

Growing Spheres

GB-702, 710 and 730

What Are Growing Spheres?

Our Growing Spheres are made from a polyacrylamide polymer with a strong affinity for water. Chemists call this property **hydrophilic**, or water loving. A hydrophilic substance is one that takes up water easily—just as a dry sponge might if dropped into a pail of water.

Materials with the opposite property are said to be **hydrophobic** or water fearing. An example of a hydrophobic material is our **Magic Sand (SS-2)**, which repels water and never gets wet.

If placed into water, Growing Spheres will absorb water and swell to several hundred times their original size. Because the amount of water Growing Spheres will absorb depends on the salt content of the water, we suggest you use distilled water for best results.



Our Growing Spheres and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

1-PS4-1

Students can use the spheres to plan and conduct investigations to provide evidence that vibrating materials make sound and that sound can make materials vibrate.

1-PS4-3

Students can use the spheres to plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.

2-PS1-2

Students can analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

5-PS1-3

Students can use the spheres to make observations and measurements to identify materials based on their properties.

Middle School

MS-PS1-1

Students can use the spheres in an investigation to develop a model to describe composition of simple and extended structures.

MS-PS1-2

Students can analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS4-2

Students can use the spheres in an investigation to develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

DCI-MS/ETS1.B: Developing Possible Solutions.

A solution needs to be tested, and then modified based on the test results in order to improve it.

High School

HS-PS1-2

Students can use the spheres in an investigation to construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the Periodic Table, and knowledge of the patterns of chemical properties.

HS-PS2-6

Students will observe and communicate scientific information about why the molecular-level structure is important in the functioning of a material.

Preparing Your Growing Spheres

Procedure:

To prepare the Growing Spheres, simply place them in clean water and allow them to sit. While you may be able to observe some changes within just a few minutes, the crystals typically take between two and eight hours to reach their maximum size. Hot water may be used to speed up the process.



Approximate mixing proportions are one gallon of water for two tablespoons of Growing Spheres, or one quart of water for 1.5 teaspoons of Growing Spheres. To color the crystals, food coloring or **Color Splash Tablets** (CSP-100) may be added to the water prior to adding the crystals.

Once fully expanded, Growing Spheres have an index of refraction almost identical to that of water. This means that when the clear, colorless, expanded hydrophilic polymers are placed in water, they are nearly invisible. It is difficult to see the spheres in water because light rays are not bent when they travel between two substances with the same indices of refraction.

Growing Spheres may be dried and expanded again and again. Simply spread the expanded spheres on a flat surface and allow to dry. When they have returned to their original size, store them in a plastic bag or container. It is recommended that you use distilled water if you intend to reuse your spheres.

A few notes:

While Growing Spheres are generally considered to be non-toxic, they should not be consumed!

Growing Spheres are sensitive to direct sunlight. Exposure to direct sunlight will decompose the polyacrylamide polymer and slowly destroy the crystals' ability to absorb water.

(This might make for a good experiment!)

Distilled water is recommended for best results.

Suggested Activities

Disappearing Spheres

Tie a thread around a single expanded sphere. Lower the sphere into a cup of water and make an observation. This can be done on an overhead projector as a demonstration for an entire class. Try carefully pushing a small nail or thin wire through the sphere. When lowered into water, the nail or wire appears to be completely suspended. Since the expanded crystals are mostly composed of water, they have the same index of refraction as water—which makes them virtually invisible!

Growing Bulbs

Grow flowering bulbs in the clear expanded spheres. This allows you to see the roots as they grow. Simply expand the spheres by placing them in clean water overnight. Pour off any excess water and plant your bulb, stem side up, about three-quarters of the way into the spheres. Remember to use a clear container and to keep your spheres out of direct sunlight. (Paperwhite bulbs work the best!)

Calculate the Change in Volume

Ask your students to determine the change in the sphere's volume, using $V = \frac{4}{3} \pi r^3$.

Further Experimentation

Your Growing Spheres can be used for many other science projects. For example, your students can investigate the effect of variables on the growth of the spheres by using:

- ✓ Different water sources: pond water, salt water, bottled water, distilled water, etc.
- ✓ Different concentrations of various dissolved substances, such as sugar, baking soda, or salt
- ✓ Solutions with varying pH, such as different concentrations of vinegar, baking soda, etc.
- ✓ Different temperatures
- ✓ Different exposures to direct sunlight
- ✓ Different carbonated beverages, sugar vs. sugar free soda, etc.

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, “*Teachers Serving Teachers*” isn’t just a slogan—it’s our promise to you!

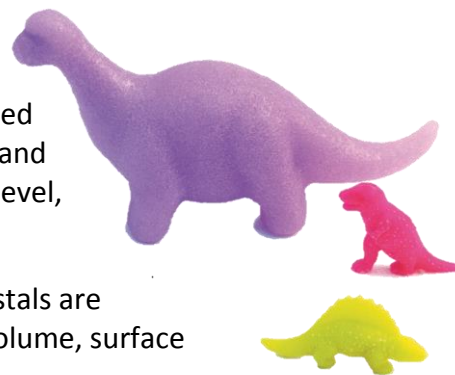
Please visit our website
for more lesson ideas:

www.TeacherSource.com

Check our blog for classroom-tested
teaching plans on dozens of topics:

<http://blog.TeacherSource.com>

Educational Innovations has many hydrophilic materials that can be used in follow-up lessons. Consider our other “Gro-Beasts” shaped of like frogs and dinosaurs. These critters start at 1-3" long and expand by up to 600% when left in water. They are fantastic for any grade level, and affordable enough to hand out to every student in your class.



Hydrophilic Growing Spheres, Cubes, Spikes and Crystals are also excellent for investigating concepts like mass, volume, surface area, absorption and more.

Gro-Beast Dinosaur (GB-1)

Growing Cubes (GB-740)

Growing Frogs (GB-25)

Growing Spheres (GB-702, GB-710, GB-730)

Water Gel Crystals (GB-5C)

Water Gel Spikes (GB-3)



And don't forget our **HYDROPHOBIC** material!

Magic Sand (SS-2)

Magic Sand is regular sand which has been dyed and coated with a hydrophobic material—a substance which repels water. The coating on the outside of the magic sand repels water and keeps the sand dry, even when submerged in water! Available in four fluorescent colors.