RAFT IDEAS

Topics: 3-Dimensional Shapes, Regular Solids, Geometry

Materials List
- ✓ Cardstock, old file folders or equivalent
- ✓ "Platonic Solid Shapes" (Die-cuts available at RAFT)
- ✓ Very small rubber bands 1 cm (1/2") long

This activity can be used to teach:
Common Core Math Standards:
- Shapes & Attributes (Geometry, Grade 2-8)
- Angles (Grade 4, Measurement and Data, 5-7)
- Volume (Grade 5, Measurement and Data, 3-5)
- Geometric construction & modeling (High School Geometry, Congruence 12; Modeling with Geometry, 1)
- Relationships between 2D and 3D objects (High School Geometry, Geometric Measurement and Dimension, 4)
- Problem Solving (Math Practices Grades 2-12)

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Making 3D Shapes
Investigating Polyhedron Models

By using Ellison die-cutting machine you can cut regular polygons with tabs on them out of folders. Your students can investigate polyhedra by assembling them with rubber bands or glue. They can put together regular polyhedra, semi-regular polyhedra and others. The models can also be used to display photographs.

Assembly
1. Choose which shape to construct.
2. Using the table below as a guide, die-cut the necessary polygons.
3. Construct the solid with the tabs out and secure the tab-edges together with rubber bands.

The Math Behind the Activity
Geometry has ancient roots. The Egyptians excelled at both 2-dimensional and 3-dimensional geometry; and the Greeks connected the solid shapes to both the natural and spiritual worlds. The most basic solid shapes to this day are termed the "Platonic and Archimedean Solids". Measurement and Geometry is one of the main strands in the California Math Standards. Students learn a bit more about shapes each year of school, starting with describing the faces of solid shapes, then adding measurement of edges, angles, volumes, and surface areas. This activity can be useful at many levels, depending on the needs and abilities of the students.

Web Resources (Visit www.raft.net/raft-idea?isid=208 for more resources!)
- Detailed descriptions of 3-dimensional shapes (including formulas), along with links to paper model plans, can be found at "Sacred Geometry": http://www.geometrycode.com/sg/polyhedra.shtml
- Teacher designed math courses – https://njctl.org/courses/math

Polyhedron	Triangles	Squares	Pentagons	Hexagons	Octagons
Tetrahedron	4				
Cube		6			
Octahedron	8				
Dodecahedron			12		
Icosahedron	20				
Truncated tetrahedron	4			4	
Truncated cube	8				6
Truncated octahedron		6		8	
Truncated icosahedron			12	20	
Cube octahedron	8	6			
Rhombicuboctahedron	8	18			
Great rhombicuboctahedron		12		8	6

The 5 Platonic Solids

Each of these solids are composed of identical regular polygons. The elements Plato ascribed to each of these are listed underneath the name of each solid. Hedron means surface (or in this context, polygon, and tetra means 4, hexa means 6, octa means 8, dodeca means 12 and icosa means 20; so these are 4, 6, 8, 12 and 20 polygon-sided objects, respectively. The cube and octahedron are duals, meaning that one can be created from the other by connecting the midpoints of all of the faces. The dodecahedron and icosahedron are also duals. The tetrahedron is a dual to itself.

