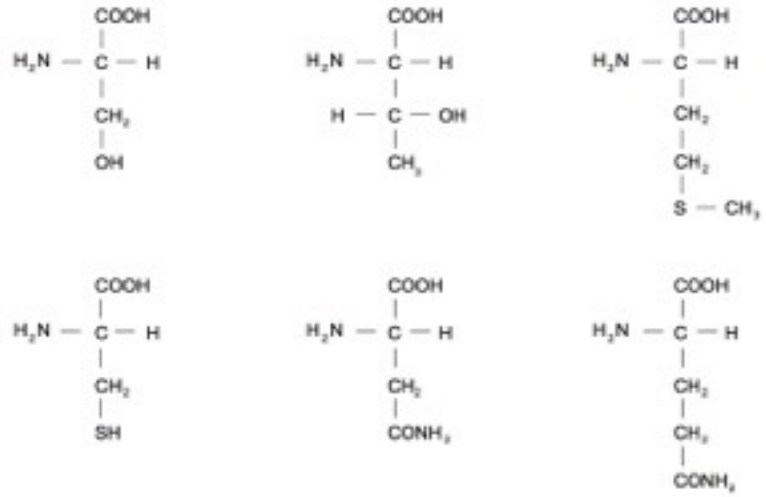


In the illustration above what type of reaction is shown for this process?

A. hydrolysis
B. dehydration synthesis
C. absorption
D. digestion



A sample of amino acids is shown above. The number and arrangement of the functional groups in the amino acids help give each molecule its unique properties. Which of the following describes the properties of the functional groups contained in the amino acid?

A. The amine group acts as a base and the carboxyl group acts as an acid.
B. The amine group makes it polar and the carboxyl group causes a release of energy.
C. The amine group acts as an acid and the carboxyl group acts as a base.
D. The amine group stabilizes the molecule and the carboxyl group makes it polar.

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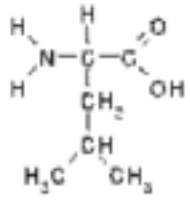
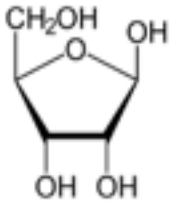
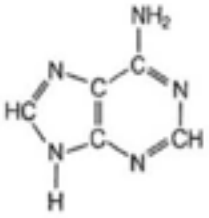
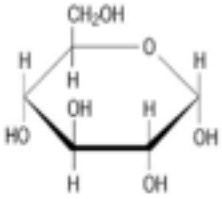
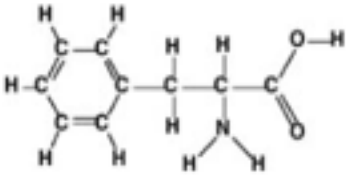
Use the diagrams to answer questions 2 and 3.

I. 

II. 

III. 

IV. 

V. 

Which of the following molecules utilize a peptide bond to form a dipeptide molecule?

A. I and II
B. II and IV
C. III and V
D. I and V

Which of these correctly illustrates the building blocks of a starch molecule?

A. III only
B. IV only
C. II and IV
D. I and V

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Refer to the passage and the chart below to answer questions 4 and 5.

Proteins from different areas in the digestive system are collected during an investigation; each is isolated and placed in a separate beaker containing water. The undisturbed solutions are incubated at 38 degrees C for three hours. After the incubation period, the contents of each beaker are analyzed and the results are recorded in the table below.

Location	Substance in Beaker	Results after 3 hours
stomach	mucus	large polypeptide
stomach	pepsin	smaller polypeptide
duodenum	trypsin	tripeptides
duodenum	chymotrypsin	4-peptide fragments

Which of the following substances exhibits no enzymatic activity?

A. chymotrypsin
B. mucus
C. pepsin
D. trypsin

Which of the following best explains how a polypeptide can be broken down into amino acids?

A. The covalent bonds between the carboxyl group and amino group of 2 amino acids release water.
B. Water surrounds the polypeptide resulting in changes to the surface of the protein.
C. As a peptide bond breaks in polypeptide, a hydrogen ion is added to one section and a hydroxyl group is added to the other section.
D. Water stabilizes the ions that result from the breaking of the peptide bond enabling the water to surround the ions in an orderly fashion.

