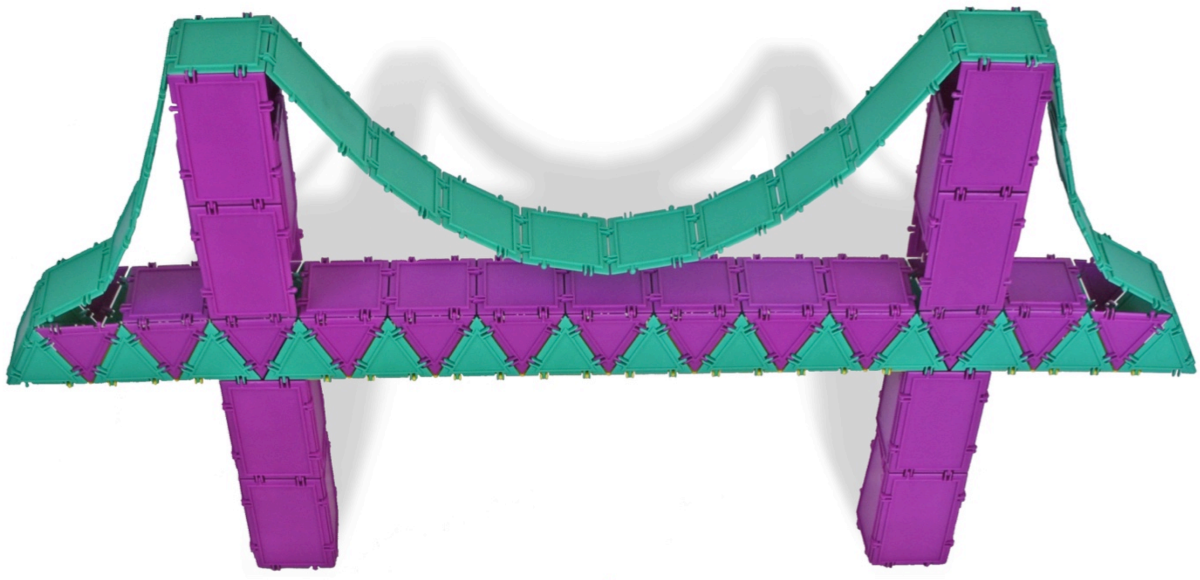

Geometiles®

10 Sample Activities with the Jumbo Set

www.geometiles.com

U.S. Patent No. 9498735

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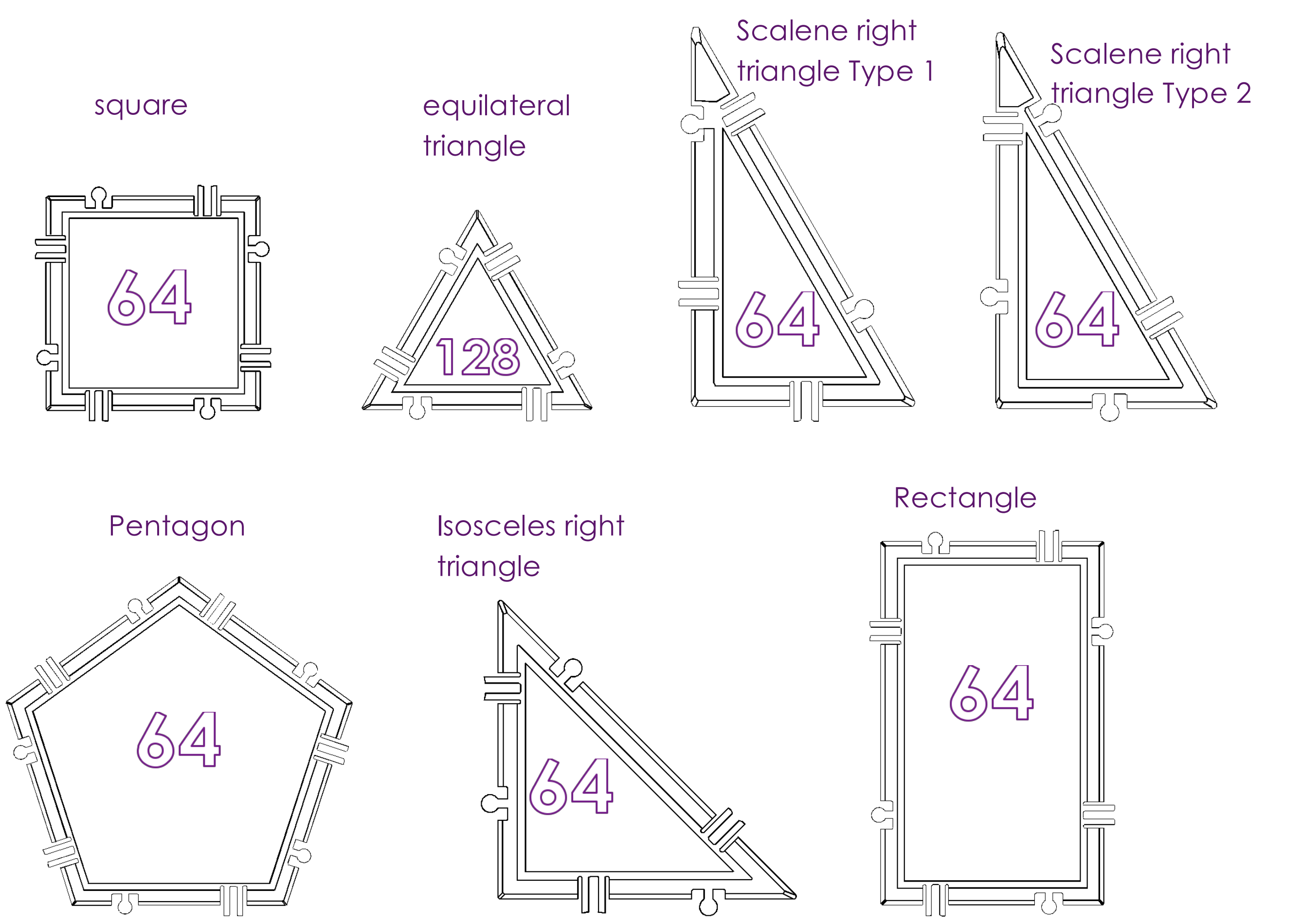
Welcome to Geometiles®!

Here are some ideas of what you can build with your Jumbo set. These are just a few of the many objects you can build --use them as a springboard for your imagination! Hints and instructions for making selected objects are in the back of this booklet.

Materials: This booklet is based on one Jumbo set of Geometiles® interlocking tile.



The number of pieces you need for each activity will be listed along with the description of that activity. Colors may vary.

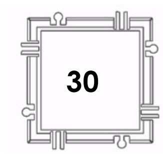
Multiple activity levels

Some of the activities can be done at different difficulty levels depending on your students' age and readiness. Feel free to do each activity up to a level that is comfortable for your class.

