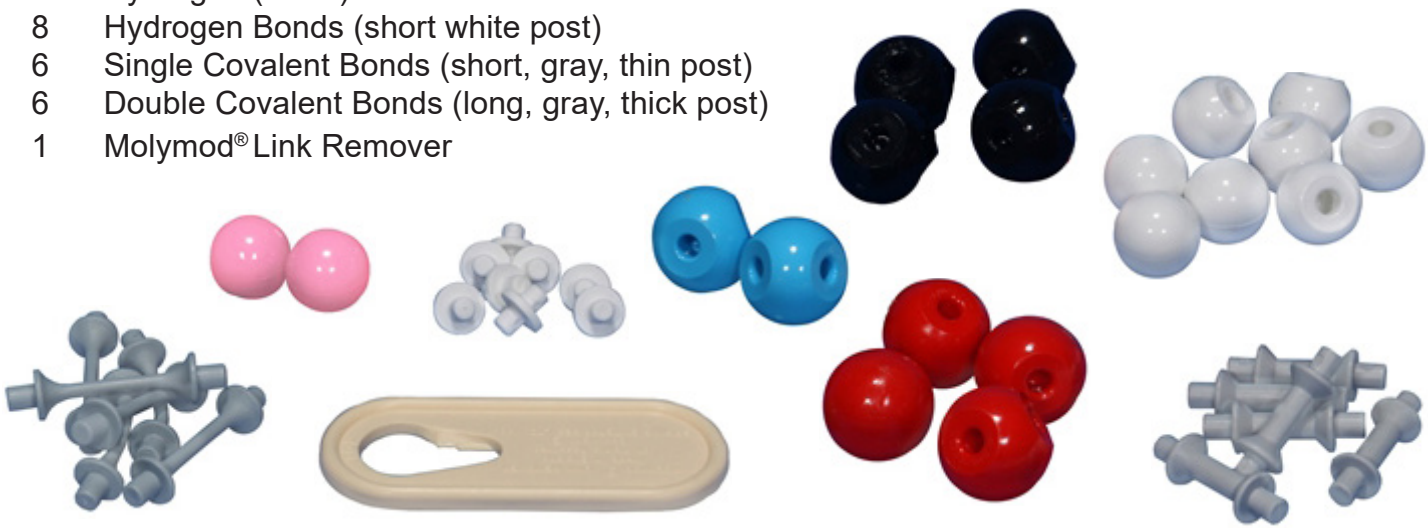
3-D Molecular Designs
...where molecules become real™

Amino Acid Building Block Models

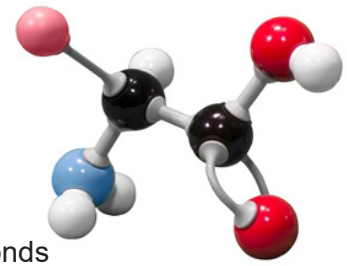
Contents List

4	Carbon (black)
4	Oxygen (red)
2	Nitrogen (blue)
2	R-Groups (pink)
8	Hydrogen (white)
8	Hydrogen Bonds (short white post)
6	Single Covalent Bonds (short, gray, thin post)
6	Double Covalent Bonds (long, gray, thick post)
1	Molymod® Link Remover



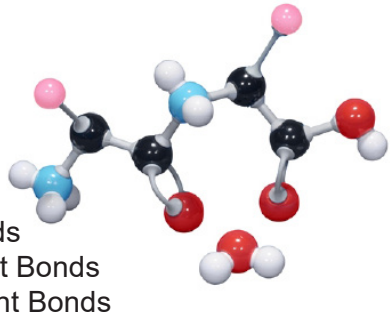
Amino Acid

2	Carbon
2	Oxygen
1	Nitrogen
1	R-Groups
4	Hydrogen
4	Hydrogen Bonds
3	Single Covalent Bonds
2	Double Covalent Bonds



Dipeptide

4	Carbon
4	Oxygen
2	Nitrogen
2	R-Groups
8	Hydrogen
8	Hydrogen Bonds
6	Single Covalent Bonds
6	Double Covalent Bonds



WARNING:

CHOKING HAZARD - This product contains small parts and should be kept out of the reach of children under the age of 3, because the parts or their pieces may present a choking hazard to small children.

CAUTION:

This is a science education product, not a toy. It is not intended for children under 8 years old.

Assembly Instructions

The purpose of this activity is to introduce students to the structure of an amino acid displayed as a ball and stick model format. Each atom is represented by a colored sphere. Covalent bonds and hydrogen bonds are represented by "sticks." Students will build an amino acid and identify the atoms and parts of an amino acid. Then they will build a dipeptide and identify components of the dipeptide. After this activity, students should be able to recognize an amino acid and identify the atoms.

Activity

1. Construct two separate amino acids using the Molymod® atoms, covalent bonds and hydrogen bonds.
   - **a.** Identify the following components: amino group, carboxyl group, the R group or side chain, alpha carbon, carboxyl carbon and nitrogen. (See labeled diagram and parts list above.)
   - **b.** Compare the two amino acids that have been built. Are they similar? How might two amino acids be different? *Amino acids are similar because they share the same "core" structure of NH_2-CHR-COOH. Amino acids are different because the composition of the "R group" is different for each of the 20 amino acids. A second way that amino acid structures may be different is their stereochemistry. The arrangement of atoms around the alpha-carbon may be "right-handed" or "left-handed" to form a D-amino acid or an L-amino acid. The L-amino acids are the naturally occurring form used to make proteins. If you hold the hydrogen atom attached to the alpha carbon in your fist, then move from the carboxyl group to the amino group to the R group in a CLOCKWISE direction, you have an L-amino acid. If you trace the path in a COUNTERCLOCKWISE direction, it is a D-amino acid. An L-amino acid is illustrated above.*
2. Two amino acids can be chemically linked by a reaction called "condensation" or "dehydration synthesis," which forms a dipetide bond linking two amino acids. A chain of amino acids linked together by peptide bonds is called a polypeptide. Using the two amino acids built in step 1, create a dipeptide.
   - **a.** What are the products of the condensation reaction? *A dipeptide and a molecule of water.*
   - **b.** Identify the following components of the dipeptide: amino groups, amino terminal end, carboxyl groups, carboxyl terminal end, carbonyl group, peptide bond, R-groups or side chains, alpha carbon and carbonyl carbon.

Teaching Points

- Amino acids are the building blocks of proteins.
- All amino acids have an identical core structure.
  - Identify the atoms nitrogen, oxygen, carboxyl carbon, alpha carbon, oxygen and hydrogen.
  - Identify the groups amino terminal, carboxyl terminal, R-group or side chain, amino group and carboxyl group.
- There are 20 different amino acids.
  - Amino acids are similar because they share a core structure.
  - Amino acids are different because they have unique R-groups or side chains.
- A linear chain of amino acids is a polypeptide.
- The primary sequence of a protein is the linear sequence of amino acids in a polypeptide.