

Name: _____

Date: _____

Molecular Modeling Activity for Diamond



Time required: one 30-minute period

A diamond is a transparent, extremely hard precious stone that is used in jewelry and in industry for cutting hard materials. In diamond, each carbon shares electrons with four other carbon atoms, forming four single bonds. Diamond is a large covalent structure which continues on and on in three dimensions. The number of carbon atoms in a real diamond is completely variable, depending on the size of the crystal.

Use Figure 1, the carbon atom models, and single bonds to build the structure of diamond. The red dots show which atoms are added in each step.

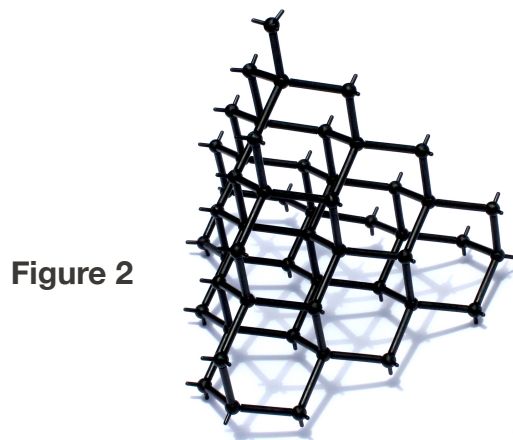
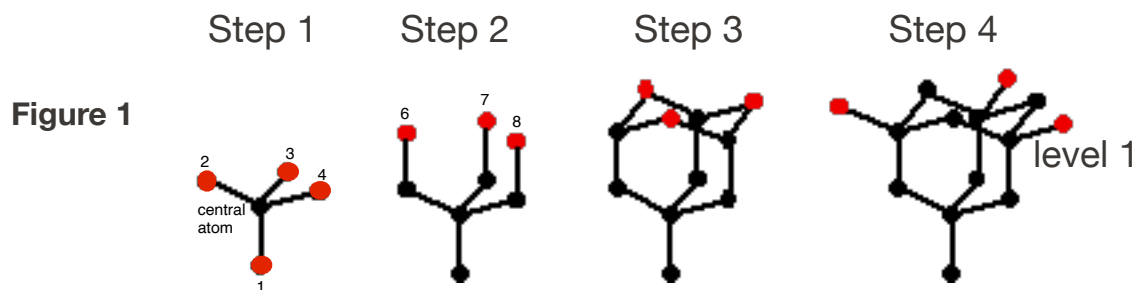
Step 1: Using black single bonds, connect 4 carbon atoms to the central carbon atom.

Step 2: Add 3 atoms (#6, 7, and 8) that point straight upward to form level 1.

Step 3: Add atoms between those atoms to form a hexagon.

Step 4: Add 3 atoms that point outward.

Step 5: Repeat Steps 2-4. When Step 2 is repeated, 6 atoms should be pointed upward for level 2; and 10 atoms for level 3. Continue to add carbon atoms to complete the three-dimensional network in Figure 2.



Physical Properties of Diamond

1. The very strong carbon-carbon covalent bonds do not allow diamond to melt at normal atmospheric pressure.
2. Diamond does not conduct electricity. All the electrons are held tightly between the atoms and are not free to move.
3. Diamond is insoluble in water and organic solvents. No attractions occur between solvent molecules and carbon atoms which outweigh the attractions between the covalently bound carbon atoms.
4. The strong carbon-carbon covalent bonds operating in a three-dimensional network make diamond very hard.

Summary

Diamonds are the world's most precious stone, formed over billions of years beneath the earth's surface. The enormous pressure and heat of the earth's mantle transforms carbon into diamonds. The carbon-carbon network gives the diamond its clarity, brilliance and other physical properties.