
DESCRIPTION OF ZEOLITE MODELS

The zeolite is a crystal composed of silicon, aluminium, oxygen and other components. It has numerous pores of molecular sizes and is used as a molecular filter or "Sieve" to absorb moisture and small sized molecules to act as a catalyst. In recent years, the zeolite has become a very important industrial material in the field of synthetic chemistry, centering around petrochemistry.

The present model kit has been designed to provide a model representing oxygen configured of only round balls to emphasize the sizes of oxygen composing the zeolite.

This is because the sieve-like pores in a zeolite are formed by several rings of Si-O (4-ring, 5-ring, 6-ring, 8-ring, 10-ring etc.).

When an oxygen molecule ball is used to create the oxygen in the ring, the size of the pores becomes visible.

This model has been manufactured accurately at a scale of 1 - 1cm, and when used together with a spacefilling molecular model/HGS solid molecular model, you can visualize actions such as molecular filtering, reaction and development.

The parts of this kit are also useful to construct such models as a single crystal of silicon, cristobalite, tridymite, rock crystal and other more complicated silicate modes.

1-1 BIO-0891 Silicon, Tetrahedral, f2m2, Yellow

BIO-0892 Silicon, Tetrahedral, f2m2, Blue

BIO classification numbers are used for these parts because they are in the same structure as the HGS protein nucleic acid precision molecular model. As they have been designed



accurately at a scale of 1 = 1cm, they are interchangeable with the HGS protein nucleic acid molecular model and the HGS spacefilling molecular model.

The covalent bond radius of silicon is originally 1.17 and BIO-0892 is correct but in case of the zeolite, if the van der Waals radius of adjacent oxygen is designed to have them contact each other, a distance between silicon and oxygen will be about 1.71 and when the oxygen covalent bond radius of 0.66 is subtracted, it will become 1.05 .

The mark "f2m2" is used to denote "female 2 points and male 2 points". The parts are available in 2 colors; yellow and blue. Use the yellow part for silicon and the blue one (BIO-0892) for aluminium and others.

1-2 BIO-0893 Silicon, Tetrahedral, f2m2

This part has been designed on the basis of the covalent bond radius original to silicon. Use this part if it is hard to assemble a model using atomic balls. (which are described later,) because they have contact with one another or



when the covalent bond length original to silicon is needed. This part is supplied as a supplementary part and is not contained in the parts-kit.

1-3 BIO-1691 Oxygen 144, f1m1

This part has the oxygen bond angle $144^{\circ} 44'$ and is used as an oxygen component of the zeolite, rock crystal and other silicates.

In the case of the zeolite, as bond angles of oxygen are not uniform, a soft product using



polyethylene is available. Since a hard type product is usually supplied, if a soft one is needed, order it under Item No. BIO-1691.

1-4 BIO-1991 Oxygen. 144, f2

In assembling a zeolite model, it should be possible to assemble the model if the silicon couplers are of 2-male and 2-female type and the oxygen couplers are of 1-male and 1-female type. However,



in some cases, male and female bond points may be reversed and the assembling work may become hard.

To eliminate this difficulty, this part that has 2 female points has been produced. By using BIO-25 connector, a female coupler can be used as a male coupler.

This part is also available in both hard and soft types. When the soft type product is needed, specify BIO-1991 when ordering.

1-5 BIO-22 Oxygen, Linear, f1m1

This part is needed in assembling cristobalite and tridymite models and also when the HGS protein nucleic acid precision molecular model hydrogen bonding oxygen is diverted.



As this part is not contained in the parts-kit, order this part as a supplementary part.

1-6 S - 30 Oxygen Ball 144, f1m1

This part is BIO-1691 Oxygen 144 encased in the oxygen cover of van der Waals size.

In assembling a zeolite model, it is easily assembled when BIO-0891 Silicon and BIO-1691 Oxygen 144 are assembled in

advance and then BIO-1691 is replaced with S-30, Oxygen Ball 144 .

If all the oxygen were replaced with this S-30 Oxygen Ball 144, the model may become somewhat heavy. This kit is composed so that only part of oxygen is replaced with this S-30 Oxygen Ball.

A soft type product is also available as a supplementary part. When the soft type is needed, specify S-30 when ordering.



1-7 S - 31 Oxygen Ball 144, f2

This part is BIO-1991 Oxygen 144 with a cover and is used when the male and female bond points are reversed and difficulty is encountered during the assembling work.

When a BIO-25 connector is

used, a female coupler can be used as a male coupler.



A soft type product of this part is also available as a supplementary part. When the soft type product is needed, specify S-31 when ordering.

1-8 BIO-25 Connector

This part is principally used together with BIO-1991 Oxygen 144 or S-31 Oxygen ball, 144 to change a female coupler to a male coupler.



1-9 Bio-26 Flexible Tube

In this case, the model can be assembled satisfactorily if this flexible tube is cut into 22 to 23 mm long pieces and used in place of the oxygen components and then, replaced with hard or soft oxygen 144 components after thoroughly understanding the shape of the model.

