

## Thread NSTA Physics of Kaleidoscopes

-----Original Message-----

From: Erin Taylor

Sent: Saturday, July 07, 2012 7:13 PM

To: physics@list.nsta.org

Subject: Physics of Kaleidoscopes

Hello physicists,

I'm in a 6-week workshop STEM this summer and am helping write a STEM lesson involving kaleidoscopes.

Since I'm the physics "expert" of the group- I'm in charge of finding all the science possibilities for this lesson... It's aimed at Jr. High students (I teach high school, new to Physics las year). I know it's a broad topic, and was hoping to expand the lesson past junior high (selfishly, for my own students). STEM lessons are great in that they are easy to differentiate.

I request your input on possible learning points.

So far I have (based off the new Ohio/National science standards drafts):

- wavelength and absorption of various wavelengths of light by different colors.
- Optics/reflection/refraction
- Energy conversions and transport (radiation, convection, and conduction on 2 sides of kaleidoscoped windows).

I am sure I'm missing some-

Ideas? (off lost replies please. U'll compile and send a condensed list to anyone who wants it)

So far

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I have students take pictures of each other via cell phones (aperature is too big for the Kalei).

Then take the jpg file and print on iron-on paper (EBay is a source or Staples). Then have them each bring in a T-shirt and iron on the six/8/10 sided pictures! Great fun.

Have them make their own kalie's and figure out how many sides you get and WHY.

If you want to get into chemistry you can melt your own beads or glass for viewing and predict what you will see.

Bob Gannon

SciChair SEHS Oakland

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For the "optics" part,

- difference(s) between using an "objective lens" and "objects"
- difference(s) between using "objective lenses" of different focal lengths
- difference(s) between using an "eyepiece lens" and plane glass (or just a hole)
- difference(s) between using "eyepiece lenses" of different focal lengths
- difference(s) between using mirrors of different lengths (i.e., distance between the two ends of the kalei)
- difference(s) between using glass mirrors (i.e., reflect from back of glass) and surfaces plated with reflective material

For those who are more "mathematical",

- the number (or pattern) of images as a function of the size of the angle between the (two) inclined mirrors
- difference(s) between cases where 360 divided by incline angle is/is not a whole number
- two-mirror kalei vs three-mirror (or n-mirror,  $n \geq 2$ )

For each of the above, students can first try to "predict", then check it out experimentally, then try to "explain" and "generalize".

Herbert Tsoi

Hong Kong

Where can you buy supplies for kaleidoscopes? Is there a way to buy local (and cheap) or do you need something special?

I'd be interested in any lessons you have and/or develop for high school physics students.

Nanette

I bought a Chinese kaleidoscope at the Discovery Center, Times Square, NYC, in conjunction with the Chinese Terracotta Warrior exhibit. It was not expensive and comes apart easily. You might use it as a template for others. I am sure there are other sources as well.

Bob Drake

I have built Pringle's can kaleidoscopes with students in the past. There are lots of sites with directions for these on the web. Paper clips, rubber bands, and colored transparent beads make for great patterns. I asked the kids and other staff members to provide the cans and to bring in extras if they

could. (It helped to make the project available to everyone with out regard to their socioeconomic status.)

Cindy Hollies  
NBCT  
Maryland

Hi Erin,

I have done them with PVC pipe and had the students bring in beads

Cheryl Miller  
Hemet Academy for Applied Academics and Technology

Somebody was asking about inexpensive supplies. I've had luck getting free scraps of mirrored plexiglas from glass suppliers. Most of the scraps were 1" - 3" wide and 48" long, which I cut into shorter lengths. Three can be easily taped into a triangluar tube.

Ed Chomka

Please be advised that the Attorney General has ruled that communication via electronic mail in the public domain is not confidential and is considered a matter of public record. Furthermore, all communications (including this one) will be retained for 10 years.

Greetings, I have used three microscope slides taped together.  
Dick

Have a great day.

Film canisters are getting harder to find, but Harry's three microscope slides (I use plastic ones) fit perfectly into a 35mm film canister. Remove the top, use a cork borer to cut an eyehole in the bottom. Insert the slides to make a triangular prism. They don't need to be taped together. Cut out a square from clear overhead transparency that is about 2.5 times as wide as the canister. Trace a circle almost as large as the square. (potato chip can top?) Use sharp permanent markers in bright colors to cover the plastic circle with small shapes. (Think stained glass.) We cover the colored side with side-by-side strips of clear tape to protect the colors and stiffen the circle. Clear packing tape might work, too. Cut out the circle. Push a straight pin through the center. Tape the pin to the side of the canister so the plastic covers the

opening. Voila! Not as much fun as the ones with beads, but it works.  
Laurie

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film canisters are available by the dozens on EBay.

Bob G

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I've made kaleidoscopes using the following:

- Pringles can
- mirror cardboard - buy at a crafts store - it comes in poster size and while the silver works best, you can use the gold
- glitter and sequins
- plastic baggie
- tissue paper

Poke an eye hole in the bottom of the can. I find a big nail works best.  
Cut the mirror board into three pieces and tape into a triangle with the shiny side facing in. Slide that into the can and use tissue paper to hold it in place in approx the center of the can.  
Put glitter and sequins in the baggie and lay that over the open end, using the lid to the can to secure it in place.

This works for both elementary and secondary.

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