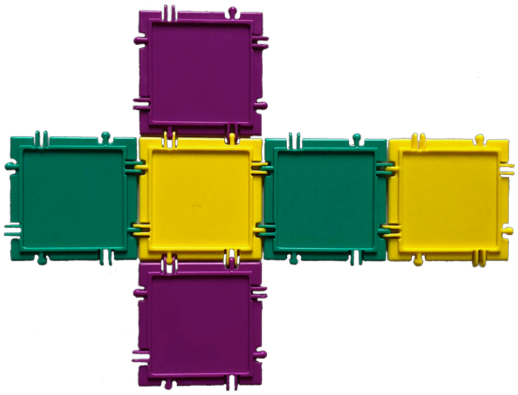
1. Family of cubes

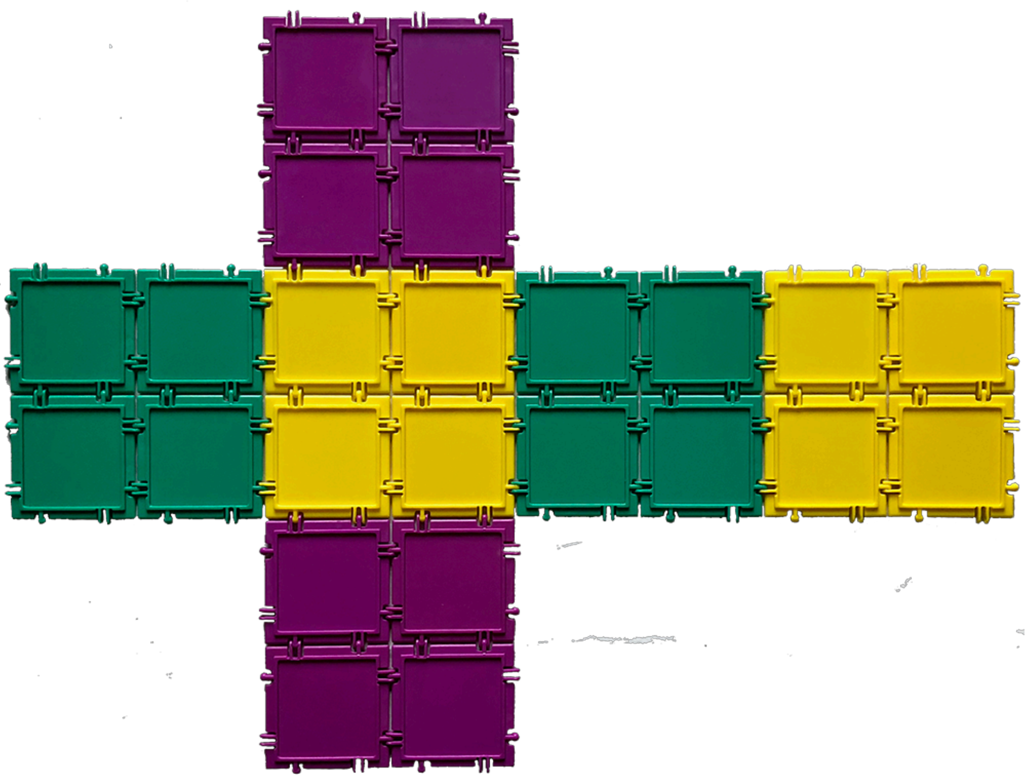
Level A

Materials needed:

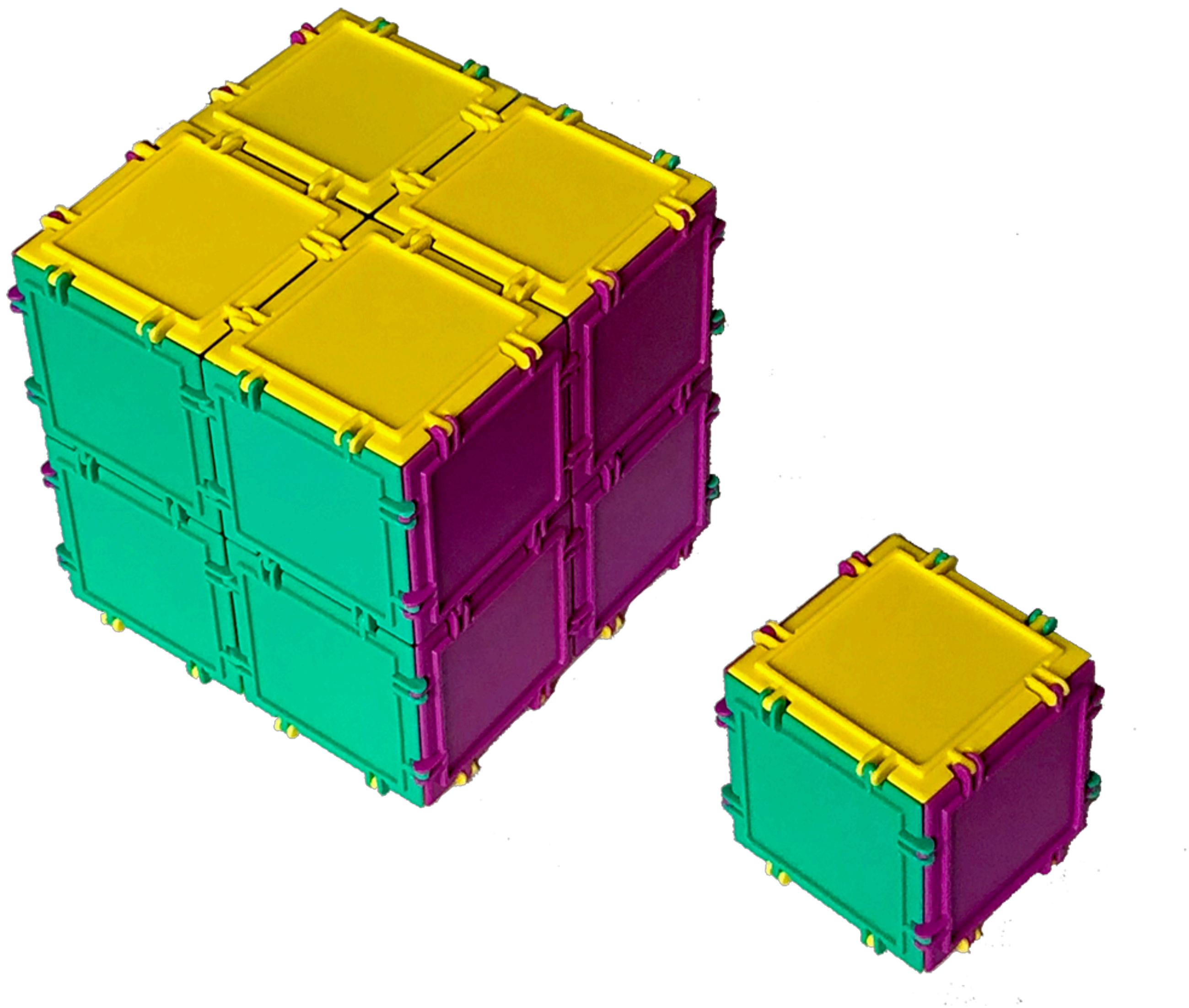


Start out with the smallest cube. Then build a cube with side lengths twice those of the original cube. Make the nets first:





Now fold:

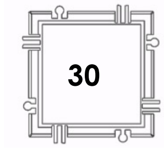


Note that the side of the large cube is twice the side of the small cube. What can you say about the relationships of the surface area (i.e. the number of squares used in building) the large and the small cube?

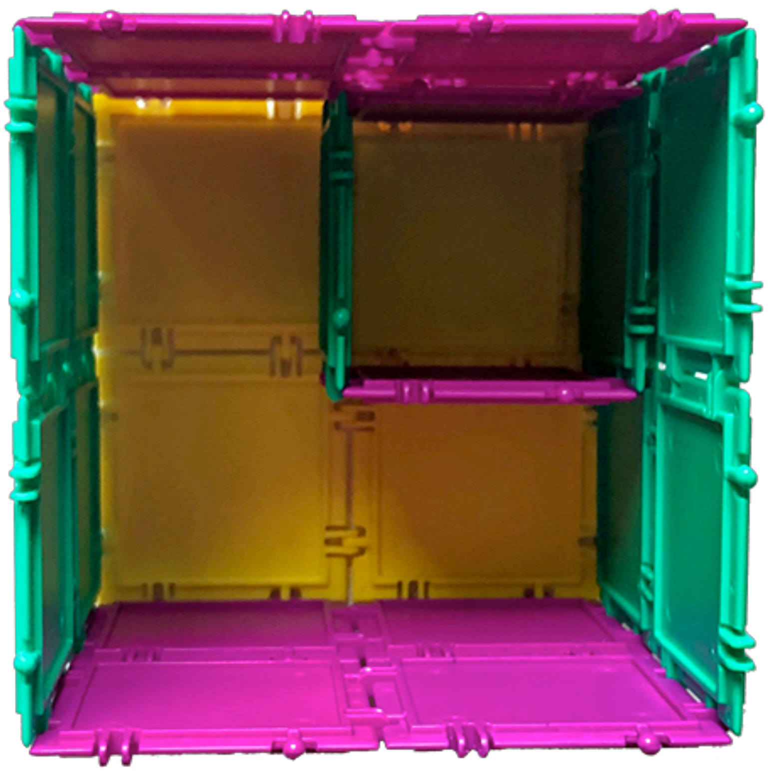
Go back to the drawing of the nets. We find that the small cube is made of 6 squares, but the large cube is made of 24 squares. So when the length gets doubled, the area gets quadrupled.

