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Educational Innovations Inc.

Activities Using
Instant Snow Polymer

GB-300, 315 and 320

What Is Instant Snow Polymer?

Instant Snow Polymer is a white granular powder which rapidly absorbs water. It will instantly absorb 40 times its original volume, producing a snow-like material.

Originally developed to clean up aqueous spills in hospitals, its unique properties make it useful for other applications. When wet, this polymer has the consistency of snow, adheres well to boots, and is very slippery. It is used as an artificial base for skiers and as artificial snow on Hollywood sets. One of its first film uses was in Stephen Spielberg's mini-series, *Band of Brothers*. Instant Snow Polymer is reusable. Simply allow your snow to dry and it will return to its powdered form, ready to be used again.

In the classroom, Instant Snow Polymer is great for showing that there is No Law of Conservation of Volume—a common student misconception!

Note: This is a good substitution for the more hazardous ammonium dichromate demonstration, commonly used until recently.

The Chemistry behind Instant Snow

Instant Snow Polymer is made by cross-linking groups of the sodium polyacrylate polymer, the material that gives disposable diapers their super absorbent quality. These small individual clusters with internal cross-linking appear as a white powdery substance. When water is added, the individual clusters internally hydrate and expand, forming small, fluffy clusters that do not cling to surrounding clusters. This appears as powdery snow. When more water is added, these clusters begin to adhere to one another. This appears as slush.

Instant Snow Polymer is a Superabsorbent Polymer (SAP). The powder is able to absorb as much as 500 times its mass of pure water within a few seconds. In the dry state, the cross-linked network is folded up on itself. When hydrated, the highly hydrophilic ("water-loving") network quickly absorbs water, unfolds and expands. The hydration is dependent upon the purity of the water. Divalent ions of hard water, Ca^{2+} and Mg^{2+}, highly decrease the absorption properties because they compete with water for the hydration sites on the polymer chain. Sodium chloride decreased the absorption due to Na^{1+} ions creating an electrostatic screening between the water and the hydration sites. The maximum absorption is with water between a pH of 4 and 8.

NGSS Correlations

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

Elementary

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 Instant Snow Polymer to make observations and measurements to identify materials based on their properties.

5-PS1-4
Students can use Instant Snow Polymer to conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Middle School

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-PS1-6
Students can use Instant Snow Polymer to undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical process.

ETS1.B
A solution needs to be tested, and then modified on the basis of the test results in order to improve it.

MS-PS1-4
Students can use Instant Snow Polymer to develop a model that predicts and describes changes in particle motion, temperature, and state of pure substance when thermal energy is added or removed.

High School

HS-PS1-4
Students can use Instant Snow Polymer to develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

HS-PS1-5
Students can use Instant Snow Polymer as evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which the reaction occurs.

HS-PS2-6
Students will observe and communicate scientific information about why the molecular-level structure is important in the functioning of a material.

HS-PS1-7
Students can use Instant Snow Polymer 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.

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Suggested Activities

Procedure A

Place 10 g (approximately 1 teaspoon) of Instant Snow Polymer in a beaker. Quickly add 200 ml (approximately 2 ounces) of water. The polymer will quickly absorb the water and expand into a large quantity of "fluffy snow." Emphasize that this demonstrates that there is NO law of conservation of volume! Allow it to pour through your fingers; it even feels fluffy like real snow.

Experiment by trying different ratios of powdered polymer to water. A good place to start is 1 part powder to 20 parts water by mass (10 g powder to 200 ml water). If mixing by volume, try 1 part powder to 12 parts water by volume. The following ratios work well.

Instant Snow Polymer	Water
10 g	200 ml
1 teaspoon	2 oz.
¼ cup	3 cups

Salt is used on streets and sidewalks to clear snow. Sprinkle some salt, e.g. sodium chloride, on the instant snow. Salt will cause the hydrated polymers to release the water. The effect looks very much like melting.

Procedure B

Add different amounts of water to the powdered polymer. As the polymer absorbs more water, it becomes thicker rather than fluffier. Try the following:

1. Compare the water absorbing qualities of the cross-linked polymer to that of the sodium Polyacrylate polymer used in diapers.
2. Experiment with different water qualities. What kind of water works best? Vary the pH, the Hardness and the salt content of the water.

Questions for further study

1. How is this artificial snow similar to real snow? How is it different?
2. Why does the snow polymer feel cold?
3. Examine a few clusters under a microscope. How do the "flakes" compare to real ice crystals?
4. What happens when you freeze the artificial snow?

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

To extend your lesson, consider these Educational Innovations products:

Sodium Polyacrylate (Diaper Polymer) (GB-6A)

You know... the super-absorbent polymer found in disposable baby diapers. Also used in many 'disappearing water' magic tricks, this fine white powder instantly turns liquid water into a slush-like solid substance. Technically speaking, the polymer absorbs from 500 to 1,000 times its own weight in water. Simply add table salt to reverse the reaction.

Goldenrod Color-Changing Paper (SM-925)

True goldenrod paper is made from a dye which is an acid-base indicator. This paper turns bright red in bases such as ammonia, baking soda or washing soda and returns to bright yellow in acids such as vinegar or lemon juice.

Educational Innovations has many hydrophilic materials that can be used in follow-up lessons. Hydrophilic Growing Spheres, Cubes, Spikes, Dinosaurs, Frogs, and Crystals are 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)