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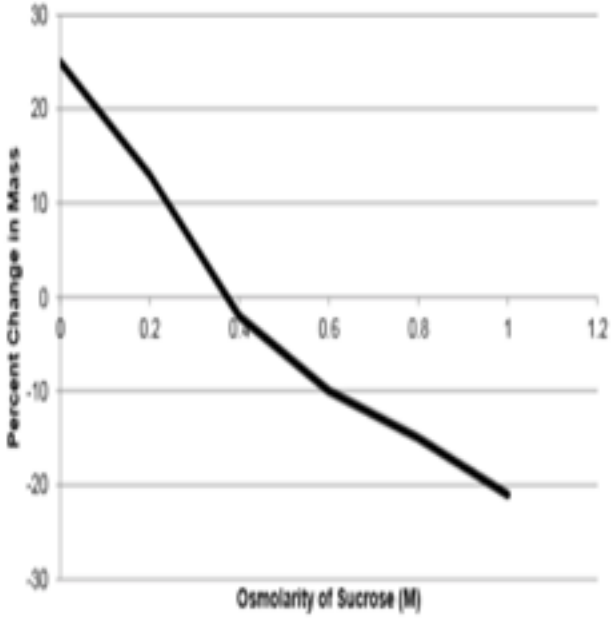
Use the information below to answer question 6.

Carrots measuring 2 cm in length were massed and placed into a series of beakers containing sucrose solutions of increasing osmolarity at room temperature. The carrots were allowed to sit in the sucrose solutions for 24 hours. After 24 hours, the carrots were removed from the solution, blotted dry, and massed again. Data were collected and a percentage change in mass was calculated. The data were then plotted on a graph, shown below.



Osmolarity of Sucrose (M)	Percent Change in Mass (%)
0	25
0.2	15
0.4	-0.1
0.6	-10
0.8	-15
1	-21

Which of the following conclusions can be reached by interpreting the data shown above?

A. Active transport of sucrose was occurring in the carrot cells at around 0.4M sucrose.
B. There is more sucrose in the environment around the carrots after 0.4M sucrose, and this caused sucrose to move into the carrot cells.
C. The carrots were gaining water when they were placed into the 0.6M sucrose solution.
D. There was no net movement of water into or out of the carrot cells at around 0.38M sucrose.

Patients who await organ transplants are often kept waiting because they do not have a donor who is a match. What component of the donor's cell membranes must match that of the recipient's in order to have a compatible organ for transplant?

A. integral proteins
B. channel proteins
C. glycoproteins
D. phospholipids

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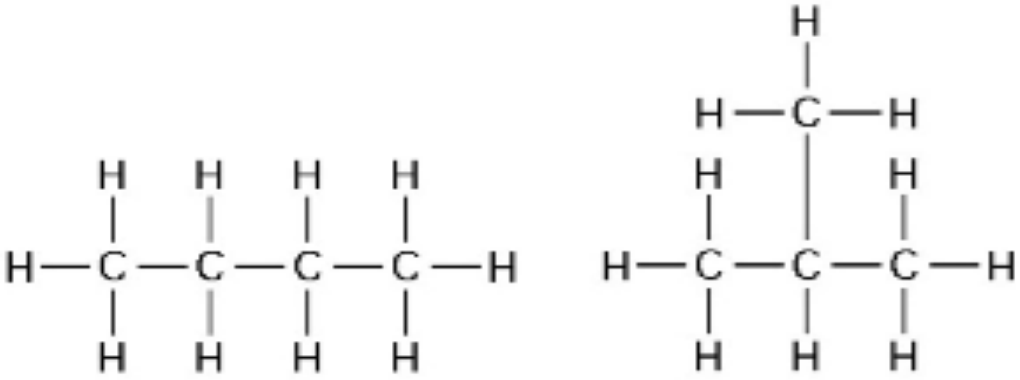

Molecules with multiple carbons can form up to four bonds per carbon. If carbon is double bonded, the structure is going to be three dimensional. This three dimensional shape determines the function. The two molecules shown above are best described as...

A. optical isomers.
B. enantiomers.
C. structural isomers.
D. cis-trans isomers.

Use the following information to answer question 9.