Level B

Materials needed:



The large cube is how many times the volume of the small cube? In other words, how many small cubes can you fit inside a large cube?



You can see from the above picture that **8 small cubes fit inside a large cube**: 4 on the bottom and 4 on the top.

Moral of the story: when you double the length, the surface area gets multiplied by a factor of $2 \times 2 = 4$, and the volume gets multiplied by a factor of $2 \times 2 \times 2 = 8$. So when we say "the large cube is twice the size of the small cube", we have to be clear whether we are talking about length, area, or volume.

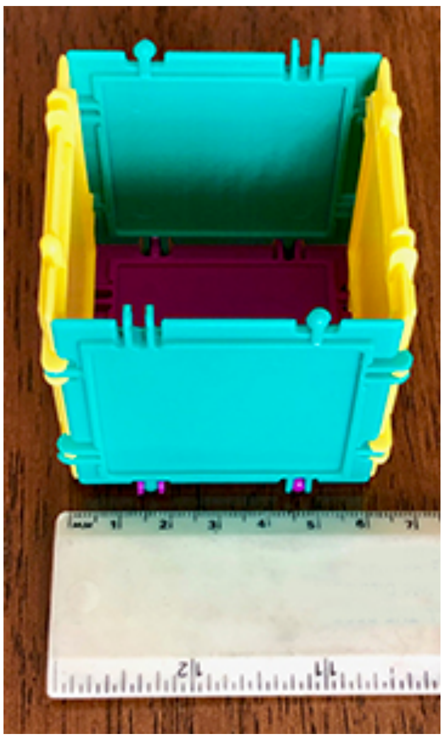
Level C

For students in grade 3 and higher, you can continue this discussion with actual volume measurements, per http://www.corestandards.org/Math/Content/3/MD. CCCS.Math.Content

Students can calculate the volume of the cubes by using the formula

Volume = $(\text{side length})^3$

Measure the side lengths of the cubes with a metric ruler.



The side length of the small cube is about 6cm, so the volume is about $(6\text{ cm})^3 = 216\text{ cm}^3$. The side length of the large cube is about 12 cm, so the volume is about $(12\text{ cm})^3 = 1728\text{ cm}^3$. Note that $216 \times 8 = 1728$, as we expected. This result makes sense, since $1\text{ cm}^3 = 1\text{ml}$, we can measure the volumes in a beaker and see if we are in the ballpark.

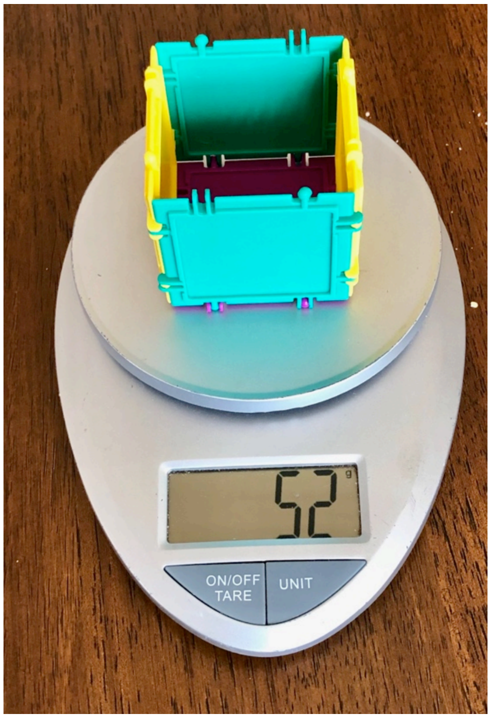
We can go further and measure the volume of rice in the cubes and see how close it is to our computations. Short grain rice works best for this.

The volume of rice in the small cube is about 180 cm³, which is the same as 180 ml.

The volume of rice in the large cube is 1liter + 700 ml= 1700 ml.

The volume of the rice in the small cube is measured to be about 180 ml, which is the same as 180 cm^3. This is smaller than the expected value of 216 cm^3. This is probably due to the error in our measurement. We did not account for the thickness of the walls of the box when we calculated the theoretical volume. The volume of the rice in the large cube is 1700 ml. This is quite close to the value we calculated earlier of 1728 cm^3.

Finally, we can weigh the cubes to compare their volumes via weight. We will use brown rice. You can use another grain or small beans. Remember to subtract the weight of the empty cube!



Weight of rice in small cube: 216 g- 52 g=164 g.

Now measure the weight of rice in the large cube:

The weight of rice in the large cube is 1649 g- 208 g= 1441 g.

Now check how many times the weight of the rice in the small cube this is:

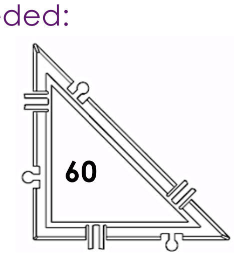
$$1441 \div 164 \cong 8.79$$

The expected value is 8. So we are in the ballpark.

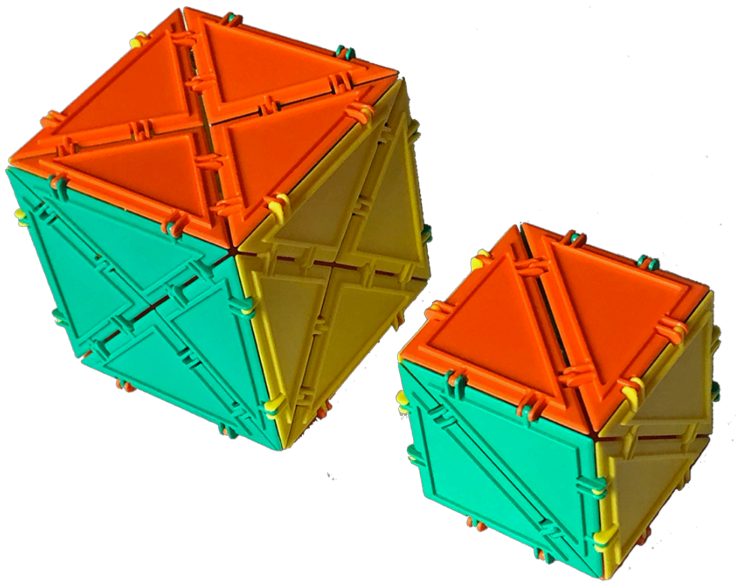
Science extension: did you know that 1 ml of water weighs about 1 gram? What can you say about the density of rice compared to the density of water?

Level D

Materials needed:



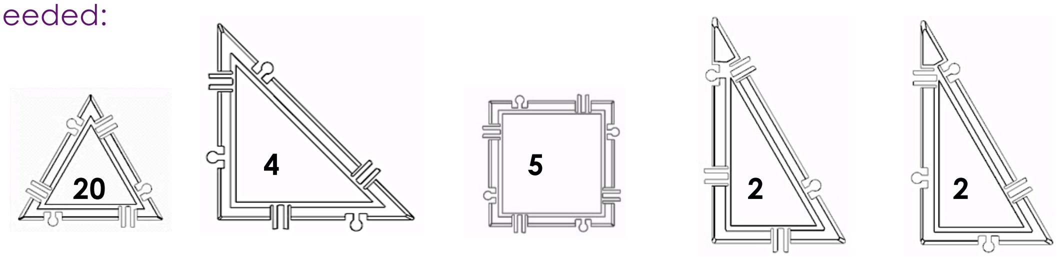
Repeat activities in Levels A-C with the following cubes.



The ratio of the sides of the cubes is not an integer this time, so this is for students who have mastered decimals.

