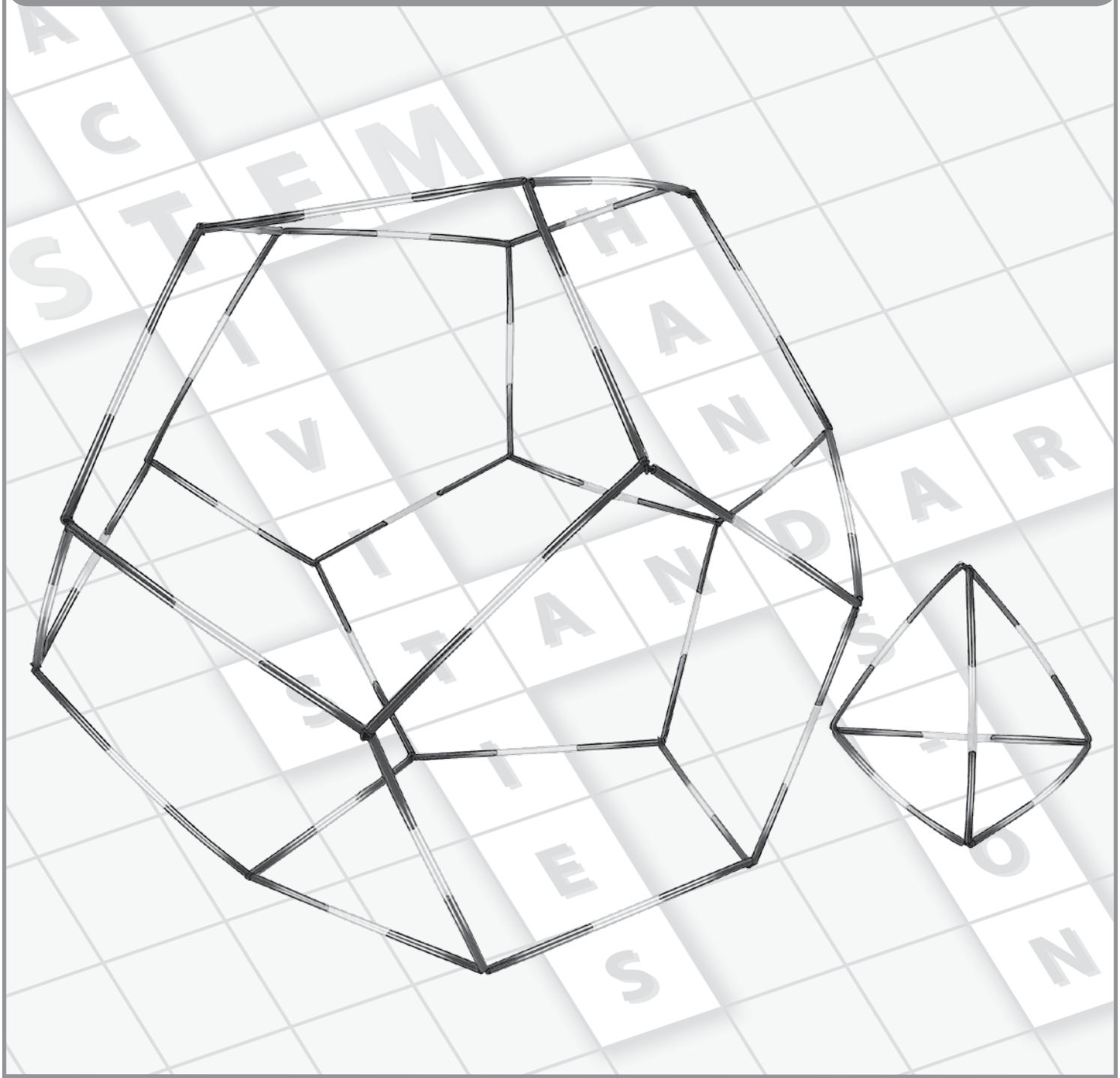
Five Regular Geosolids
User Guide



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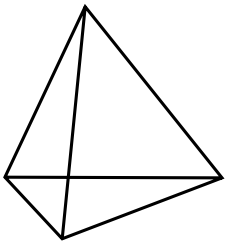
Five Regular Geometric Solids

Structures that have length, width, and height are called three-dimensional figures or structures.

