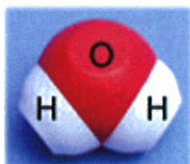


Water Kit® Description

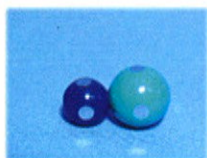
Each 3D Molecular Designs Water Kit® cup includes 12 water molecules, 1 sodium (smaller blue atom), 1 chloride (larger green atom), 1 ethane and 1 hydroxyl group (an oxygen and hydrogen molecule – OH). All atoms are magnetized to reflect their partial positive or negative charges – except for nonpolar ethane. (The hydrogen and oxygen pieces are packaged unassembled.)

Each unassembled water molecule has two red and two white pieces. When snapped together, the two red pieces represent the one oxygen atom in H₂O. Each white piece represents one hydrogen in H₂O.

The sodium (blue atom) and chloride (green atom) ions, when bonded together, represent table salt. Six magnets are embedded in each. The positive poles of the magnets in the sodium attract the negative poles of the magnets in the oxygen. The negative magnets in the chloride attract the positive magnets in the hydrogen.



The ethane molecule (CH₃CH₃) consists of two gray carbon atoms with three white hydrogen atoms on each carbon. The hydroxyl group consists of one red oxygen atom and one hydrogen atom. The hydroxyl group is a functional term. We refer to the partially charged part (oxygen and hydrogen) of the ethanol molecule. The ethane has no embedded magnets, since it is nonpolar. The hydroxyl group has two negative magnets embedded in the oxygen and one positive magnet embedded in the hydrogen.



All of the atoms in the ethane and hydroxyl group are permanently attached and can't be taken apart with one exception. One of ethane's hydrogen atoms is attached with Velcro and can be removed and replaced with the hydroxyl group. By doing so, the ethane becomes ethanol (CH₃CH₂OH) – a polar molecule.

Note: We have labeled the molecules in the photos for clarity. Molecules are not labeled in the Water Kit®.

Learning Moment – If you ask your students to assemble the water molecules, tell them to locate the embedded magnet in each piece.

Why are the magnets in each piece?

The magnets help us see and feel how water molecules “stick” together. Water molecules are able to stick together because they are polar. See the next section for more information. While the magnets help us represent polarity in these models of water molecules, polarity is not magnetic.

Misconception Caution – Although the use of magnets to represent the partial positive and negative charges that exist on the hydrogen and oxygen atoms of water is a powerful teaching tool, it is important to explain to students that atoms are not magnets.



Assembling 3D Water Molecules

Each Water Kit[®] cup contains 24 red pieces and 24 white pieces. It will take you approximately five minutes to assemble 12 water molecules in each cup.

Please note: Most Water Kits[®] are shipped with the water molecules unassembled. However, as part of its quality control program, 3D Molecular Designs randomly assembles the oxygen atoms in some Water Kits[®] and entire water molecules in other Water Kits[®].

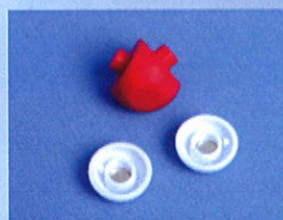
Start by selecting two red oxygen pieces and two white hydrogen pieces.



Take one red piece in each hand. You will see one post and one hole on the inside rim of each red piece.



Position the post of one piece into the hole of the other piece. Place your thumbs on the flat surface of each oxygen piece and push the two pieces together until they fit tightly and you no longer see a space between the pieces.



The red oxygen atom will now roughly resemble a sphere with two knobs sticking out of each half.



Take the red oxygen atom in one hand and one white hydrogen piece in the other and place the open side of the hydrogen piece onto the knob on the oxygen. Push the two together until the hydrogen fits tightly onto the oxygen, with no space between the two pieces.



Repeat with a second white hydrogen piece.



You now have one complete water molecule. Repeat steps 1 through 6, until 12 water molecules are assembled.

