

SODA POP CHEMISTRY

INTRODUCTION:

The relationship between a "solute" (something that is dissolved) and a "solvent" (what it's dissolved into) is "solubility." You can explore solubility by looking at solutes in different states of matter. Let's start with hard candy and move on to soda pop...

ACTIVITY: Making rock candy

TIME: 7 days

Take a solute that is a solid – sugar – and dissolve it in water.

SAFETY:

Boiling sugar water can be very hot, and it can stick to your skin and burn it. Be very careful not to spill it.

Never leave the stove unattended.

WHAT YOU NEED:

- Pot to boil water
- Measuring cup
- Spoon to stir
- 2 cups of sugar
- 1 cup of water
- String
- Wooden skewer



- Oven mitts
- Tape (optional)
- Paper clip or binder clip (optional)
- Clear jar

WHAT YOU DO:

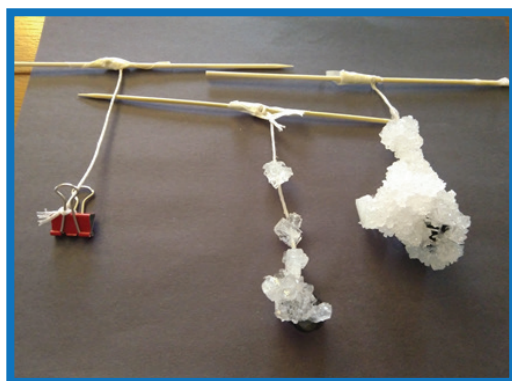
- Tie one end of the string to the middle of the skewer. If you're using a weight, like a paper clip or binder clip, tie the other end of the string to the weight.



SODA POP CHEMISTRY

WHAT YOU DO (continued):

- Pour the water into the pot and bring it to a boil on medium-low heat.
- Add the sugar half a cup at a time, while stirring. Remove the pot from the heat when the sugar stops dissolving easily, because that's when you're close to having a saturated solution — a maximum amount of the solute dissolved in the solvent.
- Pour the sugar solution into the jar before it has a chance to cool. (Wear oven mitts and be careful! It's very hot and sticky.)
- Hang the string into your sugar solution, but don't let it touch the sides or bottom of the jar. Lay the skewer across the top of the jar. You might want to tape it in place.



- And...patience. You'll now have to wait about seven days for the sugar to cool into a "supersaturated solution" which crystallizes around the string as rock candy.

ACTIVITY: Making and testing soda water

TIME: 15 minutes

While you're waiting for the candy to crystallize, treat yourself to some homemade soda water. For this, you will take a solute that is a gas — CO_2 — and dissolve it into water. Then, you can test the pH to confirm that it's carbonated.

WHAT YOU NEED:

Home Soda Maker Method

- Home soda maker (such as SodaStream)
- Bottle for home soda maker
- Water
- pH indicator (optional)

Seltzer Tablet Method

- Thick-walled bottle with a lid (such as Gatorade, Nalgene)
- Water
- Seltzer tablets (without ASA or acetaminophen)
- pH indicator (optional)



SODA POP CHEMISTRY

WHAT YOU DO:

- If you are using a home soda maker, follow the manufacturer's instructions on how to carbonate the water.
- If you are using the seltzer tablet method, fill your bottle approximately three-quarters full with water. Add the seltzer tablets to the water. Quickly close the lid of your bottle.

Note: If you plan to use a liquid pH indicator, like a homemade red cabbage indicator, add it before the carbonation. If you plan to use a pH test strip, like the one below, you can dip it into your water after carbonation.

- If you used red cabbage indicator, what did you notice about the colour of the water?
- If you are using indicator strips, follow the instructions below on how to make them.

ACTIVITY: Making pH indicator strips

TIME: 5 minutes to make and overnight to dry

WHAT YOU NEED:

- 2 tbsp turmeric powder
- 1 cup distilled water
- Kettle, or pot to boil water
- Shallow bowl
- Spoon
- Coffee filter, white paper or paper towel

- Paper towel, for drying
- Gloves or tongs (optional)

WHAT YOU DO:

- Boil the water.
- Put the turmeric in the bowl.
- Carefully pour the hot water on top of the turmeric, and stir it until the water is bright yellow. Allow the solution to cool.
- Dip your coffee filter, white paper or paper towel into the turmeric solution.

Note: Turmeric will stain: use gloves or tongs if you don't want yellow fingers, and don't drip the solution onto the counter!

- Lay your now-yellow coffee filter, white paper or paper towel on a clean paper towel to dry overnight.
- Once it's dry, cut it into strips.
- The test strip will turn bright red in the presence of bases. It will turn yellow in the presence of acids. For the clearest results for acids, dip the paper in a base, such as a baking soda solution, before you test an acid – the colour change will be much more dramatic.
- What do you expect when you dip it into your carbonated water?



SODA POP CHEMISTRY

WHY THIS MATTERS:

We take solubility for granted in our daily lives. Think about instant hot chocolate mix and laundry detergent. Or intravenous solutions — substances that we need to get into a patient's body through an intravenous line. Water molecules break the ionic bonds that hold together salts like sodium chloride or potassium chloride, allowing these solutes to be dissolved. Because water can dissolve a wide range of compounds, it's a great solvent to work with.

Solubility is also important when it comes to removing substances — for example, from our water supply. It's important to know if a contaminant is soluble or insoluble. Insoluble contaminants can be physically removed through filtration. Soluble contaminants need to be treated through chemical reactions, to "precipitate" or draw them out. This turns them from soluble to insoluble, so they can then be physically removed.

TAKING IT FURTHER: How carbonated is it?

Devise a way to measure the amount of CO_2 in a bottle of pop or soda water. Here are some things you might want to think about:

How can you measure the volume of CO_2 released from the pop?

Is any CO_2 still dissolved in the pop solution after you alter the system — by opening the bottle, for instance, or dropping a chewy mint into it?

Does the flavour or brand of pop change your results? What about regular pop compared to diet pop?

What about temperature? Acidity?

Remember to change only one variable at a time.

Remember to run a control experiment.

Collect your data with a table like the one below

Flavour of pop	Amount of reactant	Temperature of pop	Volume of CO_2	Acidity

HINT:

Adding heat changes solubility.

MORE ONLINE:

How It's Made: Soft Drinks

<https://www.youtube.com/watch?v=kY-dV-90d73g>

Why Do We Like Bubbly Drinks?

<https://www.youtube.com/watch?v=xF3m5E852Ro&feature=youtu.be>



SCIENCE AT HOME

SODA POP CHEMISTRY

GRADE: **11**

SCH3U

SUBJECT: CHEMISTRY

STRAND: SOLUTIONS AND SOLUBILITY, GASES AND ATMOSPHERIC CHEMISTRY

TOPIC: SOLUBILITY

EXPECTATIONS: E2.1, E2.4, E3.1, E3.3, E3.5, F2.1, F3.5

VIDEO: youtu.be/BhdPvGZ6L5o

MORE ONLINE: (continued)

Carbonate Your Fruit with Alka-Seltzer Tablets

<https://makezine.com/projects/carbonate-your-fruit-with-alka-seltzer-tablets/>

Treating the Public Water Supply: What Is In Your Water, and How Is It Made Safe to Drink?

<http://www.chemistry.wustl.edu/~edudev/LabTutorials/Water/PublicWaterSupply/PublicWaterSupply.html>



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