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Carbohydrates
BC Biology 12 p. 34-35

1. Carbohydrates function for quick fuel and short-term energy storage in all organisms and have a ratio of hydrogen atoms to oxygen atoms of approximately 2:1.

2. If the number of carbon atoms in a molecule is low, then the carbohydrate is a simple sugar called a monosaccharide. Monosaccharides with 5 carbon atoms are called pentoses, if it contains 6 carbon atoms it is called a hexose. A hexose sugar found in human blood is called glucose. Our bodies use glucose as an immediate source of energy.

3. Other common hexoses include Fructose, found in fruits, and galactose, a component of milk. All three of these monosaccharides have the same molecular formula: $C_6H_{12}O_6$.

4. A disaccharide contains two monosaccharides. Synthesis of a disaccharide is a dehydration reaction because water is removed as the two monosaccharides join. Degradation is a hydrolysis reaction because water is used to split a bond.

5. Starch and glycogen are large storage forms of glucose in plants and animals, respectively, and are classified as polysaccharides. The polysaccharide cellulose is found in plant cell walls and accounts in part for the strong nature of these walls.

6. Draw and label a diagram below. Include the following terms to label the diagram: hydrolysis, dehydration, glucose, maltose, water, disaccharide and monosaccharide (p. 34).

7. Match the following answers for carbohydrates to one of the statements below.

a.	glucose	b.	cellulose	c.	sucrose
d.	maltose	e.	glycogen	f.	fructose

C	a disaccharide found in table sugar
F	a hexose found in fruits
A	monosaccharide used by cells as their primary energy source
B	a polysaccharide found in plant cell walls
D	hydrolysis of this disaccharide yields two glucose units
E	storage form of glucose in animal cells

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Lipids
BC Biology 12 p. 36-37

1. Lipids have a common characteristic: they do not dissolve in water. Lipids are therefore hydrophobic.

2. Fat is used for long-term energy storage, insulate against heat loss, and forms a protective cushion around major organs.

3. A fat or oil is formed when one glycerol molecule reacts with three fatty acid molecules. A fat is sometimes called a triglyceride because of its three-part structure.

4. A fatty acid is a hydrocarbon chain that ends with the acidic group -COOH. A saturated fatty acid has no double bonds between carbon atoms and accounts for the solid nature at room temperature of butter and lard. Unsaturated fatty acids have double bonds between carbon atoms which causes the number of hydrogen atoms to be fewer. These tend to be liquids at room temperature.

5. A soap is a salt formed from a fatty acid and an inorganic base. When soaps are added to oils, the oils, too, mix with water because a soap positions its non-polar ends project into the fat droplet, while its polar ends project outward. When the oil droplet disperses in water, it is said that emulsification has occurred.

6. Phospholipids are constructed like fats, except that in place of the third fatty acid, there is a phosphate group. The **membrane** is a phospholipid bilayer in which the "heads" face outward into a watery medium and the tails face each other because they are water repelling.

7. Steroid molecules have a backbone of four fused carbon rings. Cholesterol is the precursor of several other steroids, such as the sex hormones testosterone and estrogen.

8. Match the following answers for lipids to one of the statements below.

a.	triglyceride	b.	phospholipid	c.	fat
d.	fatty acid	e.	unsaturated fatty acid	f.	saturated fatty acid

E	hydrocarbon chain that has double bonds
C	used for long-term energy storage, insulation, and protection
F	hydrocarbon chain that accounts for the solid nature of butter
D	hydrocarbon chain that ends with acidic group - COOH
A	hydrolysis of this molecule yields glycerol and 3 fatty acids
B	found in the cell membrane of cells

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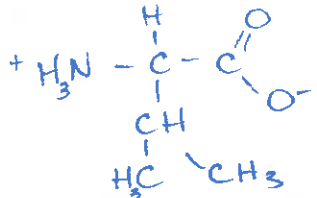
Proteins

BC Biology 12 p. 38-41

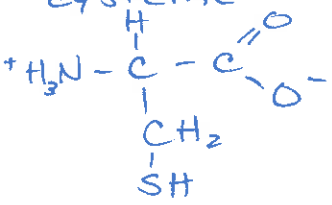
1. Proteins are polymers composed of amino acid monomers. An amino acid has a central carbon atom bonded to a hydrogen atom and three functional groups. These groups include an amino group ($-NH_2$), an acidic group ($-COOH$) and an R group. This third group determines the uniqueness of each amino acid.

