

Rock Candy Laboratory Experiment

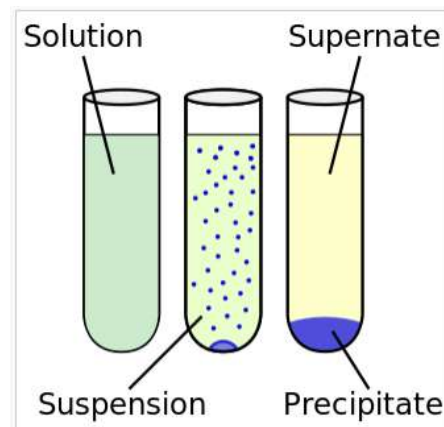
Homemade Rock Candy – SICK Science <https://youtu.be/ODEWEnAm7wU>

Vocab: solute, solvent, solubility, supersaturated, dissolves, aqueous, homogeneous, crystallize, precipitate

Background: Consider what happens when we add sand to water.

The sand you are likely aware simply sinks to the bottom if left to settle. We refer to sand as **insoluble**. However, curiously some solids seem to *vanish* if added to a **solvent** like water.

Consider what happens to sugar. A liquid solution is formed when a solid, sugar **dissolves** into a liquid, water. This type of simple mixture (sugar-water) is considered a **homogeneous** solution by chemists and further termed **aqueous**, because the solvent is water.



Rock candy is a type of sweet, formed by the crystallization (meaning to form crystals) of large sugar crystals coming out of solution. This candy is formed by allowing a **supersaturated** solution of sugar and water to **crystallize** onto a surface suitable for crystal **nucleation**, such as a string. We will be heating the water before adding the sugar **solute**, which allows more sugar to dissolve thus producing larger sugar

crystals. **Solubility** is a term used in reference to the ability of a solute like sugar to dissolve in a solvent, based on several factors, one of which is temperature. **Precipitation** is a term used to refer to the process of matter coming out of solution (the formation of a precipitate), "just as rain does" in this case however, we will have sweet, sweet rock candy raining down out of water rather than water raining down from the sky. We add some food coloring to the mixture too, just for fun and to help distinguish, whose is whose later. Crystals may take anywhere from 5 to 6 days to form, because we will need to wait for the water to evaporate.

Experiment:

One group will be provided with pure white granular cane sugar. The other group will have powdered confectionary sugar.

**What might a scientist consider studying? Describe the experiment in your own words.
(1-2 complete sent)**

What is your hypothesis? (1-2 complete sent)

List 5 constants you think we might need or that you observed during lab?

Lab procedure:

1. Add sugar to 100ml water and then stir in the extra-large beaker.
2. Carefully place the sugar-water slurry onto a ring stand
3. *"I will follow all Bunsen burner safety procedures and protocols."* Initial _____
4. Experimental Group **A** - RED food coloring / Group **B** - GREEN food / Group **C** - YELLOW
5. Boil sugar-water slurry solution in a 400ml beaker.
6. Prep rock candy strings, tooth picks, beakers and group name cards.
7. Put on gloves! Once it boils remove from flame. Turn off Bunsen.
8. Pour super heated supersaturated sugar solution into smaller beakers carefully!
9. Set hot glass back on ring stand (Not on a cool surface).
10. Be careful, ask for help.

Short answer and multiple choice (write on the line).

There are several ways to increase the solubility of a solute in a solvent. To dissolve more of a substance, a chemist might *increase surface area* of the solute (by crushing, chopping or grinding it up), *increase the temperature* of the solvent, *increase pressure* or simply *stir* the solute and solvent together.

1. List the 4 factors that increase solubility: _____

____ 2. During this lab, we did which of the following to effect solubility?

- A. *increase surface area & change pH*
 - B. *stir & increase pressure*
 - C. *increase temperature & stirred*
 - D. *increase pressure & concentrate the solvent*
- - - - -

Certain solutes like many sugars or salts have a crystalline (meaning crystal structure). Once dissolved, the molecules which form the crystals are evenly dispersed throughout the liquid water's molecules. If allowed to precipitate out their crystals reform, sometimes in new and unexpected ways. Common table salt has a molecular formula of NaCl, while sucrose (common table sugar) has a molecular formula of $C_{12}H_{22}O_{11}$.

____ 3. Which sample of matter has a crystal structure?

- A. Hg(l) B. NaCl(s) C. H₂O(l) D. CH₄(g)
- - - - -

What is the relationship between temperature and solubility of a solute like sugar? Recall this is not the case for all solutes, but is the case for the majority. Refer to solution graphing.

_____ 4. Choose all that apply

- A. direct relationship: increase temp. → increases solubility
 - B. inverse relationship: increase temp. → decreases solubility
 - C. direct relationship: decrease temp. → decreases solubility
 - D. inverse relationship: decrease temp. → increase solubility
- - - - -

____ 6. A solution is a type of mixture in which one substance is evenly mixed into another?

This is termed, or referred to as what by chemists?

