

Purpose

The purpose of this lecture guide is to guide you through the lecture and highlight important topics. This assignment will help to increase your knowledge and familiarity with amino acids, proteins (formation, structures, and types), and denaturation of proteins.

Student Learning Outcomes: After completing this lecture guide, you will be able to:

- Apply concepts of acid-base equilibrium to amino acids.
- Classify the 20 common amino acids based on bonding properties.
- Predict products of peptide formation and hydrolysis.
- Formulate names of peptides.
- Differentiate between the levels of protein structure.
- Recognize the attractive forces present in the various structures of proteins.
- Evaluate the structural elements of a protein to predict its function.
- Predict the effects of protein denaturation.
- Recognize the attractive forces present in the various structures of proteins.

Criteria

This worksheet is optional and will not count as a grade.

1. The building blocks of proteins are _____. These molecules contain a(n) _____ and _____ functional group attached to a(n) _____ carbon. This carbon also has a hydrogen atom and _____ attached to it which determines the identity of the molecule.
2. The _____ (shown as _____) indicates the strength of an acid. As the value _____ the strength of the acid increases. This value can be shown as the _____ to utilize numbers that are easier to compare. As this value _____ the strength of the acid increases.
3. When comparing the pH to the pKa, the predominant form of a substance can be determined. If the _____, the acid form is the predominant form. If the _____, the conjugate base form is the predominant form. When _____, the result is equal amounts of the acid and conjugate base forms.

4. Each protonated amine and carboxylic acid of an amino acid has a pK_a associated with it. The average (or midpoint) of these values represents the _____ (also shown as _____). At this point, the _____ of the amino acid exists where the amine is in the acidic form and the carboxylic acid is in the conjugate base form. The overall net charge of the functional groups in this form is _____. In the acidic form of an amino acid, the overall net charge of the functional groups is _____ and the overall net charge in the basic form of the amino acid is _____.
5. Amino acids can exist as two stereoisomers: _____ and _____. The naturally occurring form is the _____-amino acid. All amino acids except _____ contain an alpha carbon that is chiral.
6. Amino acids are classified based on their _____. Molecules with nonpolar side chains are classified as _____ amino acids. Molecules containing polar neutral, acidic, or basic side chains are classified as _____ amino acids. Amino acids that must be consumed in our diets because they are not synthesized in the body are known as _____ amino acids.
7. Amino acids combine with one another through _____ reactions. When these molecules become chemically combined, they are joined by a _____ bond which contains the _____ functional group. The first amino acid of this new compound has a free _____-terminus and is referred to as the _____ amino acid. The last amino acid has a free _____-terminus and is called the _____ amino acid.

8. Peptides can be classified based on the number of amino acids present. If two amino acids are present, the compound is referred to as a _____; a peptide containing three amino acids is referred to as a _____; and molecules with four amino acids are called _____. When many amino acids are present, the peptide is referred to as a _____. Biologically active peptides containing 50 or more amino acids are called _____.
9. All proteins have _____ levels of protein structure and some proteins will have _____ levels of structure. The primary level represents the _____ and contains a protein backbone that forms when amino acids become connected to one another. The secondary level is stabilized by _____. These attractive forces result in the formation of the _____ coiled structure or the _____ pleated structure. The coiled structure involves the carbonyl oxygen and amide hydrogen of an amino acid _____ units away. The pleated structure forms between amides in different parts of the protein backbone. The tertiary level represents the _____ of the protein and is dictated by the _____ of the amino acids. The protein folds to allow the hydrophobic amino acids to fold to the _____ of the protein, while the hydrophilic amino acids are located on the _____. This level involves interactions between the _____ of the amino acids in the protein. Two nonpolar amino acids will participate in _____ interactions; polar amino acids will participate in _____ interactions; oppositely charged ions will form _____ interactions; and two cysteine residues will form _____. If a protein has a

quaternary structure, it involves _____ polypeptides. The peptides, referred to as subunits, each have their own _____, _____, and _____ levels of structures.

10. When _____ occurs, attractive forces in a protein are disrupted and the protein loses its biological activity. This causes a change in the _____ level(s) of protein structure. The substance responsible for this process occurring is referred to as the _____. This can include heat, acids, bases, heavy metals, reducing agents and other substances.

11. When excess heat is applied, this results in a protein becoming denatured by disrupting the _____ attractive forces. This causes a change in the _____ levels of protein structure. Adding an acid, base, or ionic compound to a protein disrupts the _____ attractive forces. This causes a change in the _____ levels of protein structure. A reducing agent disrupts _____ attractive force and causes a change in the _____ levels of protein structure. Heavy metals, such as Ag^+ , Pb^{2+} , or Hg^{2+} , disrupt _____ attractive force and causes a change in the _____ levels of protein structure.

12. _____ proteins, such as keratins, are insoluble in water and have structural roles. The most common structural protein in the body is _____. Proteins that are generally spherical and soluble in water are classified as _____ proteins. This group of proteins includes _____, which transports oxygen in

blood. Another type of protein belonging to this group are _____, which are produced to fight foreign substances that enter the body.