

Teacher Materials – Snow Globe Lab

Disclaimer:

The idea for this lab originally came from an article in *The Science Teacher* by Thomas Haugh (see reference at the bottom of each page in this lab). Though I let him know ahead of time that this lab would be posted on my site, he hasn't read over this incarnation of the lab and cannot be held responsible for any mistakes or problems you may encounter. He has, however, graciously allowed me to post his email address for anybody who has questions or problems with the lab. He can be contacted at Tom_Haugh@gwinnett.k12.ga.us .

Another disclaimer:

As with all laboratory activities, there are inherent dangers involved. If for any reason you feel uncomfortable doing this lab in your classroom, please don't do this lab! By doing this lab, you indicate that you take full responsibility for your actions and any problems or damage that result. Remember to have your students wear goggles at all times!

About this lab:

The point of this lab is to show students how solubility is important in the real world. Using their knowledge of solubility and “like dissolves like”, your students will make working snow globes out of some common household solvents and solutes. There are many correct combinations of solvents and solutes which may be used, to varying degrees of success.

Before doing this lab, you should make sure your students understand what “like dissolves like” truly means, and how to find the relative polarities of various compounds. Briefly, polar covalent compounds tend to dissolve other polar covalent compounds (and some ionic compounds), while nonpolar covalent compounds generally dissolve neither. While working chemists are usually interested in finding solvents that will make various solutes dissolve, the snow globe lab has the opposite goal. Ideally, their solute should not be dissolved by the solvent they choose, because the goal is to make small particles of solute fall like flakes in the solvent.

There are a few ways of doing this. The simplest is for students to pick a nonpolar solvent (such as mineral oil or vegetable oil) and a polar solute such as Epsom salts or sodium chloride. A more complex way for students to do this is to have them pick a solute that dissolves well in a solvent and make a saturated solution such that the undissolved solute can move freely around the globe. This method, while seemingly foolproof, is much harder to make work than simply picking insoluble solutes – unfortunately, solutes dissolve very quickly at first, then more slowly as the solution reaches saturation. Students making a

sucrose/water solution may find that it takes them a very long time (and a very large quantity of sucrose) to make a saturated solution.

Grading this lab is determined by how nice their snow globe looks. Emphasize to your students that there's more to real world chemistry than just making things happen – usually, we want to make them happen in a way that other people find interesting or beautiful. After all, what good would a deodorant be if it smells like rancid ham? Who would want to buy purple sunblock, even if it did guarantee that the wearer could avoid skin cancer?

Overall, students seem to really enjoy this lab. Though it can be a bit of a mess (as we'll discuss later), the kids have something fun to show their parents (which makes both kids and parents feel good) as well as tangible evidence for future students that chemistry is a lot of fun. After all, isn't that part of our job, too?

Equipment:

- One small baby food jar for each student. Students will bring these in for themselves if you give them a few days' warning.
- One small oil and waterproof item for each snow globe. Have the students bring an inexpensive item from home.
- Hot glue gun.
- Package of 24 glue sticks.
- 32 oz. of vegetable oil.
- 10-16 oz. bottles of mineral oil. (Note: As mineral oil is used as a laxative, be prepared to have store clerks look at you a little funny when you buy this much at once. You may want to explain that you're a science teacher and not a weirdo.)
- 32 small vials with lids.
- 2 lb box of kosher salt.
- 2 lb box of table salt.
- 2 lb carton of Epsom salts (magnesium sulfate heptahydrate).
- 5 lb bag of table sugar (sucrose)
- 1 lb bottle of talcum powder.
- 1 lb of sand.
- 1 lb box of sodium bicarbonate.
- 1 bottle of concentrated ammonia (for cleaning up).

The quantity of supplies required for this lab is less expensive than you might imagine. The students will provide the baby food jars, and if your science budget can't afford the full cost of this lab, many can be persuaded to bring in some of the other supplies with extra credit incentives.

Safety issues:

As with all labs, students should wear goggles at all times. There isn't really anything in this lab that can cause eye damage, but it's a good habit for students to get into. Additionally, it might be a good idea to have lab aprons on hand, as students will spill mineral and vegetable oil on the countertop and lean into it, staining their shirts.

A hot glue gun will be used in this lab to hold the plastic items inside the snow globes and to seal the top of each snow globe. Though many students may already be familiar with the operation of a glue gun, it's best to keep a close eye on the action, as hot glue can cause burns if it sticks to bare skin. Despite the danger of burns – DO NOT let students wear rubber gloves during this lab, as melted rubber will stick to the skin just as badly as hot glue. If you are worried about liability issues, have the students bring their snow globes to you for gluing.

The other main safety hazard in this lab involves the slipperiness of mineral and vegetable oils. If either are spilled on the floor, it will become slippery enough that students may trip and fall. If you've got a small class, you can probably clean up the spills as quickly as they appear – for larger classes, simply place paper towels over the spills to make them less dangerous.