These figures have edges, faces, and vertices. Edges are the sides of the structure (the straws in our structures). Faces are the geometric shapes that the edges form. Vertices are the points at which the edges of the structure intersect.

In a regular geometric solid, all the edges have equal lengths and all the faces are the same shape. There are only five structures possible that are regular geometric solids: tetrahedron, hexahedron (cube), octahedron, dodecahedron, and icosahedron.

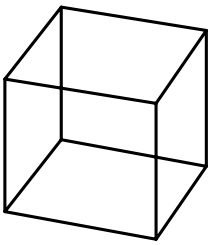
In the following activities, refer to the Basic Construction Techniques on page 3 to see how to make the various vertices.



Activity 1

Make four of the three-legged vertices, and use straws to connect them to form a **pyramid** shape. The mathematical name for this structure is a tetrahedron; it has four vertices.

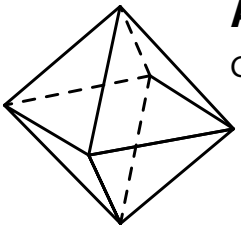
a. Count the number of vertices. _____
b. Count the number of edges the structure has. _____
c. Count the number of faces. _____
d. What is the name of the shape of these faces ? _____



Activity 2

Construct a **cube** using three-legged vertices and straws to construct. Another name for a cube is a hexahedron.

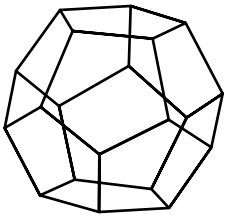
a. Count the number of vertices. _____
b. Count the number of edges the structure has. _____
c. Count the number of faces. _____
d. What is the name of the shape of these faces ? _____



Activity 3

Construct a **octahedron** using four-legged vertices and straws.

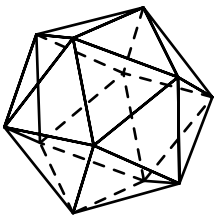
a. Count the number of vertices. _____
b. Count the number of edges the structure has. _____
c. Count the number of faces. _____
d. What is the name of the shape of these faces ? _____



Activity 4

Construct a **dodecahedron** using three-legged vertices and straws.

a. Count the number of vertices. _____
b. Count the number of edges the structure has. _____
c. Count the number of faces. _____
d. What is the name of the shape of these faces ? _____



Activity 5

Construct a **icosahedron** using five-legged vertices and straws.

a. Count the number of vertices. _____
b. Count the number of edges the structure has. _____
c. Count the number of faces. _____
d. What is the name of the shape of these faces ? _____

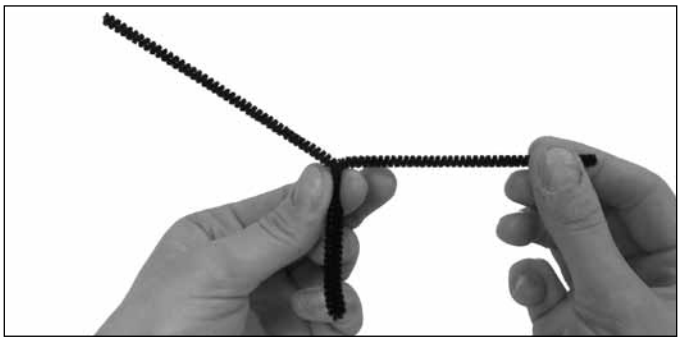
Activity 6

For each of the five structures on the opposite page, verify Euler's theorem: v + f - e = 2 , where *v* is the number of vertices , *f* is the number of faces, and *e* is the number of edges.

