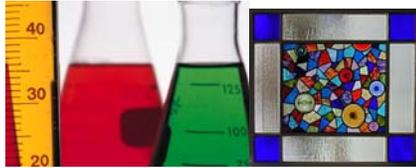


Edible Stained Glass!



For ages: 6-10

Should take about 20 minutes; make sure you have adult supervision when heating the sugar- it can burn you!

I'm sure you are familiar with normal bulk gold. However, when gold is created on the nanoscale it no longer appears gold/yellow. Remember a nanometer is one-billionth of a meter! It may appear various colors such as red or blue. The smaller the nanogold particles, the closer the nanogold will look to **orange**. For centuries, artists have been using nanogold size particles to make stained glass windows without even knowing they were using nanotechnology!

Even before medieval times, the ancient Egyptians were perfecting the art of glass making. During the Middle Ages, artists began to add crushed up gold and silver to their glass. Currently, stained glass contains crushed up minerals such as gold, silver and copper. Scientists in the laboratory make nanogold. Scientists start with a gold compound powder, to which water is added and heated. Next, chemicals are added that cause the gold to cluster up and interact with light in different ways.



What you'll need

- Buttered cookie sheet
- 1 cup sugar (white)



- Frying pan
- Spoon
- Food coloring or sprinkles

Try this!

Pre-activity

Observe the behavior of stained glass in your town. Often churches and old buildings will have stained glass windows. Does the glass look the same during the day as it does at night?



Activity

1. Pour 1 cup white sugar into a frying pan on med-low heat
2. Stirring regularly, allow the sugar to melt (approx 20 mins). Don't worry if it starts to clump and turn yellow/brownish, this is normal!



3. Once sugar is completely melted, add in food coloring or sprinkles
4. After stirring in sprinkles or food coloring for 30 sec, pour mixture onto a cold, buttered cookie sheet
5. Allow complete cooling before consumption

Final product should resemble...



Question: Once dry hold your model glass up to the light, either real or artificial light.

What do you notice about the colors?



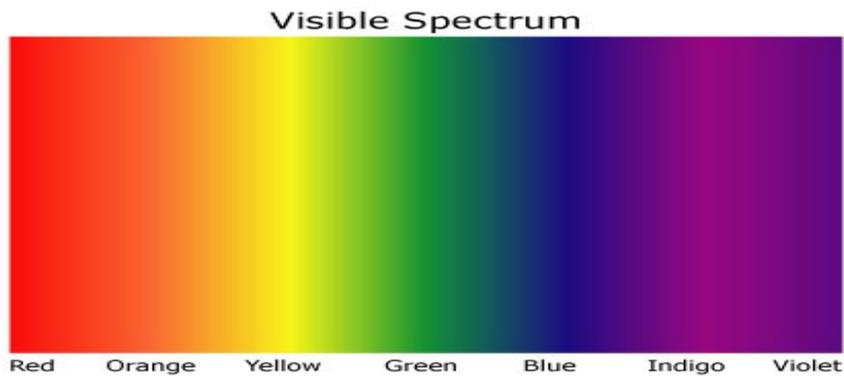
What do you notice about the color of the "glass" when it is on a dark piece of paper or table, compared to when the "glass" is held to light?

What's going on?

You have just made a stained glass model. When you hold your model up to the light the colors will appear much more vibrant than when you have the model held on a dark piece of paper or the table. The difference in color is much more noticeable when you use sprinkles. When the colored "glass" is held up to the light, the light interacts with the color (sprinkles) embedded in the cooked sugar. This is analogous to the color of real stained glass windows in the daytime versus the nighttime. During the day, the glass absorbs light and depending on the size of the nanoparticles mixed in, you will see different colors.

Red/orange indicates the smallest size nanoparticles; pink colored nanogold is slightly bigger than red; and blue/purple nanoparticles indicate the largest nanoparticles. Think of the colors in the rainbow: **Red**, **Orange**, **Yellow**, **Green**, **Blue**, **Indigo**, and **Violet**. At the start of the color spectrum the nanoparticles are the smallest, and as you move to the end of the color

spectrum (blue) the nanoparticles get bigger.



Size is important when using nanogold for cancer therapy. For cancer therapy, nanogold can be injected into the body. After being injected into the body, the nanogold will adhere to the tumor. Next, a wavelength of a particular frequency will be directed at the nanogold attached to the tumor. In order for the therapy to be successful the nanogold must be able to absorb the wavelength that is shined at the tumor. If the nanogold is too small the wavelength will pass right through. Therefore, the nanogold must be just the right size.

Want to explore more?

What you'll need



Materials

- Clear cup
- Water
- Milk (whole or half-and-half)
- Green, red or blue laser

Try this!

Grab a glass of water in a clear cup. Shine a bright light (laser) through it. Now add a splash of milk and try shining the light through again.

Question: What's different once the milk is added?



HINT: The nanoparticles of metals (gold, silver, copper) in stained glass behave in a similar way to the milk.

References

http://www.exploratorium.edu/snacks/laser_jello/index.html

<http://pbskids.org/dragonflytv/show/stainedglass.html>

<http://images.google.com/imgres?imgurl=http://www.patchworkpatterns.co.uk/images/projects/stained%2520glass.jpg>

http://www.slackerastronomy.org/slackerpedia/images/Computer_color_spectrum.jpg

http://caminomedical.org/images/healthyschools/milk_cartoon.jpg

http://peelbooks.com/123_draw_series/73-images/07_04.gif

<http://my.detroitmagic.com/fay/wp-content/uploads/2007/07/cartoon-church.jpg>