A student was conducting an experiment on the effect of salt solutions of increasing osmolarity on the behavior of *Amoeba*. The student was able to observe *Amoeba* in culture and recorded these data.

Osmolarity of Salt Solution (mM)	Contractions per Minute
0	125
0.1	100
0.2	89
0.3	71
0.4	56
0.5	37

Which of the following research questions was the student likely attempting to answer when performing the experiment?

A. Does increasing osmolarity increase the rate of active transport of water out of Amoeba cells?
B. Does increasing osmolarity decrease the rate of active transport of water out of Amoeba cells?
C. Does increasing osmolarity increase the rate of passive transport of water out of Amoeba cells?
D. Does increasing osmolarity decrease the rate of passive transport of water out of Amoeba cells?

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Use the information and the table below to answer questions 10-12.

A biologist studies the organelles located in four human cells. The presence (+) or absence (-) of an organelle is indicated in the table below. A blank does not signify the presence or absence of an organelle; it only refers to its lack of importance when comparing it to the other cells.

Cell	Golgi Complex	Lysosome	Mitochondria	Rough ER	Nucleus
A		++	+		+
B			-		-
C		++			+
D	+		+	++	+

Which cell is most likely to be found in the cardiac muscle of the heart?

A. cell A
B. cell B
C. cell C
D. cell D

Which of the following cells would be constituents of blood?

A. cell A only
B. cell B only
C. cells B and C
D. cells C and D

Which cell would most likely produce and secrete proteins?

A. cell A
B. cell B
C. cell C
D. cell D

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Acid- hydrogen donors; acids increase the hydrogen ion concentration in solution

Adhesion- the attraction between water molecules and other molecules

Alpha (α) helix- secondary protein structure resulting from stabilizing hydrogen bonds in the protein backbone; shaped like a coil or helix

Amino acids- a compound consisting of an amino group, a carboxyl group, and a side chain; the building blocks of protein

Base- hydrogen acceptors; bases decrease the hydrogen ion concentration in solution

Beta (β) pleated sheet- a secondary protein re-structure resulting from stabilizing hydrogen bonds in the protein backbone; shaped like a sheet with some twists

Biological molecules- any molecule produced by living organisms; includes four macromolecules: protein, lipids, polysaccharides, and nucleic acids

C-terminus- the side of a peptide chain/protein that ends in a carboxyl group

Carbohydrates- a compound consisting of carbon, hydrogen, and oxygen

Cellulose- a polysaccharide consisting of $C_6H_{10}O_5$ units bonded together; found in the cell walls of plants

Chaperones- a type of protein that assists in the folding of other molecules

Chitin- polymer consisting of $C_8H_{13}O_5N$ units; found in cell wall of fungi, crustacean shells, and other places.

***Cis*-** in cis/trans isomerism, cis refers to the case when the substituent groups are oriented on the same side

Cohesion- intermolecular forces between water molecules caused by the polar nature of water; responsible for surface tension

Dehydration synthesis- refers in organic chemistry in which two molecules are bound together and an H_2O is removed from the compound

Denaturation- a process in which the secondary and tertiary structures of a protein fall apart due to a change in conditions; this can be a pH out of normal conditions, extreme temperatures, or other factors

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Deoxyribonucleic acid- DNA- consists of a nucleic base, a deoxyribose (sugar), and a phosphate group. Acts as genetic information storage

Disaccharides- sugars consisting of two monosaccharides bonded together

Electronegativity- describes the ability of an atom or functional group to attract electrons

Enantiomer- a case of stereoisomerism in which two molecules form mirror images of each other

Ester linkage- the bond between a fatty acid and a glycerol that forms a lipid

Evaporative cooling- reduction of temperature that results from evaporation of liquid; as the liquid evaporates, it removes heat from the surface on which the evaporation is occurring

Functional group- group of atoms that provides a specific function to a carbon skeleton

Geometric isomer- isomer that differs in the placement of groups around a double bond; cis/trans isomerism

Glycogen- polysaccharide used as a way to store carbohydrates. Forms glucose on hydrolysis

Glycosidic bond- bond formed by a dehydration reaction between two monosaccharides

Hydration shell- refers to a specific "solvation shell" case; water acts as a solvent and dissolves a solute. When this happens, the solute becomes surrounded by water molecules and these water molecules form a "hydration shell"

