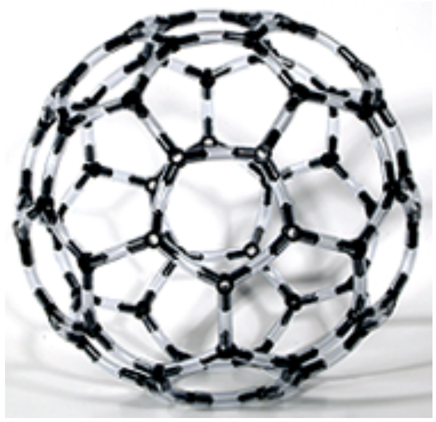
Super Models



C_{60} Buckminsterfullerene Molecular Model Kit

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Recommended for ages 10 – adult.

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

Kit contents:
62 black 3-peg carbon atom centers (2 spares)
92 clear, 1.25” bonds (2 spares)

Replacement and expansion parts available
Custom kits available

Related Kits Available:
Buckytube Molecular Model Kit
Graphite Molecular Model Kit
Diamond Molecular Model Kit

Ryler Enterprises, Inc.
5701 1st Street, Lubbock, TX 79416

Phone: 806-438-6865

Email: etishler@rylerenterprises.com

Website: www.rylerenterprises.com

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General Information

Allotropes are different forms of any one element. Carbon, is one of those elements that can be found existing, naturally, in a variety of allotropes.

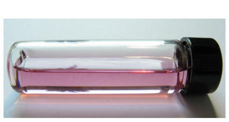
These include 1) diamond, 2) graphite (stacked layers of graphene), 3) amorphous carbon (soot and charcoal), 4) fullerenes which can contain large numbers of carbon atoms arranged as spheres, ellipsoids, or tubes, and 5) several less common forms as well. Each allotrope has its own distinct chemical and physical property.

Spherical fullerenes are also known as Buckminsterfullerenes or buckyballs. The 60 in the name C_{60} buckminsterfullerene, means that 60 carbon atoms make up the sphere. Fullerenes were named for the architect, R. Buckminster Fuller, due to the resemblance buckyballs have with Fuller's geodesic design for buildings. The C_{60} buckyball also resembles a soccer ball.

Originally discovered in interstellar space by Harry Kroto and others, using a radiotelescope, fullerenes have also been found in meteorites and the mineral, shungite, mainly from Russia. Study of vaporized carbon at Rice University by Kroto, Richard Smalley, and Robert Curl in 1985 lead to the elucidation of the structure of the C_{60} and C_{70} fullerenes and netted the three researchers Nobel Prizes.

Buckyballs and related structures such as nanotubes are made of layers of carbon atoms similar to graphene (single, flat layers of graphite) except that buckyballs have 12 cyclopentene (five atom) rings interspersed among 20 cyclohexene (six atom) rings, and they have a curved surface.

Two methods currently used to make buckyballs, are passing a spark between two very pure carbon electrodes or focusing a laser at a graphite target. The soot that is produced is then purified by chromatography. Pictured below is C_{60} in an organic solvent.



Some applications of buckyball technology are storage of hydrogen to be used as a fuel, treatment of HIV, blocking the inflammation process, delivering anticancer medications, inhibiting bacterial growth, photovoltaics, switches in computers, solar cells, lubricants, antioxidants, fiber optics, steel production, and many others.

C_{60} Buckyball Assembly Instructions

1. Construct a hexagon with six of the 3-peg carbon atom centers and six clear tubes. (Fig. 1)

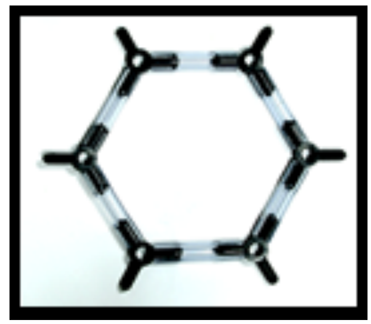


Fig. 1 A hexagon of carbon atoms

2. Attach three atoms to pegs a and b of the hexagon to form a pentagon. Repeat with atoms c and d, and then with e and f. (Fig. 2)

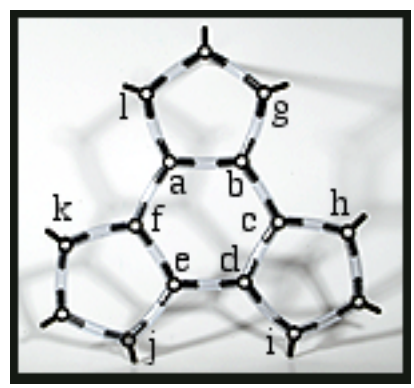


Fig. 2 Completing step 2

3. Connect atom g to atom h using two more atoms to form a hexagon. Repeat with atoms i and j and then k and l. The model should now have a slight cup shape (Fig. 3).

