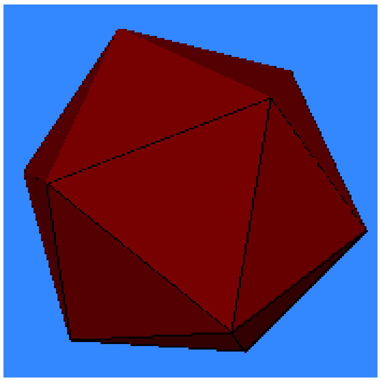
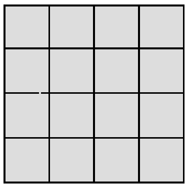
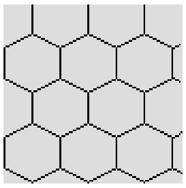
The Five Platonic Solids



Known to the ancient Greeks, there are only five solids which can be constructed by choosing a regular convex polygon and having the same number of them meet at each corner:

- The cube has three squares at each corner;
- the tetrahedron has three equilateral triangles at each corner;
- the dodecahedron has three regular pentagons at each corner.
- With four equilateral triangles, you get the octahedron, and
- with five equilateral triangles, the icosahedron, illustrated at right.





No other possibilities form a closed convex figure. For example, four squares or three hexagons at each corner would result in a flat surface, like floor tiles.

It is convenient to identify the platonic solids with the notation $\{p, q\}$ where p is the number of sides in each face and q is the number faces that meet at each vertex. Thus, the cube is $\{4, 3\}$ because it consists of squares meeting three to a vertex.

Exercise: *Give the* $\{p, q\}$ *notation for all five Platonic solids.*

Answer: *Always do these exercises yourself before looking at my answer.*

Observe that if {p, q} is a possible solid, then so is {q, p}.

In nature, the cube, tetrahedron, and octahedron appear in crystals. The dodecahedron and icosahedron appear in certain viruses and radiolaria. Note that names such as *dodecahedron* are ambiguous; sometimes the *regular* dodecahedron is meant and sometimes the word refers to any of the many polyhedra with twelve sides.

Exercise: *Get to know these polyhedra and the relationships between them by counting the number of faces, edges, and vertices found in each of these five models. Make a table with the fifteen answers and notice that only six different numbers appear in the fifteen slots.*

Answer: *Make your own table before looking at the answer.*

P.S. (Platonic System) If you are using Netscape's Live3D VRML viewer, try this out.
