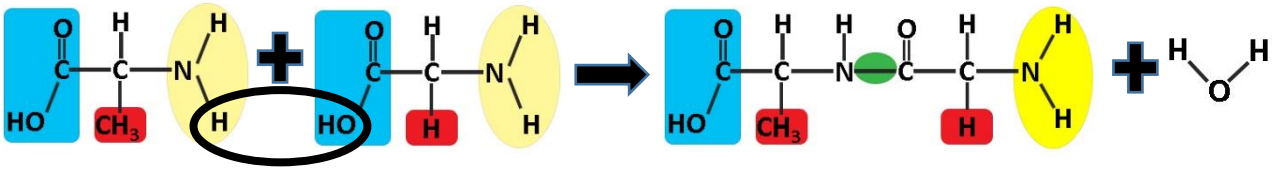
Protein: Build a Dipeptide

Proteins are macromolecular polymers built via dehydration synthesis (condensation synthesis) from the monomer amino acids. Macro- indicates the molecules are very large; the term polymer suggests the molecules are made of many subunits. Dehydration synthesis or condensation synthesis joins to monomers by removing a hydrogen ion (H^+) from one unit and a hydroxide ion (OH^-) from another to form a new covalent bond. The hydrogen ion and hydroxide ion form a water molecule, hence the name dehydration synthesis.

In the example shown below a dipeptide is formed between alanine and glycine. A hydrogen ion is removed from the amine group (yellow oval) of alanine and the hydroxide ion (blue rectangle) from the carboxyl group of glycine. The resulting bond, highlighted in green is called a peptide bond. The hydrogen ion and hydroxide ion combine to form water.

Dehydration Synthesis / Condensation Synthesis

Alanine Glycine Dipeptide Water



Materials

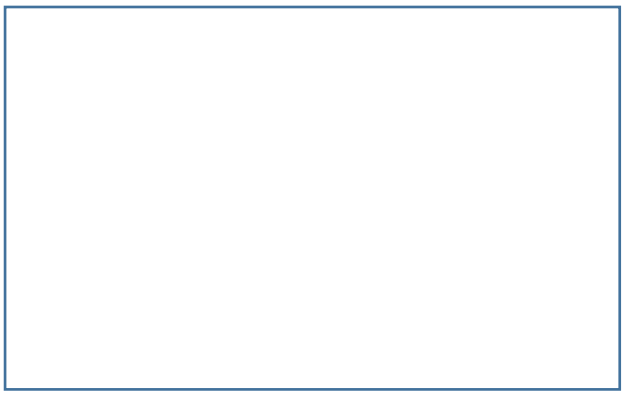
Ball and stick chemistry models or other chemical modeling kits

Procedure

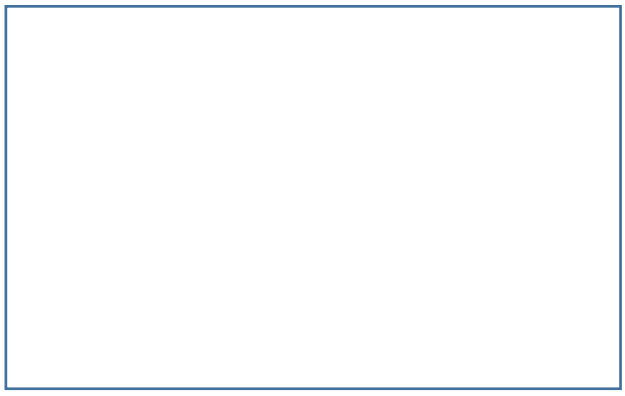
1. Use the chemistry modeling kit to build an alanine molecule. Take a photograph of your alanine molecule. Carbon is typically depicted as a black ball, oxygen as a red ball and hydrogen as a small white ball. Single bonds are formed by inserting the wooden stick into the holes drilled in each colored ball. Double bonds in the kits are often springs. Form a double bond by inserting the ends of two springs into one ball (carbon atom) and the opposite ends of the springs into the other atom (oxygen).
2. Make a model of glycine using the molecular models. Take a photograph of your glycine model.
3. Review both models and identify the amine group, carboxyl group and R-group.
4. Remove the hydrogen atom from the amine group of alanine. See the black oval above.
5. Remove the hydroxide group from the carboxyl functional group of glycine. See the black oval above.
6. Create a bond between alanine and glycine. This bond is a peptide bond.
7. Take the hydroxide ion from glycine and add the hydrogen ion from alanine. This water is formed during the formation of the peptide bond during dehydration synthesis. Take a photograph of your dipeptide and the water molecule formed by dehydration synthesis.

Data

Photograph of alanine.



Photograph of glycine.



Photograph of dipeptide and water molecule.