Room destruction factor:

It varies. If you aren't careful, you may find that there are giant puddles of oil all over your classroom. These puddles may take a considerable amount of time to clean. On the other hand, if you stay on your students to clean up their messes as they make them, this shouldn't really be a problem. For good measure, devote the last five minutes of class solely to clean up.

How the lab works:

Students will be provided with the lab sheet and told to make a snow globe. It's pretty much a free form activity, where the students will devise their own procedure and materials for the lab. Before making the snow globes, encourage your students to test their solvent/solute combinations in small vials to minimize waste.

Combinations I've seen work best in this lab include mineral oil/magnesium sulfate, mineral oil/kosher salt, and vegetable oil/magnesium sulfate. Sand tends to make "sandstorm globes" rather than snow globes, and both talcum powder and sodium bicarbonate simply make a very milky liquid that's hard to see. Water makes a lousy solvent, as it dissolves most of the solutes.

Chances are excellent that both you and your students will have a really good time with this lab. It's fun to see your students making the snow globes, and even more fun when they make one that they're really proud of. I recommend

that before you do this lab with your class you make one that you can show your students after they are completed.

What can go wrong:

- Students sometimes pick items made of clear plastic to go into the snow globes. Normally, this wouldn't be a problem, but the index of refraction of clear plastic is close enough to that of mineral oil that it's hard to see. Before doing this lab, discourage students from bringing in transparent items.
- Students can't get the tops to stop leaking. To fix, just keep dumping the glue until all of the holes are sealed.
- Students get big clumps of "snow" that won't break up. This sometimes happens when using Epsom salts. If this occurs, have your students clean out their jars with rubbing alcohol and start over.

Grading:

A grading sheet for this activity is provided on the third page of the student handout. Point it out to the students so they know the criteria under which their snow globes will be judged.

Other stuff:

If you like this lab, consider getting either of the lab books put out by Cavalcade Publishing. The first, "24 Lessons that Rocked the World", contains 24 complete lab activities, with teacher materials very similar to this lab, handouts, and worksheets. The second, "17 Effective Activities for New Chemistry Teachers", contains a variety of activities aimed toward new teachers. For information about either, visit the Cavalcade Publishing main page at www.cavalcadepublishing.com

Thanks to:

Thomas Haugh, who came up with the idea for this lab in the first place. Heck of a nice guy, too.

Snow Globe Lab

In this lab, you will be making a snow globe using a jar you've brought from home, a small item of interest to you, and some common chemicals we have around the lab. Each group will make one snow globe to be graded based on how nice it is. The end of this lab sheet contains my grading guidelines so you have an idea of how you will be scored.

The chemicals you use in your snow globe to make the snow are entirely up to you. You may use any of the chemicals I provide in any combination. I would, however, strongly recommend that you keep a few things in mind:

- "Like dissolves like"
- Undissolved solute falls to the bottom of a saturated solution.
- Your snow globe should be pretty. Nobody likes an ugly snow globe.

Procedure for putting together your snow globe:

Your snow globe will be held together with hot glue. To keep your personal item firmly affixed to the bottom of your snow globe, start by cleaning both your jar and the item with rubbing alcohol. Once the rubbing alcohol has evaporated, put a small line of hot glue on the bottom of your object and firmly stick it to the inside of the jar cap. Be careful! Hot glue is both very hot and very sticky, and can cause burns if it sticks to your exposed skin!

To seal your snow globe, clean the top of the jar and top of the lid with rubbing alcohol. When the alcohol has evaporated, put a small line of hot glue around the inside of the lid. While the glue is still hot, firmly screw the lid onto the jar.

Materials at your disposal:

Solvents:

Water, mineral oil, vegetable oil

Solutes:

Sodium chloride, Epsom salt (magnesium sulfate heptahydrate), sucrose (table sugar, formula $C_{12}H_{22}O_{11}$), talcum powder ($Mg_3Si_4O_{12}H_2$), sand (SiO_2), and sodium bicarbonate.

Write your procedure for snow globe manufacture below:

Grading:

Appearance of the snow: Does the snow actually look like snow?

1	2	3
<i>no</i>		<i>yes</i>

Snowfall rate: Does the snow fall at an appropriate rate?

1	2	3
<i>no</i>		<i>yes</i>

Bubbles: Is the “air” in the snow globe free of bubbles?

1	2	3
<i>no</i>		<i>yes</i>

Appearance of the figure in the globe: Does the object you added to the snow globe look nice? Is it firmly stuck to the bottom of the jar?

1	2	3
<i>no</i>		<i>yes</i>

Does the snow globe leak after being placed upside down for a 24-hour period?

-2	2
<i>yes</i>	<i>no</i>

Total Score: _____

Maximum Score: 14

Final Grade: _____