1. PARTS

The following component parts are available to construct models of zeolite and silicates

Item No.	Name	Bond Angle	Bond Radius	Color	Zeolite Model	Crystal	Clay & Others
BIO-0891	Silicon, tetrahedral, f2m2	109 °28	1.05	Yellow	200		
BIO-0892	Silicon, tetrahedral, f2m2	109 °28	1.05	Blue	20		
BIO-0893	Silicon, tetrahedral, f2m2	109 °28	1.07	Yellow	* *	*	*
BIO-16	Oxygen, single bond, 109, f1m1	109 °28	0.66	Red	* *		*
BIO-1691	Oxygen, 144, f1m1	144 °44	0.66	Red	250	*	*
BIO-1991	Oxygen, 144, f2	144 °44	0.66	Red	20		*
BIO-22	Oxygen, 1linear, f1m1	180 °00	0.66	Red	* *		*
BIO-23	Oxygen, double bond, f1	144 °44	0.66	Red	* *		*
S-30	Oxygen ball, 144 f1m1	144 °44	0.66-14.0	Red	100		
S-31	Oxygen ball, 144 f1m1	144 °44	0.66-14.0	Red	20		
BIO-25	Connector				40		
BIO-26	Flexible tube				1m		*

2. Principal Structures of Zeolite and Number of Parts

The principle structures of the zeolite and the number of balls required are depicted in the following table.

Except for Sodalite Cage, Zeolite A and Foujasite, only the number of oxygen is listed in the table.

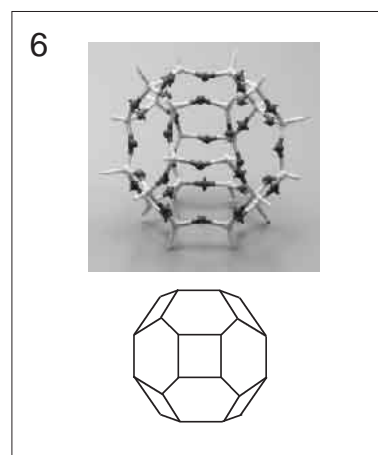
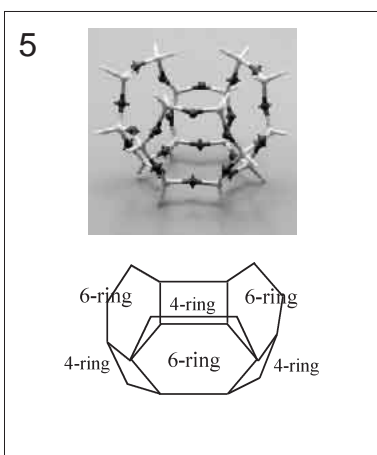
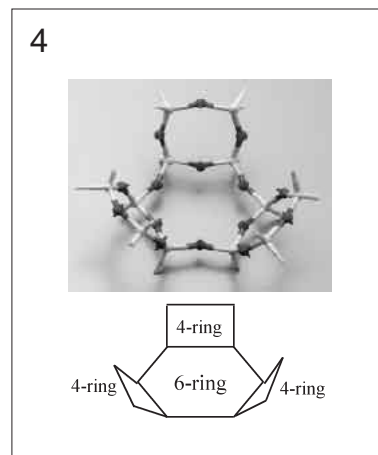
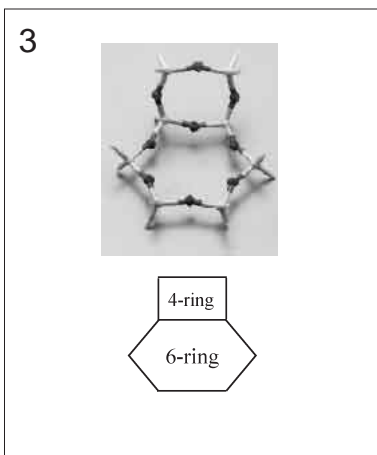
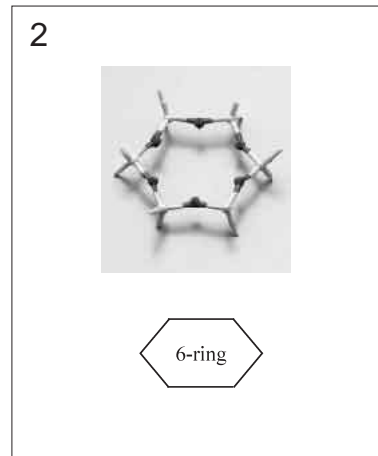
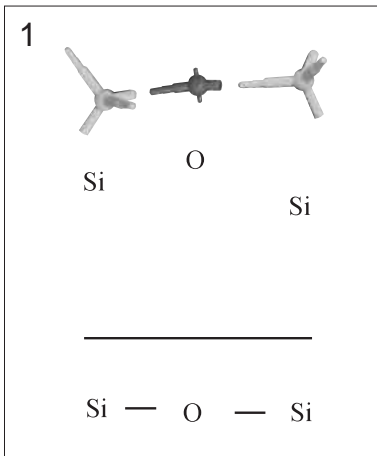
Principal Structure of Zeolite	No. of Silicon or Aluminium	No. of Oxygen	Required No. of Kits
Sodalite Cage	24	36	1
Zeolite A	192	336	1
Foujasite	240	432	2
Zeolite A (Regularly Arranged Al)		648	2
Mordenite		498	2
Ferrierite		322	1
ZSM-5		404	2
ZSM-11		404	2
Zeolite L		594	2
VPI-1		500	2
Chiral Zeolite A		800	3

The zeolite model can be basically made from only the hand type of oxygen.

***1 :** Orders without specification for hard or soft type will be processed as the orders for hard type. If soft type parts are needed, specify "Soft" after order code.

2 :** Parts marked with *** are not contained in the Zeolite kit. If they are needed in assembling other silicate models, obtain them by ordering.

The example for the assembly of sodalite cage



The example for the assembly of sodalite cage, zeolite A and faujasite.

