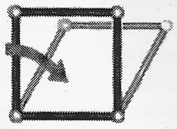
side braces the two opposite sides, preventing them from moving in relation to one another. This is true even if the connections are flexible, as they are with Roger's Connection. In a triangle of equal edge lengths, there is only one angle (60°) that each side can assume to complete, and lock-in the triangular form.

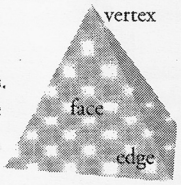


A square built with Roger's Connection, is not a stable shape, as it can bend and flex in many different ways. Try it! Build a square, pick it up, and you'll see how easily it becomes distorted.

Using triangles as much as possible while building with Roger's Connection ensures the strongest and most stable designs. Squares and other shapes can be used if they are strengthened with triangles, as you will see further on in this manual.

Building With Roger's Connection

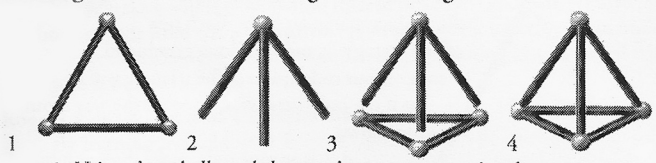
In the next few sections, we will show you several different ways to build 3 important shapes. Each method highlights a different aspect of building and gives you insight into creating your own designs. These 3 shapes are the only three regular polyhedra built entirely out of triangles, so they are especially useful as a starting point.



The Tetrahedron

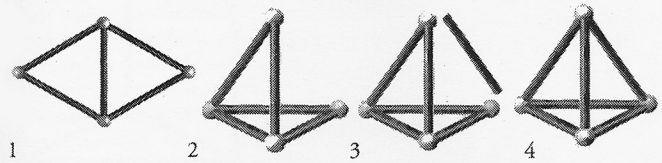
A tetrahedron has 4 sides, 6 edges, and 4 vertices. You will need 6 rods, and 4 balls to build one. There are many ways to build this polyhedron, three of which are shown here.

Building the Tetrahedron Starting with a Triangle



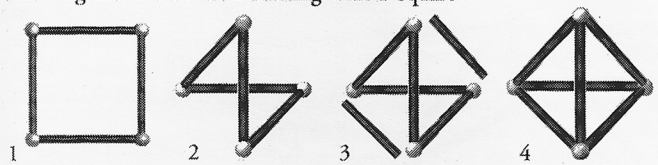
1. Using three balls and three rods, construct a triangle.
2. Attach three rods to a single ball, forming a tripod.
3. Connect the three free ends of the tripod to the three balls of the triangle. That's it! You have just constructed a tetrahedron, the simplest and most basic of all the polyhedra.

Building the Tetrahedron Starting with a Ditriangle



1. Using four balls and five rods, construct the ditriangle. A ditriangle is simply two triangles that share a side (rod). It is also a diamond, which has been cross-braced with a rod.
2. Fold up one of the triangles along the shared rod.
3. Add the last rod between the two balls of the original triangles as shown. Here once again is the completed tetrahedron.

Building the Tetrahedron Starting with a Square

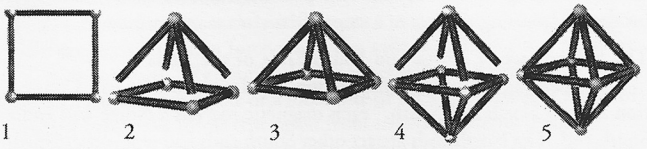


1. Build a square. Keep one of the rods of the square on your work surface, and lift the other three rods up to stand the square up on its edge.
2. Keeping the rod on your work surface from moving, rotate the top rod above it a quarter of a turn clockwise. Looking down from the top, illustration 2 shows what it should look like.
3. Add two rods, between each of the top and bottom balls that are not yet connected. You have once again built a tetrahedron. By adding the last two rods, you cross-braced the original square in two different ways, converting the unstable square into a stable tetrahedron, made entirely of triangles.
4. Here is the final tetrahedron. The view might look unfamiliar, but it is the same tetrahedron. This view of the tetrahedron, which shows the central rods crossing at right angles, demonstrates how the angles of a square or a cube (90°) can be found inside a structure made entirely of triangles.