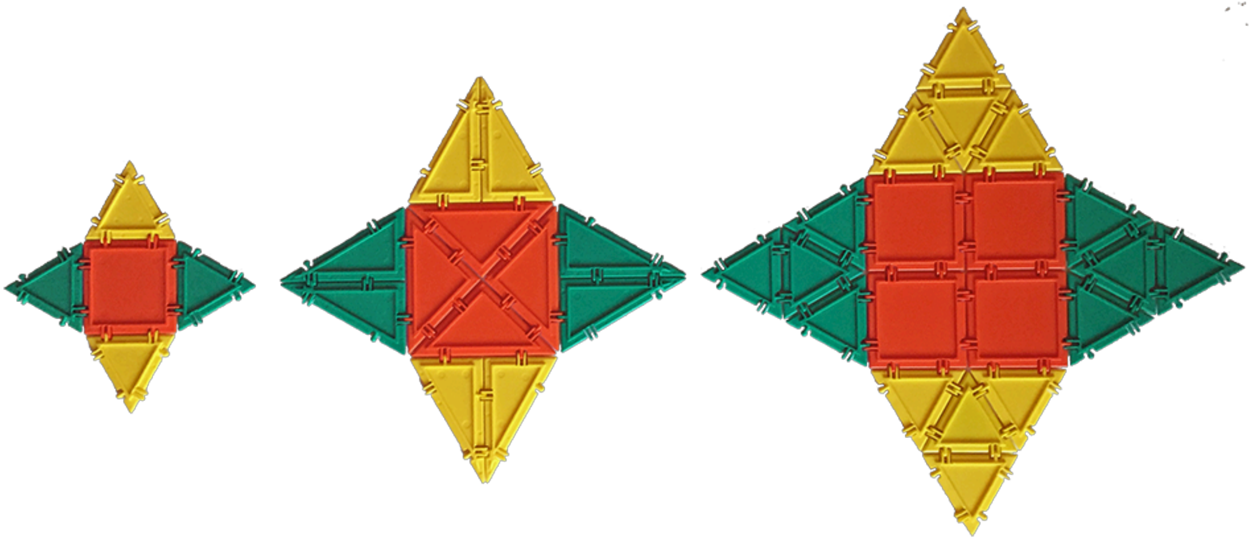
2. Family of Pyramids

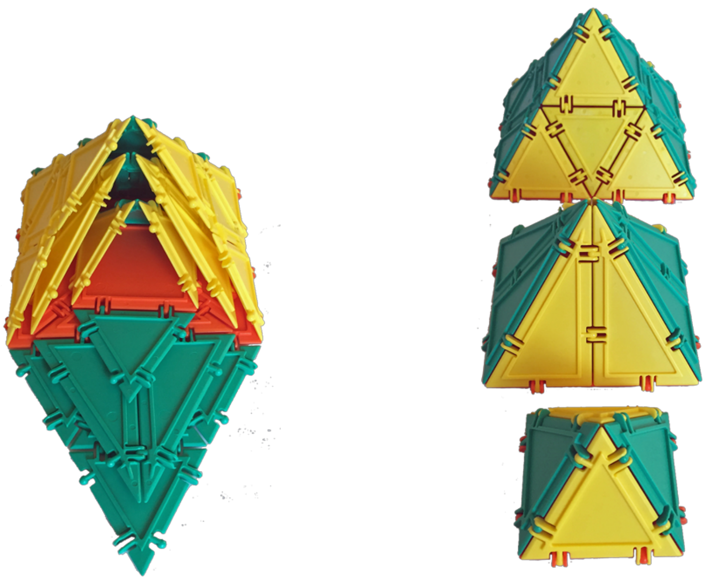
Materials needed:



Level A

Have students build this family of square pyramids:





Level B

Look at the smallest and largest pyramid. Notice that the largest pyramid has side lengths that are twice those of the smallest one. Now look at the surface areas of the largest and smallest pyramid. The surface area of the smallest pyramid is the area of 1 square and 4 triangles, while the surface area of the largest pyramid is the area of 4 squares and 16 triangles. We see that, just as in the case of the cubes, when we scale lengths by a factor of 2, the surface area goes up by a factor of 4.

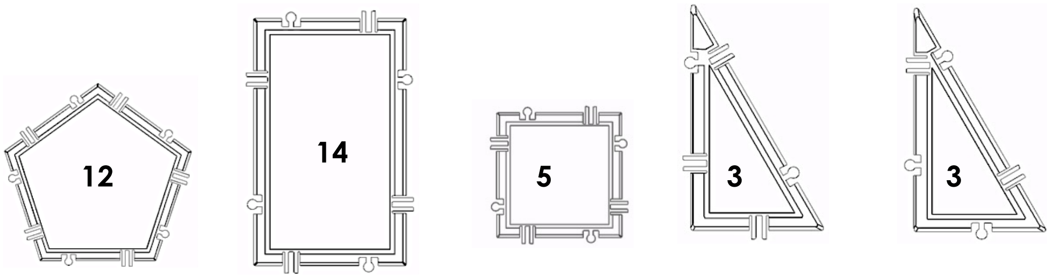
Level C

Investigate the volumes of the three pyramids using the formula for the volume of a pyramid:

$$V = \frac{1}{3}(area\ of\ base)(height).$$

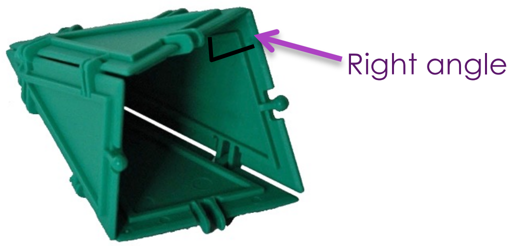
3. Flower

Materials needed:



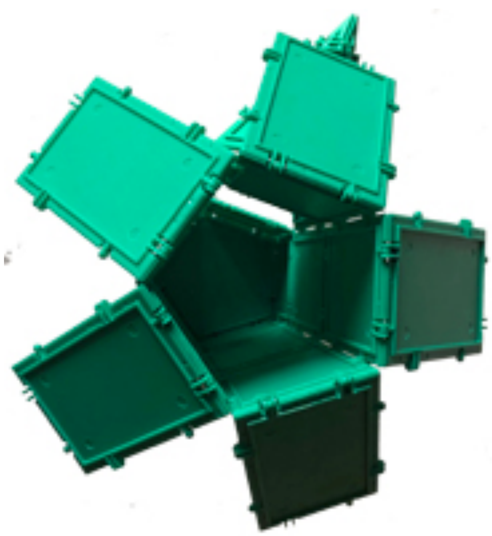
You can challenge the students to construct a flower, or have them copy this one:

Hint for making leaf for flower: first make the leaf using 4 scalene triangles.



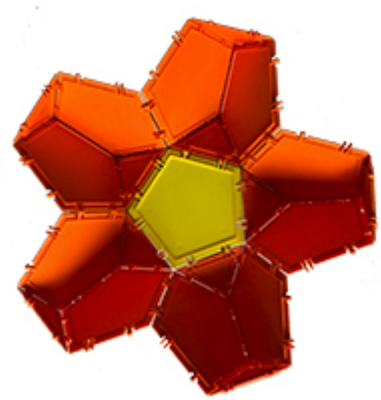
Leaf and stem.

Attach leaf

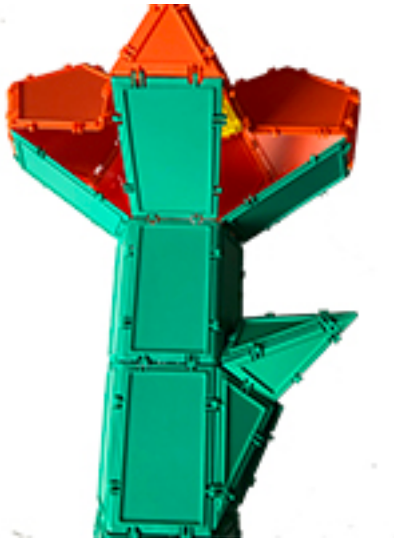


The rectangles attach to the flower

Flower, view from above



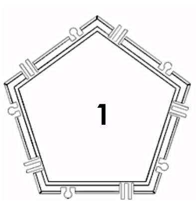
Flower, view from below.