2. Draw valine, cysteine and phenylalanine. Label the 3 groups on each of the amino acids. p. 38

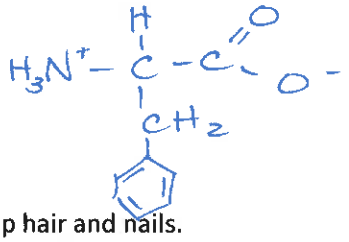
valine:



cysteine:



phenylalanine



3. Proteins perform many functions. The protein Keratin makes up hair and nails. collagen lends support to ligaments, tendons, and skin. These are structural proteins. Proteins can also be enzymes which help to speed up chemical reactions. Many hormones, messengers that influence cellular metabolism are also proteins. Contraction of muscles and movement is accomplished by the protein actin and myosin.

4. Peptide bonds are polar. The hydrogen attached to the nitrogen has a slight positive charge, while the oxygen has a slight negative charge. This polarity of the peptide bond means that hydrogen bonding is possible between the C=O of one amino acid and the N-H of another amino acid in a polypeptide.

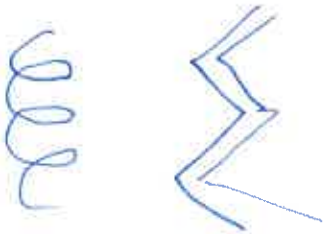
5. The primary structure is the linear sequence of the amino acids joined by peptide bonds. The secondary structure of a protein comes about when the polypeptide takes on a particular orientation in space. A coiling of the chain results in an α (alpha) helix or a right-handed spiral. A folding of the chain results in a β (beta) pleated sheet similar to a hand-held fan. The tertiary structure of a polypeptide is its final three-dimensional shape. In proteins with multiple polypeptide chains, a fourth level of structure exists termed the quarternary structure, such as in hemoglobin.

6. The final shape of a protein is very important to its function. When proteins are exposed to extremes in heat and pH, they undergo an irreversible change in shape called denaturation. Denaturation occurs because the normal bonding between R groups is disturbed. Once a protein loses its normal shape it is no longer able to function normally.

7. Draw a diagram below showing the different levels of protein organization. (p. 40).

primary:

secondary:



tertiary:

quarternary:

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Nucleic Acids
BC Biology 12 p. 41-45

1. Human genes are composed of a nucleic acid called DNA. The nucleic acid RNA works in conjunction with DNA to bring about protein synthesis.

2. A nucleotide has three subunits: a pentose sugar, a phosphate group, and a nitrogen-containing base. For DNA, the sugar is deoxyribose, in RNA the sugar is ribose. RNA is single stranded, and DNA is double stranded, held together by hydrogen bonding.

3. The four bases found in DNA are:
   - adenine
   - thymine
   - cytosine
   - guanine

4. The four bases found in RNA are:
   - adenine
   - uracil
   - cytosine
   - guanine

5. ATP is a nucleotide that functions as an energy carrier in cells. The wavy lines between the phosphate groups indicate that ATP is a high-energy molecule.

6. Match the following answers for nucleic acids to one of the statements below. Some answers may be used more than once. A statement can have more than one answer.

   a. DNA b. RNA c. nucleotide

C	monomer of nucleic acids
A	makes up genes
B	works with DNA to bring about protein synthesis
A	composed of deoxyribose sugar and is double stranded
C	held together by hydrogen bonds
C	composed of a pentose sugar, a phosphate group, and a nitrogen base

7. Fill in the table below comparing DNA and RNA (p. 41):

	DNA	RNA
Sugar	deoxyribose	ribose
Bases	-adenine -cytosine -thymine -guanine	-adenine -cytosine -uracil -guanine
Strands	-double-stranded	-single stranded (one)
Structure	-double helix	-single stranded.