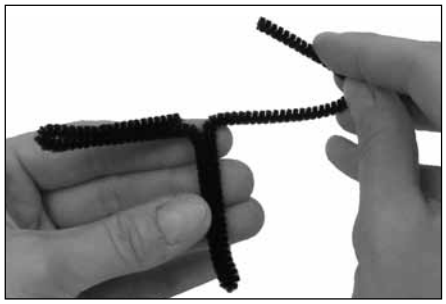
Basic Construction Techniques

Three-way Joint

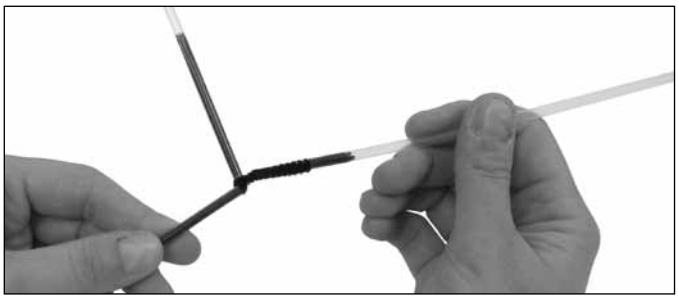
1. Fold the pipe cleaner in half. Hold the pipe cleaner about one-third of the way up from the folded end. Spread the two loose legs apart from each other about 90 degrees.



2. Twist the two loose legs together just above the place you are holding the pipe cleaner.
3. Fold the end of each loose leg toward the middle. This will form a T shape.

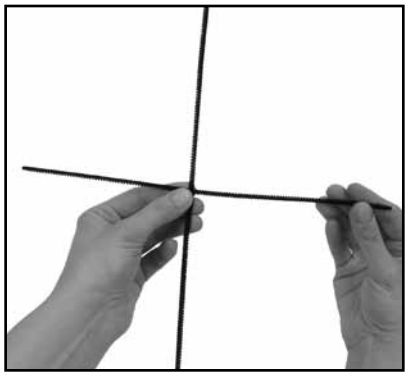


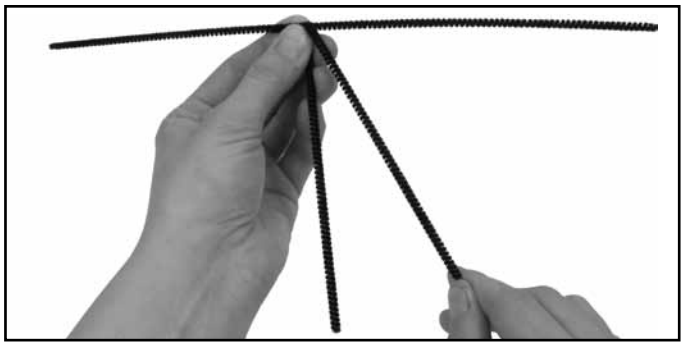
4. Place a straw on each of the three legs.