- A. *Homo erectus*
- B. *homogeneous*
- C. *heterogeneous*
- D. *heterogynous*

____ 7. Saltwater is a solution formed when salt _____ into water?

- A. *melts*
- B. *solutes*
- C. *solubles*
- D. *dissolves*

Examine Table 1 on the right for # 9-12 →

____ 8. Solutions can be formed when gases dissolve into _____.

- A. other gases
- B. liquids
- C. solids
- D. All of the above

9. True or false ← circle

Liquid ether will dissolve in solid rubber?

10. True or false ← circle

A solid can form a mixture and "dissolve" into another solid?

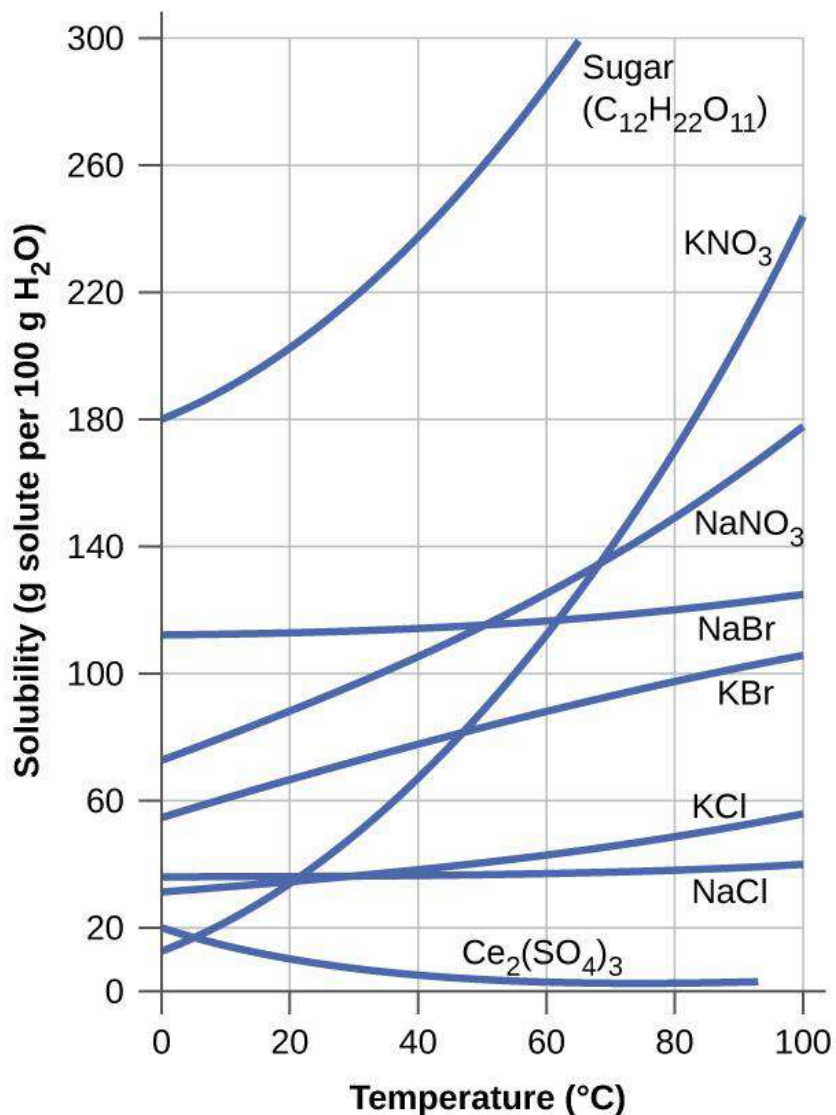
Table 1 Types of Solutions

SUBSTANCE	DISSOLVED IN	EXAMPLES
Liquid	Liquid	alcohol in water
	Gas	water vapor in air
	Solid	ether in rubber
Gas	Liquid	club soda
	Gas	(CO ₂ in water)
	Solid	air (N ₂ , O ₂ , and other gases)
Solid	Liquid	hydrogen in palladium
	Gas	salt in water
	Solid	iodine vapor in air
		brass (copper and zinc)

11. Which of the following substances are solutions? **Circle all that apply.**

<i>sugar</i>	<i>(water vapor in air)</i>	<i>salt</i>	<i>mud</i>	<i>club soda</i>	<i>flour</i>
<i>dissolves</i>	<i>(hydrogen in palladium)</i>		<i>rock candy</i>	<i>brass</i>	<i>H₂O</i>
<i>supersaturated</i>	<i>coffee</i>	<i>alcohol</i>	<i>sand</i>	<i>(food coloring)</i>	

Comparative Solubility Graph



Analyze the above graph.

- _____12. How many grams of sugar solute per 100grams of H_2O will dissolve at $20^{\circ}C$?
- _____13. At what temperature will 260grams of $C_{12}H_{22}O_{11}$ dissolve in 100grams of water?
- _____14. At what temperature will 140grams of $NaNO_3$ dissolve in 100grams of water?
- _____15. How many grams of KBr per 100grams of H_2O will dissolve at $80^{\circ}C$?
16. Describe in detail what is going on with $Ce_2(SO_4)_3$ Cerium III Sulfate? (1-2 complete sent.)
Use the terms: solubility, solute, solvent, temperature