Hydrocarbon- a molecule consisting of only hydrogens and carbons

Hydrolysis- “water cutting”; reaction in which water is added to break a bond

Hydrophilic- "water loving"- polar or charged molecules that interact well with water

Hydrophobic- "water fearing" - nonpolar uncharged molecules that do not interact well with water

Lipids- class of macromolecules including fats and steroids; Generally nonpolar and insoluble in water

Messenger RNA- mRNA- RNA that is sent to ribosomes for translation in order to produce proteins

MicroRNA- miRNA- small noncoding RNA segments that have a role in gene regulation (interrupting other mRNA messages)

Molarity- unit of concentration; moles solvent/liters solution

Monomers- a molecule that can act as a unit that bonds to other monomers to form a larger molecule called a polymer

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Monosaccharides- a basic carbohydrate unit; a carbohydrate monomer

N-terminus- the side of a peptide chain/protein that ends in an amino group

Nucleotide- monomer of a nucleic acid; consists of a pentose sugar, a nitrogenous base, and one or more phosphate groups

Omega fatty acids- type of polyunsaturated fat that is required by the body; the numbering of the carbon omega starts from the methyl end (end farthest from carboxylic end)

Organic molecule- any molecule containing carbon

Peptide bond- bond formed between two amino acids by a dehydration reaction

pH- a number that refers to the acidity of a solution; 7 is neutral, lower than 7 is acidic, higher than 7 is basic

Phospholipids- major constituent of membranes; two fatty acids and a phosphate containing group attached to a glycerol backbone

Phosphodiester linkage- covalent bonds between phosphate group and carbon rings that join together a polynucleotide

Polar covalent bond- type of covalent bond in which the electrons are shared unequally; this results in a partially positive side and a partially negative side

Polymers- a molecule made up of smaller monomer units

Polysaccharides- a carbohydrate polymer made of many smaller carbohydrates

Primary structure- refers to the order and composition of amino acids in a peptide chain

Proteins- biological macromolecule composed of amino acids

Purine- type of nitrogenous base in DNA and RNA (adenine and guanine)

Pyrimidine- type of nitrogenous base in DNA and RNA (cytosine, thymine, and uracil)

Quaternary structure- refers to the association of discrete polypeptide subunits in a protein

R-groups- a side chain attached to an amino acid; the R group determines the identity of the amino acid and may give the amino acid additional properties (positive/negative charge or acid/base activity)

Ribonucleic acid- RNA- a single strand of nucleic acids that have several different functions within the cell. All the different functions are carried out by specific types of RNA and are named according to their functions.

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Ribosomal RNA- rRNA- RNA used to ensure proper alignment of mRNA and ribosomes during translation; catalyzes formation of peptide linkage

Saturated fatty acids- a fatty acid that has no double bonds along the hydrocarbon chain; this means the number of hydrogen atoms attached to the carbon backbone is maximized or "saturated"

Secondary structure- refers to shapes formed by hydrogen bonding along the peptide chain; forms alpha helices and beta-pleated sheets

Solute- the dissolved part of a solution; the smaller part

Solution- a uniform mixture composed of one phase; consists of solvent and solutes

Solvent- a substance that can dissolve other substances

Starch- storage carbohydrate in plants

Steroids- type of lipid composed of four fused hydrocarbon rings in a planar structure

Structural isomer- molecules that have same chemical formula but different arrangement; different "structure"

Substituted hydrocarbon- a molecule consisting of hydrogens, carbons, and another atom or functional group replacing a hydrogen

Surface tension- created by attractive cohesive forces between molecules of a liquid; prevents molecules from separating at the surface

Tertiary structure- refers to the overall 3D structure of a protein and how it folds

***Trans*-** in cis/trans isomerism, trans refers to the case when the substituent groups are oriented on opposite sides

Transfer RNA- tRNA- RNA that carries amino acids to the site of protein synthesis on the ribosome

Triglycerides- a fat molecule; three fatty acids linked to a glycerol

Unsaturated fatty acids- a fatty acid that has one or more double bonds on the hydrocarbon chain

Waxes- lipid made of a long chain fatty acid that is esterified to a long chain alcohol; serves as a protective coat on leaves, fur, and feathers