

## Geometric Straw Sculptures

Age 9+ independently or 4+ with help from an adult

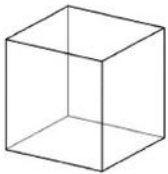
**The Challenge:** Build three geometric sculptures inspired by shapes called the Platonic Solids. Then experiment and build your own shapes, and choose your favourite to display in your house or hang in a window.

**The Inspiration:** The Platonic Solids are 5 special shapes which are important in maths and science.

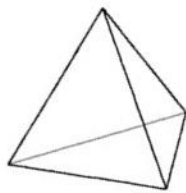
First, let's look at the maths. A Platonic Solid is a symmetrical shape where:

- The sides (or 'faces') are all the same shape (these are called 'polygons')
- The same number of edges meet at each corner (or 'vertex')

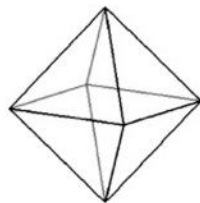
These shapes were discovered and studied in Ancient Greece, and they get their name from the philosopher Plato, who used them to represent the elements; fire, earth, air, water and the heavens (space).



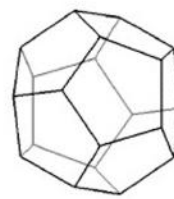
cube/hexahedron



pyramid/tetrahedron



prism/octahedron



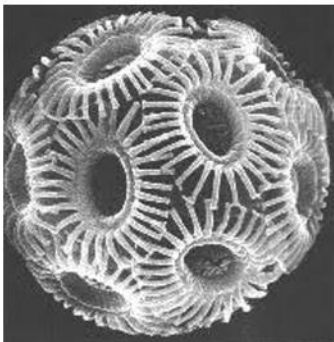
dodecahedron



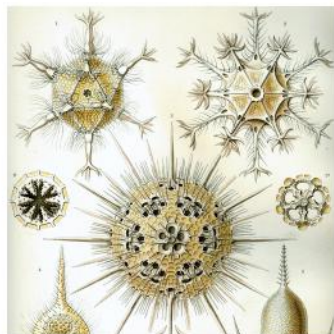
icosahedron

These shapes are also important in science. The Ancient Greeks used them in astronomy when working out how the Universe was built. They also can be found in nature, especially when looking through a microscope, at things like:

- The centres of flowers, which often have hundreds of tiny shapes arranged in a perfect spiral (another very important shape called the 'Golden Ratio' and appears in lots of things that grow)
- Tiny organisms that are found in water called plankton and diatoms, which have many different shapes
- Some viruses, like Herpes and Polio, which are shaped like a dodecahedron or icosahedron, with lots of sides which are all identical



A diatom under the microscope



Drawings of Rhizaria, a type of plankton, by Ernst Haeckel

## Geometry in Sculpture

Many artists use the Platonic Solids and other geometric structures in their work. Leeds based sculptor Dominic Hopkinson carves stone and build shapes from wood to explore geometry and maths. Artist Gego drew 3D structures with wire that appear to float in space. Edward Allington was inspired by Plato and tried to make 'perfect' geometric shapes by hand.



Gego, *Esfera No 5 1977*



Dominic Hopkinson,  
*Scientific Sublime*  
exhibition, 2019



Edward Allington, *Ideal Standard Forms, 1980*

## Step 1: Prepare your materials



Gather your materials. You'll need the 6 straws and 8 pipe cleaners from your box, plus scissors, a pencil and a ruler. A calculator will also be useful!

## Step 2: Make hubs



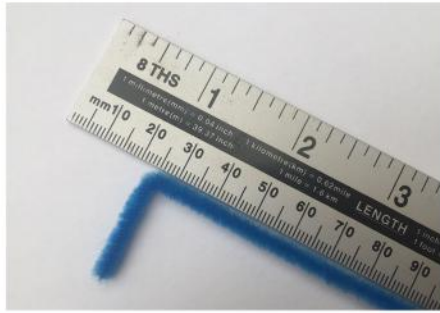
You're going to turn 4 of your pipe cleaners into connectors, or 'hubs' to join your straws together. The next few steps will explain how!



