

# Chapter 3; Organic Chemistry

## Molecules containing carbon

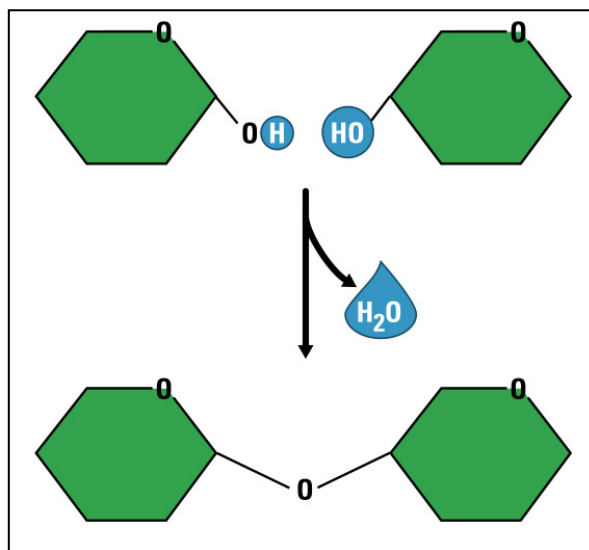
- A \_\_\_\_\_ is two or more atoms connected together with a \_\_\_\_\_.
- Molecules that contain carbon are called \_\_\_\_\_ molecules
- If a molecule does not contain \_\_\_\_\_, it is called \_\_\_\_\_.
- The study of the chemistry inside of living things is \_\_\_\_\_

## Carbon is the key

- Since carbon is in family \_\_\_\_\_ of the periodic table, and it seeks to have \_\_\_\_\_ electrons in its outer shell, it will form four bonds and thus pick up \_\_\_\_\_ extra electrons.
- Carbon can form \_\_\_\_\_ (two electrons, \_\_\_\_\_, being shared)
- Carbon can also form \_\_\_\_\_ and \_\_\_\_\_ by sharing 4 and 6 electrons, respectively

## Carbohydrates

- \_\_\_\_\_ are composed of carbon, hydrogen and oxygen atoms.
- Simple sugars, or \_\_\_\_\_, are single sugar molecules. (mono = \_\_\_\_\_, saccharide = \_\_\_\_\_) example:
- Double sugars, or \_\_\_\_\_, are double sugars. An example of a double sugar is \_\_\_\_\_ (table sugar)
- When many sugar molecules are linked together, it is called a \_\_\_\_\_ or starch. Examples of starches include many foods and the \_\_\_\_\_ you are writing on.
- Disaccharides are joined by the process of \_\_\_\_\_



What is happening here?

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- One familiar example of a \_\_\_\_\_ is starch
- Plant cells store \_\_\_\_\_ for \_\_\_\_\_

■ \_\_\_\_\_ and \_\_\_\_\_ are major sources of \_\_\_\_\_ in the human diet

■ Animals store excess \_\_\_\_\_ in the form of a polysaccharide called \_\_\_\_\_

■ \_\_\_\_\_ is similar in structure to \_\_\_\_\_

### Cellulose

■ \_\_\_\_\_ is the most abundant organic compound on \_\_\_\_\_

■ It forms cable-like \_\_\_\_\_ in the tough walls that enclose \_\_\_\_\_

■ It is a major component of \_\_\_\_\_

■ It is also known as \_\_\_\_\_

■ Most animals cannot derive \_\_\_\_\_ from \_\_\_\_\_

■ How do grazing animals survive on a diet of cellulose?

