Pattern: Kaleidocycle

Kaleidocycles are turning toys that combine ideas from origami and engineering. They are built from hinged pairs of geometric forms called Tetrahedra, or Tetras.

The Primary Cycle

A single Tetrahedron is built from four Triangles. Below left, you can see a unit made of two hinged Tetrahedra – it has eight Triangles. This powerful double unit is a building block of many different kinds of chains and linkages found in nature, engineering, and architecture.

Three sets of hinged Tetras joined together make a special sort of Machine; a turning toy called a Kaleidocycle that can rotate inward or outward, showing as many as eight different designs.

1 pair of hinged Tetrahedra x 3 = a turning Kaleidocycle

Understanding Hex Faces

Eight different Hex Faces can be displayed on one 24-Triangle Kaleidocycle.

These photos are all of the same piece, and they show the range of Hex Faces our Primary Cycle can show. Hex Faces are the groupings of six Triangles that come and go as the Cycle is turned.

Kaleidocycles turn both inward and outward, so each of the four Triangle designs have the potential to show two different faces. As the Triangles of our Diamonds pattern (left) are the same in each section, or Quadrant, our Cycle only has seven faces.

If your Triangles are unique in each of their three Quadrants, then the Hex Face that they make when turned in each direction is a different picture.

You can see the two faces of each of our other three Triangle designs below.
There are a few simple guidelines for planning the arrangement of Triangle faces into Hex Faces.

In the pattern for the Primary Cycle, the Triangle faces of the red-edged Tetras mirror those of the blue-edged Tetras, and the Hinges (which you see in green and yellow here) and the faces shift positions as the Cycle is rotated.

Turning a Kaleidocycle is mesmerizing, especially if it moves smoothly.

Hinges don't come into play until late in the making, but it's important to consider them when designing your faces if you want a certain outcome. They can be visually powerful, as in these Hex Faces, or nearly invisible.

Center-Radiant Faces

For a Center-Radiant Hex Face, place the Hinge on one side of the Triangle. If the Hinge is at the bottom/center, the points will never meet at the center of the face like those in the Dots Hex Face (below).

Rotationally-Symmetrical Faces

Triangles with patterns that are rotationally symmetrical (like our Diamonds Face, right) don't care on which side the Hinges go; the Hex Face they make will look the same no matter which way the Cycle is turned or flipped.
Our Primary Cycle Colourway

The beads of our Primary Cycle are colour-coded for function.

**Our Colours**

*Miyuki Delica or Rocaille #*

- 010  Adam-12
- 351  Fleet Week
- 791  Kandi
- 651  Yellow Sun
- 724  Gojira
- 726  All Aboard
- 15°  Mercury

Black and white beads make up the Triangle Faces of our Primary Cycle.

Red and blue beads form the Edge Rounds; shared rounds where the Triangles are Zipped together; first into linked strips of four, and then closed into Tetras.

Each Tetra can be built as a Strip of four Triangles, one of each design.

The Triangles of the red-edged Strips must mirror those of the blue-edged Strips.

To build the six Strips that make the six Tetras of the Cycle, you will add Edge Beads and Triangle Tips, as you Zip four different Triangles together. Arrange them as shown on the this page – to make Mirror Tetrahedra, the Triangle Faces all need to be placed correctly.

Using the Stitch-In-The-Ditch method (see Basics, page xx) in Step 3, you will add the green and yellow Hinge Beads to the designated two Hinge Rows on each Strip.

Making Tetras from Strips
Step 1: Make 24 Flat Peyote Triangles

Bead 6 each of 4 designs.

Each Triangle is 9 beads per side

1

2

3

4

To learn to bead a Flat Peyote Triangle, see Basics, page xx

Use whatever thread you are comfortable with for this project! Most of our team uses fiber-like thread, such as Nymo B from the cone. See our Basics Section for more.

After finishing each Triangle, neatly weave in the starting tail. Leave your working tails attached, as you will continue working with them as you grow your connections.

Step 2: Understanding Edges

Triangles to Strips

We set up the Strips so that when the four Triangles are Zipped into one Tetra, the Edge Beads needed to connect the sides are already in place. Each side has a shared Edge, and shared Edge Beads.

Three Strips will have red Edge Beads, and three will have blue Edge Beads.

Be sure to get the orientation of each Triangle correct – there are as many as six possible ways to attach each Triangle.

(for help with Zipping peyote stitch, see the Basics section.)

When joining the triangles together, add the silver rocailles at each tip, and the red or blue Edge Beads, and then Zip them together with your thread.

They should fit together neatly. If you’ve never Zipped peyote stitch up, it’s lots of fun. See our Basics Section, if you need help with this. A useful tip is to keep the thread loose as you are Zipping, and then snug it up after you’ve passed your needle through the beads.
Step 3: Hinges

Hinge-Rows are an engineering addition to the Kaleidocycle, made Stitch-in-the-Ditch style on top of two designated Edge joins in each Strip.

This yellow run of beads is half of a Hinge. (It will be joined to the other half with a Hinge Pin of 15° rocailles when its time to join the Tetras into sets of two.)

Step 4: Zipping Strips Into Tetras

After your Hinge Beads are added, it’s time to Zip the six Strips into Tetras.

The Tetras are fun to fold up and finish, especially when they go from floppy to structurally sound.

This Step will result in six finished Tetras, which will make three sets of Mirror Tetrahedra. Join the three sets together in the next Step.
Step 5: Make Pairs of Mirror Tetras

We use small 15° round beads to make neat Hinge Pins for the Mirror Tetra pairs.

Rather than zipping one Tetra to the other with a standard peyote-stitched row, try lacing them together:

Add one size 15° rocaille (you can substitute 11° cylinder beads if you prefer) as you pass between alternating Half-Hinges. When you reach the end, string one size 15°, then pass up through the skipped Hinge Beads and the 15° between them; add a 15° to the other end and weave through the beads again to reinforce. Secure thread and trim.

Step 6: Complete the Joins

Continue to join the yellow Hinge Beads to the yellow and the green to the green, using 15° silver rocailles.

When all three of your Mirror Tetra Sets are connected, you have a finished Kaleidocycle!
This is a gorgeous Folding Net of beads sewn together without Hinges, origami-style. 15° rocailles were used to connect all 24 Triangles. The little rocailles not only bring the sparkle, but they help the Cycle move smoothly.

A Kaleidocycle built from a net like this makes a machine that feels a bit more like a hacky-sack than an engineering marvel, but it’s really fun to build, and to see it scrunch up into a chain of Tetrahedra as you Zip.

Studying this Net will tell you a lot about the arrangement of both the Triangles and the Hex Faces. You can see the diamond shapes that the Mirror Tetra faces make so easily, and it’s a different view from the Tetras.

It’s an entertaining and enlightening experience, if you have the time, to make the 24 Triangles of a Kaleidocycle and then arrange them both ways, into a Folding Net and into a chain of Tetras, and see what you prefer.

We show a variety of pieces made both ways in our gallery.