Practice Sheet Proteins KEY

(Amino Acid list last page)

1. Consider the following structures, which are Fischer projections, and answer the questions that follow.

|  |  |  |
| --- | --- | --- |
|  |  |  |
| What is the name of the amino acid? | Lysine | Serine |
| Is the amino acid D or L? | L | D |
| Is the amino acid at an acidic, neutral, or basic pH? | Basic | Acidic |
| What function group(s) are shown in the side chain (R group) | amine | alcohol |
| What family does the amino acid belong to?  (nonpolar, polar neutral, polar acidic or polar basic) | polar basic | polar neutral |
| What is the three-letter and one letter abbreviation for this amino acid? | Lys, K | Ser, S |

1. Draw structures of the following amino acids at the indicated pH’s.

|  |  |  |
| --- | --- | --- |
| a. Valine at a neutral pH (isoelectric point) | b. Valine at a very basic pH | c. Valine at a very acidic pH |
| At a neutral pH, the amine has pulled the acidic H off of the carboxylic acid group to form the zwitterion form. | At a very basic pH, the acidic groups have lost their acidic H’s, and the molecule is negatively charged. | At an acidic pH, all of the basic groups are protonated, and the molecule is positively charged. |

1. Define isoelectric point

The **isoelectric point** (**pI**), sometimes abbreviated to **IEP**, is the pH at which a particular molecule or surface carries no net electrical charge.

1. Draw the structure of the polypeptide represented by the sequence SFG at pH=7. Label the C-terminus and the N-terminus.



1. Shows structures for the acid hydrolysis of a dipeptide.

 

1. Explain why the notations Val-Phe-Cys and Cys-Phe-Val represent two different molecules rather than the same molecule.

The shape of the protein is essentially determined by the amino acid sequence, so if you change the sequence, you change the shape. A change in this sequence will create a different 3D structure than before. This affects the function as enzymes have a specific active site shape for its substrate, a change in the shape of this active site will be the same substrate can no longer bind to it and the function has changed.

1. Explain what is meant by the following terms.
2. The primary structure of a protein.

The sequence of amino acids bonded together with amide bonds.

1. The secondary structure of a protein. What kinds of attractive forces are associated with this?

The bending and folding of the chain of amino acids into alpha-helices, and beta-sheets. Hydrogen-bonding between the C=O and the N-H’s of the amides.

1. The tertiary structure of a protein. What kinds of attractive forces are associated with this?

More folding of the chain of amino acids. Interactions between side-chains, such as hydrogen- bonding, salt bridges, hydrophobic attractions, and disulfide bonds.

1. What kind of tertiary interaction occurs between the following amino acids at pH 7 ? Draw the structure of the amino acid side chains illustrating the interaction
   * 1. Aspartic acid and Lysine \_\_\_Salt Bridge\_\_\_\_\_



* + 1. Serine and Asparagine \_\_Hydrogen Bonding\_\_\_\_\_\_\_



* + 1. Valine and Phenylalanine \_\_Hydrophobic Interactions\_\_\_\_\_\_\_\_



1. Answer the following:
   1. Describe the denaturation of proteins. Be sure to address what happens and doesn’t happen to the protein structure.

Denaturation is the unwinding of a proteins secondary and tertiary structure. That is the protein goes from a well defined 3-D structure to a no defined 3-D structure. The primary structure is not affected.

* 1. Give three examples of a reagent which would cause denaturation?

heavy metals ions such as Pb2+, Hg2+, Cd2+ ...

alcohol

detergents

reducing agents

heat

acids or bases

urea

* 1. How is denaturation of proteins different from coagulation of proteins?

Coagulation follows denaturation and involves entanglement of the chains to form a solid

* 1. What is the difference between protein digestion and protein denaturation?

Digestion is when you break up the protein strand into its amino acid components, they're no longer linked. Denaturation just unwinds the proteins to its primary structure

1. Compare two differences between fibrous and globular proteins.

Globular proteins are spherical and soluble in water are while fibrous protein are elongated and are insoluble. They also differ in their structure, wherein globular proteins have up to tertiary and quaternary structure as compared to fibrous proteins have primary, secondary structures and little or no tertiary structure

An example of a fibrous protein would be keratin, and an example of a globular protein would be hemoglobin

1. Why do amino acids typically have very high melting points?

Amino acids typically have high melting points because they exist as zwitterions, which act like salts. They have very strong intermolecular forces because of their dipolar nature.

1. How does detergent denature?

Detergent has a hydrophobic side and a hydrophilic side. Proteins have hydrophobic and hydrophylic sides, the detergent is attracted to these and forces the protein apart. A protein's 3-D structure is partially created by hydrophobic and hydrophilic interactions to itself, the detergent substitutes this self bonding with detergent-amino acid bonding. Furthermore, detergent is a salt and breaks up salt bridges and hydrogen bonding of the 3-D shape as well.