■ \_\_\_\_\_

### Polymers

■ Most macromolecules are \_\_\_\_\_

■ \_\_\_\_\_ are made by stringing together many smaller molecules called \_\_\_\_\_

■ Cells link \_\_\_\_\_ by a process called \_\_\_\_\_

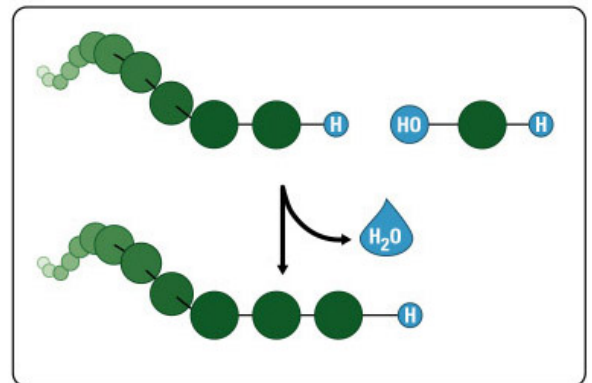
■ How does dehydration synthesis work? (Take notes!) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



■ Organisms also have to break down \_\_\_\_\_

■ Cells do this by a process called \_\_\_\_\_

■ How does hydrolysis work?

\_\_\_\_\_

\_\_\_\_\_

### Lipids

■ **Lipids** are commonly called \_\_\_\_\_, but include **phospholipids** and \_\_\_\_\_.

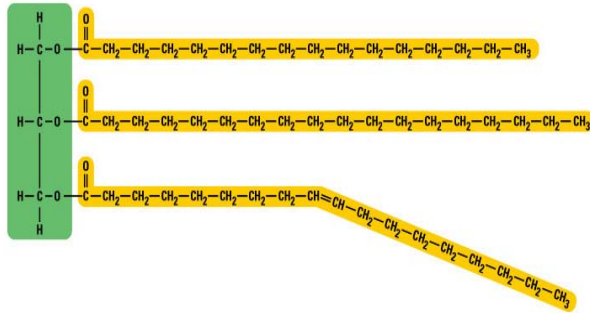
■ Most lipids are \_\_\_\_\_, meaning that they don't mix well with \_\_\_\_\_.

■ \_\_\_\_\_ compose most of the cell membrane in most \_\_\_\_\_

■ Most lipids (except for steroids) are composed of \_\_\_\_\_ molecules that have been bonded together using a molecule of \_\_\_\_\_.

## A Fat Molecule

- Glycerol (on the left) is the backbone of the molecule
- The fatty acid chains (yellow) are variable in length and saturation




- \_\_\_\_\_ fatty acids
  - Have less than the \_\_\_\_\_ number of \_\_\_\_\_ bonded to the carbons
- \_\_\_\_\_ fatty acids
  - Have the \_\_\_\_\_ number of hydrogens bonded to the \_\_\_\_\_

## Proteins

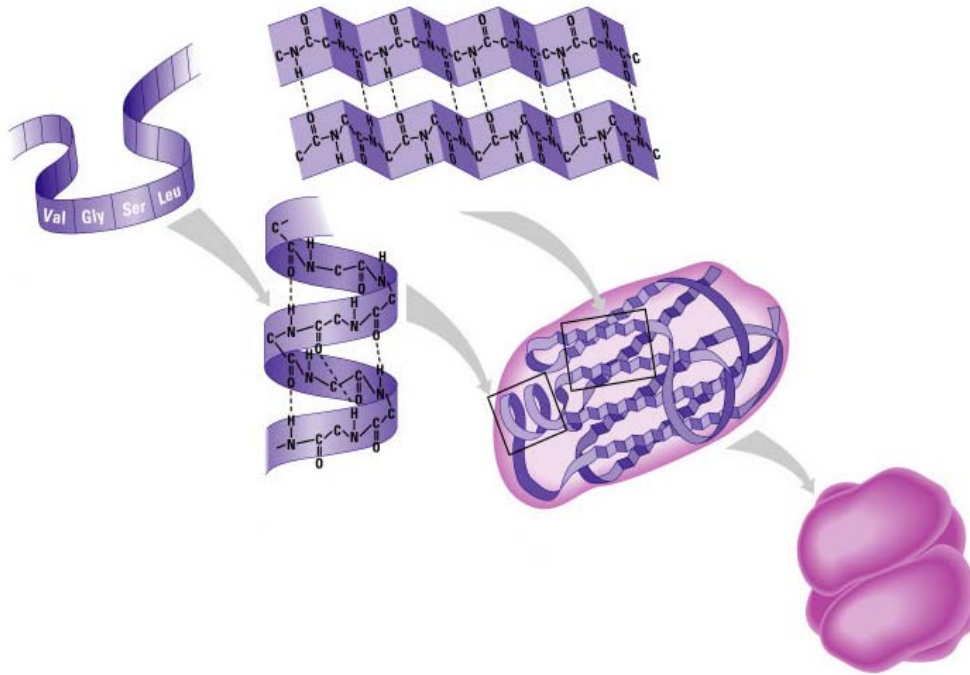
- \_\_\_\_\_ make up muscle tissue, hair, and the enzymes that cause chemical \_\_\_\_\_ inside of our \_\_\_\_\_.
- Proteins always contain \_\_\_\_\_, not found in most other \_\_\_\_\_ molecules
- Proteins are composed of long chains of \_\_\_\_\_.
- The behavior of a protein is based on how the \_\_\_\_\_ are arranged.
- The bonds between amino acids are called \_\_\_\_\_ **bonds**.