Tetrahedron
fire

Cube
(Hexahedron)
earth

Octahedron
air

Dodecahedron
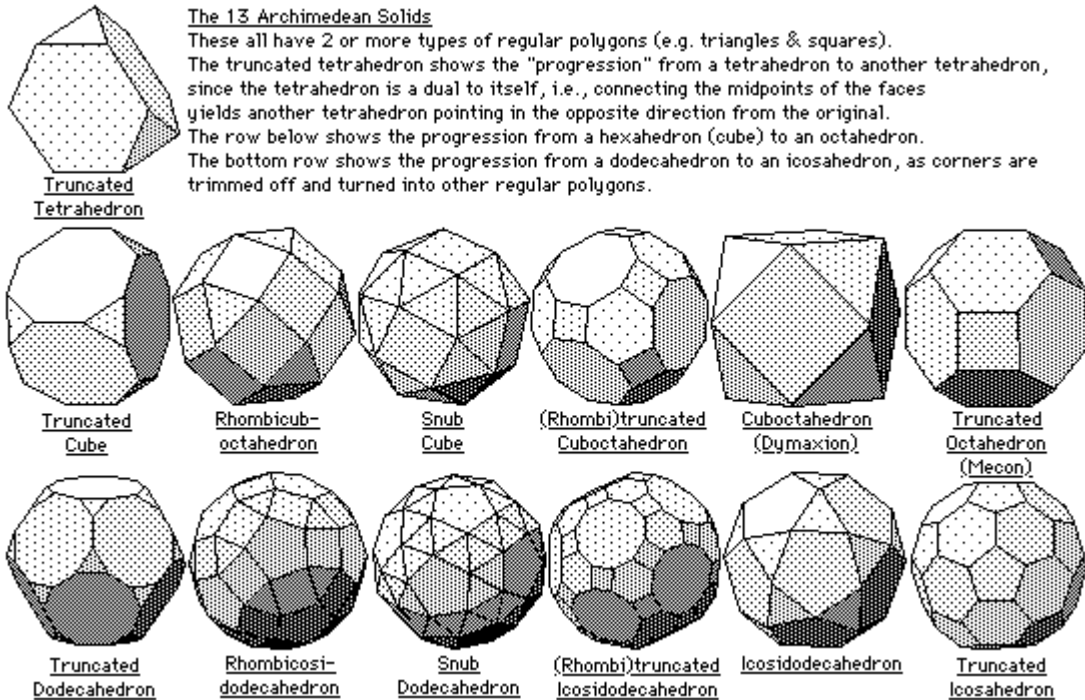spirit or ether

Icosahedron
water
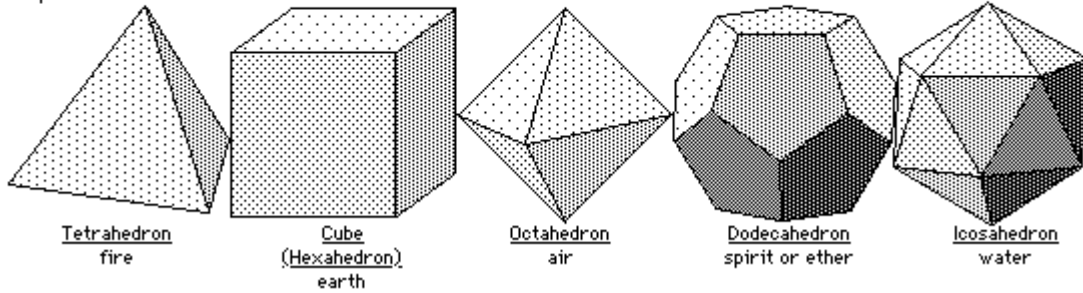
The 13 Archimedean Solids

These all have 2 or more types of regular polygons (e.g. triangles & squares).
The truncated tetrahedron shows the "progression" from a tetrahedron to another tetrahedron, since the tetrahedron is a dual to itself, i.e., connecting the midpoints of the faces yields another tetrahedron pointing in the opposite direction from the original.
The row below shows the progression from a hexahedron (cube) to an octahedron.
The bottom row shows the progression from a dodecahedron to an icosahedron, as corners are trimmed off and turned into other regular polygons.

Truncated
Tetrahedron

Truncated
Cube

Rhombicub-
octahedron

Snub
Cube

(Rhombi)truncated
Cuboctahedron

Cuboctahedron
(Dymaxion)

Truncated
Octahedron
(Mecon)

Truncated
Dodecahedron

Rhombicosi-
dodecahedron

Snub
Dodecahedron

(Rhombi)truncated
Icosidodecahedron

Icosidodecahedron

Truncated
Icosahedron

Images and descriptions on this page are from the "Sacred Geometry" website:
http://www.geometrycode.com/sg/polyhedra.shtml