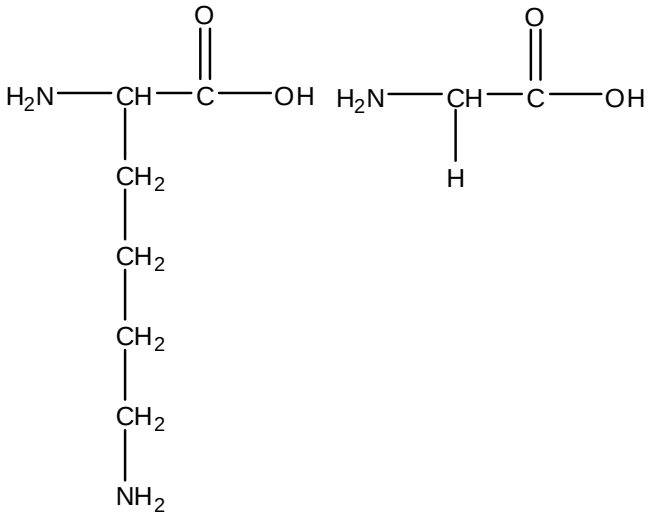
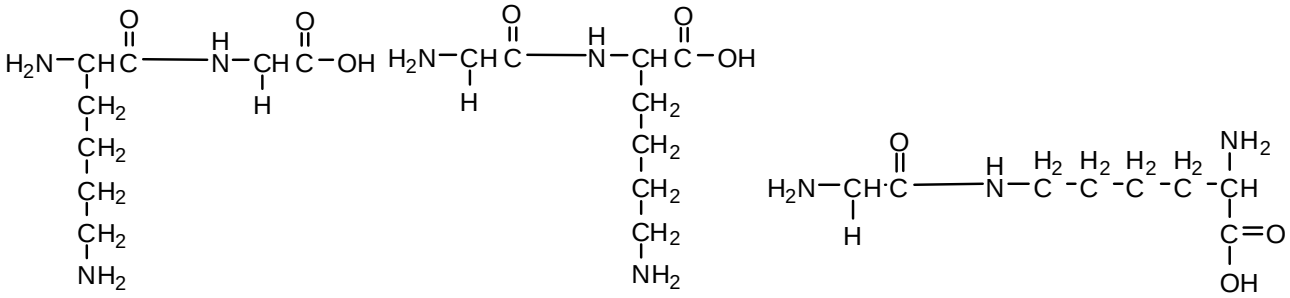
CHEM 3.5 Worksheet 9 Amino acids and proteins Name _____

Two amino acids lysine and glycine can form three possible dipeptides.



Lysine Glycine

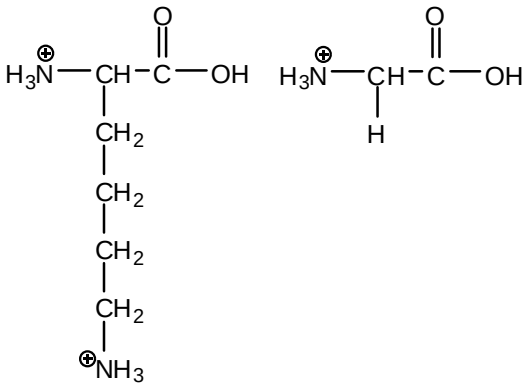
a) Draw the three possible dipeptides with a short description of why there are three possibilities.



There are three possible reactions, this is because Lysine contains two amine groups (on the second carbon and sixth carbon)

1) The carboxylic acid group in Lysine reacts with the amine group in Glycine
2) The carboxylic acid group in Glycine reacts with the amine group located on the second carbon in Lysine
3) The carboxylic acid group in Glycine reacts with the amine group located on the sixth carbon in Lysine

b) For one of the dipeptides, draw the products for hydrolysis under acidic condition. Write a short description on what would be the difference if hydrolysis is under basic condition.



For the product of hydrolysis under acidic conditions, all the amine groups of the amino acid will be protonated due to the excess amount of H^+ in the environment

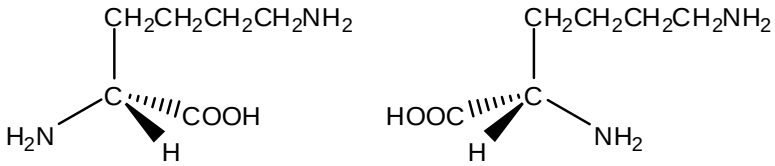
However for basic conditions, instead of the amine gaining protons, the carboxylic acid will lose its hydrogen forming a carboxylate ion. This is because the excess OH^- ion in the environment

c) **Discuss** optical isomerism using Lysine and Glycine as an example. Your discussion should include

- Definition of optical isomers
- The condition(s) required for optical isomerism
- A 3D diagram on the possible enantiomer pair
- Comparison of physical and chemical properties

Optical isomerism arises when a molecule contains a chiral carbon (carbon bonded to four different groups). This is because the mirror image of the molecule that contains a chiral carbon cannot be superimposed making the pair a stereoisomer; same atom bonding arrangement but different position in space.

As mentioned before, in order for optical isomerism to occur, a chiral carbon is needed. Glycine does not contain a chiral carbon while Lysine contains a chiral carbon (the second carbon), therefore the molecule of Lysine will have optical isomers.



The pair of enantiomers will have the same physical properties such as boiling point and melting point, however, the difference in physical properties comes when it is exposed to polarized light. The pair will rotate plane polarized light in the opposite directions.

As for chemical properties, they usually have the same chemical properties because they contain the same functional groups. However, they will behave differently in biological systems because only one of the enantiomers respond to biological enzymes.