## What Determines Protein Structure?

- A protein's shape is sensitive to the \_\_\_\_\_
- Unfavorable \_\_\_\_\_ and \_\_\_\_\_ changes can cause a protein to unravel and lose its \_\_\_\_\_
- This is called \_\_\_\_\_ or being \_\_\_\_\_

## Protein Shape

■ Proteins have four levels of structure (see figure)



## Levels of Protein Structure; Take notes here

### Nucleic Acids: DNA and RNA

- DNA is \_\_\_\_\_
- Carries \_\_\_\_\_ information
- DNA contains large amounts of \_\_\_\_\_ in its structure
- Double-\_\_\_\_\_ formation
- Found in the \_\_\_\_\_ of every \_\_\_\_\_ in your body
- \_\_\_\_\_ is Ribonucleic Acid; is used to carry information about the making of \_\_\_\_\_ from the nucleus to the \_\_\_\_\_ where protein is formed
- Each DNA nucleotide has one of the following bases
- \_\_\_\_\_ (A), \_\_\_\_\_ (G), \_\_\_\_\_ (T), \_\_\_\_\_ (C)

## Review Questions:

- What is the term for molecules that do not contain carbon?
  - Noncarbonic
  - Inorganic
  - Organic
  - Biochemical
  - None of the above are correct
- What is the study of the chemistry inside of living things?
  - Biology
  - Anatomy
  - Physiology
  - Biochemistry
  - None of the above are correct
- What is two or more atoms connected together with a bond?
  - Element
  - Compound
  - Molecule
  - Protein
  - None of the above are correct
- What molecules are composed solely of carbon, hydrogen, and oxygen atoms?
  - Proteins
  - Carbohydrates
  - Lipids
  - Nucleic acids
  - None of the above are correct
- Through what process are disaccharides joined?
  - Respiration
  - Enzymatic degradation
  - Hydrolysis
  - Dehydration synthesis
  - None of the above are correct
- When you join two molecules of glucose together, what new disaccharide is formed?
  - Sucrose
  - Maltose
  - Galactose
  - Fructose
  - None of the above are correct
- What is the term for simple sugars?
  - Sucrose
  - Monosaccharides
  - Disaccharides
  - Polysaccharides
  - None of the above are correct
- When you join many simple sugars together in a long chain, this is called a;
  - Sucrose
  - Monosaccharides
  - Disaccharides
  - Polysaccharides
  - None of the above are correct
- What type of molecule is this paper you are writing on?
  - Carbohydrate
  - Starch
  - Cellulose
  - Polysaccharide
  - All of the above are correct
- What is the term for molecules that contain carbon?
  - Noncarbonic
  - Inorganic
  - Organic
  - Biochemical
  - None of the above are correct
- In what family on the periodic table would you find carbon?
  - I
  - II
  - III
  - IV
  - None of the above are correct
- What is the term for double sugars?
  - Sucrose
  - Monosaccharides
  - Disaccharides
  - Polysaccharides
  - None of the above are correct
- How many bonds does carbon seek to form?
  - 1
  - 2
  - 3
  - 4
  - None of the above are correct
- What type(s) of bonds can carbon form?
  - Ionic only
  - Covalent bonds
  - No bonds
  - Barry Bonds
  - None of the above are correct
- How many electrons are there in a double bond?
  - 1
  - 2
  - 4
  - 0
  - None of the above are correct
- What is the most familiar type of polysaccharide?
  - Glucose
  - Starch
  - DNA
  - Polyester
  - None of the above are correct