The Octahedron

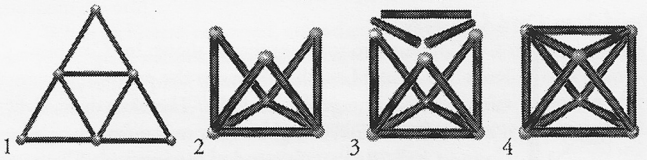
An octahedron has 8 sides, 12 edges, and 6 vertices. You will need 12 rods, and 6 balls. Three ways to build this polyhedron are shown here.

Building the Octahedron Starting with a Square



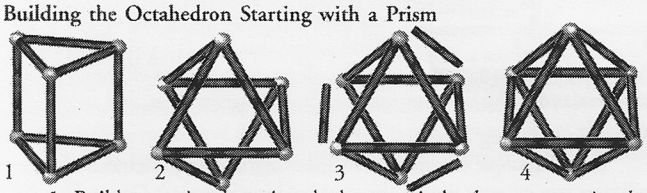
1. Using four balls and four rods, construct a square.
2. Make a "quadpod" (like a tripod, but with four legs instead of three).
3. Attach the quadpod to the square to created a pyramid.
4. Prepare a new quadpod. Carefully turn the pyramid upside down, so that the square is facing up, and attach the new quadpod to the square as shown. Congratulations! You have completed the octahedron!

Building the Octahedron Starting with a Triangle



1. Using six balls and nine rods, construct four small connected triangles that share rods as shown. This is called a two frequency triangle.
2. Fold up the three outer triangles.
3. Add three rods as shown to complete the octahedron!

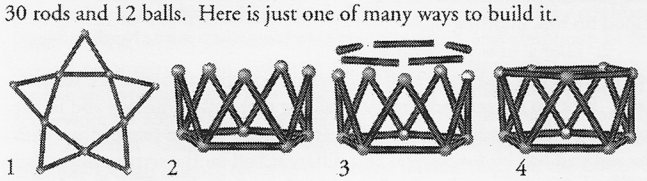
Building the Octahedron Starting with a Prism



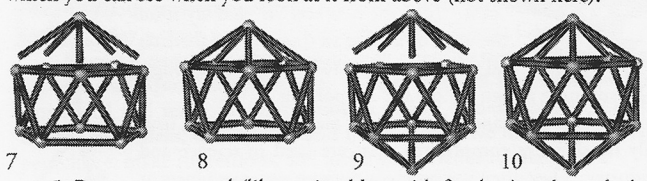
1. Build two triangles. Attach three vertical tubes to one triangle. Add the other triangle to the top to create a trigonal (3 sided) pyramid.
2. Keeping the bottom triangle on your work surface from moving, rotate the top triangle 1/6 of a turn clockwise. This picture is a top view.
3. Connect three rods as shown. Each of these three rods should connect from one ball of the triangle on the top to the ball of the triangle on the bottom that is 1/6 of a turn clockwise from it. When you added the last three rods, you cross-braced each of the three unstable squares of the original trigonal prism. This changed each of these unstable squares into two stable triangles, resulting in a stable octahedron.

Building the Icosahedron

An icosahedron has 20 sides, 30 edges, and 12 vertices. You will need 30 rods and 12 balls. Here is just one of many ways to build it.



1. Using five balls and five rods, make a pentagon. Create a star by forming five triangles, each of which share a rod with the pentagon.
2. Fold the triangles up to make a crown.
3. Connect 5 rods between each of the balls on the points of the crown.
4. Here, the rods are shown attached. They form another pentagon which you can see when you look at it from above (not shown here).



5. Prepare a pentpod (like a tripod but with five legs) and attach the free ends of the pentpod to the five balls of the top pentagon.
6. You have made a geodesic dome.
7. Turn the dome upside down and rest it on one of its triangular faces. Make another pentpod and attach it to the five balls of the pentagon that is now facing up. Congratulations! You have made the icosahedron!