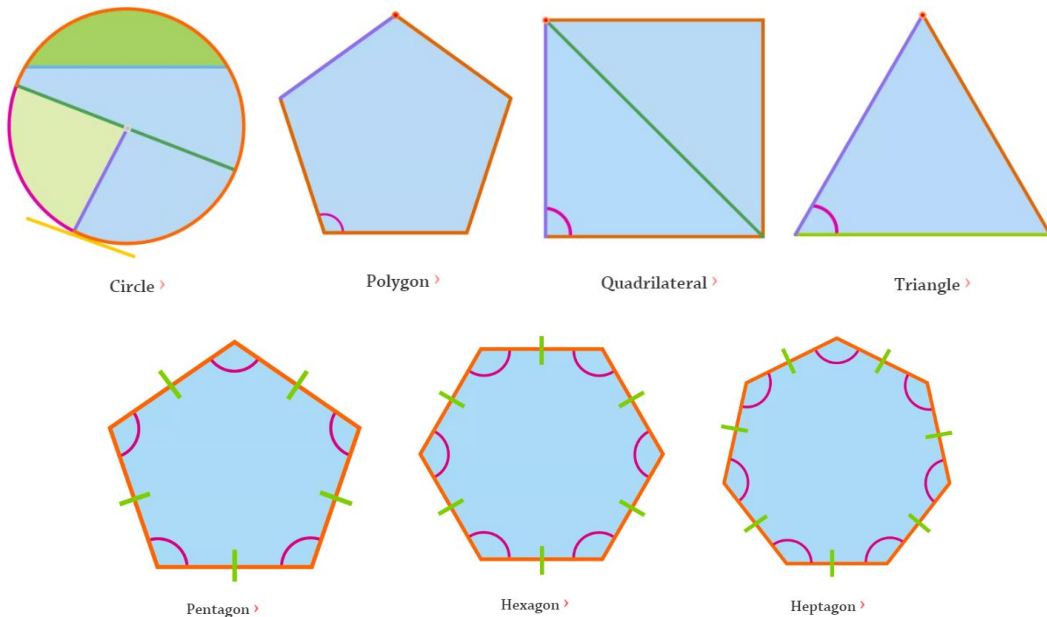


Geometric Bubbles

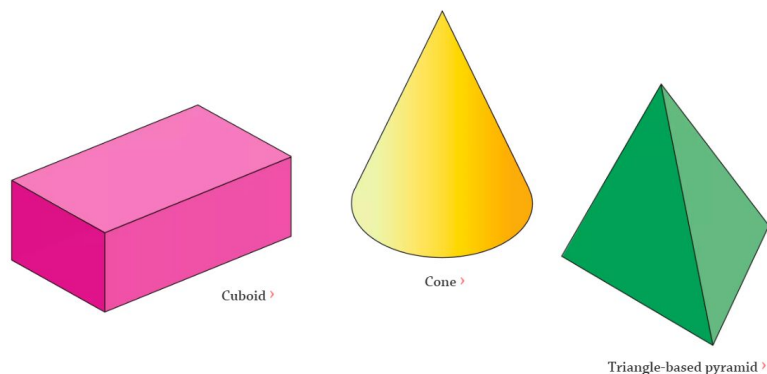
Background Information

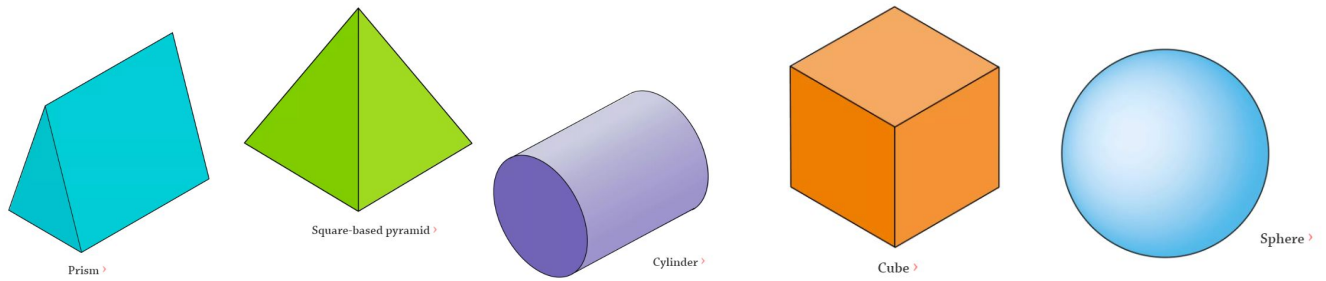
- **What is the difference between a 2D shape & a 3D shape?** 2D shapes are those that have 2 dimensions - length and width - like a square. They are flat as if they are cut out of paper. 2D shapes have vertices (corners) and internal angles (except the circle which is a continuous loop). 3D shapes have 3 dimensions - length, width & height - like a cube. 3D shapes have vertices (corners), faces (sides), and edges (lines where faces meet).
- **What is geometry?** Geometry is the branch of math concerned with the shape of objects & spatial relationships. It is one of the oldest branches of mathematics that came about in response to solving problems as those found in land surveying, and its name is derived from Greek words meaning "Earth measurement." Eventually it was realized that geometry shouldn't be limited to the study of flat surfaces (called plane geometry) and three-dimensional objects (called solid geometry) but even abstract images. So geometry is all about lines, angles, shapes & space & is useful in careers such as architecture, art & astronomy.
- Examples of 2D & 3D shapes:

2D Shapes:



3D Shapes:





Materials

Chenille Stems/Fuzzy Sticks/Pipe Cleaners

Straws

Craft sticks

Tape

Plastic container (can use a plastic tub, 5 gallon bucket, trash can, or even a shoe box with a crockpot liner or trash bag taped in - be creative!)

Pre-made Bubble Solution

Dish Soap

Water

*optional - for even thicker & slimier bubble solution you can add in glycerin (available at drug stores) or even white karo syrup!

Directions

1. For your bubble solution, you can use purchased bubbles or make your own at home. Make sure the container you use is big enough and deep enough so that your bubble wand shape will be entirely covered by the bubble solution when you dip it in. To make your own bubbles, fill your container with water and pour in dish soap. The general recipe is $\frac{1}{2}$ gallon of water and $\frac{1}{2}$ cup dish soap. (We found that Dawn works best & distilled water works better than tap water - but you can use the water at your house and whatever dish soap you have). Adding in an optional ingredient (1 Tbsp glycerin OR 1 Tbsp white karo syrup) can help make your bubble solution thicker & slimier - but this is not a requirement! Fill your container with water first, then add the other ingredients. Be sure to gently mix - do not stir vigorously and make too many bubbles. Once it is mixed, scrape all of the foam off the top of the bubble solution. If you can make it ahead of time and let the bubble solution sit undisturbed overnight before using it, that will make an even better bubble solution!
