Super Models

Table Salt (sodium chloride)
Crystal Lattice Model Kit

Ryler Enterprises, Inc.

Recommended for ages 10 - adult.

Caution: Atom centers and vinyl tubing are a choking hazard. Do not eat or chew model parts.

Kit Contents:

40 silver 6-peg sodium atom centers (1 spare)
40 green 6-peg chloride atom centers (1 spare)
158 clear, 1.25" bonds (2spares)

Related Kits Available:
Wurtzite (ZnS)
Zinc Blende (ZnS)
Fluorite (CaF_2)
Cesium Chloride (CsCl)

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General Information

The mineral form of sodium chloride is called halite. Some halite crystals are colored, but usually they are white or colorless (see photos below). A deep blue or violet color in halite is caused by defects in the crystal, while other colors are formed by the presence of microorganisms.

When observed through a hand lens common table salt can be seen as almost perfect minute cubes.

Sodium chloride is an essential part of human nutrition. When ingested, it produces ions that help to regulate water movement into and out of cells. The ions are also important in normal nerve and muscle activity.

Some home uses of sodium chloride include flavoring, preserving, de-icing, water softening, tenderizing, cleaning (on surfaces and in shampoos and toothpaste), fire extinguishing (in some types of extinguishers such as Super D), and gargling (for sore throats). Salt is even an important part of many religious practices and certain events in many cultures.

A great number of industrial processes depend on the use of salt producing materials such as chlorine, sodium, sodium hydroxide, plastics, PVC, synthetic rubber, aluminum, textiles, tanned animal hides, preserved meats and fish, etc.

Sodium chloride forms a face centered cubic crystal composed of alternating positive sodium ions (cations) and negative chloride ions (anions). Each sodium ion is surrounded by six chloride ions, and each chloride ion is surrounded by six sodium ions within the crystal. This arrangement is called a coordination number (CN). Thus, this salt has a cation CN of six and an anion CN of six.

Instructions for Assembly of NaCl Crystal

1. Connect green chloride ions to silver sodium ions to form a 4 by 4 layer. (Fig. 1)

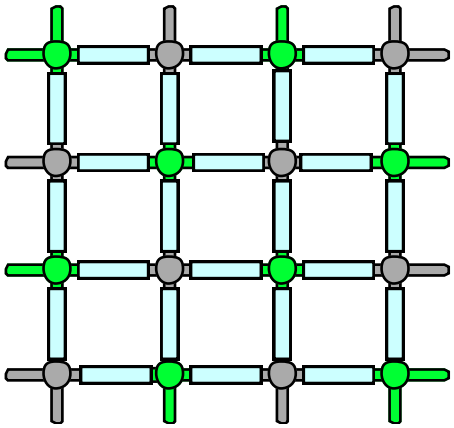

Fig. 1 One of four layers of NaCl Model

2. Repeat step one three more times to form a total of four layers.
3. Connect the layers so that the colors of the ions alternate, corresponding to sodium ions bonding with chloride ions. (Fig. 2)

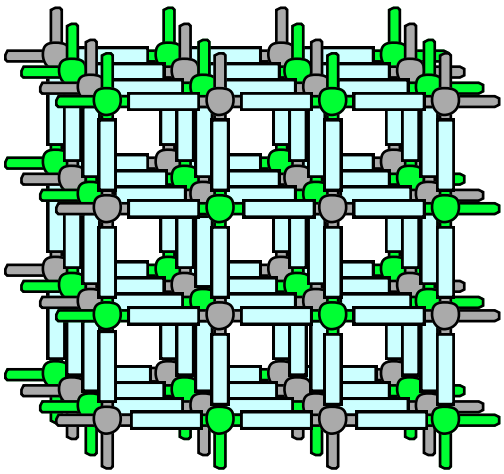

Fig. 2 Complete NaCl model.

4. Each ion in a crystal is surrounded by several ions of opposite charge. The number of surrounding ions is the coordination number (CN).