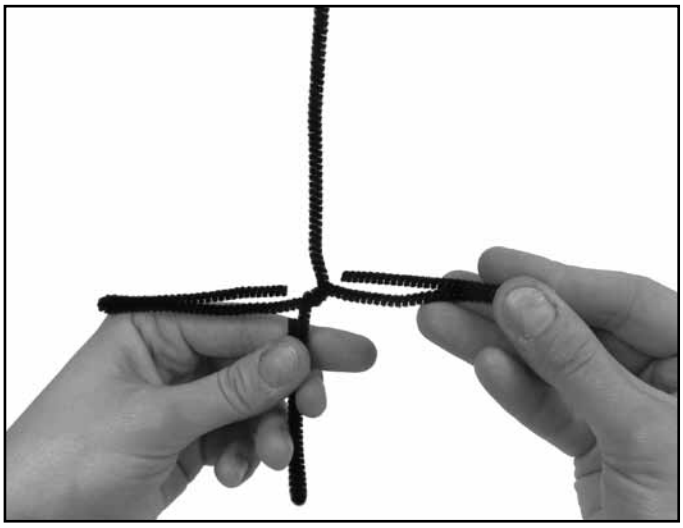
Four-way Joint

1. Cross two pipe cleaners in the middle to form a plus sign.
2. Twist the pipe cleaners together at their midpoints.





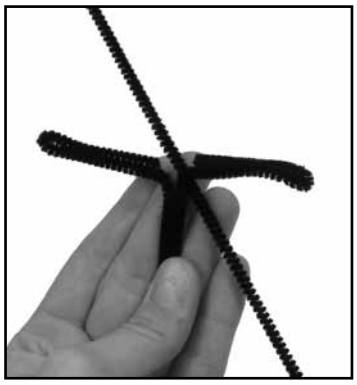
3. Bend each leg in half toward the center of the two joined pipe cleaners.

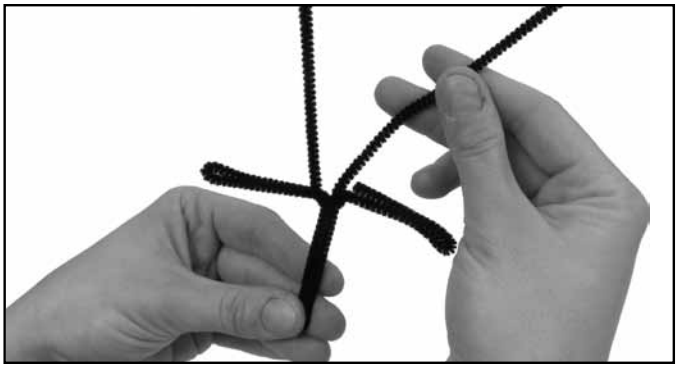


4. Place a straw on the end of each leg. Adjust the legs so they form the appropriate angles.

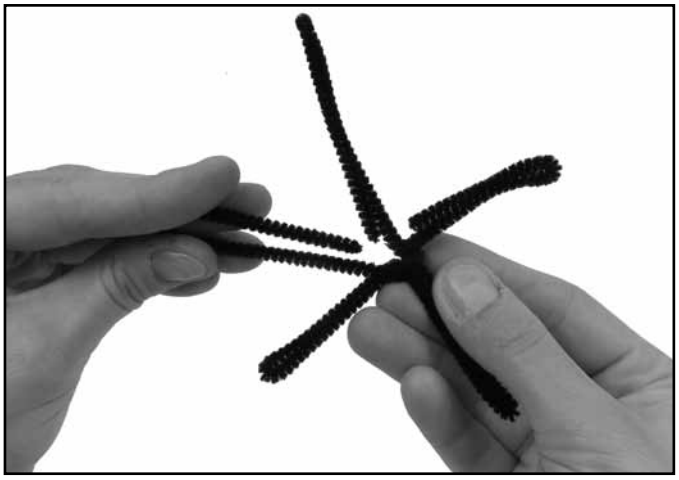
Five-way Joint

1. Fold a pipe cleaner to form a three-way joint.
2. Wrap a second pipe cleaner twice around the center of the three-way joint.





3. Fold the two arms in half so the ends meet at the center.



4. Place a straw on each arm and adjust them to form the appropriate angles.

Glossary

angle – a figure composed of two lines or rays with a common end point (the vertex of the angle)

area – the size of an enclosed region

edge – the set of points where the faces of a geometric solid intersect

face – a planar surface of a geometric solid

polyhedra – the plural of polyhedron, a three-dimensional figure with many faces

solid geometry – the branch of mathematics dealing with three-dimensional shapes

surface area – for a polyhedron, the sum of the area of all the faces

tetrahedron – a polyhedron with four triangular faces

three-dimensional (3-D) – having length, width, and depth

vertices – the plural of vertex; the set of all the points of intersection of a geometric solid's edges

volume – the amount of space occupied by a three-dimensional object

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