Western Engineering Outreach

Snow Globe Solutions

Grade 3-5

Meet Today's ENG HERO!

Kelly Ogden - Professor with Western Engineering

Kelly Ogden is an Assistant Professor in Mechanical and Materials Engineering at Western University. Dr. Ogden conducts numerical and analytical research to further understand mixing, waves, and hydraulic processes in coastal flows. These flows affect tidal energy available for extraction, water properties (temperature, salinity, and oxygen) that impact the ecosystem, and distribution of contaminants. Furthermore, in a changing climate, changes in coastal flows can have significant impact on society. To learn more about Dr. Ogden visit: https://www.eng.uwo.ca/mechanical/faculty/ogden_k/index.html

Learning Goal:

- There are three common states of matter
- Physical change refers to the fact that a substance can be changed from one form to another
- Chemical change implies the formation of a new substance
- Identify indicators of a chemical change
- Distinguish between a physical and chemical change

Materials Needed:

- Measuring cups: ½ cup, ¼ cup water
- Thicker liquids: baby oil, corn syrup, glycerin - safe concentration that is used on skin (from drug store)
- glitter or other snow-like substances
- Stirring sticks
- Transparent 250 ml mason jar or recycled jar that can be sealed tightly
- Craft materials that can get wet (pipe cleaners, plasticine, small styrofoam balls, etc)
- either scotch tape or a hot glue gun

Engineering and Science Connections:

Background:

Today we will learn a bit about chemistry as we make our own homemade snow globes, but what even is chemistry?

Chemistry:

Chemistry is the study of chemicals and the reactions between them. Chemists can study two different kinds of reactions: physical changes (where the change can be reversed) and chemical changes (where the reaction cannot be reversed). In chemistry, scientists also study the states of matter: solids, liquids and gasses.

States of Matter:

Solids:

Solids have a specific volume , and a specific shape. This means that the size and shape of a solid doesn't change when you move it to a different container. If you put a rock in a cup, it just sits there and doesn't generally change much.

Liquids:

Liquids have a specific volume, but no set shape. This means that the overall size of the liquid doesn't change much regardless of what container you put it in, but if you move a liquid to a different shaped container, it's shape will change to the shape of the inside of the container. If you put some water in a cup the actual size stays the same even though its shape changes to match the container.

Gas:

Just like liquids, gases don't have a set shape and can change their shape to that of their container. Unlike solids and liquids, gases can change their size depending on how big their container is.

There are actually other (harder to understand) states of matter, like plasmas, supercritical fluids, time crystals, and more! Many of the other states of matter are really hard to make and can behave weirdly so they aren't very common.

Physical VS Chemical Change:

There are two common different types of changes that can occur in materials/substances. Physical and Chemical changes make of the vast majority of common types of changes that we see materials go through. But how do we know when something is physically changing or if it's chemically changing?

A physical change doesn't change the actual material itself. This can be a change of state like freezing water to make ice cubes, or it could be a mechanical action like cutting a piece of paper into tiny bits or breaking a sandcastle.

In general, physical changes don't change the chemicals that something is made of. When we freeze water into ice, it is still made of water. When we cut up paper into small bits, the little bits are still made of paper.

Chemical changes are a bit more complicated.

A chemical change occurs when a material is changed to form a new substance with different properties. The original substances that are mixed are called reactants, while the substances produced are called products.

Sometimes chemical reactions can be observed by noticing a new product being produced (may be solid, liquid or gas), a colour change, a new smell, or a change in temperature. Baking a cake is an example of a chemical reaction that is easy to understand. The ingredients of the cake are the reactants (eggs, flour, sugar, etc.), and the heat of the oven causes a chemical reaction to occur, and a new product is produced (a cake).

Indicators of a chemical change:

a. Light being given off (ie. Fire, glow sticks)
b. Temperature change
c. Production of gas
d. Change in colour
e. Forms a precipitate (a solid separated from a liquid solution)

Video Recommendation:

https://www.youtube.com/watch?v=FofPjj7v414

Solutions:

A solution is a homogeneous mixture of two or more substances, at least one of which need to be a liquid. Homogeneous refers to the uniform nature of a mixture, it means that it is perfectly mixed. In this type of substance, a solute is dissolved in another substance, referred to as a solvent. In this activity, the glycerin or syrup is the solute while the water is the solvent. Once the glycerin/syrup is dissolved in the water it becomes a homogeneous solution.

Do you think the mixing of water and glycerin will create a physical change or a chemical change when mixed together?

It's neither! The water and glycerin do not form a new substance - they just form a solution that gives us the right liquid consistency (thickness). The two things being mixed are NOT changing their chemical composition or creating a new substance. We could use purely physical methods to separate them back out again, even though it might be difficult.

Tell your students that we will be making the snow globes in mason jars and they will get to create what will be going into the snow globe out of plasticine and pipe cleaners. Their creations will be made on the lids of the Mason jars. When this is done, they can move on to adding the snow solution.

Activity:

1. Hand out one 250ml glass jar and lid to each student. Instruct them that they will be building a model that is related to the theme of the week on their lid out of modelling clay.
2. Have the students design what the inside of the snow globe will be (we've found 10 mins to be a good amount of time for this step, but you can design for as long as you want!) using whatever water safe craft materials you have. Ensure the models are made to be sturdy and will stay together even if shaken a bit, the model will be slightly stronger when in the globe, but not much. If you have a hot glue gun, you can use it to glue all parts together well, but it shouldn't be necessary if you start by taping a pipe cleaner to the lid and building the rest of your structure on the pipe cleaner.
3. Fill jar about 3/4 full of water (or about 1/2 if using corn syrup).
4. Put 1-2 teaspoons of glitter or fake snow in the jar (no more as it would get hazy when shaken).
5. Screw the lid on very tightly, turn your jar upside-down and watch the snow fall inside.
6. Now add several drops to 1 tsp of a thickening liquid and make sure you leave room at the top to have the model inserted in without spilling the solution.
7. Finally, if you like, you may decorate the base (lid of the jar) of your snow globe with ribbon, fabric, paper, or whatever other materials you have.

What Did You Learn?

- What are the 3 common states of matter?
- What are the two common kinds of material changes?
- How could we tell if the glycerin and water had chemically reacted?

Future Learning

- Turn this Snow Globe activity into an experiment! In order to do this, try three different fluid mixtures. Use just water in the first attempt, 4 parts water mixed with 1 part glycerin in the second recipe, and 2 parts water to 1 part glycerine or syrup in the third recipe. Have your student make a prediction: what will happen to each recipe because we have changed the ratio of water to glycine? Make chalk with each recipe and compare the end results. Did the amount of water make a difference? Which recipe did you like the best and why?

Share your creations!

We would love to see what you made! Email as at discover@uwo.ca or tag us on social media.

Instagram: @westernueng
Twitter: @westernueng
Facebook: @westernueng

Thanks for discovering with us!