   Bond one sodium with six chlorides to form a separate model to show the cation CN of six. It will be observed later that each sodium ion, when in a unit cell of sodium ions, is at the center of a face, or side, of a cube. (Fig. 3)

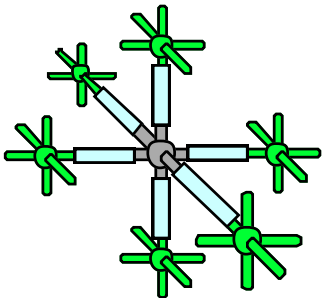

Fig. 3 Cation coordination number 6.

5. Bond one chloride ion with six sodium ions to make a separate model which shows the anion coordination number of six. It will be observed later that each chloride ion, when in a unit cell of chloride ions, is at the center of a face of a cube. (Fig. 4)

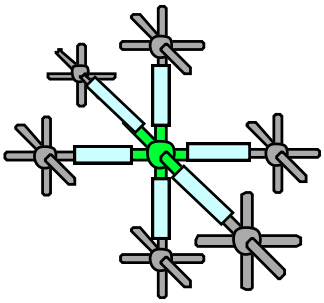

Fig. 4 Anion coordination number 6.

6. It is important to note that a unit cell is determined by looking for the positions of like ions only. Therefore, in NaCl, when observing a unit cell of sodium ions, we ignore the chloride and vice-versa.

   The unit cell (basic building block) of a sodium chloride crystal is a face centered cube. In Fig. 5 the four sodium ions a, b, d, and e are at the corners of a square, and the sodium ion c is in the center of the face. Each of the six faces of the sodium chloride unit cell has the same arrangement.

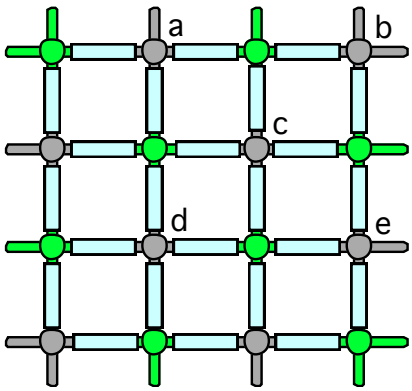

Fig. 5 One face of a unit cell of NaCl.

7. A unit cell of sodium ions can now be located in the model. The red arrows in Fig. 6 indicate the sodium ions at the corners of a cube, while the black arrows point to the face centered sodium ions. Fig. 7 shows the isolated cube.

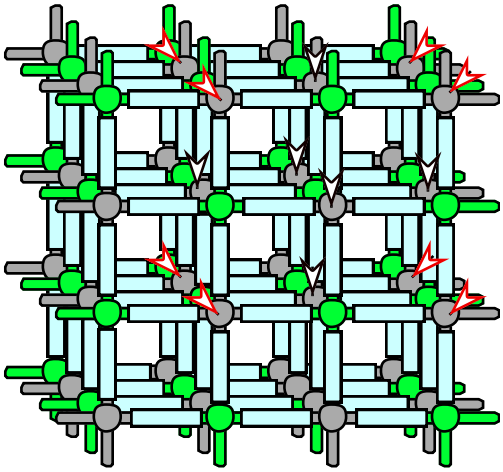

Fig. 6 Locating a face centered cube in the model.

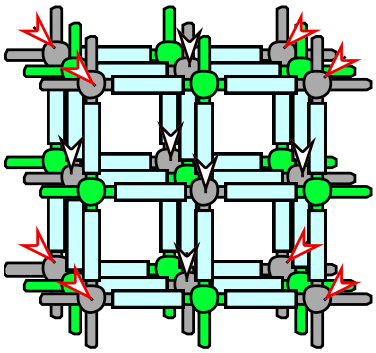

Fig. 7 An isolated face centered cube.

8. Now locate a similar face centered cube of chloride ions in the model.