Cut your straws in half. To make sure they're the right length, measure one of your straws and divide this number by 2. Measure and mark the halfway point with a pencil, then cut your straw.



Now, use the straw you measured as a guide to cut all your straws in half. You should now have 12 straws, all roughly the same length. If they're different lengths your shapes will be all wonky!



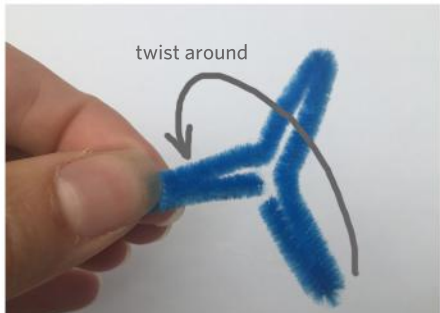
Measure a pipe cleaner, and divide this number by 6. Measure to this point and make a bend in the pipe cleaner.



Bend your pipe cleaner into a zig zag, making each section the same length as the part you measured, to make 6 equal sections.



Your finished zig zag should have 5 bends, and look like an M with an extra point! If you run out of space for the final bend, go back and shorten the other sections.



Pull the points of your zig zag round to make a star with 3 prongs. Then, to make it stronger, twist one of the prongs around the middle so you can't pull the prongs apart.



Make 3 more hubs. Use the 'pull test' to check if they're strong enough by gently pulling on the prongs. If they come apart, twist them around each other again until they hold together.

## Step 3: Build a pyramid



Use your hubs and straws to build a pyramid. Place a prong of one of your hubs in the end of a straw.



Add another straw to your hub, then place hubs into the other end of the straws.



Connect another straw to the two end hubs to make a triangle. This is the base of your pyramid.

**Step 4: Build a cube**

Bend the spare prongs on your base upwards and place a straw on each one. Add another hub to one of the new straws.



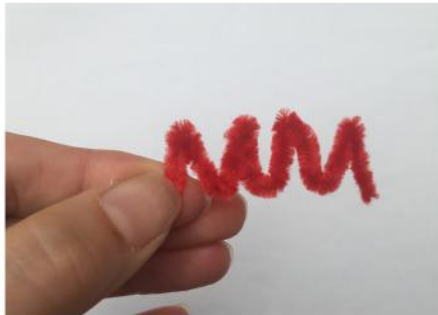
Carefully join the straws together, pushing the prongs down into the straws. You may need to adjust the hubs at each corner to stop them popping out. Your pyramid is complete!



Next, try building the cube. You'll need to take the pyramid apart and make more hubs. Count the corners (or vertexes) on this photo to see how many hubs you'll need.

**Step 5: Make new hubs (for the prism)**

Take your cube apart and unfold 6 of your hubs, to make new ones with 4 prongs. Measure the pipe cleaner and divide this number by 8, then measure and make your first bend at that point.



Fold your pipe cleaner into a zig zag, but this time with 7 bends. It should look like two M's next to each other, with each section being roughly the same length.



Pull the zig zag around to make a star shape with 4 prongs, then twist one of the prongs around the middle to stop it pulling apart.

**Step 6: Build a prism**

Once you've made your 6 hubs, try to build the prism using this photo as a guide. Start by making a square, then build a 4 sided pyramid on the top and bottom of the square.

Now you've mastered the technique, why not play around and try making your own shapes and structures? They don't need to be symmetrical!

**Step 7: Display your sculpture**

Once you've built all three shapes and made some of your own, choose your favourite to put on display somewhere, or hang it in a window. If the hubs keep popping out, or you want to hang it up, you may want to fix it together permanently. To do so, take out each hub one at a time and put a dab of PVA glue on each prong, then put it back in the straw to fix it in place.

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