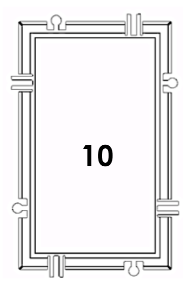


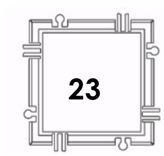
View of flower from the bottom

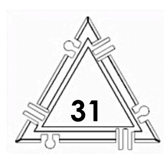
4. Mini Saguaro

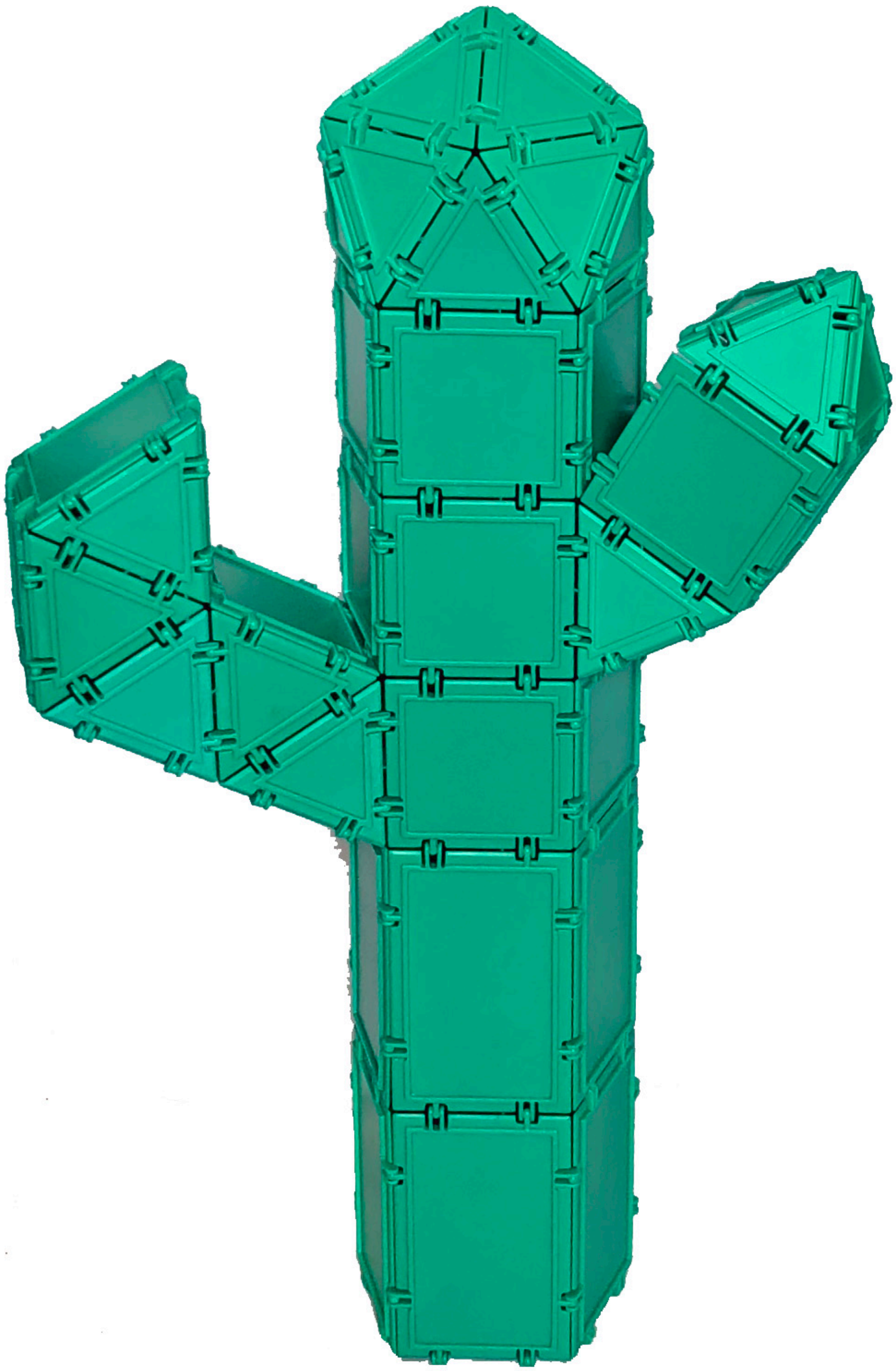
Materials needed:





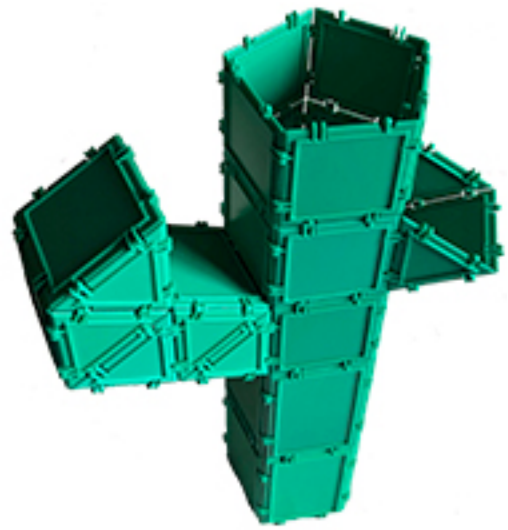




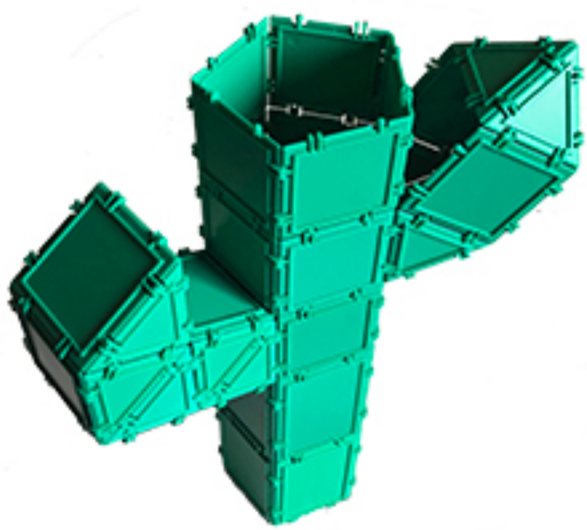


Hints for construction of the saguaro

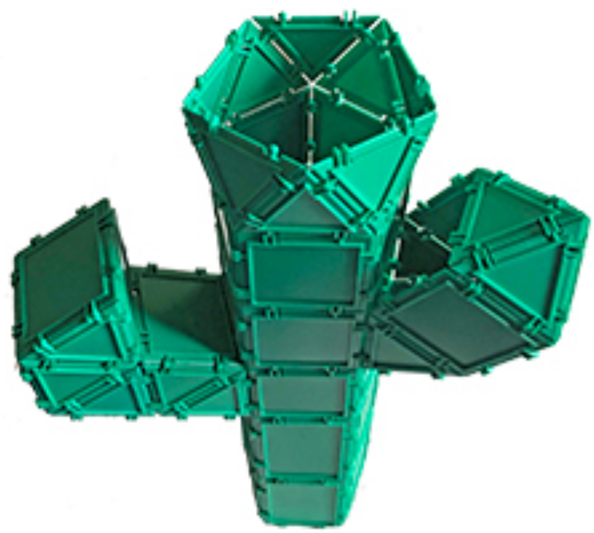
Starting lower branch



Lower branch completed, start of upper branch



Both branches completed

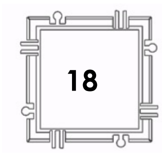


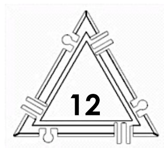
Preparing to attach top

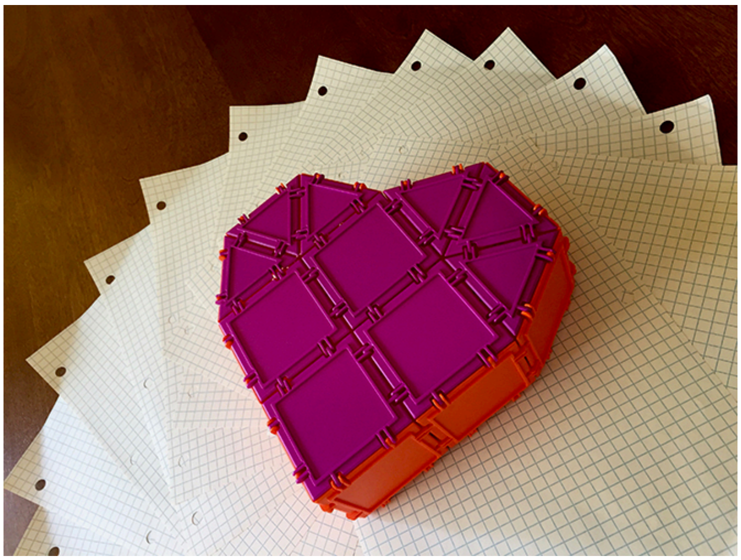
Attaching the very top

5. Heart

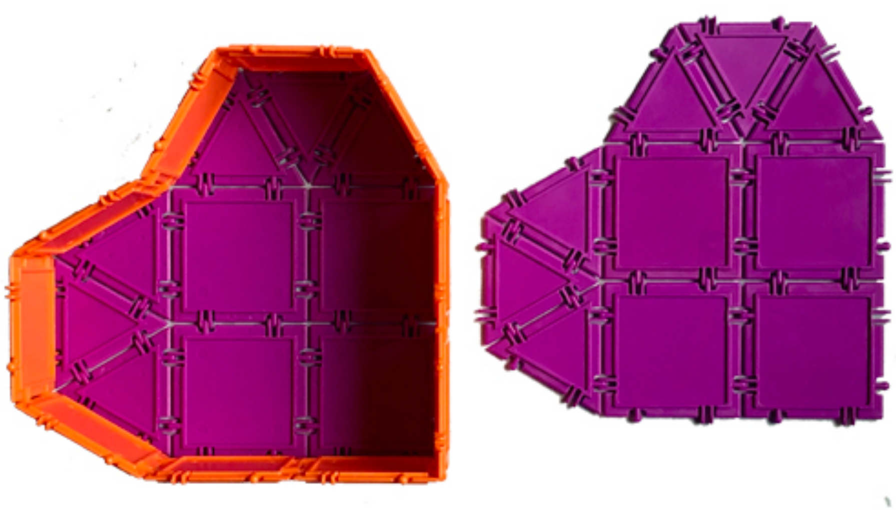
Materials needed:





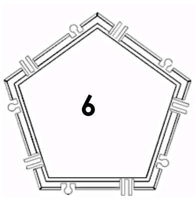


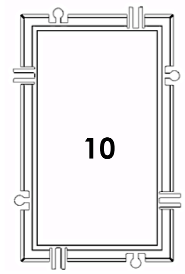
Build the top and bottom heart, then connect.

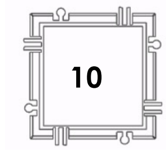


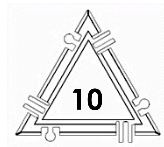
6. Building with dome roof

Materials needed:





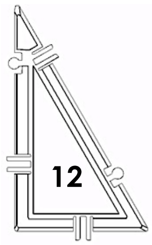


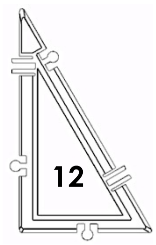


You can replace the owl with your own character.

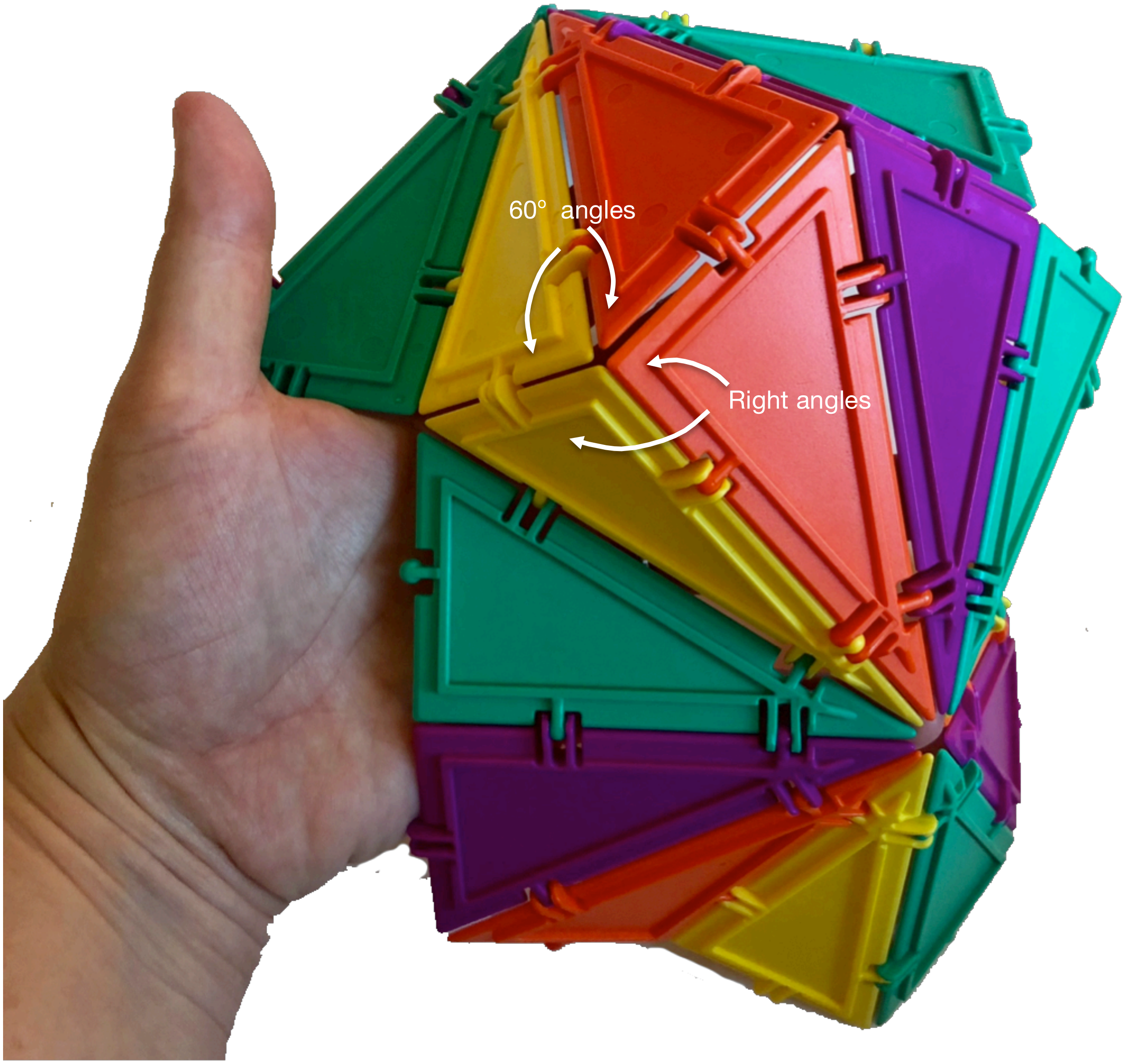
7. Spinner

Materials needed:





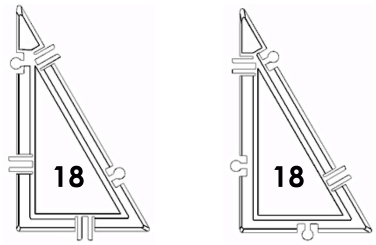

Note how the parts
are aligned



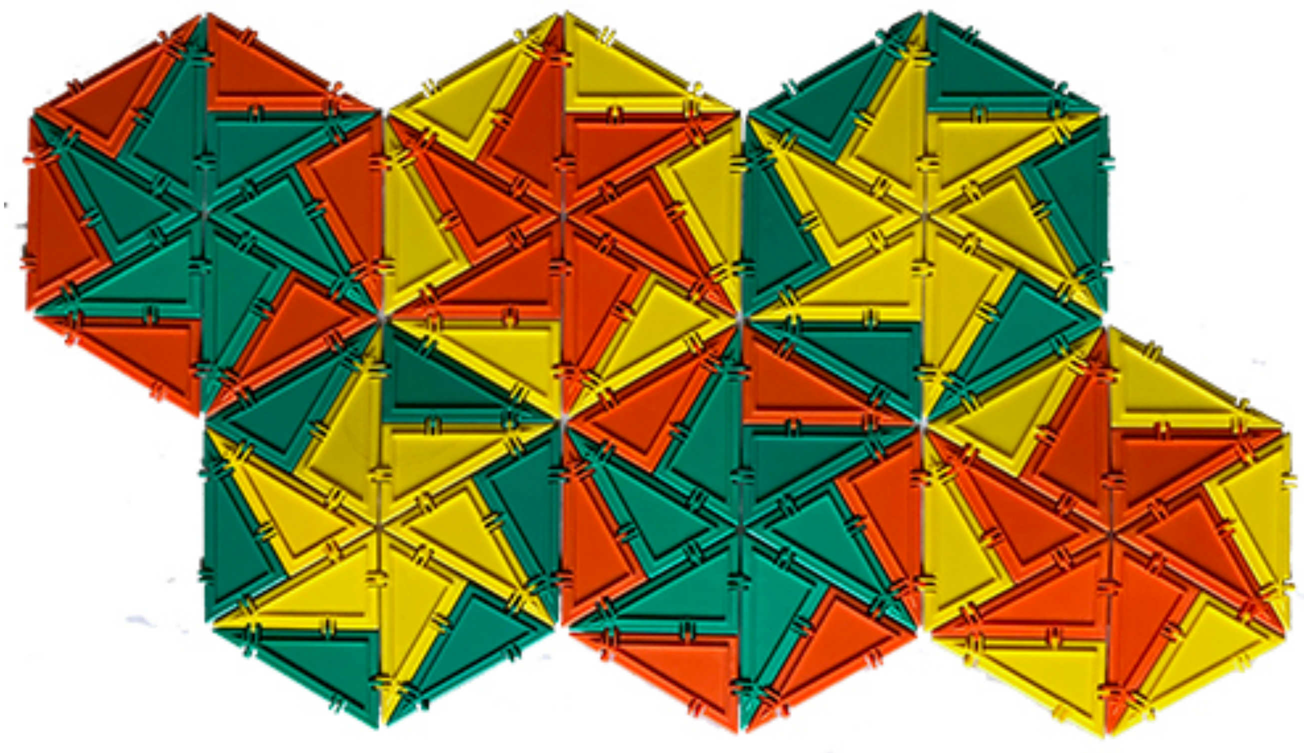
Start snapping them together along the perimeter

8. Tessellation

Materials needed:



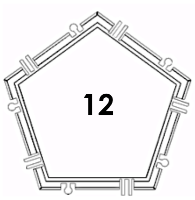
For this activity, choose colors thoughtfully to get an aesthetically pleasing design.

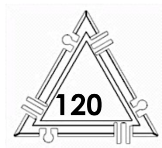


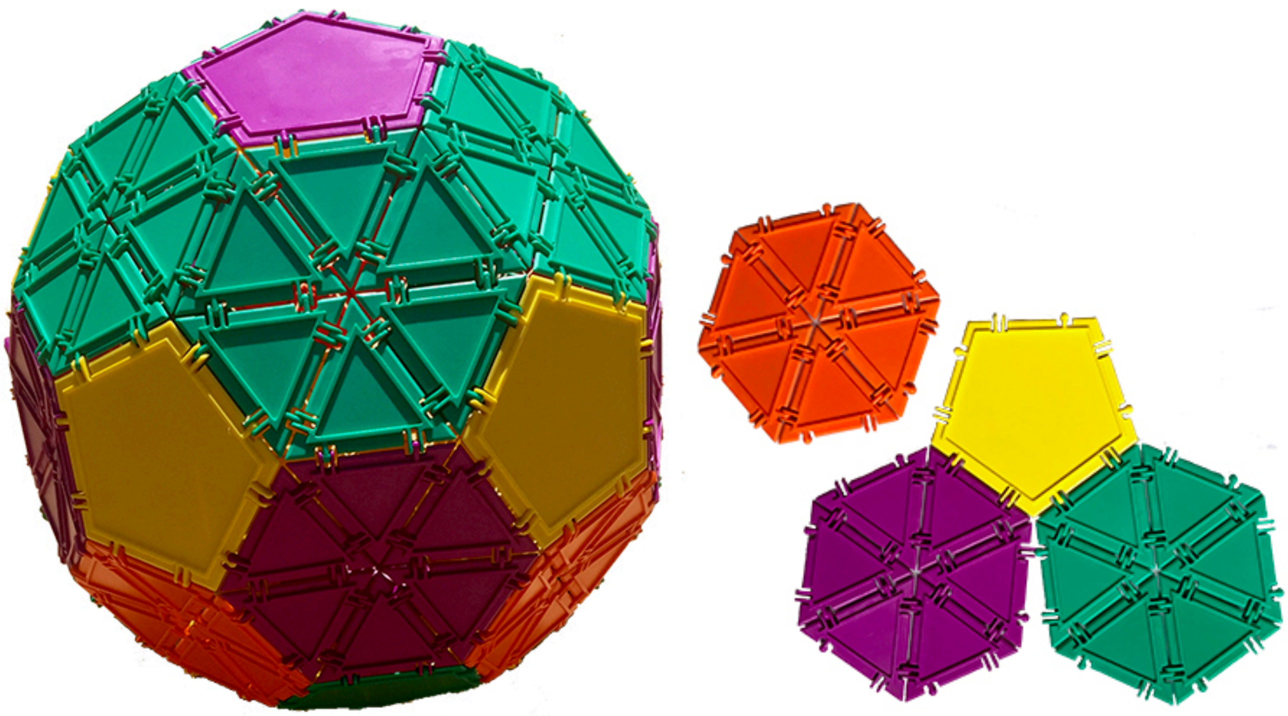
Assemble each hexagon, then join the hexagons.

9. Soccer Ball

Materials needed:



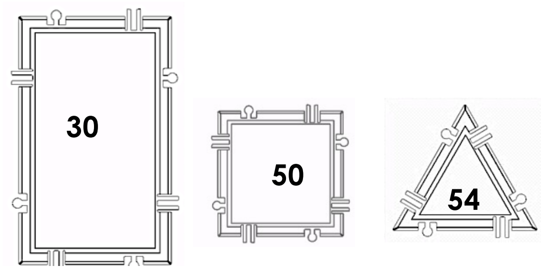


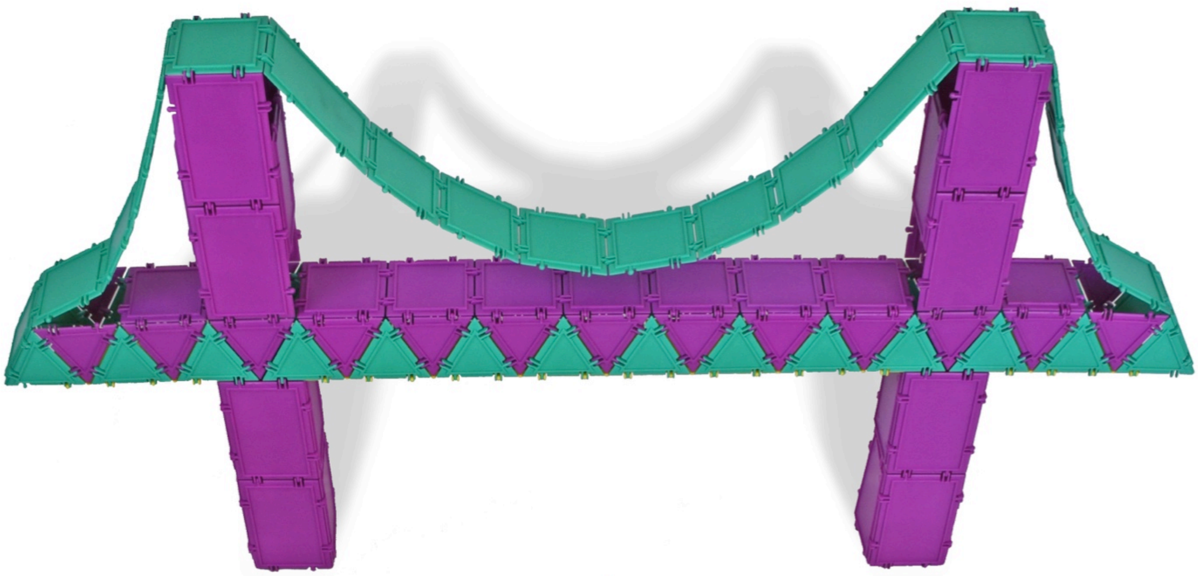


As in a real soccer ball, each pentagon is surrounded by 5 hexagons; each hexagon is surrounded by 3 pentagons and 3 hexagons, which are alternating. Make all the 20 hexagons ahead of time. Then assemble.

