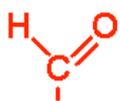
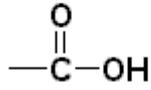
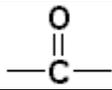
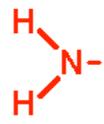
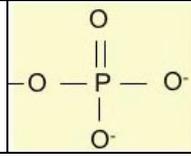


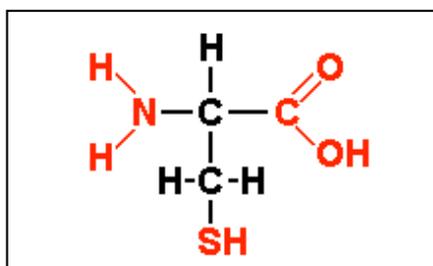
Chemistry of Life Answers

- Differentiate between an ionic and covalent bond. Provide an example for each.
 - Ionic:** occurs between metals and non-metals, e.g., NaCl
 - Covalent:** occurs between two non-metals; stronger than ionic, e.g., H₂O
- Define the term *electronegativity*. What does a large electronegativity number represent?
 - Electronegativity:** a measure of an atom's ability to attract a shared electron pair when it is participating in a covalent bond.
- Hydrogen bonds form between which atoms?
 - Between an electropositive hydrogen and an electronegative N, O or F.**
- Define the terms hydrophobic and hydrophilic.
 - Hydrophobic:** a nonpolar molecule that does not dissolve in water ("water-hating").
 - Hydrophilic:** a polar molecule that dissolves in water ("water-loving").
- Differentiate between an acid and a base.
 - Acid:** solutions with a pH less than 7; release hydrogen ions in solution; sour-tasting, conducts electricity.
 - Base:** solutions with a pH greater than 7; release hydroxide ions in solution; bitter-tasting, conducts electricity and has a slippery feel.
- Explain why functional groups are important.
 - Involved in chemical reactions**
 - gives compounds their chemical properties**
 - makes organic compounds polar**
- Draw each of the following functional groups:

Carbonyl (aldehyde)		Carboxyl	
Carbonyl (ketone)		hydroxyl	-OH
Amino		phosphate	

- Which kind(s) of organic compounds are the following functional groups associated with?

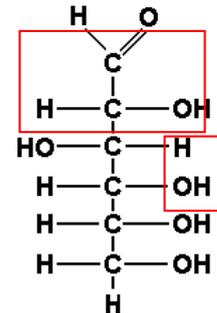
Phosphate	Phospholipids, Nucleotides, Energy Compounds
Carboxyl	Organic acids (amino acids, fatty acids)
hydroxyl	alcohols
- How many functional groups can you identify in the compound below? Circle and identify each group. **Three**
 - NH₂ - amino**
 - COOH -carboxyl**
 - SH -sulfhydryl**



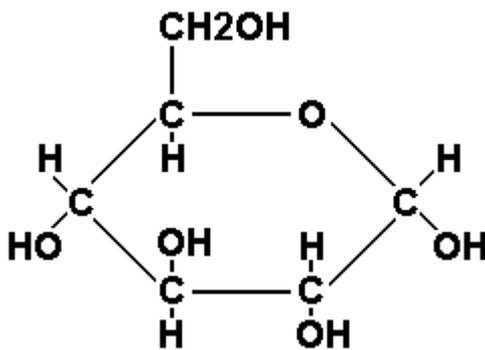
10. What is the name for the compound in question 9? **Amino acid**
11. What functional groups can you identify in the compound below? Circle and label them and then name the compound.