Water Kits now include plastic ethane and ethanol

Congratulations! You are the first 3D Molecular Designs customers to receive plastic ethane and hydroxyl pieces instead of plaster pieces. The new plastic pieces will be much more durable than the plaster ones and we believe you will be able to do more with them.

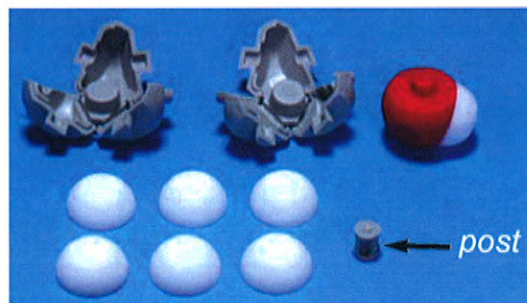
Please let us know what carbon structures you can make with the new pieces.

Since the carbon pieces are "just off the press," there may be some problems that we didn't find. Please let us know of any problems you discover, so the engineers can "tweak" (official engineering term) the mold to correct the problem. Thank you.

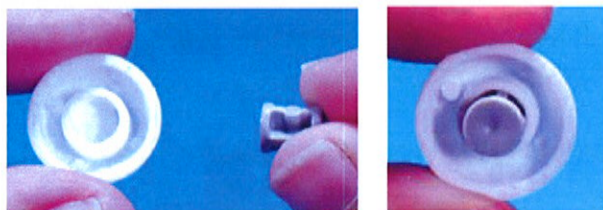
The following photos and instructions will explain how to assemble the new pieces.



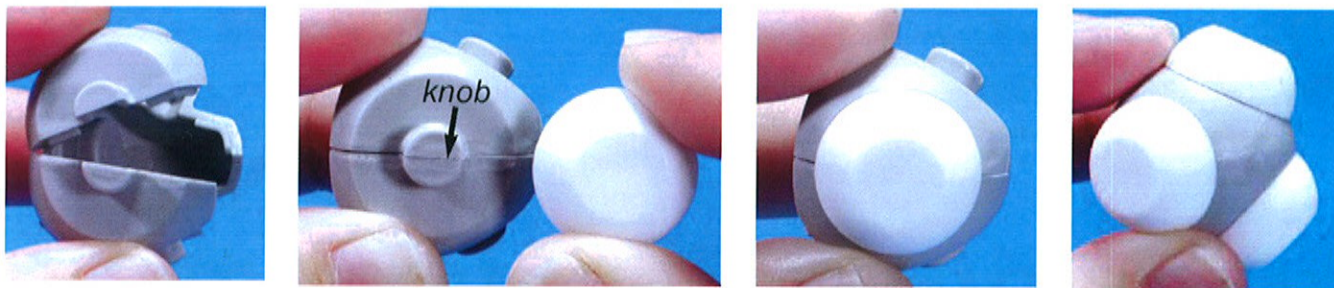
In addition to the red oxygen and white hydrogen pieces (with magnets) in each Water Kit[®] cup, you'll find these additional pieces – two gray carbon pieces, one hydroxyl (red oxygen with white hydrogen attached to it) and six white hydrogen pieces with a gray post packed in a zip-bag. The six hydrogen are bagged to separate them from the other hydrogen in your kit because, the hydrogen that attach to the carbon to form ethane don't have embedded magnets.



Hydrogen with magnet.

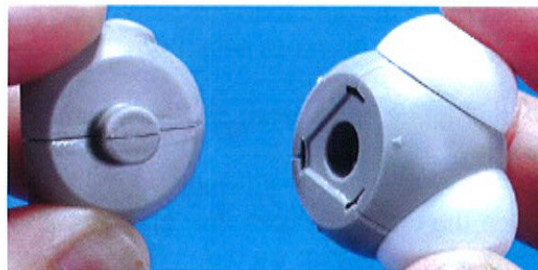


Take one of the white hydrogen pieces (without a magnet) and the gray post (*see upper right photo*) and firmly insert the post into the center hole in the hydrogen. Push until securely in place. Set aside until the rest of the ethane is nearly assembled.



