STEM Connections

Straw Structures

Below are ideas for connecting the Straw Structure activity to STEM concepts and principles. For more ideas and detailed STEM lessons, consult the *Straw Structures Teacher's Guide*.

ACTIVITY OVERVIEW

Students design and build structures and geometric solids made of straws using pipe cleaners as connectors and joints.

SCIENCE

Modeling Crystalline Structures

Have students begin building various geometric solids and structures, including some of their own design. When students are comfortable with the construction techniques, have them model various crystalline structures or lattices using straws and pipe cleaner connectors.

Here are some examples of structures for students to model:

- Tetrahedral
- Cubic
- Octahedral
- Hexagonal
- Quartz
- Carbon, graphite, diamond (contrast and compare)

In some instances, the use of modeling clay at some vertices or midpoint nodes might be helpful in student visualization of the intended structure.

Researching mineral structures and modeling those structures could be an extension to the activity and can provide an avenue for gifted students to demonstrate their comprehension of complex subject matter.

ENGINEERING

Bouncing Egg Competition

Student competitions can be an excellent way to bring out the engineering potential in many students. Where many students might not excel in the learning of specific content, they can excel in the practical application of concepts and principles in problem solving through hands-on activities.

In this competition, students can work either individually or in teams to create a vehicle that will simulate the landing of the *Pathfinder* vehicle on the surface of Mars. This concept is that the vehicle had to drop on Mars with little atmosphere to slow its descent via traditional parachutes and with minimal rocket propulsion support.

An egg (raw or boiled, depending on your mood at the time) simulates the passenger (rover) within the bouncing vehicle. Students may use straws, pipe cleaners, and transparent tape to engineer their protective bouncing vehicle.

The vehicles can be tested by rolling them down an inclined plane, the edge of which is at the edge of a lab table. So the vehicle has both horizontal and vertical motion as it drops. The drop is determined to be successful if the egg remains uncracked.

TECHNOLOGY

Modeling Nanotechnology Structures

One of the most difficult portions of teaching students about nanotechnology is the relative size of the structures being talked about. Modeling these structures at a molecular level can help students visualize both the processes involved and the resulting structures.

Have students begin building various geometric solids and structures, including some of their own design. When students are comfortable with the construction techniques, have them move to some basic structures that are formed via the nanotechnology process:

- Buckyball (buckminsterfullerene)
- Carbon nanotubes

The carbon nanotube model can be lengthened at will by repeating the circular lattice structure over and over. The end(s) of the nanotube can be left open or can be closed – much like the shape of half a buckyball.

Students can also research other nanotechnology structures and can add modeling clay to some structures to simulate unusual connection nodes or particle attachments that occur within the nanotechnology process.

MATH

Real-World Surface Area and Volume

Three-dimensional figures are typically represented in two dimensions in the pages of the geometry book. By modeling three-dimensional geometric objects, students can have the objects in hand to rotate; count; and see and feel vertices, faces, and sides of those objects.

For this activity, students can become familiar with the construction techniques using the straws and pipe cleaners and then move to constructing specific geometric solids such as tetrahedrons, cubes, prisms, and other geometric structures with straight sides.

For each structure, students can determine the number of sides, faces, and vertices. They can also measure critical values needed to calculate surface area and volume of the structures. These values can be entered into appropriate places on a worksheet.

Formulas for the various geometric solids can be added to the worksheet, or students can research to find these formulas. One option is to provide the formulas for the first couple of structures and then have students be responsible for finding the formulas for the remaining structures.

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