17. In what form do plants store energy from the sun?  
A. Proteins  
B. Carbohydrates/starches  
C. Lipids  
D. Nucleic acids  
E. None of the above are correct
18. Animals and plants store starches using the same polysaccharide; True (A) or False (B)
19. What animal starch is similar to plant starch?  
A. Glucose  
B. Glycocalyx  
C. Glycogen  
D. Glucagon  
E. None of the above are correct
20. What do humans use plant starches for?  
A. Food  
B. Clothing  
C. Building  
D. All of the above  
E. None of the above are correct
21. Most macromolecules are polymers; True (A) or False (B)
22. What do grazing animals have in their digestive tracts that helps them digest cellulose?  
A. Termites  
B. Bacteria  
C. Cows  
D. Acid  
E. None of the above are correct
23. Polysaccharides in plants and animals are similar in the monomers that make up their structure; True (A) or False (B)
24. What is the most abundant organic compound on Earth?  
A. DNA  
B. Cellulose  
C. Fat  
D. Oxygen  
E. None of the above are correct
25. Where would you find cellulose in nature?  
A. Plant cell walls  
B. Sugar  
C. Human body cell walls  
D. Air  
E. None of the above are correct
26. In what form do humans purposely consume cellulose?  
A. Sugar  
B. Dietary fat  
C. Dietary fiber  
D. Protein  
E. None of the above are correct
27. Most animals can derive energy from cellulose fiber; True (A) or False (B)
28. What do the bacteria in the digestive tracts of grazing animals produce that helps them break down cellulose?  
A. Acids  
B. Air  
C. Cows  
D. Enzymes  
E. None of the above are correct
29. What bonds together fatty acid molecules in a lipid?  
A. Hydrogen bonds  
B. A glycerol molecule  
C. A glucose molecule  
D. Ionic bonds  
E. None of the above are correct
30. The process of attaching molecules together by creating and then removing a molecule of water is;  
A. Respiration  
B. Enzymatic degradation  
C. Hydrolysis  
D. Dehydration synthesis  
E. None of the above are correct
31. How are dehydration synthesis and hydrolysis related?  
A. Similar  
B. Opposites  
C. Identical  
D. Not related  
E. None of the above are correct
32. A type of fatty acid in which you would find only single bonds is;  
A. Long chain  
B. Saturated  
C. Unsaturated  
D. Polymerated  
E. None of the above are correct
33. The process of splitting molecules together by splitting and then inserting a molecule of water is;  
A. Respiration  
B. Enzymatic degradation  
C. Hydrolysis  
D. Dehydration synthesis  
E. None of the above are correct
34. A type of fatty acid in which you would find at least one double bond is;  
A. Long chain  
B. Saturated  
C. Unsaturated  
D. Polymerated  
E. None of the above are correct