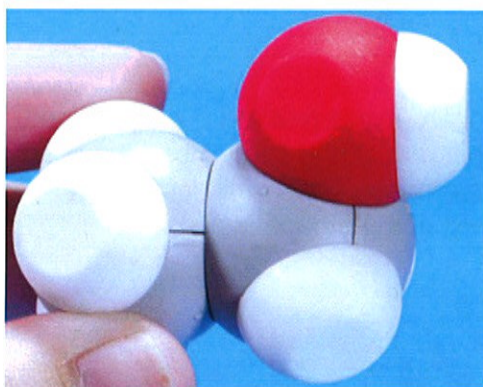
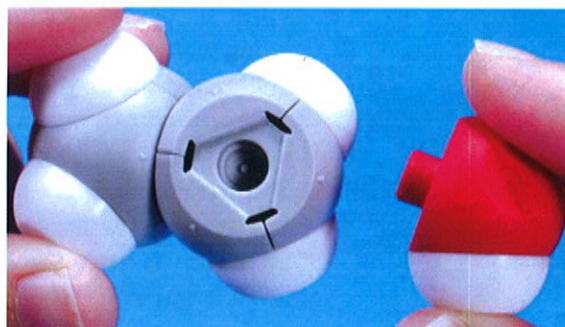
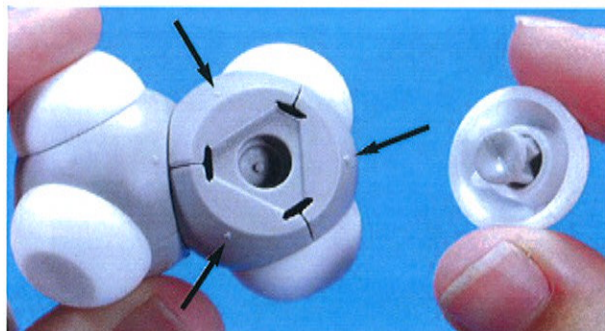
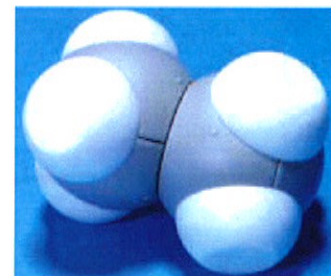
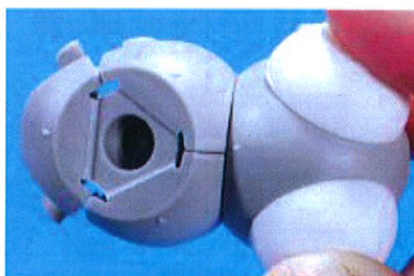
Select one of the gray carbon pieces and fold its three petals together until it is completely closed. Place one of the white hydrogen (without a magnet) over one of the knobs on the carbon (see second photos from left). Press together until the hydrogen is securely attached. Repeat with two other white hydrogen. (See photos above.)

All three knobs on the carbon should now have a hydrogen attached. Turn the carbon until you see the hole on one side. Take the unfolded carbon and press the petals together as you did before. Insert one of the knobs in this carbon into the hole of the carbon with the attached hydrogen. (See photo to right.)



Take one of the remaining hydrogen (without a magnet) and push it onto one of the exposed knobs. Repeat with the last hydrogen and knob.

Place the hydrogen with the post into the exposed hole to complete the ethane. Note the tiny triangles around the outer edges of of this hydrogen. (See black arrows pointing to triangles in photo below.)



To change the ethane to ethanol, remove the hydrogen surrounded by these triangles.

Once the hydrogen and post are removed insert the hydroxyl (red oxygen with one attached hydrogen) into the hole.

Please see the CD that came with your Water Kit® for lessons and other activities.