Monosaccharide (C₆H₁₂O₆)/ carbohydrate

Aldehyde and several hydroxyl groups



12. What kind of organic compound is show below? What functional groups can you identify? Circle and label one of them.

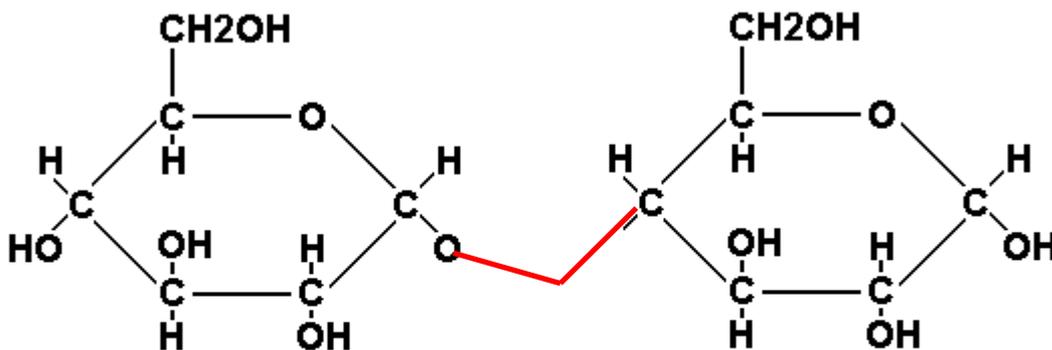


Monosaccharide – glucose (C₆H₁₂O₆)/ carbohydrate

Only hydroxyl groups

13. Two of the above compounds are being linked together in the diagram below to form what new compound? Complete the bond that joins these two compounds together. What type of linkage connects these two compounds together?

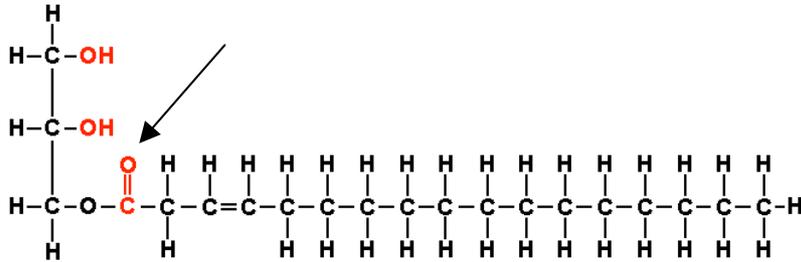
A Disaccharide (maltose) – glycosidic linkage



+ H₂O

- a) What are the products of this reaction?
Water plus a disaccharide (maltose)
- b) What is the name given to this type of reaction?
Condensation reaction or dehydration synthesis.

14. Name four examples of polysaccharides and state their primary function.
 Starch – energy storage in plants
 Cellulose – structural support in plants
 Glycogen – energy storage in animals
 Chitin – structural support in fungi & exoskeleton of insects and crustaceans
15. What functional groups are found in lipids, such as the one found below? Circle and identify each group.



Hydroxyl and carboxyl...the hydroxyl groups are found in the glycerol backbone and the carboxyl is found on the fatty acid.

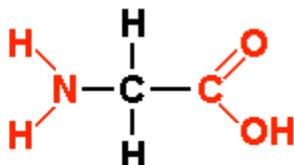
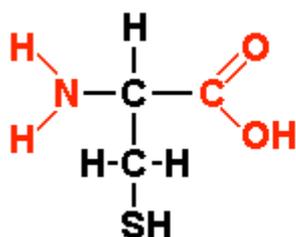
16. What is the name of the bond indicated by the arrow in the lipid above?
 Ester bond
17. What type of fatty acid is shown in the lipid above?
 Monounsaturated
18. How would a polyunsaturated fatty acid differ?
 It would have several double bonds between the carbon atoms.
19. How would a saturated fatty acid differ?
 There would be no double bonds between carbon atoms
20. If the lipid above was a triglyceride, how many fatty acids would be linked to the glycerol?
 3
21. If the lipid above was a phospholipid, how many fatty acids would be linked to the glycerol and what additional group(s) would be present in the molecule?
 2, phosphate
22. What type of reaction would occur to link each fatty acid to the glycerol?
 Condensation reaction or dehydration synthesis
23. List the different types of lipids and state each of their functions.
 1. Phospholipids & sterols: structural support
 2. Triglycerides: stored energy, cushioning, insulation, padding
 3. Waxes: protection (e.g., waxy cuticle on leaves)
 4. Lipid hormones & fat soluble vitamins: chemical regulators
24. What functional group do lipids share with carbohydrates?
 Hydroxyl groups

25. When a person goes on a diet, stored lipids begin to be digested. What happens chemically when the lipids are digested?

They are hydrolyzed to fatty acids and glycerol, which are then used for energy.

