

Workbook



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Amino Acids, Peptides, and Proteins

Amino Acids

Questions

- 1) Which statement is false?
 - a. Proteins are the most abundant biological macromolecules.
 - b. There are thousands of different kinds of proteins, ranging in size, shape and function.
 - c. All proteins are constructed from 20 amino acids.
 - d. Enzymes are the least varied and specialized of proteins.
 - e. Proteins are linear sequences of amino acids covalently linked together.
- 2) List at least 3 types of protein products made by organisms.
- 3) The 20 common Amino Acids Share certain Structural Features, mention at least 2.
- 4) Proteins are polymers of amino acids – explain this and how the amino acids come together to form proteins.
- 5) What are the 2 conventions used to identify the carbons in an amino acid?
- 6) For all the common amino acids, except glycine, the α -carbon is bonded to four different groups. List these.
- 7) What is the term that defines the α -amino acids?
- 8) What are amino acids mainly classified by?
- 9) How many classes of amino acids are the common 20 grouped into, and state what they are.

Answer Key

- 1) d.
- 2) Enzymes, Hormones, Antibodies.
- 3) They differ from each other in their side chains, which are also known as R groups: these vary in structure, size, and electric charge, and influence the solubility of the amino acids in water.
- 4) Proteins are polymers of amino acids, with each amino acid residue joined to its neighbor by a specific type of covalent bond.
- 5) The additional carbons in an R group. For most other organic molecules, carbon atoms are numbered from one end, giving highest priority (C-1) to the carbon with the substituent containing the atom of highest atomic number.
- 6) A carboxyl group, An amino group, An R group, A hydrogen atom.
- 7) All the common amino acids, have four different groups bonded to their α -carbon, which means it is a chiral center.
- 8) Amino Acids Can Be Classified by their side chains, their R Group.
- 9) The 5 groups are:
 1. Nonpolar, Aliphatic R Groups
 2. Aromatic R Groups
 3. Polar, Uncharged R Groups
 4. Positively Charged (Basic) R Groups
 5. Negatively Charged (Acidic) R Groups

Peptides and Proteins

Questions

- 1) Describe the formation of a peptide bond.
- 2) Though the terms “protein” and “polypeptide” are sometimes used interchangeably, typically there is a difference between them. What is it?
- 3) In a peptide, the ends are distinctive from each other, describe this.
- 4) Define the terms:
 1. Oligomeric protein.
 2. Protomer.
- 5) Which of these statements is false?
 - a. Naturally occurring peptides range in length from two to many thousands of amino acid residues.
 - b. Even the smallest peptides can have biologically important effects.
 - c. Many small peptides exert their effects at very low concentrations.
 - d. Some toxic mushroom poisons are also small peptides, as are many antibiotics.
 - e. The vast majority of naturally occurring proteins contain more than 2,000 amino acid residues.
- 6) What are oxytocin and bradykinin examples of?
- 7) Which statement about protein composition is false?
 - a. Amino acid composition of proteins is highly variable.
 - b. The 20 common amino acids almost never occur in equal amounts in a protein.
 - c. When completely hydrolyzed, each type of protein yields a characteristic proportion or mixture of the different amino acids.
 - d. We can calculate the approximate number of amino acid residues in a simple protein containing no other chemical constituents by dividing its molecular weight by 110.
 - e. All Proteins Contain Chemical Groups Other Than Amino Acids.
- 8)
 - a. Define conjugated proteins and how it is different from a simple protein.
 - b. What is the non–amino acid part of a conjugated protein called?

9) How are conjugated proteins classified?

10) Complete the sentences:

- a. _____ proteins: only contain amino acid residues (but not other chemical components).
- b. _____ proteins: contain amino acid residues & other permanently associated chemical components.
- c. Prosthetic group: _____ bound _____ - amino acid part of a conjugated protein.

Answer Key

- 1) Two amino acid molecules can be covalently joined through a substituted amide linkage termed a peptide bond, to yield a dipeptide.
- 2) Molecules referred to as Polypeptides typically have molecular weights below 10,000, while those called proteins have higher molecular weights.
- 3) In a peptide, the amino acid residue at the end with a free α -amino group is the amino-terminal (or N-terminal) residue; the residue at the other end, which has a free carboxyl group, is the carboxyl-terminal (C-terminal) residue.
- 4)
 1. If at least two of the polypeptide chains are identical the protein is said to be an Oligomeric protein.
 2. The identical polypeptide chains units are referred to as protomers
- 5) e.
- 6) Oxytocin has nine amino acid residues, Bradykinin has nine residues as well.
- 7) e.
- 8)
 - a. Proteins that contain only amino acid residues, and no other chemical constituents, are considered simple proteins. Proteins that contain permanently associated chemical components in addition to amino acids, are called conjugated proteins.
 - b. The non-amino acid part of a conjugated protein is typically called its prosthetic group.
- 9) Conjugated proteins are classified on the basis of the chemical nature of their prosthetic group.
- 10) Simple, Conjugated, tightly, non.

Sequence and Proteins

Questions

- 1) We covered 3 specific facts that demonstrate the link between amino acid sequence and function. List these.
- 2) Which statement is true?
 - a. The amino acid sequence of a particular protein has some flexibility.
 - b. 20% -30% of proteins in humans are polymorphic.
 - c. These variations in sequence have little or no effect on the function of the protein.
 - d. Proteins that carry out similar function in distantly related species can differ greatly in amino acid sequence and overall size.
 - e. All of the above.
- 3) What can be said about the flexibility of a protein sequence?
- 4) Two major discoveries were mentioned in relevance to the understanding of the link between genetics and proteins. What were these, and what was their important contribution in the history of biochemistry?
- 5) What can the sequence of amino acids in a protein infer aside from the protein's 3-dimensional structure and elaborate for each?
- 6) What criteria is used to assign proteins to families?
- 7) If we sum up the knowledge accumulated thus far, what can be said about what the string of letters denoting the amino acid sequence of a given protein, elucidates?

Answer Key

- 1)
 1. Proteins with different functions always have different amino acid sequences.
 2. Human genetic disorders have been traced to the production of defective proteins.
 3. Upon comparison of functionally similar proteins from different species, the proteins have similar amino acid sequences.
- 2) e.
- 3) To view the answer to this exercise, please refer to the appropriate video on site.
- 4)
 1. James D. Watson and Francis deduced the structure of DNA.
 2. Frederick Sanger worked out the sequence of amino acid residues in the polypeptide chains of the hormone insulin.
- 5) To view the answer to this exercise, please refer to the appropriate video on site.
- 6) Members of a family, Proteins in these families and, by identities involving only a few amino acid residues that are critical to a certain function.
- 7) Its 3-dimensional structure and how life evolved on this planet.