

**KITAMO**  
MOLECULAR MODELS

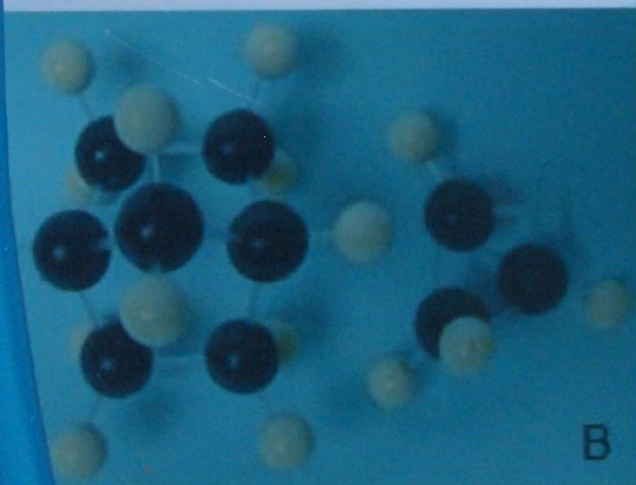
ORGANIC  
CHEMISTRY  
SERIES

Set OS-01A

This Set Contains:

- 16 Carbon (Black / Tetrahedral)
- 6 Nitrogen (Blue / Tetrahedral)
- 10 Oxygen (Red / Bent)
- 30 Hydrogen (White)
- 8 Chlorine (Green)
- 3 Bromine (Orange)
- 3 Iodine (Purple)
- 12 14 mm Link (Single Bond)
- 12 19 mm Link (Single Bond)
- 12 Bent Link (Multiple Bond)
- 1 Uncut Link Material, 100 cm

Made in the Philippines  
© 2013 Kitamo Molecular Models



[www.kitamomolecularmodels.com](http://www.kitamomolecularmodels.com)

## KITAMO MOLECULAR MODELS

### Set No. OS-01

### ORGANIC CHEMISTRY SERIES

The **KitaMo Molecular Models Set No. OS-01** is designed for the construction of physical models of organic molecules using tetrahedral, bent and monovalent atoms. The supplied links for making bonds yield models with a scale of about 1.7 centimeters per Angstrom (cm/Å). Uncut link material is supplied for the preparation of additional links using any scale.

#### Set Components

Qty	Part Description	Model Usage
16	Black Bead /Tetrahedral (16 mm)	Carbon
6	Blue Bead /Tetrahedral (16 mm)	Nitrogen
10	Red Bead/Bent (16 mm)	Oxygen
30	White Bead/ Monovalent (12 mm)	Hydrogen
8	Green Bead /Monovalent (12 mm)	Chlorine
3	Orange Bead /Monovalent (12 mm)	Bromine
3	Purple Bead /Monovalent (12 mm)	Iodine
12	14 mm Straight Link*	Single bond, Length = 1.09 Å (C-H and similar bonds)
12	19 mm Straight Link*	Single bond, Length = 1.54 Å (C-C and similar bonds)
12	27 mm BentLink*	Double bond, Length =1.34 Å (C=C and similar bonds, triple bonds)
1	Uncut Nylon Line, 100 cm	For making additional links

\* The supplied links are cut based on a scale of about 1.7 centimeters per Angstrom.

The set is packaged in a plastic case.

The colored pictures on the case cover are described in the discussion below (referred to as Figures).

#### Atoms

Atoms are represented by colored polyurethane beads with at least one hole. The holes are designed for 2.0 mm diameter links with an insertion depth of 4.5 mm. Each hole has a PVC insert which holds the link in place and allows for bond rotation.

#### Bonds Using Straight Links

The 14 mm and 19 mm straight links are cut to scale based on the lengths of C-H and C-C bonds, respectively. They may also be used for bonds of approximately the same length (e.g., the 14 mm links for N-H and O-H bonds, and the 19 mm links for C-N, C-O and N-O bonds).

The slightly flexible straight links allow for angular variations and can be used for strained single bonds. *Figure B* shows models of Norbornane and Cyclopropene, molecules with highly-strained bonds.

## Bonds Using Bent Links

The 27 mm bent links are made specifically for C=C double bonds. They can also be used for other double bonds of approximately the same length. When used for triple bonds, the resulting bond length is short relative to the 1.7 cm/Å scale. [Figure C](#) shows models with multiple bonds: pyridinium ion, ethane and diatomic nitrogen.

To assemble multiple bonds, first insert all the bent links into one bead only. Then insert the free ends of the links into the second bead one at a time. Holding the assembly against a hard surface bends the link at a convenient angle and helps during link insertion.

**Note:** Multiple bonds made with bent links result in a physical model which lacks a representation for the sigma bond and does not accurately show the pi bond structure. In certain cases, multiple bonds are better represented by other bead structures (e.g., trigonal bipyramidal) which will be included in other KitaMo model sets.

## Scale

Models of a smaller or larger scale can be made using links of the appropriate length, shape and material. [Figure A](#) shows methane-based models constructed at different scales.

The minimum scale possible is about 1.0 cm/Å. At this scale the bead surfaces touch, the links are not visible and the C-H bonds are off-scale (i.e., slightly larger). [Figure D](#) shows a model of myristic acid using this minimum scale and approximating the appearance of a space-filling type model.

**Note:** The nylon link material is supplied in rolls and tends to curve, making it inappropriate for larger scales. Rigid materials may be necessary (See discussion on Other Link Materials below). However, for larger scale models with multiple bonds, the curving tendency of the nylon material is more suitable and may eliminate the need for bent links.

## Using Other Link Materials

Links other than those supplied with the set can be made by using a variety of readily-available materials (e.g., toothpicks, wooden dowels, plastic/metal rods and flexible plastic tubing). While the preferred cross-section is circular with a 2.0 mm diameter, other geometries may also be practical.

Given this choice of materials, models of varying scale and appearances may be constructed. As an example, the largest methane-based model in [Figure A](#) was made using colored toothpicks as links.

Practical issues must be considered when using other link materials (e.g., toothpick diameter variations). Please visit our website ([kitamomolecularmodels.com](http://kitamomolecularmodels.com)) for model making hints and tips.