26. What type of compound is shown below?

Amino acids



27. What functional groups are present in **both** of the compounds found in question 21? Circle and label all of the functional groups visible.

Amino group and carboxyl group

NH₂ – amino group; COOH – carboxyl group; SH – sulfhydryl group

28. Describe what would have to occur to link the two compounds together. What substance is removed (produced)?

A hydrogen from the amino group of one amino acid is removed; an OH from the carboxyl of the second amino acid is removed permitting a bond to form between the two amino acids. A molecule of water is removed

29. What is the name of the bond that is formed between these two compounds?

Peptide bond

30. What is the name given to this type of reaction?

Condensation reaction or dehydration synthesis

31. What functional group is found in both amino acids and fatty acids?

Carboxyl group

32. List several functions of proteins.

1. structure – cell membranes, bone, cartilage, muscle
2. buffers
3. chemical regulation – enzymes, hormone
4. protection – bones, antibodies, blood clotting
5. muscle contraction & movement

33. Explain what is meant by a protein's *primary structure*, *secondary structure*, *tertiary structure* and *quaternary structure*.

- Primary structure: sequence of amino acids that make up a polypeptide chain.
- Secondary structure: Hydrogen bonding that causes coils and folds in a polypeptide chain (e.g., alpha helix, beta-pleated sheet).
- Tertiary structure: Supercoiling of a polypeptide chain
- Quaternary structure: two or more polypeptide chains bond together to form a functional protein.

34. What is a nucleic acid?

- Informational macromolecules

35. What does a nucleotide consist of?

A pentose (5-carbon) sugar, a nitrogenous base and a phosphate group.

36. What are the five nitrogenous bases found in nucleic acids?

Adenine (A), guanine (G), thymine (T), cytosine (C), uracil (U)

37. Differentiate between DNA and RNA.

DNA: deoxyribonucleic acid; contains sugar deoxyribose; A, T, G & C bases; double helix (held by hydrogen bonds); antiparallel strands

RNA: ribonucleic acid; contains sugar ribose; A, U, G & C bases; single stranded helix

38. Differentiate between purines and pyrimidines. Provide examples for each.

Purines: double-ring nitrogenous base (adenine & guanine)

Pyrimidines: single-ring nitrogenous base (thymine, uracil and cytosine)

39. What is the rule of complementary base pairing?

Purine bonds to pyrimidines (A to T or U and G to C)

40. What is ATP?

Adenosine triphosphate (another type of nucleotide): adenine + ribose + 3 phosphate groups. Used as an energy-transferring molecule.

41. Define the following terms:

- a. Energy: ability to do work.
- b. Metabolism: sum of anabolic and catabolic processes.
- c. Kinetic energy: energy found in moving objects.
- d. Potential energy: stored energy based on an object's position.
- e. Endothermic (endergonic) reaction: A chemical reaction in which the energy of the products is more than the energy of the reactants.
- f. Exothermic (exergonic) reaction: A chemical reaction in which the energy of the products is less than the energy of the reactants.
- g. ATPase: an enzyme that catalyzes the hydrolysis of ATP into ADP (and a molecule of inorganic phosphate) and free energy
- h. Phosphorylation: the process by which a phosphate group is added onto ADP to form ATP

42. What are the two Laws of Thermodynamics?

First Law of Thermodynamics: "the total amount of energy in the universe is constant. Energy cannot be created or destroyed but only converted from one form into another. If an object or process gains an amount of energy, it does so at the expense of a loss in energy somewhere else in the universe."

Second Law of Thermodynamics: "The entropy of the universe increases with any change that occurs."

NOTE: entropy is a measure of the randomness or disorder in energy.

43. What is a redox reaction?

A chemical reaction in which one or more electrons are transferred from one atom to another.

44. Differentiate between oxidation and reduction and a reducing agent and an oxidizing agent.

An atom is oxidized when it loses one or more electrons.

An atom is reduced when it gains one or more electrons.

A reducing agent is the atom that loses one or more electrons in a redox reaction to become oxidized...it causes the other atom to become reduced.

An oxidizing agent is the atom that gains one or more electrons in a redox reaction to become reduced...it causes the other atom to become oxidized.