10. Bridge

Materials needed:

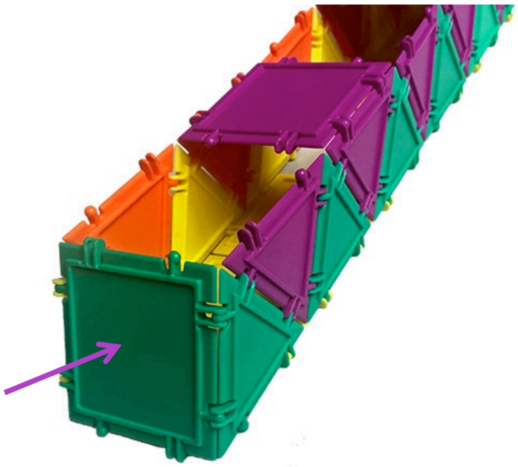




Step 1: Body of the bridge. The holes are for the poles.

Step 2: Fold it on itself and snap together

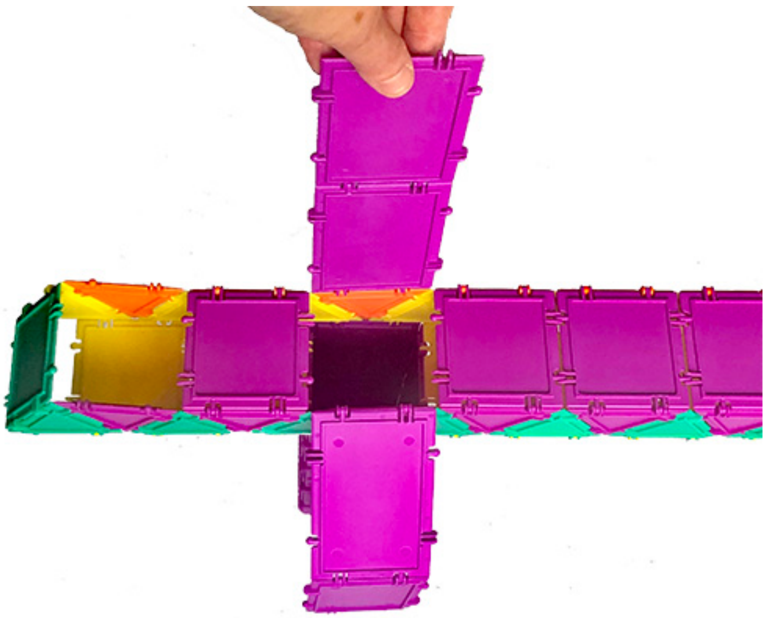
Step 3: close the ends with squares

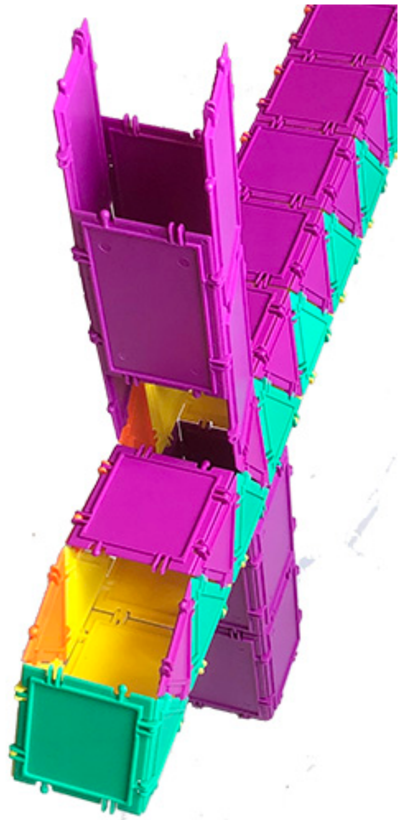


Step 4: Attach legs.

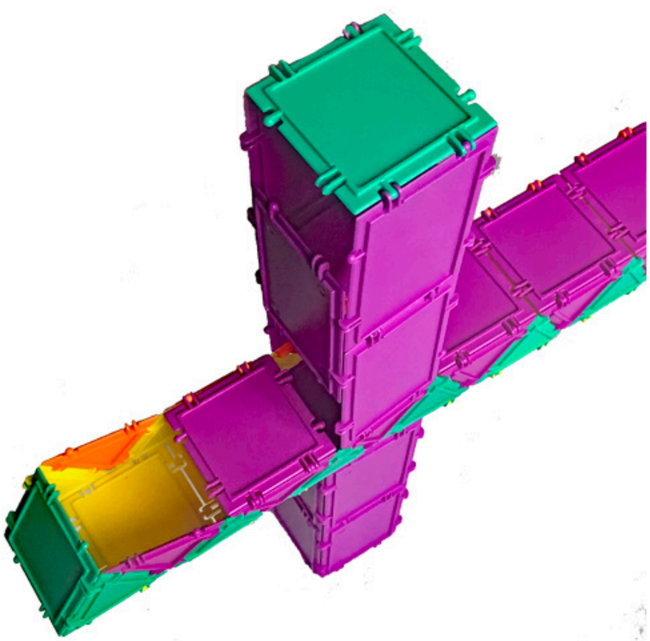
Step 5: Now the bridge can stand on its legs.

Step 6: Attach the poles as shown.

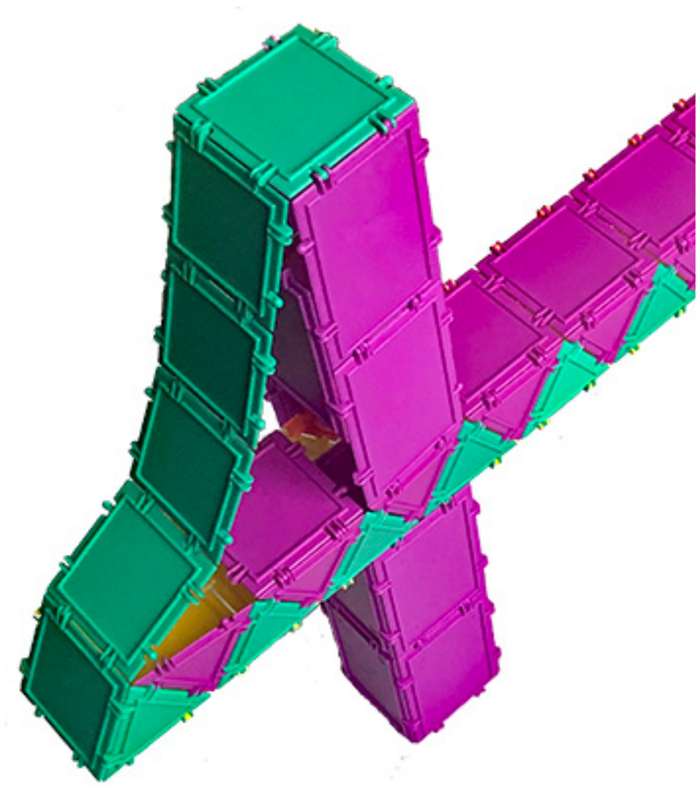




Step 7: Cap off the poles at the top; attach the "suspension cable".



Step 8: Attach the "suspension cable"



Now come up with your own bridge design!