2. Build your geometric bubble wands. Decide what geometric shapes you want to build. Use your imagination and try out different supplies you have at home to build with.

You might try popsicle sticks, chenille stems, straws, or a combination. With chenille stems, you can bend & twist them together and not have to use tape. What we found works best is to build your bubble wand out of chenille stems and cover them with straws. Be sure to build a handle for you to hold the wand. Test your shape and be sure it will fit in the container & completely submerge in your bubble solution. Here's how your geometric bubble wand might look when done:



3. Now get to dipping! Try different techniques - dip the entire geometric shape under the bubble solution, try dipping just one face of the figure, or try dipping it at an angle with one of the vertices first. Be sure to observe your geometric wand after you remove it from the solution to investigate the shape of the bubble that forms before you blow the bubble. Observing the shape the bubble forms on your wand before blowing a bubble is when you will get to observe the geometric bubble shape.
4. Now try to blow your bubbles using a straw. Dip one end of the straw in the bubble solution and insert that end into the bubble formed on the geometric wand. Then blow air inside through the straw & see what happens!

Activity Conclusion

- **How did the bubble blowing go? What shapes did you see? How were the bubbles different based on different dipping techniques?**
- **How does this work - what is the science behind it?** The surface tension of the soap film makes the film stick to the edges of the geometric shape & form into a surface of minimal area. Classic bubbles you make from a round bubble wand make a sphere shape because that is the surface of minimal area needed to surround the air you are blowing through the circular shaped wand.
- Be sure to put away your supplies and clean up any mess you made making your bubble wand and blowing bubbles. Save your bubble solution for another day!
- Send us pictures of your geometric bubble wands and cool shaped bubbles to Programs@sciencemill.org or tag us on social media.