Before building the solids, look at how the foam pieces fit together on a flat surface. First try the small triangles. Notice the shape of a piece is different when it’s flipped over. Be sure the same side is facing up (in a flat arrangement) or outward (in a polyhedron) for all of them. This is also true for the pentagons.

Ignoring holes and small gaps, they cover a flat surface. Equilateral triangles form one of the regular tessellations (tilings) without "real" gaps or overlaps. A regular tessellation is like a two-dimensional Platonic Solid. Now look at a point (vertex) where six triangles come together. Remove one of the six to leave a gap. If you bring the two edges of the gap together, you get a three-dimensional pyramid with a regular pentagon as its base. This pyramid is part of an icosahedron.

Finally, lay them flat again and remove another triangle, so only four are left. If you bring these together to close the gap, you get a pyramid with an equilateral triangle base. This is a tetrahedron.

Next, lay them flat again and remove another triangle, so only four are left. If you bring these together to close the gap, you get a pyramid with a square base. This is half of an octahedron.

Finally, lay them flat again and remove another triangle, so only three are left. If you bring these together to close the gap, you get a pyramid with an equilateral triangle base. This is a tetrahedron.

You can build the five Platonic Solids, or polyhedra, and their duals. A polyhedron is a solid whose faces are polygons. Only five convex regular polyhedra exist (i.e., each face is the same type of regular polygon—a triangle, square or pentagon—and there are the same number of faces around every corner.)

If you put a point in the center of each face of a polyhedron, and connect those points to their nearest neighbors, you get its dual. These center points are now the corners (or vertices) of the dual.

The Platonic Solids are named according to the number of faces (F) they possess. For example, “octahedron” means “8-faces.” The number of faces (F), edges (E) and vertices (V) for each solid are shown below. An edge is a line where two faces meet, and a vertex is a point where three or more faces meet.

Each Platonic Solid has another Platonic Solid as its dual. The dual of the tetrahedron (“4-faces”) is again a tetrahedron; the dual of the cube is the octahedron (“8-faces”), and vice versa. The dual of the dodecahedron (“12-faces”) is the icosahedron (“20-faces”), and vice versa.

The Platonic Solids and other polyhedra were widely studied during the Renaissance. Johannes Kepler was a German mathematician and astronomer who lived from 1571 – 1630. He discovered the laws of planetary motion that for the first time explained the orbits of the planets in our solar system. Earlier, he incorrectly associated the orbs of the six known planets with a nesting of the five Platonic Solids within a sphere.

Renaissance artists also studied the Platonic and other polyhedra. Albrecht Dürer (1471 – 1528) prominently featured a polyhedron in one of his most famous engravings, Melancolia I.
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