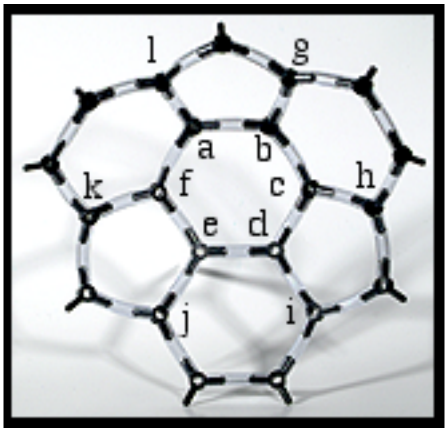


Fig. 3 Model with cup shape

4. Using nine tubes, connect one atom center to each of the unattached pegs. (Fig. 4)

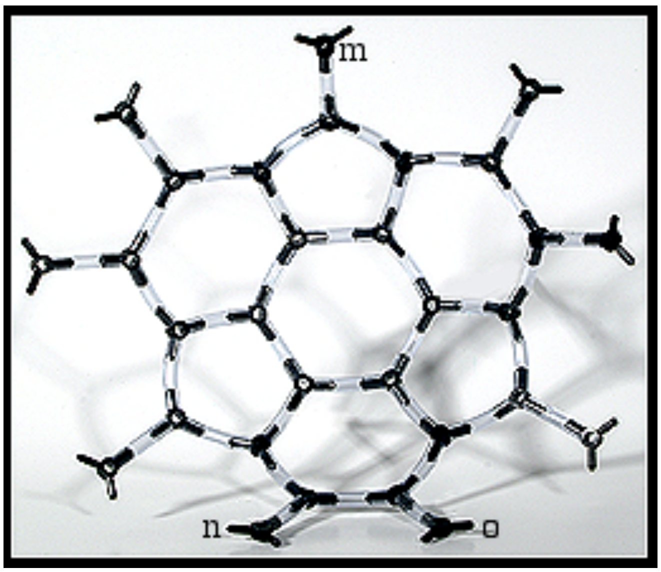


Fig. 4 Attaching nine tubes and atoms

5. Repeat steps 1-4 so that you have two copies of Figure 4.

6. Attach bonds to all of the unattached pegs of one of the copies of Figure 4. See Fig. 5.

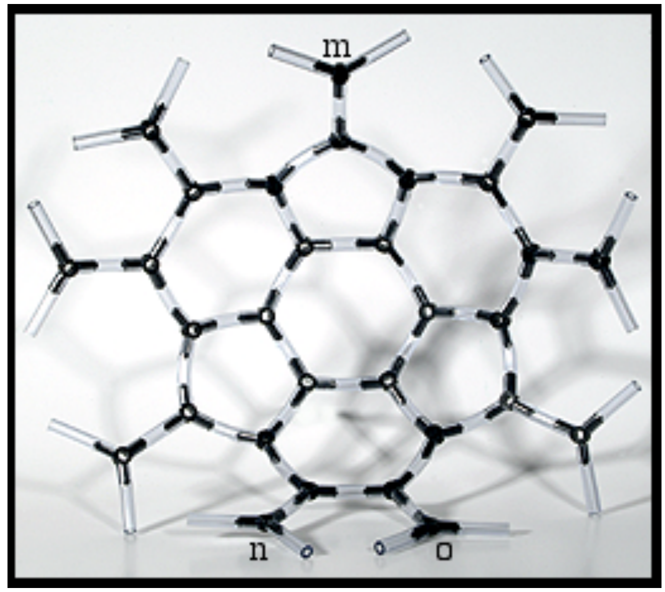


Fig. 5 One half Buckyball

7. Attach atom m of one copy of Figure 4 to atoms n and o of the other copy of Figure 4. Connect the rest of the atoms around the edge to form the complete buckyball. See Fig. 6.

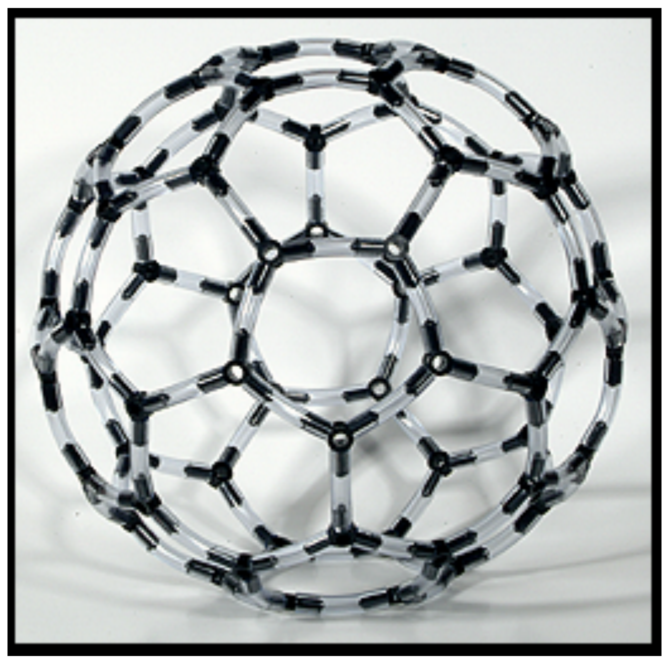


Fig. 6 Completed Buckyball

TEACHING TIPS

1. Insert a tennis ball in the buckyball to simulate a caged atom of another element.

2. Compress and release the buckyball to show the elasticity of the molecule.

3. Compare the buckyball to diamond (Ryler kit DIA-1) and graphite (Ryler kit GRA-1) to show:

a. aromatic bonds in graphite vs. single bonds in diamond, conjugated bonds in buckyball,

b. definite number of carbons in buckyball vs. indefinite number in graphite and diamond,

c. crystalline form of all three allotropes,

d. graphite layers slip; diamond is rigid with cleavage planes; buckyball is cage-like,

e. simulation of forming buckyballs and buckytubes by rolling a sheet of graphite (a small section of chicken wire can be used as graphite,

f. different applications of the three allotropes.

4. Diamond is usually colorless, graphite is black, and buckyballs are red in solution.