35. Fatty acid molecules are variable in \_\_\_\_\_ and \_\_\_\_\_
- Height and weight
  - Color and texture
  - Nitrogen content and light
  - Length and width
  - None of the above are correct
36. If you are eating fat, then you are also eating a type of;
- Protein
  - Lipid
  - Wax
  - Health food
  - None of the above are correct
37. Besides fats and oils, what are two other types of lipids?
- Waxes and phospholipids
  - Waxes and polishes
  - Proteins and carbohydrates
  - DNA and RNA
  - None of the above are correct
38. What term means that a molecule does not like to mix with water?
- Snooty
  - Water loving
  - Hydrophobic
  - Hydrophilic
  - None of the above are correct
39. What biomolecule composes most of the cell membrane in organisms?
- Protein
  - DNA
  - Phospholipids
  - Carbohydrates
  - None of the above are correct
40. You can visually distinguish a saturated fatty acid from an unsaturated one by looking at their;
- Length
  - Color
  - Weight
  - Bonds
  - None of the above are correct
41. What type of biomolecule makes up muscle tissue, hair, and enzymes?
- Protein
  - DNA
  - Phospholipids
  - Carbohydrates
  - None of the above are correct
42. Proteins always contain what element?
- O
  - P
  - H
  - N
  - None of the above are correct
43. Nitrogen is found in all types of biomolecules; True (A) or False (B)
44. Proteins are composed of long chains of;
- Lipids
  - Amino Acids
  - Carbohydrates
  - DNA
  - None of the above are correct
45. What determines the basic behavior of a protein?
- Its upbringing
  - Its sequence of amino acids
  - Its primary structure
  - Both B and C above are correct
  - None of the above are correct
46. What are the bonds between amino acids in a protein called?
- Hydrogen bonds
  - Ionic bonds
  - Disulfide bonds
  - Double bonds
  - None of the above are correct
47. A protein's shape is sensitive to what?
- Temperature and pH
  - Its environment
  - Other biomolecules
  - Both A and B above are correct
  - None of the above are correct
48. Unfavorable changes in what two environmental conditions can cause a protein to change its shape?
- Temperature and pH
  - Color and texture
  - Other biomolecules
  - The State of the Union
  - None of the above are correct
49. What is a change in the shape of an enzyme or other protein called?
- Natured
  - Being denatured
  - Broken
  - Denaturalized
  - None of the above are correct
50. Which level of protein structure involves the sequence of the amino acids?
- Primary
  - Secondary
  - Tertiary
  - Quaternary
  - None of the above are correct

51. Which level of protein structure involves the simple shape of the amino acid chain?
- Primary
  - Secondary
  - Tertiary
  - Quaternary
  - None of the above are correct
52. Deoxyribonucleic acid is more commonly known as:
- Protein
  - RNA
  - Carbohydrate
  - Lipid
  - None of the above are correct
53. What does DNA carry?
- Too much worry on its mind
  - Genes/genetic information
  - Lipids
  - Capacity
  - None of the above are correct
54. What is the shape of DNA?
- Circular
  - Double rolex
  - Double helix
  - Ladder
  - None of the above are correct
55. Where do you find DNA?
- In a living thing
  - In a living cell
  - In the nucleus
  - All of the above are correct
  - None of the above are correct
56. What is the abbreviation for ribonucleic acid?
- Protein
  - RNA
  - Carbohydrate
  - Lipid
  - None of the above are correct
57. What is the name of the nucleic acid that is used to carry information about the making of proteins from the nucleus to the ribosomes?
- DNA
  - mRNA
  - tRNA
  - rRNA
  - None of the above are correct
58. What is formed at the ribosomes?
- Protein
  - RNA
  - Carbohydrate
  - Lipid
  - None of the above are correct
59. DNA is composed of how many different bases?
- 1
  - 2
  - 3
  - 4
  - None of the above are correct

## Essays

1. What is the difference between dehydration synthesis and hydrolysis? Explain each in detail.
2. What are the four levels of protein structure? Which of these is most important to the function of the protein?

Extra credit: The Venus Flytrap (a carnivorous plant) lives in soil that is very nitrogen-poor. Why does it need to eat flies if it can photosynthesize using CO<sub>2</sub> and water?